

## The *Lecanora dispersa* group (*Lecanoraceae*) in Argentina

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**Abstract:** A preliminary study of the *Lecanora dispersa* group in Argentina is presented. Two species (*L. dispersa* and *L. hagenii*) have been previously recorded and their known distribution is extended, one species (*L. semipallida*) is a new record from Argentina, and five taxa (*L. flowersiana*, *L. persimilis*, *L. torrida*, *L. wetmorei* and *L. zosteræ* var. *zosteræ*) are reported for the first time from South America. Three species (*L. albescens*, *L. crenulata* and *L. populicola*) previously recorded for Argentina have not been confirmed as occurring in this country. *Lecanora* aff. *fugiens* is also treated and compared to the related species. The morphology, anatomy, secondary metabolites, distribution and ecology of the nine studied taxa are described and discussed, and a key to the taxa is included.

**Keywords:** lichenized Ascomycota, lichens, new records, South America, taxonomy

### Introduction

*Lecanora* Ach. is a large and diverse genus of lichenized Ascomycota with a worldwide distribution. Several subgeneric groups can be distinguished within this genus by a combination of morphological, anatomical and chemical characters. The *Lecanora dispersa* group is well characterized by a thallus generally immersed in the substratum, in rock (endolithic) or bark (endophloeodal), with only the apothecia on the surface, but the thallus can also be indistinctly superficial to clearly visible in a very few cases; the apothecia are small, scattered to crowded, with a mostly white to grey thalline margin. Many important characters used to describe species in other subgeneric groups of *Lecanora* are difficult to study in the *L. dispersa* group due to the high intraspecific variability. Within this group, the species are currently distinguished mainly by the following taxo-

nomic characters: margin morphology, amphithecial cortex structure, epihymenium granulation and chemistry (Śliwa 2007a).

The first attempt toward a taxonomic treatment of this group was made by Poelt *et al.* (1995), based mainly on a study of eastern Alpine taxa. Fröberg (1997) described species from south Sweden, and Laundon (2003) provided a circumscription of *L. zosteræ* (Ach.) Nyl. and described the new species, *L. antiqua* J. R. Laundon (Laundon 2010). Śliwa (2007a) presented a systematic revision of the species of the *L. dispersa* group for North America, and Brodo (2010) added a new species from there.

The phylogenetic study of lobate *Lecanora* species (subgen. *Placodium*) by Arup and Grube (1998) revealed the monophyly of the *L. dispersa* group, incorporating lobate representatives with xanthones [*L. contractula* Nyl., *L. pruinosa* (Trevis.) Schaer., *L. reuteri* Chaub.] and a monotypic genus *Arctopeltis thuleana* Poelt. This broader delimitation of the group was confirmed with significant support in a recent phylogenetic study by Śliwa *et al.* (in press). These authors reconstructed phylogenetic relationships among several morphospecies within the *L. dispersa* group and evaluated their circumscription

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based on the ribosomal internal transcribed spacer (ITS) region.

Although the taxonomy of this complex has been studied for more than 50 years, it remains far from completely understood, particularly outside Europe and North America (e.g. Grube *et al.* 2004; Śliwa 2006, 2007*b*). A few species of the complex are cosmopolitan, while others show various distribution ranges. However, much of the data concerning distribution of particular taxa, based on critical treatments, refer to the Northern Hemisphere (Poelt *et al.* 1995; Laundon 2003, 2010; Ryan *et al.* 2004; Śliwa 2006, 2007*a, b*). A valuable source of information on members of the complex in the Southern Hemisphere is provided by Øvstedal & Lewis Smith (2001), Castello (2003) and Olech (2004) for Antarctica, and Lumbsch & Elix (2004) for Australia, but there are regions where observations on the *L. dispersa* group are particularly scarce, for example, South America and Africa.

In Argentina, only five members of the *L. dispersa* complex have been previously reported: *L. albescens* (Hoffm.) Branth & Rostr., *L. crenulata* Hook., *L. dispersa* (Pers.) Sommerf., *L. hagenii* (Ach.) Ach. and *L. populicola* (DC.) Duby (Calvelo & Liberatore 2002; Scutari *et al.* 2002; Rosato 2006). Ongoing field studies have revealed the existence of additional species that so far have been found mainly in the temperate regions of Argentina.

We present here a preliminary revision of the *L. dispersa* group in Argentina, including descriptions of nine taxa and comments on three species that have not been confirmed as occurring there. A key to the species is provided. This is the first review of the group for South America.

### Materials and Methods

Material from the following herbaria was studied: BCRU, H, KRAM, M, MERL, MIN, S (herbarium acronyms according to Holmgren *et al.* 1990), and hb. Guderley (Ruhr Museum). Morphological and anatomical observations were made using dissecting and light microscopes. Spot tests were carried out with 10% potassium hydroxide (K), paraphenylenediamine (PD), and calcium hypochlorite (C) (Orange *et al.* 2001). The ultra-violet fluorescence (UV) reaction of the apothecia was examined under UV-light of 350 nm wavelength. Hand-cut sections mounted in water were prepared for anatomical observations and measurements of ascumal structures. Ascospores were measured in 25% K using an oil immersion objective. The granules were observed with polarized light (pol) and its solubility was tested with 25% K and 65% nitric acid (N), on different sections of apothecia (Śliwa 2007*a*). The chemical constituents were identified by high performance thin-layer chromatography (HPTLC) in solvents A, B', and C, using standardized techniques as outlined by Arup *et al.* (1993) and Lumbsch (2002). For the identification of xanthenes, some samples were also chromatographed in solvent J (Hanko 1983; Leuckert & Knoph 1992).

Most of the terminology used in the descriptions follows Śliwa (2007*a*). The terms epihymenium and interspersed (crystals/granules) are used as explained by Bungartz (2002).

Synonymy for particular species is available in Śliwa (2006, 2007*a*) unless otherwise indicated.

### Key to the species

Note: *L. albescens*, *L. crenulata* and *L. populicola* are not included in the key (see below).

- |      |   |                       |
|------|---|-----------------------|
| 1    | Thallus immersed in the substratum (endolithic or endophloeodal); if visible, inconspicuous very scanty, consisting of dispersed, small warts . . . . . | 2                     |
|      | Thallus frequently superficial, crustose, areolate to membranous . . . . .  | 8                     |
| 2(1) | Epihymenium with conspicuous granules (pol+) . . . . .  | 3                     |
|      | Epihymenium not granular or granules inconspicuous (pol- or pol±). . . . .  | 4                     |
| 3(2) | Apothecia UV-; epihymenial granules insoluble in K, interspersed in whole hymenium . . . . .  | <b>L. dispersa</b>    |
|      | Apothecia UV+ yellow-orange; epihymenial granules soluble in K, only in the upper part of hymenium . . . . .  | <b>L. semipallida</b> |

- 4(2) Apothecial margin incised, cracked or at least partly discontinuous; amphithecial cortex indistinctly delimited. . . . . 5  
 Apothecial margin generally entire; amphithecial cortex well-developed and usually distinctly delimited . . . . . 6
- 5(4) Apothecia small (0.3–0.9 mm diam.), epruinose to moderately covered with white pruina; epihymenium pigmented only at the upper most part . . . . . **L. hagenii**  
 Apothecia large (0.6–1.3 mm diam.), epruinose; epihymenium pigmented deeper down . . . . . **L. flowersiana**
- 6(4) Apothecia biatorine in appearance, algae more abundant near the base of the margin; parathecium distinct. . . . . **L. persimilis**  
 Apothecia with a conspicuous thalline margin, algal layer continuous; parathecium not differentiated . . . . . 7
- 7(6) Apothecia with conspicuous pruina, sessile to constricted at base . . . . . **L. wetmorei**  
 Apothecia epruinose, strongly constricted at base to peltate . . . . . **L. zosteræ**
- 8(1) Epihymenium PD+ orange . . . . . **L. aff. fugiens**  
 Epihymenium PD- . . . . . **L. torrida**

### The Species

#### *Lecanora dispersa* (Pers.) Sommerf.

*Suppl. Fl. Lapp.* 1826: 96 (1826).—*Lichen dispersus* Pers., *Neue Ann. Bot.* 1 [Ann. Bot. 7]: 27 (1794); type: Germany, Mitteldeutschland, Bez. Nordhessen: kleinflächig an licht- und windoffenen, aber teilweise regengeschützten Stirn- und Überhangflächen stark ausgearbeiteter Dolomithfelsen im *Caloplacetum saxicolae* Du Rietz, 300 m, SO-SW, pH 7.5 naturnaher Trockenrasen auf dem Höhenzug in der Werraschleife von Albugen südlich Hitzerode, April 1977, *Follmann & Follmann* (MIN 760355!—neotype).

(Fig. 1A)

*Thallus* not visible, immersed in the substratum, or poorly developed, inconspicuous, crustose, comprised of small scattered warts, rarely continuous, smooth to rough, thin, whitish to chestnut-brown.

*Apothecia* lecanorine, disciform, sessile, constricted at the base, occurring singly, rarely clustered in groups, 0.3–1.0 (–1.2) mm diam.; *disc* flat to slightly convex, reddish brown to almost black, epruinose to moderately pruinose; *margin* well-developed, conspicuous, prominent or level with the disc, entire to rarely slightly fissured, frequently flexuose, smooth to rough, white to greyish, covered by a dense white pruina. *Amphithecium* well-developed, (40–) 60–200 µm wide; *algal layer* continuous to ±interrupted below

*hypothecium*; *cortex* distinct, hyaline to pale brownish, gelatinous, uniform in thickness to slightly thicker at base, 15–35 µm thick laterally, 40–75 µm thick basally, with granules (pol+), insoluble in K and soluble in N; *parathecium* indistinct, hyaline, prosoplectenchymatous, 12–25 µm thick; *epihymenium* brownish to yellowish brown, 5–25 µm high, with granules (pol+), insoluble in K, insoluble in N; *epipsamma* rarely present, insoluble in K, soluble in N; *hymenium* hyaline to brownish, 40–75 µm high, with small granules (pol+); *subhymenium* inconspicuous; *hypothecium* hyaline, gelatinous, 50–200 µm high; *paraphyses* simple, rarely branched, not anastomosed, c. 2 µm wide, tips not expanded to rarely dilated without a dark brown cap, 2.5–3 µm wide. *Asci* cylindrical to clavate, 8-spored; *ascospores* hyaline, simple, ellipsoid to oblong, rarely spindle-shaped, 8.9–12.0 (–13) × (3.0–) 4.0–5.7 (–6.5) µm.

*Pycnidia* not seen.

*Chemistry.* Apothecia K–, C–, PD–, UV–. Secondary metabolites: 2,7-dichlorolichexanthone, pannarin; or no secondary metabolites detected by HPTLC.

*Ecology and distribution.* *Lecanora dispersa* is a common species occurring on a wide range of substrata, including calcareous and siliceous rocks, bark, bones, and many

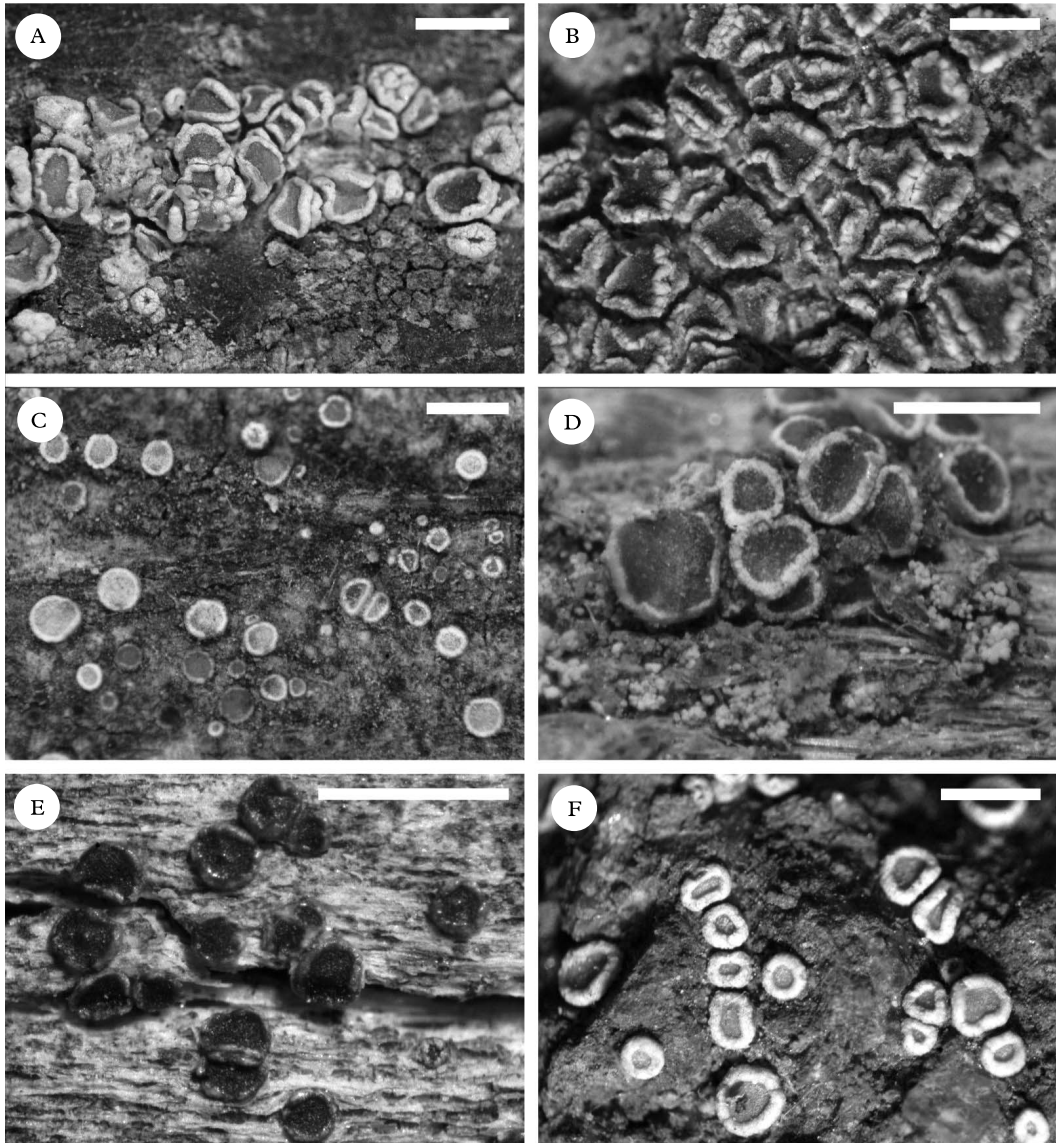


FIG. 1. The *Lecanora dispersa* group in Argentina, habit. A, *L. dispersa* [Messuti, Ferraro & Vobis (BCRU 4813)]; B, *L. flowersiana* [Räsänen (MERL 5969)]; C, *L. aff. fugiens* [Messuti (BCRU 5227)]; D, *L. hagenii* [Messuti (BCRU 5212)]; E, *L. persimilis* [Guderley, Lumbsch & Vobis (BCRU 5233)]; F, *L. semipallida* [de la Rosa & Barbar (BCRU 5211)]. Scales: A–F = 1 mm.

man-made substrata. This species has a cosmopolitan distribution, and is known from all continents (Lindsay 1974; Poelt *et al.* 1995; Śliwa & Olech 2002; Ryan *et al.* 2004; Śliwa 2006, 2007a; Edwards *et al.* 2009; van den Boom 2010a). In Argentina, it has been

previously reported on mortar, concrete, rocks and soil in the urbanized areas of Buenos Aires province and in the Patagonian steppe of Chubut province (Scutari *et al.* 2002; Rosato 2006). The distribution of *L. dispersa* within Argentina is extended for

Neuquén, Río Negro and Tierra del Fuego provinces.

**Remarks.** *Lecanora dispersa* is characterized by having fine epihymenial granules (pol+) between the paraphyses tips, and also interspersed in parts or all of the hymenium, insoluble in K and insoluble in N. Externally it can easily be confused with *L. hagenii*, because both species have reddish to blackish brown apothecia, with epruinose to slightly pruinose discs, and entire to cracked margins (Laundon 2003). Nevertheless, *L. hagenii* differs anatomically from *L. dispersa* by a thinner and regular apothecial margin, and epihymenial granules (pol±) that are insoluble in K, soluble in N, and occur only at the top of the hymenium. The paraphyses of *L. hagenii* are also simple, thicker and apically expanded, and the spores are slightly larger (9–15 × 5–7 µm) (Ryan *et al.* 2004; Śliwa 2006, 2007a). *Lecanora dispersa* is chemically similar to *L. albescens*: both contain 2,7-dichlorolichexanthone and ±pannarin. However, *L. albescens* has a well-developed thallus, often lobate at the margin, with generally pruinose apothecia. Another similar species is *L. semipallida*, which has UV+ yellow-orange apothecia (due to the presence of 5-chloro-3-*O*-methylnorlichexanthone) and epihymenial granules that are soluble in K and located only in the uppermost part of the hymenium (Śliwa 2006, 2007a, b). Comparing the North American material examined by Ryan *et al.* (2004) and Śliwa (2007a) with the Argentinean specimens, it was noted that the latter have a thinner amphithecial cortex (15–35 µm thick laterally, 40–75 µm thick basally versus 30–80 µm thick laterally, 35–120 µm thick basally in North American material).

**Specimens examined.** **Argentina:** Neuquén: estancia Arroyo Verde, a 70 km de San Carlos de Bariloche, camino a Villa Traful, ñirantal cerca de corral, junto a la manga, 26 ix 2010, *Messuti* (BCRU 5213). **Río Negro:** Pilcaniyeu, estancia San Ramón, 8 xii 1992, *Messuti* (BCRU 5214); San Carlos de Bariloche, barrio Jardín Botánico, calle Las Orquídeas 1243, 6 i 2011, *Vobis* (BCRU 5226); Elordi y Mitre, 21 xii 1992, *Messuti* (BCRU 4812). **Chubut:** ruta nac. 25, camino a Tecka, c. 12 km de Esquel, 42°58'08" S, 71°09'53" W, 770 m alt., 28 ii 2010, *de la Rosa* (BCRU 5216). **Tierra del Fuego, Antártida e Islas del Atlántico Sur:** Ushuaia, río

Pipo, frente al campo Monseñor Alemán, sobre la ladera que mira al N, zona muy alberta, con renovales de lenga, Monte Susana, 11 iii 1995, *Messuti, Ferraro & Vobis* (BCRU 4813).

### *Lecanora flowersiana* H. Magn.

*Acta Horti Gotob.* 19(2): 38 (1952); type: USA, Utah, Wayne Co., Ekkers Ranch, on dry exposed sandstone, at 6000 ft., 19 May 1951, *Flowers* (COLO L-80895!—isotype).

(Fig. 1B)

*Thallus* immersed in the substratum, sometimes superficial, poorly developed, inconspicuous, crustose, consisting of irregular warts, more frequent around the apothecia, whitish beige, brown or grey, mingled with the substratum (rock).

*Apothecia* lecanorine, disciform, sessile, constricted at the base, numerous, clustered in groups, irregular when grouped, 0.6–1.3 mm diam.; *disc* concave to plane-concave, brown, reddish brown to pale reddish brown, occasionally black, epruinose, rarely covered by a small white pruina; *margin* well-developed, ±prominent, incised, with deep cracks, strongly flexuous in larger ascomata, white, sometimes pruinose with a bluish tinge. *Amphithecium* well-developed, 50–200 µm wide; *algal layer* conspicuous, dense, ±continuous; *cortex* poorly defined, prosoplectenchymatous, hyphae with strongly gelatinized walls, uniform in thickness, 20–80 µm thick, filled with granules (pol+), insoluble in K, soluble in N; *parathecium* inconspicuous, hyaline, prosoplectenchymatous, without crystals (pol–), 25–40 µm thick; *epihymenium* ±deeply pigmented or pigment only in the upper part of the hymenium, reddish to reddish brown, sometimes pale brownish, 5–12.5 µm high, not granular (pol–) or with inconspicuous granules (pol+); *epipsamma* present (pol+), insoluble in K, soluble in N; *hymenium* brownish at upper part, hyaline below, with oil droplets, 40–75 µm high; *subhymenium* hyaline, granular; *hypothecium* hyaline to brownish, prosoplectenchymatous, gelatinous, 12–25 µm high, granules present or absent (pol±); *paraphyses* branched in the upper third, c. 1.5 µm wide, tips furcated, slightly expanded (submoniliform), with or without dark cap, 1.5–

2.5 µm wide. *Asci* clavate, 8-spored; *ascospores* hyaline, simple, ellipsoid, broadly ellipsoid to narrowly ellipsoid, 8.0–10.5 × 4.0–5.7 µm.

*Pycnidia* not seen.

*Chemistry.* Apothecial margin K–, C–, KC–, PD–, UV–. No secondary metabolites detected by HPTLC.

*Ecology and distribution.* This species grows on sandstone, granite and sporadically on wood, in desert to montane habitats, at elevations from 1000 to 2800 m, in central and western North America (Śliwa 2007a). Recently it has also been recorded from Iran, growing on bark (Valadbeigi & Sipman 2010), and also from the Canary Islands (van den Boom 2010b). In Argentina, *L. flowersiana* has been found on calcareous rocks, between 800–900 m a.s.l. in the lower montane region of Mendoza province (Las Heras). This is the first record of the species in South America.

*Remarks.* The diagnostic characters for *L. flowersiana* are: apothecial discs reddish brown, margin cracked, often flexuose, cortex uniform in thickness, epihymenium pigmented deeper down, generally not at all granular (pol–) and paraphyses submoniliform with pigmented tips. *Lecanora percrenata* H. Magn. is a closely related species which has a markedly cracked apothecial margin, but differs in having apothecia submersed in the substratum, with a more prominent and fissured margin and brown to blackish discs. The collection from MERL has been previously recognized as *L. crenulata* by Räsänen (1941), but this species is distinguished by its pruinose apothecia, cracked to crenate margin, well defined cortex, distinct parathecium and yellowish brown to brownish epihymenium. The Argentinean specimens are similar to North American material in most apothecial characters (Ryan *et al.* 2004; Śliwa 2007a), but differ in having a prosoplectenchymatous amphithecial cortex and a thinner hypothecium (15–25 µm high versus 50–90 µm high).

*Specimens examined.* **Argentina:** Mendoza: Las Heras, Cerro de la Gloria, 18 vi 1939, Räsänen (MERL 5969); *ibid.*, 20 xi 1996, Vobis & Messuti (BCRU 5215); reserva natural Divisadero Largo, ruinas mina quebrada la Atala, c. 10 km westl. Mendoza, offene Buschlandschaft, 35°52'S, 68°55'W, c. 1000 m alt., 19 xi 1997, Guderley & Guinazu [hb. Ruhr Museum (ex Guderley) 159].

### **Lecanora aff. fugiens Nyl.**

(Fig. 1C)

*Thallus* developed within the substratum to superficial, inconspicuous, crustose, ± continuous, very thin, membranous, smooth, and whitish.

*Apothecia* lecanorine, disciform, regular, sessile, constricted at base, single, 0.3–0.5 mm diam.; *disc* flat to slightly convex, brown with orange tint to reddish brown, dark brown to blackish, epruinose to moderately pruinose; margin prominent, smooth, entire, rarely incised in young apothecia, white, epruinose to slightly pruinose. *Amphithecium* well-developed, 90–130 µm wide; algae scattered in groups to continuous below the hypothecium; cortex well differentiated, hyaline, composed of agglutinated hyphae, strongly gelatinized, uniform in thickness to thicker at base, 10–25 µm thick laterally, 40–70 µm thick basally, with granules (pol+) only in the upper part, partially soluble in K, soluble in N; *parathecium* inconspicuous, hyaline, gelatinous, without crystals (pol–), 20–25 µm thick; *epihymenium* brown to greyish brown, 7.5–12.5 µm high, with coarse granules (pol+), on the top and between the paraphyses tips, insoluble in K, soluble in N; *epipsamma* rarely present (pol+), indistinct, insoluble in K, soluble in N; *hymenium* hyaline to pale brownish, 100–130 µm high; *subhymenium* and *hypothecium* poorly differentiated, hyaline, paler than hymenium, 12.5–50.0 µm high; *paraphyses* furcate in the uppermost part, 1–2 µm wide, tips often expanded, c. 3 µm wide. *Asci* clavate, 8-spored; *ascospores* hyaline, simple, ellipsoid to broadly ellipsoid, 8.1–10.5 × 4.9–6.5 µm.

*Pycnidia* not seen.

**Chemistry.** Thallus and apothecial margin K–, C–, PD–; disc K–, C–, PD–; apothecia UV± yellowish. Apothecial disc in section PD+ orange. Secondary metabolites detected by HPTLC: pannarin, unknown substance [In solvent A:  $Rf_{\text{unknown substance}} = 26 / Rf_N = 58$ ,  $Rf_A = 77$  (A: atranorin, N: norstictic acid), spot yellowish after charring].

**Ecology and distribution.** *Lecanora fugiens* grows on rocks in temperate oceanic regions of North America and northern Europe (Sliwa 2007a; Edwards et al. 2009). Hitherto this species has not been reported for South America. The single collection of *Lecanora* aff. *fugiens* from Argentina was made from the bark of a thorny bush (*Berberis buxifolia* Lam.) in the transitional forest in Río Negro province.

**Remarks.** The specimen from Argentina is distinguished by its visible thallus, small, single apothecia, with a rather pale disc, a distinct amphithecial cortex and a PD+ orange epihymenium. *Lecanora fugiens* shows a similar PD± orange reaction in the apothecial disc, but has an evanescent to crustose thallus, a white dendroid prothallus, K+ yellow and C+ orange reactions of thallus and apothecia, and occurs on siliceous rocks. The species also differs by its amphithecial cortex being thinner at the base (30–45 µm), and having an epihymenium with granules soluble in K (Sliwa 2007a). The Argentinean material studied is also morphologically similar to *L. hagenii*, because of the small, single, brown to reddish brown apothecia. However, *L. hagenii* has an endophloeodal or endolithic thallus, and an indistinctly granular epihymenium, which is PD–. Our understanding of this taxon and its relationship to the *L. dispersa* group is still incomplete since only one specimen was found.

**Specimen examined.** **Argentina:** Río Negro: San Carlos de Bariloche, Pampa de Huenuleo, 25 ii 1992, Messuti (BCRU 5227).

### **Lecanora hagenii (Ach.) Ach.**

*Lichenogr. Universalis* 1810: 367 (1810).—*Lichen hagenii* Ach. nom. cons., *Lichenogr. Suec. Prodr.* 1799: 57

(1799); type: Germany, An einem alten Brette der Hofeinfassung des Linderl-Anwesens in Nymphenburg. München, 27 October 1889, Arnold (M 0035420!—conserved type).

(Fig. 1D)

**Thallus** developed within the substratum, rarely superficial, crustose, inconspicuous, thin, whitish grey to brownish.

**Apothecia** lecanorine, disciform, broadly sessile, single to ±grouped, 0.3–0.9 mm diam.; disc flat to slightly convex, concave to flat in young apothecia, yellowish brown, reddish, orange-brown, dark brown to blackish, epruinose to moderately whitish pruinose; margin prominent to level with disc, smooth to rough, entire or more often partly discontinuous, white, paler than disc, rarely greyish, epruinose or covered by a thick, whitish pruina. **Amphithecium** well-developed, 75–150 µm wide; **algal layer** dense, continuous below the hypothecium; **cortex** poorly differentiated to distinct, hyaline, formed by hyphae with gelatinized walls, prosoplectenchymatous, uniform in thickness to slightly thicker at base, 10–25 µm thick laterally, 20–25 µm thick basally, with granules (pol+), often more abundant on top of margin, insoluble in K, soluble in N; **parathecium** inconspicuous, hyaline, without granules (pol–), 25–50 µm thick; **epihymenium** brownish to dark brown, frequently reddish brown, 5.0–12.5 µm high, with inconspicuous granules (pol±), coarse, on the top and between the paraphyses tips, insoluble in K, soluble in N, or granules absent; **epipsamma** present (pol+), insoluble in K, soluble in N; **hymenium** hyaline, 50–75 µm high; **subhymenium** indistinct; **hypothecium** hyaline, composed of agglutinated hyphae, 40–60 µm high; **paraphyses** branched, frequently furcated in the uppermost part, c. 2 µm wide, tips dilated, with dark brown cap, c. 3 µm wide. **Asci** clavate, 8-spored; **ascospores** hyaline, simple, ellipsoid, broadly to narrowly ellipsoid, 8.9–14.6 × 4.8–7.3 µm.

**Pycnidia** not seen.

**Chemistry.** Apothecia K–, C–, PD–, UV–. No secondary metabolites detected by HPTLC.

*Ecology and distribution.* *Lecanora hagenii* grows generally on bark, wood, bryophytes, bones, and on other organic substrata, and less commonly on rocks. It is widespread in temperate regions of Europe, North America and Asia (Poelt *et al.* 1995; Ryan *et al.* 2004; Śliwa 2007a; Edwards *et al.* 2009). In Argentina it has been found previously on calcareous rocks and mortar in various urban environments in Buenos Aires province and the Magellan steppe region of Tierra del Fuego province [Cengia Sambo 1926; Rosato 2006, under the synonym *L. umbrina* (Ach.) A. Massal.]. *Lecanora hagenii* is here reported for the first time in Neuquén and Río Negro provinces.

*Remarks.* *Lecanora hagenii* is characterized by its slightly cracked apothecial margin and indistinct amphithecial cortex. *Lecanora hagenii* resembles *L. dispersa*, but the differences are discussed under the latter species. *Lecanora wetmorei* Śliwa has similar pruinose apothecial discs, but has larger apothecia [0.4–1.2 (–1.5) mm diam.], with an entire to flexuose margin, reddish brown to black discs, and thicker cortex at the base (60–100 µm). *Lecanora hagenii* may also be confused with *L. crenulata* Hook. However, the latter species differs by having a distinctly cracked to crenate apothecial margin and a cortex that is thicker at the base (30–70 µm wide laterally, 50–130 µm basally). Moreover, *L. crenulata* grows exclusively on calcareous rocks (Ryan *et al.* 2004; Śliwa 2007a). The Argentinean specimens examined have a slightly thicker amphithecium (75–150 µm thick versus 75–90 µm thick), but in all other respects the morphological and anatomical characters of this material agreed with the variation accepted for the species in North America and Europe (Ryan *et al.* 2004; Śliwa 2007a; Edwards *et al.* 2009).

*Specimens examined.* **Argentina:** Neuquén: ruta Confluencia-Traful, en dirección a Paso Córdoba, estancia Arroyo Verde, cercanías a la manga, 3 v 2007, *Messuti* (BCRU 5204); junto al río Limay, puente de la ruta 237, cercanías al Boliche Viejo, iv 1994, *Messuti* (BCRU 5212). Río Negro: San Carlos de Bariloche, cerro Otto, camino a la curva Bariloche, 17 xi 2007, *de la Rosa* (BCRU 5210); balneario Las Grutas, en dirección a San Antonio Oeste, pasando bajada La Rinconada,

zona de matorral cerca de la costa del mar, 40°47'35"S, 65°03'26"W, c. 7 m alt., 2 i 2010, *de la Rosa & Moreno Azócar* (BCRU 5209). Tierra del Fuego, *Antártida e Islas del Atlántico Sur*: estancia San Luis, a 40 km de Río Grande, cerca de la costa del océano Atlántico, entre Punta María y estancia Viamonte, 14 iii 1995, *Vobis* (BCRU 4814); Lapataia, lago Roca, en el bosque cerca de sendero, cerca de la costa, 12 iii 1995, *Vobis* (BCRU 5219).

### *Lecanora persimilis* (Th. Fr.) Nyl.

*Flora* 59: 577 (1876).—*Lecanora hagenii* [subsp.] *persimilis* Th. Fr. *Lichenogr. Scand.* 1: 251–252 (1871); type: Sweden, Westrogothie: Källandsö, på ask, 1861, *Graeve* (UPS—lectotype, *non vidi*).

(Fig. 1E)

*Thallus* developed within the substratum, rarely on the surface, scattered in patches, smooth, membranous, whitish to frequently grey.

*Apothecia* lecanorine, sometimes biatorine in appearance, disciform, rounded, broadly sessile, usually single, dispersed throughout the thallus, 0.2–0.5 mm diam.; *disc* flat, epruinose, brown to dark brown, often glossy; *margin* prominent, entire, rarely with some radial fissures, smooth, epruinose, concolorous with disc. *Amphithecium* ±developed, 40–90 µm wide, algae more abundant near the base, forming a loose, discontinuous algal layer, without crystals (pol–); *cortex* distinct, hyaline to reddish brown, prosoplectenchymatous, hyphae with pigmented ends, reddish-brown, covered externally by a gelatinous layer, slightly thicker at the base, 12–25 µm thick laterally, 25–35 µm thick basally, with granules (pol+), insoluble to partly soluble in K, soluble in N; *parathecium* distinct, hyaline, prosoplectenchymatous, reddish brown at the upper part, 12.5–25 µm thick; *epihymenium* reddish brown, 5–15 µm high, without granules (pol–), pigment slightly altered in K, turning brown; *epipsamma* absent; *hymenium* hyaline to pale brownish, 35–50 µm high; *subhymenium* and *hypothecium* hyaline, 50–75 µm high; *paraphyses* simple, free, c. 1 µm wide, tips expanded and pigmented, c. 3 µm wide. *Asci* clavate, 8-spored; *ascospores* hyaline, simple, narrowly ellipsoid to ellipsoid, more



rarely widely ellipsoid, 10.5–14.0 (–15.4) × 4.0–5.7 µm.

*Pycnidia* not seen.

**Chemistry.** Apothecia K– yellow, C–, KC–, PD– orange-yellow. No secondary metabolites detected by HPTLC.

**Ecology and distribution.** This species belongs to the boreal and mainly temperate regions, found on the bark of branches and twigs of deciduous trees. It is known from Europe and North America (Śliwa 2007a; Edwards *et al.* 2009). The specimen examined here was collected on wood from Andean Patagonian *Nothofagus* forest in Tierra del Fuego province. This is the first record of the species in South America.

**Remarks.** The combination of endophloeodal thallus, and small chocolate-brown, epruinose apothecia, frequently with a biatorine appearance, is characteristic of *L. persimilis*. Unfortunately the lectotype was not available in the herbarium (UPS) during this study. The similar species *Lecanora sambuci* (Pers.) Nyl. is distinguished by the apothecia being slightly immersed in the substratum and having multispored asci (Śliwa 2007a). *Lecanora persimilis* also resembles *L. hagenii* by its epruinose apothecia, but the latter species has an apothecial margin that is paler than the disc or whitish, and a well-developed amphithecium with a thick, dense algal layer. The Argentinean material presents the same morphological and anatomical characters as reported from the North American and European specimens (Ryan *et al.* 2004; Śliwa 2007a; Edwards *et al.* 2009), but differs in having a thinner amphithecial cortex at the base (25–35 µm thick versus 20–69 µm thick).

**Specimens examined.** **Argentina:** Tierra del Fuego, Antártida e Islas del Atlántico Sur: Parque Nacional Tierra del Fuego, bahía Ensenada, c. 15 km W von Ushuaia, exponierte Künstenfelsen, 54°50'S, 67°28'W, 8 xi 1997, Guderley, Lumbsch & Vobis (BCRU 5233).

### **Lecanora semipallida H. Magn.**

In Hedin, S. (ed.), *Lichens from Central Asia I, Reports Scientific Exped. North-west. Provinces of China (the Sino-*

*Swedish expedition)*. 13, XI Botany, 1. Aktiebolaget, Thule & Stockholm: 89 (1940); type: China, China occidentalis, prov. Kansu: Wai-chüan-ku, E ab Yeh-ma-ta-chüan, c. 3000 m.s.m., 13 December 1931, Bohlin (S L3745!—holotype).

(Fig. 1F)

**Thallus** developed within the substratum, rarely visible, crustose, inconspicuous, thin, smooth to rough, ± granular, greenish grey to pale grey.

**Apothecia** lecanorine, disciform, sessile, single, 0.3–0.9 mm diam.; *disc* flat, concave when immature, rarely convex, epruinose, brownish, yellow to yellowish brown; *margin* prominent to level with the disc, smooth, sometimes crenate, rarely flexuose, yellowish white to grey, brownish, covered by whitish pruina. **Amphithecium** well-developed, 100–150 µm wide, *algal layer* dense, continuous; *cortex* distinct, hyaline, prosoplectenchymatous, thicker at base, 35–70 µm thick laterally, 80–180 µm thick basally, with granules (pol+), insoluble in K, and soluble in N; *parathecium* hyaline, conspicuous, without crystals (pol–), 20–40 µm thick; *epihymenium* yellowish brown to dark brown, 20–30 µm high, granular (pol+), granules soluble in K, insoluble in N; *epipsamma* absent; *hymenium* hyaline, 50–70 µm high; *subhymenium* and *hypothecium* hyaline, 25–75 µm high; *paraphyses* 1.0–1.5 µm wide, with slightly expanded and furcate tips, c. 3 µm wide. **Asci** clavate, 8-spored; *ascospores* hyaline, simple, ellipsoid, 8.9–14.6 × 4.8–7.3 µm.

*Pycnidia* not seen.

**Chemistry.** Apothecia K–, C–, PD–, UV+ orange. Secondary metabolites detected by HPTLC: vinetorin (5-chloro-3-O-methylnorlichexanthone).

**Ecology and distribution.** *Lecanora semipallida* is a saxicolous species, found on calcareous rocks, concrete, or growing on other lichens, but occasionally occurs on bark, bryophytes, plant debris and metals. It is widely distributed in Europe and North America, Asia, Australia and New Zealand (Śliwa 2007a, b; Edwards *et al.* 2009). Most

recently it has been noted also from Peru (see Śliwa *et al.*, in press). In Argentina it is found on bones and calcareous rocks in the provinces of Río Negro and Tierra del Fuego. This is the first record for the species in Argentina.

*Remarks.* *Lecanora semipallida* is easily recognized by its immersed thallus, the apothecia being yellowish, occurring singly, with a UV+ bright orange to pale orange reaction, and by the presence of vinetorin. It is superficially similar to *L. dispersa*, but it can be distinguished by the solubility of the epihymenial granules and by the chemistry (see under the latter species). The two collections studied here exhibit the expected anatomy of the species (Lumbsch & Elix 2004; Śliwa 2007a, b), but had a significantly thicker amphithecial cortex (up to 180 µm), and asci that were constantly 8-spored.

*Specimen examined.* **Argentina:** *Río Negro:* San Carlos de Bariloche, cerro Tronador, Ventisquero Negro, cerca del mirador, 27 iv 2010, *de la Rosa & Barbar* (BCRU 5211). *Tierra del Fuego, Antártida e Islas del Atlántico Sur:* Ushuaia, entre río Tuerto y lago Fagnano, sobre ruta 3, 10 iii 1995, *Vobis & Messuti* (BCRU 1331).

### *Lecanora torrida* Vain.

*Arkiv. Bot.* 8 (4): 45 (1909); type: Russia, Sibiria Septentrionalis: Peninsula Jinretlen, 67° lat. bor., 174° long. occid. (Greenw.), November 1878–July 1879, *Almqvist* (S L1924!—holotype).

(Fig. 2A)

*Thallus* ±developed, superficial, inconspicuous, discontinuous, consisting of flat, thin, whitish to pale brownish areoles.

*Apothecia* lecanorine, disciform, rounded, sessile, strongly constricted at the base, numerous, singly to frequently clustered in groups, usually deformed by mutual compression, 0.2–0.7 mm diam.; *disc* flat to convex, epruinose, greyish brown to black; *margin* well developed, conspicuous, entire, flexuose or crenate, white, epruinose to rarely pruinose, occasionally excluded. *Amphithecium* ±differentiated, 60–180 µm wide; *algal layer* dispersed in groups, continuous or discontinuous below the hypothecium; ±abun-

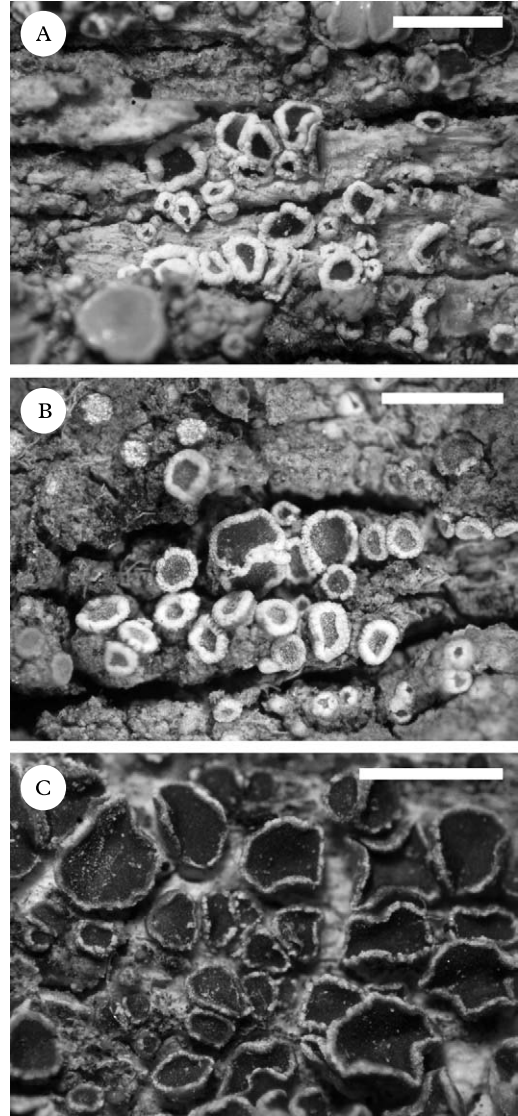


FIG. 2. The *Lecanora dispersa* group in Argentina, habit. A, *L. torrida* [Messuti (BCRU 5202)]; B, *L. wetmorei* [Vobis (BCRU 522)]; C, *L. zosteræ* var. *zosteræ* [Vobis & Messuti (BCRU 1217)]. Scales: A–C = 1 mm.

dant or rare; *cortex* poorly differentiated, prosoplectenchymatous, thicker at base, 20–45 µm thick laterally, 50–75 µm thick basally, filled with granules (pol+), insoluble in K, soluble in N; *parathecium* distinct, hyaline, without crystals (pol–), 12.5–50 µm thick, prosoplectenchymatous, blackish on

top; *epihymenium* brownish to olivaceous brown or blackish, gelatinous, K+ greenish brown, N+ reddish, 7.5–12.5 µm high, without crystals (pol−) to rarely with scarce, small granules (pol±), insoluble in K, soluble in N; *hymenium* hyaline, 45–60 µm high, with granules scattered throughout its height (pol+); *subhymenium* and *hypothecium* hyaline, composed of agglutinated hyphae, 25–75 µm high; *paraphyses* branched, with few anastomoses, ±free in K, 1.0–1.5 µm wide, tips expanded, with a dark cap, 2–3 µm wide. *Asci* clavate, 8-spored; *ascospores* hyaline, simple, ellipsoid to narrowly ellipsoid 8.9–14.6 × 4.9–6.5 µm.

*Pycnidia* not seen.

**Chemistry.** Thallus and apothecial margin K−, C−, PD± orange, UV−. Secondary metabolites detected by HPTLC: 2,7-dichlorolichexanthone, pannarin.

**Ecology and distribution.** This species occurs on rocks and is reported from Europe, North America, New Zealand and Antarctica (Poelt *et al.* 1995; Śliwa & Olech 2002; Śliwa 2007a; Valadbeigi & Sipman 2010). In Argentina it has been found on bones and on calcareous rocks. This is the first record for South America.

**Remarks.** *Lecanora torrida* differs from other taxa in the *L. dispersa* complex by having a non-granular epihymenium (pol−) and by the presence of granules (pol+) that are interspersed throughout the hymenium. It is anatomically and chemically similar to *L. albescens* and *L. dispersa*, but the latter two species have distinct epihymenial granules. Furthermore, they do not develop a conspicuous parathecium that is clearly visible and consists of bluish hyphae in the upper part, as in the case of *L. torrida*. The Argentinean specimens of *L. torrida* studied are also similar to *L. zosteræ* var. *beringii* (Nyl.) Śliwa in the morphology of the thallus and the apothecia; however, in the latter species the parathecium is indistinct and the cortex is distinctly delimited. North American collections of *L. torrida* differ from material observed in this study by having a

more developed thallus and entire apothecial margin.

**Specimen examined.** **Argentina:** Santa Cruz: a 2 km estancia Monte Aymond, camino al puesto de carabineros, en dirección a Punta Delgada (Chile), 52° 07' 07" S, 69° 32' 01" W, 226 m alt., 8 xi 1997, Messuti (BCRU 5202). Tierra del Fuego, Antártida e Islas del Atlántico Sur: Ushuaia, río Pipo, frente al campo Monseñor Alemán, sobre la ladera que mira al N, zona muy alberta, de renovales de lenga, Monte Susana, 11 iii 1995, Messuti, Ferraro & Vobis (BCRU 5222).

### *Lecanora wetmorei* Śliwa

In Nash III, T. H., Ryan, B. D., Diederich, P., Gries, C. & Bungartz, F. (eds), *Lichen Flora of the Greater Sonoran Desert Region 2*: 293 (2004); type: USA, Utah, Salt Lake Co., E of Salt Lake City, along Big Cottonwood Canyon, on road to Brighton, on oak, at 5800 ft., 11 June 1967, Wetmore (MIN 722988!—holotype, KRAM-L 64137!—isotype).

(Fig. 2B)

**Thallus** not visible, immersed in the substratum, partly superficial, inconspicuous, crustose, thin, brownish to greyish.

**Apothecia** lecanorine, disciform, sessile to constricted at the base, occurring singly or clustered in groups, 0.4–1.1 mm diam.; *disc* flat to slightly convex, reddish brown to almost black, moderately to heavily pruinose; rarely epruinose, margin well developed, conspicuous, prominent or level with the disc, entire, flexuose in larger ascomata, smooth, white to greyish, covered by a dense white pruina. *Amphithecium* well developed, 75–200 µm wide; *algal layer* continuous to ±interrupted below the hypothecium; *cortex* distinct, hyaline to pale brownish, composed of agglutinated hyphae, with gelatinous walls, uniform in thickness to slightly thicker at base, 25–50 µm thick laterally, 60–90 µm thick basally, with granules (pol+), more abundant at the upper part of the margin, insoluble in K and soluble in N; *parathecium* indistinct, hyaline, prosoplectenchymatous, 12–25 µm thick; *epihymenium* brownish, reddish to yellowish brown, N+ reddish, 7.5–12.5 µm high, with thick granules (pol±), scarce, insoluble in K, insoluble in N, frequently with a conspicuous layer of additional thick granules (pol+), soluble in K,

insoluble in N; *epipsamma* rarely present, insoluble in K, soluble in N; *hymenium* hyaline to brownish, 40–75 µm high; *subhymenium* and *hypothecium* hyaline, gelatinous, 50–75 µm high; *paraphyses* simple, rarely branched, not anastomosed, 1.5–2.0 µm wide, tips dilated with a dark brown cap, 3.0–3.5 µm wide. *Asci* clavate, 8-spored; *ascospores* hyaline, simple, ellipsoid to narrowly ellipsoid, 8.9–13.0 × 5.0–6.5 µm.

*Pycnidia* not seen.

**Chemistry.** Apothecia K–, C–, PD–, UV–. No secondary metabolites detected by HPTLC.

**Ecology and distribution.** *Lecanora wetmorei* grows on the bark of various trees. Hitherto, it has been recorded only from western North America (Ryan *et al.* 2004; Śliwa 2007a) and Iran (Valadbeigi & Sipamn 2010). In Argentina it occurs on the bark of the following trees and shrubs: *Austrocedrus chilensis* (D. Don) Pic. Serm. & Bizzarri, *Berberis buxifolia* Lam., *Nassauvia glomerulosa* (Lag. Ex Lindl.) S. Don and *Schinus patagonicus* (Phil.) I. M. Johnst. in the Patagonian steppe and transitional forest. It also grows on exterior painted walls in urban areas of the San Carlos de Bariloche town. These are the first records of this species for South America.

**Remarks.** *Lecanora wetmorei* is characterized by its heavily pruinose apothecia, with entire margin, amphithecial cortex which is distinctly delimited, thicker at base, and epihymenium with two types of coarse granules (with different solubility). It can be mistaken for *L. hagenii* with similar pruinosity of ascospores, but the latter species differs by its paler discs, entire to slightly incised thalline margin and by the amphithecial cortex being inconspicuous and generally uniform in thickness (c. 25 µm). Some Argentinean specimens show a visible thallus, that is only slightly developed and inconspicuous. Moreover, a laterally thicker amphithecial cortex has been observed in the Argentinean material, by comparison with specimens from North America (Śliwa 2007a).

**Specimens examined.** **Argentina:** Río Negro: San Carlos de Bariloche, barrio Jardín Botánico, calle Las Orquídeas 1243, 10 iii 2009, *Vobis* (BCRU 5205); *ibid.*, 24 iii 2009, *Vobis* (BCRU 5228); *ibid.*, 15 i 2010, *Vobis* (BCRU 5224); *ibid.*, 6 i 2011 (BCRU 5225); Península San Pedro, esquina frente a capilla, 1 x 2008, *de la Rosa* (BCRU 5207); Pampa de Huenuleo, 25 ii 1992, *Messuti* (BCRU 5206); arroyo del Medio, 23 xi 1993, *Messuti* (BCRU 5203); Pilcaniyeu, cerca del río Pichileufu, 14 vi 1992, *Messuti* (BCRU 5208).

### ***Lecanora zosteræ* (Ach.) Nyl. var. *zosteræ***

*Flora Meth.* 59: 577 (1876).—*Lecanora subfusca* var. *zosteræ* Ach., *Syn. Meth. Lich.* 1814: 158 (1814); type: Sweden, ‘... ad littora marina in foliis exsiccatæ *Zosteræ*’ [sensu Brodo & Vitikainen (1984)] (H-ACH 1147 A—lectotype, image!).

For synonymy see Brodo & Vitikainen (1984).

(Fig. 2C)

**Thallus** growing within the substratum, or ±superficial, inconspicuous, very thin, evanescent, white to whitish or greyish, prothallus invisible.

**Apothecia** lecanorine, disciform, rounded, thin, sessile, strongly constricted at the base, peltate, numerous, crowded, 0.3–1.2 mm diam.; *disc* flat to concave, rarely convex, sinuose, epruinose, dark reddish brown to black; *margin* well developed, persistent, entire, thin, smooth, usually flexuose, with white pruina, involute when old, rarely excluded. *Amphithecium* distinct, ±60 µm wide; algae dispersed, filled with granules (pol–); *cortex* well defined, hyaline, gelatinous, compact, 40–60 µm thick laterally, 50–100 µm thick basally, with small crystals (pol+), insoluble in K, soluble in N; *parathecium* inconspicuous, 12–25 µm thick; *epihymenium* yellowish brown, pigment unaltered with K, N+ reddish to orange-brown, 5.0–12.5 µm high, not granular (pol–) *epipsamma* absent; *hymenium* hyaline, c. 40 µm high; *subhymenium* and *hypothecium* hyaline poorly developed, 20–50 µm high; *paraphyses* simple to sparsely branched, free, agglutinated, thin, c. 1.6 µm wide, slightly expanded to capitate, tips pigmented, c. 4 µm wide. *Asci* clavate, 8-spored; *ascospores* hyaline, simple, ellipsoidal to oval, 8.9–12.0 × 4.0–5.7 µm.

*Pycnidia* not seen.

**Chemistry.** Apothecial margin K–, C–, KC–, CK–, PD–. No secondary metabolites detected by HPTLC.

**Ecology and distribution.** *Lecanora zosteræ* var. *zosteræ* grows on organic substrata such as wood, debris and grass. This maritime lichen is widely distributed, and has been recorded from Europe, Asia and North America (Laundon 2003; Sliwa 2007a). The specimens examined were found growing on the bark and wood of fallen branches in the vicinity of the coast in a sub-antarctic region of Argentina. This is the first record of the species in South America.

**Remarks.** This species is characterized by the large, often peltate apothecia with brownish discs, an amphithecial cortex which is distinctly delimited and clearly thickened at the base. Three morphological races, correlated with geographical distribution are recognized at varietal level (Sliwa 2007a): *Lecanora zosteræ* var. *behringii* and *L. zosteræ* var. *palanderi* (Vain.) Sliwa are rather common in arctic-alpine regions, while *L. zosteræ* var. *zosteræ* has a widespread distribution. This typical variety is characterized by the large, up to 1.2 mm diam., peltate apothecia, with dark brown to reddish brown epruinose discs, which become sinuous and concave when old, with a thin, white to whitish grey, flexuous margin and an amphithecial cortex which is distinctly delimited, clearly thickened at the base. The related *L. hagenii* differs in having small sessile apothecia up to 0.9 mm diam., with plane, often pruinose discs (Laundon 2003). The Argentinean material presents the same morphological and anatomical characters as reported from North American and European specimens (Laundon 2003; Ryan *et al.* 2004; Sliwa 2007a).

**Specimen examined.** **Argentina:** Tierra del Fuego, Antártida e Islas del Atlántico Sur: Ushuaia, Puerto Almanza, on the coast, 16 iii 1995, *Vobis & Messuti* (BCRU 1217); estancia San Luis, a 40 km de Río Grande, cerca de la costa del océano Atlántico, entre Punta María y estancia Viamonte, 14 iii 1995, *Vobis* (BCRU 5221).

## Untreated species

### *Lecanora albescens* (Hoffm.) Branth & Rostr.

The species was recorded for the Chubut province on the basis of a single collection (Cengia Sambo 1930) by its synonym *L. galactina* (Ach.) Ach. This specimen could not be found in any known herbaria; no further collections of *L. albescens* have been identified.

### *Lecanora populicola* (DC.) Duby

The only record of this species was published in the checklist of Argentinean lichens by Calvelo & Liberatore (2002). Unfortunately, reference material has not been found in any known herbaria.

## Excluded species

### *Lecanora crenulata* Hook.

The collection cited for Argentina (Räsänen 1941) has been identified in this study as *L. flowersiana*.

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