

## Some new *Lecanora* species from western and central Europe, belonging to the *L. saligna* group, with notes on related species

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**Abstract:** A revision of the *Lecanora saligna*-group is provided, based on specimens mainly from western and central Europe. Four new *Lecanora* species related to *L. saligna* are described: *L. calabrica*, *L. coppinsii*, *L. pseudosarcopidoides* and *L. subsaligna*, as well as a new variety, *L. albellula* var. *macroconidiata*. The species treated have in common relatively short and  $\pm$  curved or bacilliform conidia and/or isousnic acid as a secondary metabolite. Species without isousnic acid, containing exclusively filiform conidia are excluded. Notes on various types of conidia (macroconidia, microconidia, mesoconidia and leptconidia), morphology, ecology, chemistry and distribution are given and a key to the treated species is provided. Detailed descriptions are presented for eight related species in order to highlight the distinguishing characters.

**Key words:** conidia, *Lecanoraceae*, leptconidia, *L. calabrica*, *L. coppinsii*, *L. pseudosarcopidoides*, *L. subsaligna*, new species and a variety, taxonomy

### Introduction

*Lecanora* species most closely related to *L. saligna* form a well-defined group. According to Printzen (2001) it is characterized by a corticate, lecanorine apothecial margin, bacilliform and slightly bent conidia, isousnic acid, instead of or in addition to usnic acid, in the thallus and apothecia (with a few exceptions) and occurrence in habitats at elevations above 1200 m (this is the case for SW North American species). Observations on conidia are presented only for *L. mughicola* and *L. saligna*. However, in Printzen's opinion there is no reason for a generic distinction.

Conidial and pycnidial characters are of great help with the identification of the species in the *L. saligna* group. We have studied intensively the occurrence and the

nature of pycnidia and conidia found in all species treated in the group and are now able to add some new information about conidia for several species. Four kinds of conidia are recognized. Our concept of the distinguishing features of three types, microconidia, mesoconidia and macroconidia, are analogous to those used by Coppins (1983: 67) in *Micarea*. We introduce here a fourth conidium type, termed leptconidia, which differ from macroconidia as defined in Coppins (1983: 67). Leptconidia are filiform, often curved and relatively narrow, non-septate, 0.6–1.0  $\mu\text{m}$  wide and vary in length between 10 and 27  $\mu\text{m}$ . They are known from many *Lecanora* species, even from some outside the *L. saligna* group. Macroconidia as treated here are slightly to strongly curved, 0–3-septate and 1.7–3  $\mu\text{m}$  wide. Macroconidia have been found in 6, microconidia in 12, and mesoconidia in 7 of the taxa treated here. There is much confusion regarding measurements of conidia in the literature, which can be explained by the numerous specimens within the *Lecanora saligna* group that have been misidentified.

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Consequently conidial characters reported in the literature are compared with those observed in our study.

Some additional chemical compounds are also reported in this study for some species of the *L. saligna* group; most of them recorded for the first time in the group. These are brialmontin 1, neousnic acid, 7-*O*-methylnorascomatic acid, paraensic acid C and D, pseudoplacodiolic acid, placodiolic acid and squamatic acid. Although the chemistry is often useful for separation of the species, some compounds are encountered in several species. *Lecanora sarcopidoides* is unique in having pseudoplacodiolic acid as the major compound and the chemistry of *L. hypoptoides* is easily recognized by the presence of paraensic C and D acids. In our study, *L. subintricata* is unique in having usnic acid as its major compound, although it has been found as a rare major compound in North American specimens of *L. albellula* Printzen (2001).

A detailed study of *Lecanora* specimens belonging to the *L. saligna* group, has led to the discovery of four new species and a new variety: *L. calabrica*, *L. coppinsii*, *L. pseudo-sarcopidoides* and *L. subsaligna* and *L. albellula* var. *macroconidiata*, all from western or central Europe. A few 19th century specimens and one recent collection of *L. subravida* have been studied and this species, described by Nylander (1872), appears to belong to the *L. saligna* group. The present

study includes twelve species and one variety of the *L. saligna* group or closely related species, all of them corticolous or lignicolous.

**Material and Methods**

This study is based on material of the *Lecanora saligna* group, mainly from the herbaria of both authors, with additional collections from B, BR, E, L, M, GZU, LG, LUX, MAF, H-Nyl and the private collections of P. Diederich and J. Etayo. We have attempted to observe all the species treated in their natural habitats, so both authors made many fieldtrips throughout most countries of Europe with an emphasis on western countries of continental Europe. A total of about 400 specimens has been examined, some of them are indeterminate because of the lack of pycnidiomata, often in combination with their scanty nature. We have studied specimens from central and western Europe and some specimens from elsewhere.

Hand-cut sections and squash preparations were usually mounted in water and 10% KOH. Measurements of internal features were made at a magnification of  $\times 1000$  or rarely at  $\times 2000$  using a Leitz microscope fitted with a drawing tube. For the examination of conidiogenesis and conidia or ascospores only material mounted in water was employed.

The granulation of tissues was observed in polarized light. Granules, bright in polarized light, have been found in all the species treated here except *Lecanora hypoptoides*. These granules are yellowish to pale brownish and soluble in 25% KOH (K) and not soluble in 35% HNO<sub>3</sub> (N). These two reagent tests have been carried out on material of all species. The epiphytenium in all treated species is K- and N± reddish. Amyloid reactions were tested using Lugol's iodine solution (K/I). Many specimens were checked by TLC (nearly always in TDA) and some by HPLC. The identity of chemical compounds was checked partly by the second author and partly by Prof. J. Elix, according to the methods of Culberson & Ammann (1979), Culberson & Johnson (1982), or Elix & Ernst-Russell (1993).

**Key to the species of the *Lecanora saligna* group**

- 1 Ascospores 10–14  $\mu\text{m}$  long and 4.4–6.2  $\mu\text{m}$  wide . . . . . 2  
 Ascospores usually shorter and/or narrower . . . . . 3
- 2(1) Ascospores 10–14  $\times$  4.4–5.2; apothecia plane, appressed; margin somewhat shiny; disc yellowish brown to often bluish grey to black . . . . . **L. mughicola**  
 Ascospores 10.5–11  $\times$  5–6(–6.2)  $\mu\text{m}$ ; apothecia with a relatively thick yellowish margin, becoming folded or knobby; habitus resembles *L. varia* . . . . .  
 . . . . . **L. subravida**
- 3(1) Ascospores relatively small, *c.* 6–8.4  $\times$  2.5–3.6  $\mu\text{m}$ ; disc yellowish beige to grey, becoming dark olive-brown or bluish pruinose . . . . . 4  
 Ascospores usually  $>8 \mu\text{m}$  long and  $>3.5 \mu\text{m}$  wide; disc different . . . . . 5

- 4(3) Ascospores  $6.7-8.4(-10) \times 3.1-3.6 \mu\text{m}$ ; thallus and apothecia margin yellow (usnic acid as major substance); disc yellowish beige or grey, becoming dark olive brown,  $\pm$  slightly white or bluish pruinose . . . . . **L. subintricata**  
 Ascospores  $6-8(-8.5) \times 2.5-3.5 \mu\text{m}$ ; thallus and apothecia margin greyish (isousnic acid as a major substance); apothecia becoming biatorine; disc bluish pruinose . . . . . **L. coppinsii**
- 5(3) Ascospores  $8.4-9.6 \times 5-5.7 \mu\text{m}$ ; granules of isousnic present in epihymenium; habitus resembles *L. hagenii* . . . . . **L. calabrica**  
 Ascospores  $<5 \mu\text{m}$  wide; granules of isousnic acid  $\pm$  present in epihymenium; habitus not resembling *L. hagenii* . . . . . 6
- 6(5) Thallus KC+ yellow (pseudoplacodiolic acid); apothecia mostly plane, whitish pruinose, except in (over)mature apothecia . . . . . **L. sarcopoidoides**  
 Thallus KC-; apothecia often becoming convex; disc not or usually slightly pruinose . . . . . 7
- 7(6) Thallus warted, thick, to  $0.35 \text{ mm}$ ; apothecia without yellowish tinge; disc reddish brown to dark brown, becoming blackish, epruinose; ascospores simple to rarely 1-septate; thallus and apothecia with minute oil droplets (paraensic C and D acids) . . . . . **L. hypoptoides**  
 Thallus thinner; apothecia with a pale yellowish margin; disc pale yellowish, yellowish brown to medium brown or a mixture of pale yellowish and more darker,  $\pm$  pruinose . . . . . 8
- 8(7) Macroconidia abundantly present, non-septate, curved  $>6 \mu\text{m}$  long and  $>1.5 \mu\text{m}$  wide; margin of apothecia often persistent; epihymenium yellow-brown to olive brownish, N- . . . . . 9  
 Macroconidia different, usually present but not easily found, or mesoconidia present; margin of apothecia often excluded; epihymenium brownish, N+ reddish violet . . . . . 10
- 9(8) Macroconidia  $6.0-8.1 \times 2.0-2.4 \mu\text{m}$ ; lignicolous or corticolous . . . . . **L. saligna**  
 Macroconidia  $8.5-9.5 \times 2.7-3.0 \mu\text{m}$ ; corticolous or on decorticated trunks . . . . . **L. quercicola**
- 10(8) Apothecia finally with a disc-coloured margin, pale to dark brown, becoming convex,  $\pm$  biatorine; ascospores  $8.6-11.3 \times 3.4-4.7 \mu\text{m}$ ; macroconidia not known; mesoconidia not rare, straight or very slightly curved,  $4.4-6.3 \times 1.4-2.2 \mu\text{m}$  . . . . . **L. pseudosarcopoidoides**  
 Apothecia with a thallus-coloured margin; ascospores usually less wide; macroconidia septate, strongly curved; mesoconidia absent or  $2.9-5.1 \times 1.6-2.1 \mu\text{m}$  . . . . . 11
- 11(10) Macroconidia 1-septate, rarely a few 3-septate,  $(19- )22-27(-30) \mu\text{m}$  long, tips attenuated . . . . . **L. subsaligna**  
 Macroconidia mainly 1-3-septate,  $7-14 \mu\text{m}$  long, tips obtuse . . . . . 12
- 12(11) Macroconidia  $12.4-14 \times 1.8-2.3 \mu\text{m}$ , 1-3-septate; lignicolous and on *Pinus* or *Populus* bark . . . . . **L. albellula var. macroconidiata**  
 Macroconidia  $7-10.5 \times 1.8-2.1 \mu\text{m}$ , 1(-3)-septate; on bark of trunks and branches of various trees, decorticated trunks or rarely on wood of fence posts . . . . . **L. albellula**

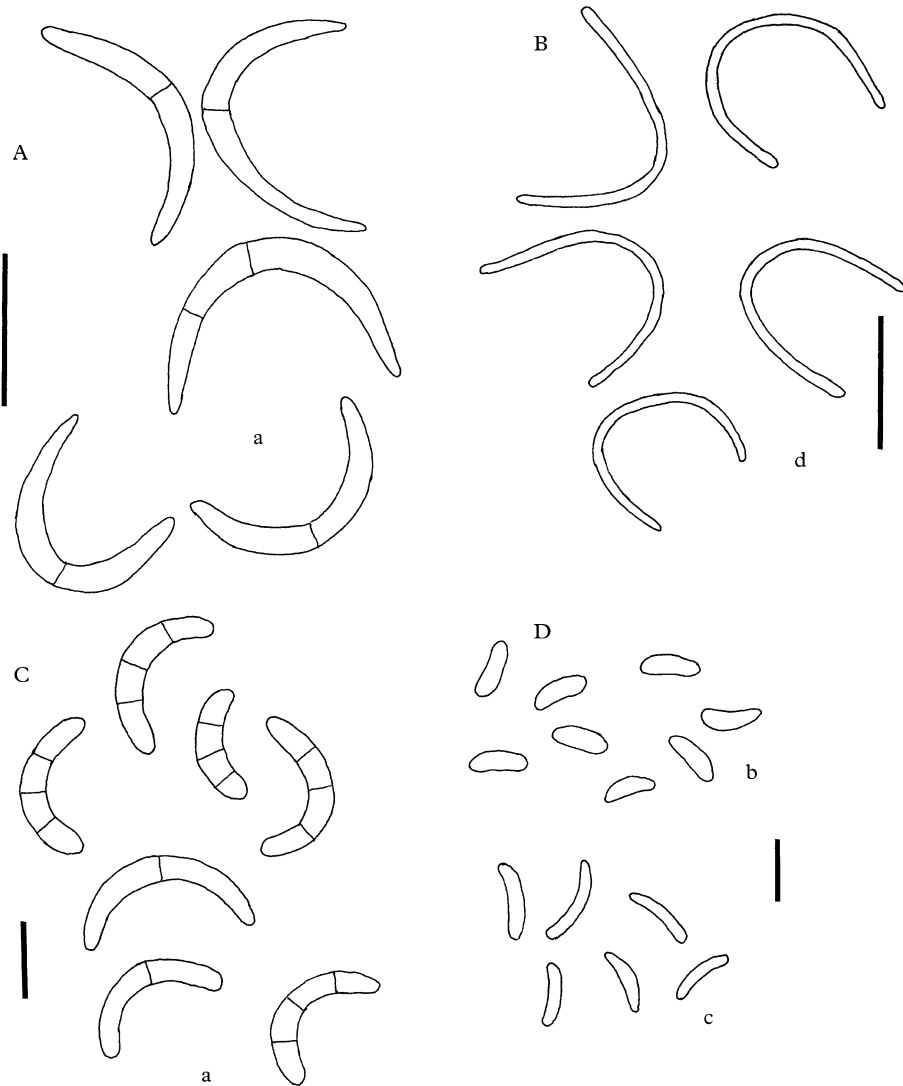


FIG. 1. *Lecanora saligna* group, conidia. A, *L. subsaligna*; B, *L. calabrica*; C, *L. albellula* var. *macroconidiata*; D, *L. pseudosarcopidoides*. a=macroconidia; b=mesoconidia; c=microconidia; d=leptoconidia. Scales: A & B=10 µm; C & D=5 µm.

### The New Taxa

#### *Lecanora albellula* Nyl. var. *macroconidiata* M. Brand & van den Boom var. nov.

Varietas lignicola, *Lecanorae albellulae* similis sed thallo verrucoso et verrucis ad 0.15(–0.2) mm crassis, ascosporis 9–11.5(–13) × 3.4–3.7(–4) µm, macropycnidiis frequentibus; macroconidia 12.4–14.0 × 1.8–2.3 µm,

valde curvata (c. 45–90°), paulo attenuata vel apicibus obtusatis, 1–3-septata; microconidia rara, 9.6–12.3 × 1.0–1.1 µm, valde curvata; leptoconidia rara, c. 14 × 0.8 µm; thallus acidum isousnicum et ± 7-O-methylnorascomaticum continens.

Typus: France, Jura, 10 km S of Champagnole, 1 km NE of Chaux Crotenay on fence post along meadow, 680 m, 25 July 1986, M. Brand 14651 (LG—holotypus; hb. Brand—isotypus).

(Figs 1C & 2)

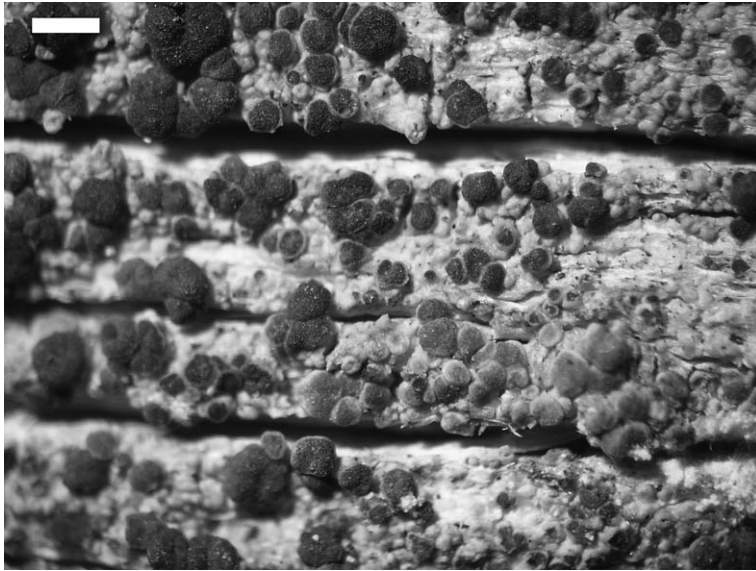


FIG. 2. *Lecanora albellula* var. *macroconidiata*, habitus (holotype). Scale: 0.5 mm.

*Thallus* corticolous or lignicolous, effuse, up to 2 cm wide, often aggregating in patches, consisting of warted to sublobulate particles, warts subglobose and 0.15–0.25 mm diam., scattered to mostly crowded, to 0.15(–0.2)  $\mu\text{m}$  thick; without cortex, with a hyaline epinecral layer, 5–15  $\mu\text{m}$  tall; in section with minute granules scattered all over the thallus, without medulla, algal layer not separated; upper surface pale brown or yellowish brown to medium brown, shiny. *Photobiont* cells  $\pm$  globose, 6–15  $\mu\text{m}$  diam. *Prothallus* not observed.

*Apothecia* abundant, scattered to crowded and overlapping, sessile, rounded, 0.2–0.6 mm diam.; margin prominent, initially raised, especially in young apothecia, becoming level with the disc and excluded in mature apothecia, entire, concolorous with thallus, 0.03–0.07 mm wide; disc plane, becoming moderately or strongly convex, pale or reddish brown, dark greyish brown to blackish, slightly pruinose or epruinose, often with a mixture of pale with darker brownish discs. *Thalline excipulum* with cortex, chondroid, 20–35  $\mu\text{m}$  wide at base, sometimes reduced. *Parathecium* hyaline at

inner part, brownish at outer rim and to 35  $\mu\text{m}$  wide. *Epihymenium* hyaline to spotted greyish brown, with minute granules, N+ reddish violet. *Hymenium* hyaline, with a few orange granules, 35–65  $\mu\text{m}$ . *Hypothecium* hyaline, to 120  $\mu\text{m}$  high. *Paraphyses* mostly branched to anastomosing, septate, sometimes slightly constricted at septa, 1.5–2 (–2.5)  $\mu\text{m}$  wide in the middle, top sometimes slightly widened up to 3.5(–5)  $\mu\text{m}$  wide, hyaline to greyish olive-brown in a weakly developed gel matrix. *Ascospores* ellipsoid, simple, overmature spores sometimes 1-septate, 9–11.5(–13)  $\times$  3.4–3.7(–4)  $\mu\text{m}$ .

*Macropycnidia* often present, sessile or somewhat stalked, pale to dark brown in the upper part, 150–190  $\times$  100–140  $\mu\text{m}$ . *Macroconidia* curved, with obtuse, not or slightly attenuate apices (allantoid), (0–)1–3-septate, 12.4–14.0  $\times$  1.8–2.3  $\mu\text{m}$ . *Microspycnidia* rarely found, immersed, c. 50  $\mu\text{m}$  diam. *Microconidia* rather strongly curved, 9.6–12.3  $\times$  1.0–1.1  $\mu\text{m}$ . *Leptopycnidia* rarely found, immersed, c. 50  $\mu\text{m}$  diam. *Leptoconidia* c. 14  $\times$  0.8  $\mu\text{m}$ .

*Chemistry*. K–, C–, KC–, Pd–. Isosuccinic acid (major), 7-O-methylnorascomatic



acid (major). This latter compound was detected in most specimens recorded here (TLC & HPLC).

**Ecology and distribution.** *Lecanora albellula* var. *macroconidiata* is known from bark of *Pinus* and *Populus tremula*, and on wooden fence posts. The holotype, collected from a wooden fence post, is accompanied only by fragments of *Parmelia* cf. *sulcata*. The other specimens are accompanied by *Lecanora symmicta* and also sometimes by some poorly developed lichen material, belonging in *Buellia* and *Rinodina*. The new variety is known so far only from western Europe, where it seems to be rare and confined to lowland areas, apart from the most southern record from 1600 m.

**Notes.** This variety is easily mistaken for *Lecanora albellula* s. str., but differs by its more warted, thicker and shiny, sometimes sublobulate thallus with more convex (sub-globose) apothecia and with macropycnidia, and even macroconidia, which are larger and more often 3-septate. In addition, the microconidia are longer than those in *L. albellula*. The chemistry also differs, as it contains 7-*O*-methylnorascomatic acid (major), a chemical compound which has been recently recognized only in the *Lecanora saligna* group (van den Boom 2007). It has also been detected in *L. subsaligna* and *L. albellula* s. str., but only in small amounts. The mixture of yellow and brown apothecial discs, representing all states of development, is typical of this new variety. This same characteristic has sometimes been recorded, probably from misidentified material, for *L. albellula*. Comparison of the two varieties suggests that *L. albellula* var. *macroconidiata* should perhaps have the status of species. However, of the few collections available, only two are well developed. More knowledge of its variability and ecology, as well as molecular data, are needed to determine its taxonomic status.

**Additional specimens examined.** **The Netherlands:** Friesland: Ameland, Lange Duinen, binnenduin, 5°39.3'E, 53°27.4'N, *Populus tremula* woodland in dune area, 1989, *M. Brand* 21079 (hb. Brand).

**Gelderland:** Nijkerkerveen, 5°30.1'E, 52°11.6'N, dead *Pinus* trunk in heathland, 1974, *M. Brand* 4070 (hb. Brand).—**Sweden:** Norrbotten: 95 km NNE of Umeå, 50 m, on *Salix*, 1988, *P. van den Boom* 8025 (hb. v.d. Boom).—**France:** Yonne: N of Pontigny, N of Auxerre, 3°41'E, 47°55'N, 200 m, on wood of pole of fence, 1976, *M. Brand* 6602 (hb. Brand).—**Spain:** Teruel: Javalambre, 7 km NNE of top, 1°0.8'W, 40°9.85'N, 1600 m, *Pinus halepensis*, open *Pinus* wood, wood of dead branches, 2005, *M. Brand* 52019 (hb. Brand).

**Exsiccata examined:** Crombie, *Lich. Brit. exs.* 160 (B). [as *Lecanora piniperda*: ad ligna vetusta fabrefacta Mill Hill in Angliae Middlesex].

### ***Lecanora calabrica* M. Brand & van den Boom sp. nov.**

Species lignicola vel corticola, habitu *Lecanorae hageni* similis, sed thallo laeve, nonnumquam rimuloso, ad 120 µm crasso, ascospores late ellipsoideae, 8.4–9.6 × 5.0–5.7 µm, simples; leptopycnidia frequentes; leptocnidia filiformia, curvata, 22–27 × 0.6–0.9 µm; thallus et apothecium acidum isousnicum continent.

Typus: Italy, Calabria, Sila Grande, Lago Arvo, 1 km NE of Barachella, 16°29'E, 39°14'N, 1200 m, on *Robinia* along road near bridge over a small stream, 14 May 2001, *M. Brand* 42986 (LG—holotypus; hb. Brand—isotypus).

(Figs 1B & 3)

**Thallus** in rather small patches, up to c. 1.5 cm, sometimes weakly rimose, up to 120 µm thick, composed of loose hyphae, without a clear cortex, sometimes containing granules; upper surface rather smooth, whitish. **Photobiont** chlorococcoid, cells c. 11–14 µm diam., rather thick walled, with only a few haustoria. **Prothallus** often present, bluish grey.

**Apothecia** broadly appressed, c. 0.5–0.6 µm wide; margin thin (0.05–0.09 mm wide), persistent, pale greyish; medulla filled with algae, with rather large granules at the outer edge; disc plane to slightly convex, beige or pale to dark brown. **Thalline excipulum** cortex clearly present, 25–55 µm thick at the base, hyaline, chondroid, consisting of anticlinal or branched hyphae to 6 µm thick, lumina 1 µm wide; granules present at the top of the excipulum and more or less in epipsamma, stout, for example 2.5–3 µm wide. **Parathecium** hyaline at inner part, dark brown outer rim and to 35 µm wide. **Epithemium** hyaline to slightly brownish, N+

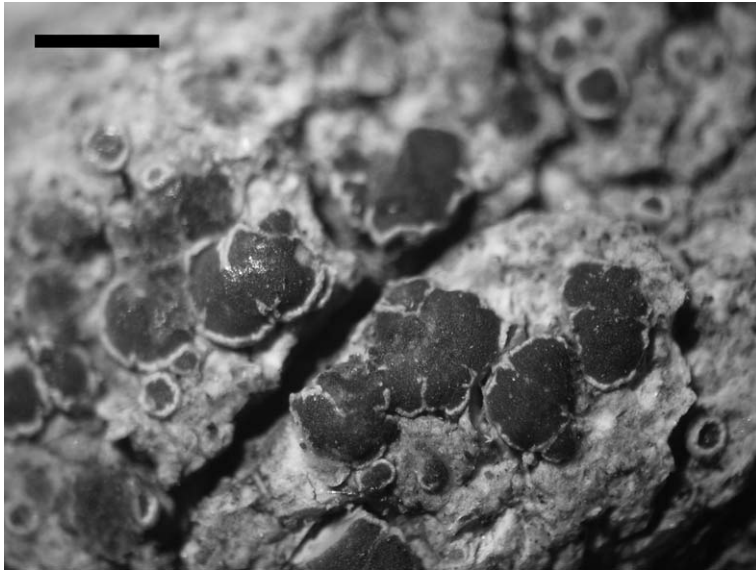


FIG. 3. *Lecanora calabrica*, habitus (holotype). Scale: 0.5 mm.

reddish violet. *Hymenium* hyaline, *c.* 45–70  $\mu\text{m}$ . *Hypothecium* hyaline, to 120  $\mu\text{m}$  high. *Paraphyses* simple, conglutinated, to 2.7  $\mu\text{m}$  wide, top not or slightly widened, often pale brownish. *Asci* *c.* 35  $\times$  12  $\mu\text{m}$ ; tholus amyloid with a broad axial mass. *Ascospores* broadly ellipsoid, simple, wall rather thick, 0.4–0.5  $\mu\text{m}$ , 8.4–9.6  $\times$  5.0–5.7  $\mu\text{m}$ .

*Leptopycnidia* often present, immersed, to *c.* 150  $\mu\text{m}$  diam., apices pale brown or hyaline: *leptoconidia* thin and relatively long, curved, 22–27  $\times$  0.6–0.9  $\mu\text{m}$ .

*Chemistry.* K–, C–, KC–, P–. Isousnic acid (TLC).

*Ecology and distribution.* *Lecanora calabrica* occurs mostly on smooth bark of *Abies*, *Castanea*, *Corylus*, *Fagus*, *Juglans*, *Populus*, *Robinia* and *Salix* in mountain areas in southern Italy (Abruzzi and Vesuvius to Calabria) where it appears not to be rare. It occurs, for example, with *Caloplaca cerina*, *Lecanora carpinea*, *Lecidella elaeochroma*, *Rinodina capensis*, etc. Elsewhere it is known only from Croatia (Velebit).

*Notes.* In the field, *Lecanora calabrica* is very easily confused with *L. hagenii*, but

differs in its chemistry and by its wider, sometimes nearly globose ascospores. Both species have a similar ecology. Other species in the *L. saligna* group which also possess isousnic acid, have usually paler apothecia, a more yellowish appearance and smaller ascospores, except *L. subravida*, which has larger ascospores, 10.5–11  $\times$  5–6(–6.2)  $\mu\text{m}$ , and also a more prominent apothecial margin.

*Additional specimens examined. Italy: Lazio:* pr. Frosinone, W of Roccasecca, NE of Colle S. Magno, 13°42.7'E, 41°33.2'N, 750 m, *Juglans* in meadow in mountain valley, thinner branches, 2001, *M. Brand* 42636 (hb. Brand). *Abruzzo:* shore of Fiume Sangro, SW of Villetta Barrea, 13°54.9'E, 41°46.3'N, 1000 m, *Corylus* in wood, 2001, *M. Brand* 43553 (hb. Brand). *Calabria:* Sila Grande, Botte Donata, *c.* 0.5 km SW of top, 16°26.7'E, 39°16.7'N, 1880 m, on *Fagus* in wood on flat top of mountain, 2001, *M. Brand* 42947 (hb. Brand); Sila Greca, M. Altare (col in road Longobucco–Lago di Cecita), 16°33.3'E, 39°25.2'N, 1500 m, *Fagus* in wood on top of mountain ridge, 2001, *M. Brand* 42931 (hb. Brand); 18 km ENE of Catanzaro, along road from Cropani to Botricello, 200 m, on *Juglans* along meadow and road, 1986, *P. van den Boom* 4974 (hb. v.d. Boom); Aspromonte, 2 km S of S. Eufemia, road to Villaggio de Leo, edge of plateau, 15°51.4'E, 38°14.8'N, 950 m, old *Castanea*, in open field, 2001, *M. Brand* 43105 (hb. Brand); Aspromonte, 7.5 km SE Gambari, Diga Menta, valley below new constructed dam, 15° 53.9'E, 38°7.4'N, 1600 m, on

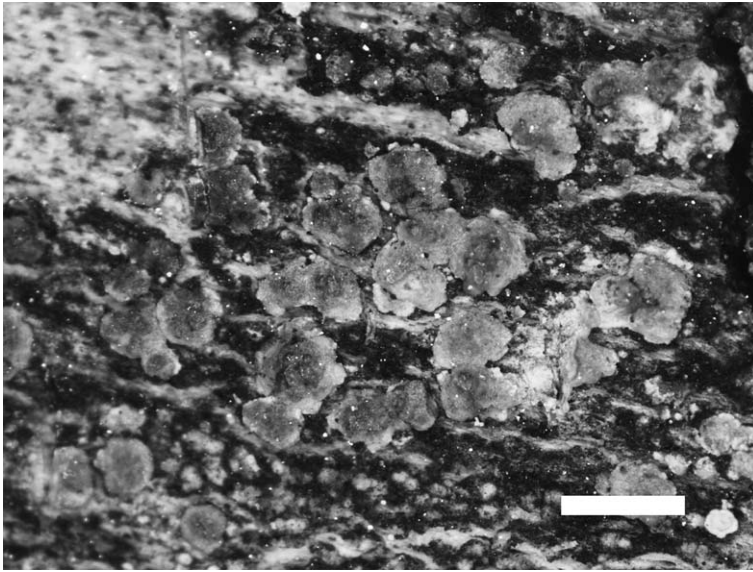


FIG. 4. *Lecanora coppinsii*, habitus (holotype). Scale: 0.5 mm.

*Abies* in forest in cleft, 2001, *M. Brand* 43262 (hb. Brand); Aspromonte, c. 3 km S of Gambari, 15°51'E, 38°8'N, 1600 m, *Salix* shrub near brook in valley with *Abieto-Fagetum*, 2001, *M. Brand* 43146 (hb. Brand). *Campania*: Napoli, Vesuvio, 0.6 km N of top, 14°25.5'E, 40°49.6'N, 1100 m, *Populus*, isolated, small trees on N slope, on bare slope of lapilli, 2001, *M. Brand* 42711 (hb. Brand).—**Croatia**: *Velebit*: 21 km S of Senj, 1 km N of Vucjak, 14°58.5'E, 44°49.1'N, 1450 m, on *Fagus* in *Fagus* forest, 1987, *M. Brand* 16660 (hb. Brand).

### *Lecanora coppinsii* M. Brand & van den Boom sp. nov.

Species lignicola, *Lecanorae abellulae* similis, sed differt thallo endoxylico ad epixylico, paulo rimoso areolato, interdum laeve, ad 100  $\mu$ m crasso, ascosporis 6.0–8.0 (–8.5)  $\times$  2.5–3.5  $\mu$ m, ellipsoideis, simplicibus; mesoconidia 2.8–3.3  $\times$  1.1–1.2  $\mu$ m parva, ellipsoidea vel bacilliformia, vel  $\pm$  curvata; microconidia simplicia, 4.5–5.5  $\times$  0.8–0.9  $\mu$ m, bacilliformia vel curvata; thallus acidum isousnicum continens.

Typus: Great Britain, Scotland, V.C. 82 East Lothian, Lammermuir Hills, Monynut Forest, 36/689.671, on lignum of conifer branch by forest path, alt. 340 m, 31 October 1999, *B. J. Coppins* 18567 (E—holotypus; hb. v.d. Boom—isotypus).

(Figs 4 & 5)

*Thallus* endoxylic to epixylic, very thin, sometimes slightly rimose areolate, uneven

to sometimes contiguous, patches up to 4 cm wide, up to 100  $\mu$ m thick, but mostly found in the substratum, without cortex, granules <3  $\mu$ m wide, present and scattered throughout the thallus, algal cells scattered over the thallus; upper surface smooth, grey, yellowish grey, or pale to dark brownish grey. *Photobiont* chlorococcoid, cells c. 9–18 (–20)  $\mu$ m.

*Apothecia* c. 0.4–0.8 mm wide, closely appressed to broadly sessile and slightly constricted at the base, sometimes innate in the substrata, irregular in appearance, rounded to oval; margin at first prominent, 0.02–0.05 mm wide, initially raised, becoming level with the disc, concolorous with the thallus or paler, becoming darker and concolorous with the disc, mainly crenulate, evanescent and apothecia finally biatorine; disc at first flat, later convex to sometimes nearly subglobose, pale pinkish brown to pale orange, cream, yellowish brown, pale to intensively grey-brown to bluish brown or greyish, grey to bluish pruinose. *Thalline excipulum* with a weakly developed cortex, first thin but mostly becoming thicker (20–50  $\mu$ m), finally evanescent, algae present from the outermost part to inner part reaching the hypothecium. *Parathecium*





FIG. 5. *Lecanora coppinsii*, conidia. a=macroconidia; b=microconidia. Scales: a=1  $\mu\text{m}$ ; b=2  $\mu\text{m}$ .

not developed. *Hymenium* with polarized, orange-brown scattered to clustered granules, 25–50  $\mu\text{m}$  high. *Epithymenium* yellowish to greyish brown with olive parts (spotted), filled with many coarse, yellowish granules, N–. *Hypothecium* hyaline to pale yellowish, 40–60  $\mu\text{m}$  high. *Paraphyses* immersed within a gelatinous matrix of the hymenium, simple to more often strongly branched, septa difficult to observe, 1–1.5(–2)  $\mu\text{m}$  diam., top not widened, hyaline to sometimes weakly more or less brown to olive greyish pigmented. *Asci* clavate, *Lecanora*-type, 25–30  $\times$  (7–)8–10(–11)  $\mu\text{m}$ . *Ascospores* c. 6.0–8.0(–8.5)  $\times$  2.5–3.5  $\mu\text{m}$ , ellipsoid, simple.

*Microperycnidia* immersed to semi-immersed, often on apothecia (margin or hymenium), 60  $\mu\text{m}$  high  $\times$  50–70  $\mu\text{m}$  wide, ostiole moderately to dark brown with greenish tinge; *microconidia* bacilliform to slightly curved, 4.5–5.5  $\times$  0.8–0.9  $\mu\text{m}$ . *Mesoperycnidia* (not rarely present) immersed, 65–100  $\mu\text{m}$   $\times$  50–100  $\mu\text{m}$ , top brownish pigmented, or bluish green to blackish, *mesoconidia* short bacilliform to weakly curved, 2.8–3.3  $\times$  1.1–1.2  $\mu\text{m}$ .

*Chemistry*. K $\pm$  yellow, C–, KC–, P–. Isousnic acid (major) (TLC).

*Ecology and distribution*. *Lecanora coppinsii* has been found on wood, usually on rotting trunks of conifers, at altitudes of 100–380 m, in poorly developed lichen communities. In all the collections studied, *Lecanora conizaeoides* has been found, sometimes accompanied by *Hypocenomyce scalaris*, *Hypogymnia physodes*, *Mycoblastus fucatus* and *Parmelia sulcata*. All this material is in poor condition.

*Notes*. The known distribution of *L. coppinsii* is limited to a rather small area in southern Scotland, but it is probably an overlooked species. We found no reference to this species, either in the literature or among herbarium specimens. All the specimens studied were labelled as *Lecanora piniperda* (= *L. albellula*). Although the latter species is rather similar (it can have a similar chemistry with isousnic acid as major substance), it has longer and wider ascospores, a better developed apothecial margin, larger mesoconidia (see Table 1), is not found exclusively on wood and is distributed from lowland to alpine areas. *Lecanora coppinsii* can be confused with a *Lecanora saligna* in poor condition which is also found in lowland areas. *Lecanora saligna*, however, has larger ascospores, apothecia with a more

TABLE 1. Comparison of chemistry, ascospores and conidia of the species studied in the *Lecanora saligna* group

Species	Chemistry*	ascospores	macroconidia	microconidia	mesoconidia	leptoconidia
<i>L. albellula</i> s.str.	iu	8.5–11.5 × 3.1–4.2	7–10.5 × 1.8–2.2	5.6–9.8 × 0.9–1.3	2.9–5.1 × 1.6–2.1	10–15 × 0.7–1
<i>L. a</i> v. <i>macroconidiata</i>	im	9–11.5 × 3.4–3.7	12.4–14 × 1.8–2.3	9.6–12.3 × 1–1.1		14 × 0.8
<i>L. calabrica</i>	i	8.4–9.6 × 5–5.7				22–27 × 0.6–0.9
<i>L. coppinsii</i>	i	6.0–8.5 × 2.5–3.5		4.5–5.5 × 0.8–0.9	2.8–3.3 × 1.1–1.2	
<i>L. hypoptoides</i>	pa	9.6–13.3 × 3.1–4		4.8–5.7 × 0.9–1.1	2.7–3.9 × 1.4–1.8	
<i>L. mughicola</i>	i	11–13.8 × 4.4–5.2		8–9 × 0.8		13–16 × 0.8–1
<i>L. pseudosarcopidoides</i>	i	8.6–11.3 × 3.4–4.7		5.3–7.4 × 1–1.3	4.4–6.3 × 1.4–2.2	10.5–16.8 × 0.7–0.9
<i>L. quercicola</i>	in	8.6–10 × 4.3–4.8	8.5–9.3 × 2.7–3	10–11 × 1.1		
<i>L. saligna</i>	ainz	8–10 × 4.1–4.8	6–8.1 × 2.0–2.4	8.4–10.5 × 0.9–1.2	3–5 × 1.1–1.5	
<i>L. sarcopidoides</i>	ppcu	8–10 × 3.3–3.7		4–5.7 × 1–1.2	2.7–3.7 × 1.3–1.7	19–21 × 0.7
<i>L. subintricata</i>	ub	6.7–8.4 × 3.1–3.6		4.8–6.2 × 1–1.3	2.8–3.4 × 1.4–1.6	
<i>L. subravida</i>	ipsu	9.4–10.9 × 5–6	12.5–13 × 2.8–3	7–8 × 0.8		10.8–11 × 0.8–0.9
<i>L. subsaligna</i>	im	8.4–11.5 × 3.3–4	22–27 × 1.7–2	8–10 × 0.9–1		13–22 × 0.8–0.9

\*a-atranorin; b-brialmontin 1; i-isousnic acid; m-7-O-methylnorascomatic acid; n-neousnic; p-pseudoplacodiolic acid; pa-paraensic; pc-placodiolic acid; s-squamatic acid; u-usnic acid; z-zeorin. All measurements in  $\mu\text{m}$ .



FIG. 6. *Lecanora pseudosarcopoidoides*, habitus (holotype). Scale: 0.5 mm.

prominent margin and a dark red-brown, rarely pale white yellowish pruinose disc (bluish pruinose in *L. coppinsii*). Macroperycnidia are abundant in *L. saligna* and unknown in *L. coppinsii*. Even *L. pseudosarcopoidoides* may be confused with *L. coppinsii*, but in the former, the apothecia are paler and become subglobose, the mesoconidia and ascospores are larger and it has a preference for more rotten wood. The only two species of the *L. saligna* group with similar small ascospores are *L. subintricata* and *L. latens*. However, these two species possess usnic acid as a major compound and the ascospores in *L. subintricata* are in general somewhat wider. *Lecanora latens* is also further distinguished by a shallower hymenium and is so far known only from California. Most of the collections of *L. coppinsii* are infected by an unknown hyphomycete and one specimen with an unknown *Psammia* sp. with non palmate and non-septate branches.

*Additional specimens examined.* **Great Britain:** Scotland: V.C. 78, Peebles: Glentress Forest, 36/28.41, on old conifer stumps among replanted plantation, 300 m, 1993, B. J. Coppins 16378 (E). V.C. 85, Fife: East Lomond, 37/20, on hillside on rotting log, 16 v

1970, U. Duncan s.n. (E); *ibid.*, on fir fence post on moor, 37/239059, 380 m, 16 v 1970, P. Topham s.n. (E). V.C. 90, Angus: Glenprosen, Balnabooth, West Burn, 37/3167, on rotting conifer log by stream, 1 xii 1967, U. Duncan s.n. (E); Sidlaws, near summit of Auchterhouse Hill, on rotting conifer log, iii 1975, U. Duncan s.n. (E). V.C. 104, North Ebuades: Eigg, Sandavore, on wooden post of old sheep pens, 100 m, 2000, B. J. & A. M. Coppins 19146 (E).

### ***Lecanora pseudosarcopoidoides* M. Brand & van den Boom sp. nov.**

Species lignicola, *Lecanorae salignae* similis, differt thallo endoxylico ad epixylico, tenuissimo, nonnumquam paulo rimoso areolato, laeve vel irregulariter verrucoso, ad 130  $\mu\text{m}$  crasso, ascosporis  $8.6\text{--}11.3 \times 3.4\text{--}4.7 \mu\text{m}$ , ellipsoideis, simplicibus, rariter 1-septatis; conidiarum typi tres, frequentiores; mesoconidia  $4.4\text{--}6.3 \times 1.4\text{--}2.2 \mu\text{m}$  parva, ellipsoidea vel bacilliformia vel curvata; microconidia simplicia ad nonnumquam 1-septata,  $5.3\text{--}7.4 \times 1.0\text{--}1.3 \mu\text{m}$ , semper paulo curvata; leptoconidia curvata,  $10.5\text{--}16.8 \times 0.7\text{--}0.9 \mu\text{m}$ ; thallus acidum isousnicum continens.

Typus: Italy, Trentino-Alto Adige, Bolzano, 54 km WSW of Merano, NP Stilfser Joch, road Prad-Stilfserjoch, SW of Trafoi, SE slope with *Picea* forest and outcrops, 1850 m, on *Pinus* stump, 14 August 1990, P. van den Boom 10793 (B—holotypus; hb. v.d. Boom—isotypus).

(Figs 1D & 6)

*Thallus* endoxylic to epixylic, very thin, sometimes slightly rimose areolate, uneven to sometimes slightly warted, warts often scattered, sometimes contiguous, patches up to 4 cm wide, up to 130  $\mu\text{m}$  thick; without cortex, granules present only in the upper layer of the thallus; upper surface grey, yellowish grey, or pale to brownish grey, smooth. *Photobiont* chlorococcoid, algal cells scattered over the thallus. *Prothallus* not observed.

*Apothecia* appressed, broadly sessile, becoming subglobose, *c.* 0.4–0.9 mm diam.; margin at first strongly prominent, 0.04–0.07 mm wide, concolorous with thallus or paler, becoming darker and concolorous with the disc, smooth, evanescent, apothecia finally biatorine; disc at first flat, later convex, pale pinkish to pale orange, pale to intensively red-brown to dark brown or greyish, epruinose to slightly white or bluish pruinose. *Thalline excipulum* with cortex, variable in development, at first thin but becoming thick (20–35  $\mu\text{m}$ ), chondroid, algae present in outermost parts, finally algae only present at base of excipulum and up to *c.* 13  $\times$  16  $\mu\text{m}$  diam.; I  $\pm$  blue to violet. *Parathecium* slightly widened at the outer part, closely connected to the cortex, to 30  $\mu\text{m}$  wide at the outer rim. *Epihymenium* yellowish, yellowish brown, to medium greyish brown, with many coarse, yellowish granules, N+ reddish violet. *Hymenium* hyaline, with orange-brown granules, 40–50  $\mu\text{m}$  high. *Hypothecium* hyaline to pale yellowish, 60–90  $\mu\text{m}$  high. *Paraphyses* simple, branched or more rarely anastomosing,  $\pm$  septate, rarely constricted at the septum, 1.5–2  $\mu\text{m}$  diam., apices not or slightly widened to 3.5  $\mu\text{m}$ , hyaline to sometimes more or less brown to olive greyish pigmented. *Ascospores* ellipsoid, simple, rarely 1-septate, *c.* 8.6–11.3  $\times$  3.4–4.7  $\mu\text{m}$ .

*Micropycnidia* not rare, immersed, greenish brown at upper part, hyaline below, *c.* 40–50  $\mu\text{m}$  diam.; *microconidia*  $\pm$  allantoid, simple to sometimes 1-septate, always weakly curved, 5.3–7.4  $\times$  1.0–1.3  $\mu\text{m}$  diam. *Mesopycnidia* not rare, immersed, upper part pale to brown or dark blackish olive, (80–) 100–180  $\times$  90–150  $\mu\text{m}$ ; *mesoconidia* bacilliform to weakly curved, 4.4–6.3  $\times$  1.4–

2.2  $\mu\text{m}$ . *Leptopycnidia* rather rare, immersed to semi-immersed, often on the margin or hymenium of apothecia, upper part hyaline, brown or greenish blue-black, 80–100  $\times$  80  $\mu\text{m}$ ; *leptoconidia* curved, *c.* 10–17  $\times$  0.7–0.9  $\mu\text{m}$  diam.

*Chemistry.* K–, C–, KC–, P–. Isosuccinic acid (major) (TLC).

*Ecology and distribution.* *Lecanora pseudosarcopidoides* has been found on wood, mostly on the rotting trunks of conifers (*Larix*, *Pinus cembra*) mainly in the subalpine zone, at (800–)1400–2200 m, in poorly developed lichen communities, but nearly always associated with *Parmeliopsis ambigua*.

*Notes.* This new species is not rare in central Europe and has most probably been much overlooked because we did not find any reference to it in the literature or on herbarium specimens. It can easily be confused with *L. saligna* in poor condition, but *L. saligna* has different conidia (see Table 1), darker, reddish brown apothecia, with a more prominent margin and is distributed mainly in lowland areas. It is also very similar to poorly developed *L. sarcopidoides*, but the latter has a different chemistry, shorter and smaller ascospores, a better developed apothecial margin, smaller mesoconidia and is distributed in both lowland and montane areas. *Lecanora pseudosarcopidoides* is easily mistaken for a poorly developed *L. albellula* which has similar apothecia and pruina colour, but the thallus in the new species is much thinner and mostly endoxylic and never corticolous as are most specimens of *L. albellula*. Furthermore, macroconidia have never been found in *L. pseudosarcopidoides* whereas in *L. albellula* they are conspicuous, 1-septate and curved; the mesoconidia are larger in the former. The new species differs from *L. mughicola* by its paler apothecia with a much thinner pale yellowish margin becoming subglobose and subbiatorine, the presence of mesoconidia, a less well-developed thallus, shorter ascospores and a preference for more rotten wood. The I+ blue reaction of the excipulum



has been found in one specimen only (*P. v. d. Boom* 13464). Several specimens of this species have been found labelled as *L. subintricata*. However *L. subintricata* has usnic acid as a major compound and also has much smaller ascospores. Two collections, *M. Brand* 24827 and *P. v.d. Boom* 9847, are strongly infected by *Lichenodiplis lecanorae* (Vouaux) Dyko & D. Hawksw.

*Selected specimens examined.* **France:** *Puy de Dome:* Mts du Forez, E of Col de Chamboite, 3°48'E, 45°40'N, 1480 m, branches of *Fagus*, 'Krumholz', rel.1208, 1976, *M. Brand* 6510 (hb. Brand). *Savoie:* 3.5 km NE of Col du Galibier, Valloirette S of Plan Lachat, 6°26.4'E, 45°5.1'N, 2000 m, *Rhododendron ferrugineum*, near brook in open valley, 2002, *M. Brand* 45506 (hb. Brand). *Alpes Maritimes:* 1.6 km ESE of Col de Cayolle, 6°45.9'E, 44°15.0'N, 2000 m, *Larix* in open wood near tree line, 2002, *M. Brand* 45332 (hb. Brand). *Alpes-de-Haute-Provence:* 3.7 km NNW of Col de la Bonette, near Torr. de Clapouse, 6°47.1'E, 44°21.3'N, 2100 m, sandstone boulders at shore of brook, 2002, *M. Brand* 45069 (hb. Brand). *Savoie:* c. 66 km S of Mt Blanc, 1.5 km SW of Bessans, 6°59'E, 45°18'N, 1760 m, on *Larix* in open wood at foot of rock face, 1984, *M. Brand* 11726 (hb. Brand). *Hautes Alpes:* c. 27 km SE of Briançon, near Fontgillarde, 6°52'E, 44°43'N, 1970 m, on decorticated wood of *Larix* in open wood on N-slope, 1984, *M. Brand* 11674 (hb. Brand). *Pyrénées Atlantiques:* 46 km SW of Pau, 4.2 km ENE of St. Engrâce, Col de St. Gracie, Serre de Benou, gently sloping *Fagus* forest along road, on decorticated rotting trunk (1 m tall), 3°26.7'W, 47°47.2'N, 1350 m, 1992, *P. van den Boom* 13464 (hb. v.d. Boom).—**Switzerland:** *Valais:* val d'Hérens, 2.6 km SSW of Haudères, 7°29.7'E, 46°3.8'N, 1700 m, wood of tree trunk washed ashore along mountain stream in narrow valley, 1990, *M. Brand* 24918 (hb. Brand); 0.4 km SW of Evolène, 7°29.5'E, 46°6.6'N, 1380 m, wood of hay-shed in meadow, 1990, *M. Brand* 24566 (hb. Brand); 1.2 km S of Evolène, 7°29.5'E, 46°6.7'N, 1680 m, in forest, wood of trunk of *Larix*, 1990, *M. Brand* 24827 (hb. Brand); 1.4 km S of Evolène, 7°29.5'E, 46°6.0'N, 1760 m, dead trunk in *Larix* forest, 1993, *M. Brand* 29705b (hb. Brand); 0.7 km N of Arolla, 7°27.3'E, 46°1.7'N, 2120 m, decayed wood of dead log in open *Larix-Pinus cembra* wood on E slope, 1990, *M. Brand* 24876b (hb. Brand); E of Evolène, E facing exposed meadow with calcareous schistose outcrops and barns, on vertical W-exposed wood, 1400 m, 1990, *P. van den Boom* 9847 (hb. v.d. Boom).—**Austria:** *Tirol:* SE of Innsbruck, Patscherkofel, between Bosschede and Isshütte, 1900 m, open forest on N slope, on dead wood of *Pinus cembra*, 1981, *M. Brand* 31811 (hb. Brand). *Karnten:* Gailtaler Alpen, 12 NW of Hermagor, near Weissbrach, on wood of bird-observation post, 820 m, 1994, *P. van den Boom* 15728 (hb. v.d. Boom).—**Spain:** *Lérida:* Pireneos, Aigües Tortes national park, S-side of

lake S. Mauricio, 1°2'E, 42°34.7'N, 1940 m, on old, free standing *Abies* on N-slope, 1983, *M. Brand* 32762 (hb. Brand).—**Italy:** *Trentino-Alto Adige:* Bolzano, 54 km WSW of Merano, NP Stilfser Joch, road Prad-Stilfserjoch, SW of Trafoi, SE slope with *Picea* forest and outcrops, on stump, 1850 m, 1990, *P. van den Boom* 10824 (hb. v.d. Boom); *ibid.*, *Pinus* forest with stumps, on *Pinus* stump, *P. van den Boom* 10790 (hb. v.d. Boom). *Alpi Dolomitiche:* c. 1 km S of Marmolada, SW of barrage, 11°51'E, 46°27'N, c. 2100 m, wood of dead trunk of *Pinus cembra* on open N-slope with limestone and shrubs, 1994, *M. Brand* 31632, 31633 (hb. Brand).

### Lecanora subsaligna M. Brand & van den Boom sp. nov.

Species lignicola vel corticola, *Lecanorae salignae* similis, sed thallo minore, inconspicuo, ad 3 cm lato, 20–150 (–200) µm crasso, ascosporae 0(–1)–septatae, 8.4–11.5 × 3.3–4.0 µm; macroconidia (19)–22–27(–30) × 1.7–2.0 µm, valde curvata (c. 45–90°), apicibus attenuatis (falcata), 1-septata, nonnumquam ad 3-septata, non rara; microconidia c. 8–10 × 0.9–1.0, paulo curvata; leptocnidia tenues, longitudine variabiliore, c. 13–22 × 0.8–0.9 µm, curvata.

Typus: Belgium, Namur, SSW of Beauraing, WSW of Gedinne, 300 m, E of Croix Scaille, open area with many big stumps (K5.26), on *Vaccinium*, 500 m, 2 May 2000, *P. & B. van den Boom* 24408 (LG—holotypus; hb. van den Boom, hb. Brand—isotypus).

(Figs 1A & 7)

*Thallus* corticolous or lignicolous, often endophloeodal, relatively small, patches up to c. 3 cm wide, mostly much smaller, thin, c. 20–150(–200) µm high, uneven to slightly verrucose, continuous, inconspicuous; without true cortex, with epinecral layer, often abundantly filled with granules at the upper surface, also with epipsamma on upper surface and at the inside of the 'cortex' and then spotted by anticlinal streaks, granules ± finely to coarsely granular, 0.2–3 µm wide, sometimes granules only present near upper surface around the apothecia and pycnidia; algal layer not differentiated, algal cells filling the whole thallus; upper surface grey or whitish to pale grey, yellowish grey, or pale grey-orange, smooth, matt to somewhat shiny, some specimens being overgrown by algae. *Photobiont* chlorococcoid, cells 5–15 µm diam. *Prothallus* not observed.

*Apothecia* appressed to sessile, rounded to rarely irregularly angular in outline, slightly

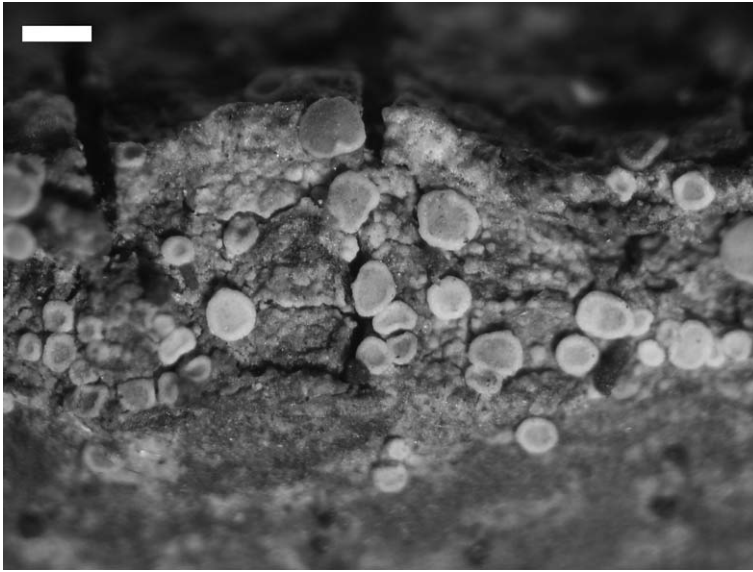


FIG. 7. *Lecanora subsaligna*, habitus (holotype). Scale: 0.5 mm.

constricted at the base, (0.2–)0.3–0.5 mm wide, scattered to densely crowded; margin distinct, rather small, initially thick and clearly prominent, finally thin and level with the disc, 0.03–0.07 mm wide, sometimes becoming excluded, concolorous with the thallus, entire or sometimes irregularly incised; disc pale beige, pale orange to orange-brown, pale brown or pale reddish brown, rarely darkened, flat to slightly or sometimes moderately convex, epruinose. *Thalline excipulum* only corticated in lower part, 20–30  $\mu\text{m}$  thick, at least partly, chondroid, cells with thicker, conglutinated margins and inconspicuous lumina of *c.*  $2 \times 4 \mu\text{m}$ , filled with many yellow-brown to orange-brown, fine granules, algae  $15\text{--}18 \times 11\text{--}14 \mu\text{m}$ , with haustoria. *Parathecium* not or weakly developed, up to 10  $\mu\text{m}$  wide in lower part, up to 25  $\mu\text{m}$  wide at outer rim, strongly conglutinated with elongate cells, containing yellowish brown to orange-brown, fine granules. *Epithymenium* yellowish, yellowish brown or medium to dark brown, abundantly filled with fine granules, N+ reddish violet. *Hymenium* hyaline, with yellow-brown to orange-brown granules often present but inconspicuous and scattered, 35–50(–55)  $\mu\text{m}$

high. *Hypothecium* hyaline, of unoriented hyphae, sometimes with pseudoparaplectenchymatous cells, especially in lower parts, up to 80  $\mu\text{m}$  high. *Paraphyses*  $\pm$  conglutinated, simple to often branched, non-septate, 1–2  $\mu\text{m}$  wide, sometimes slightly widened at the tips and rarely up to 5  $\mu\text{m}$  wide, tips hyaline to rarely brown pigmented. *Asci* clavate to pyriform, *Lecanora*-type, 10–15  $\times$  20–35  $\mu\text{m}$ . *Ascospores* ellipsoid to oblong, 0(–1)-septate, *c.*  $8.4\text{--}11.5 \times 3.3\text{--}4.0 \mu\text{m}$ .

*Macropycnidia* not common, immersed, or top somewhat exposed, upper part hyaline to brown-pigmented, lower part hyaline, *c.* 70–110 (high)  $\times$  50–100  $\mu\text{m}$ ; *macroconidia* strongly curved (*c.*  $45\text{--}90^\circ$ ), attenuate at both apices (falcate), 1(–3)-septate, (19–) 22–27(–30)  $\times$  1.7–2.0  $\mu\text{m}$ . *Microspycnidia* rare, *c.* 50  $\mu\text{m}$  diam.; *microconidia* slightly curved, *c.* 8–10  $\times$  0.9–1.0. *Leptopycnidia* not rare, *c.* 70–80  $\times$  50–60  $\mu\text{m}$ ; *leptoconidia* thin, rather variable in length, curved, *c.* 13–22  $\times$  0.8–0.9  $\mu\text{m}$ .

*Chemistry.* K–, C–, KC–, Pd–. Isosuccinic acid (major), 7-*O*-methylnorascomatic acid (traces and very rare); many specimens tested by TLC or HPLC.

**Ecology and distribution.** *Lecanora subsaligna* is weakly acidophilous and clearly a pioneer species. It is known from a wide range of substrata, such as bark of trunks and branches of *Sambucus*, *Salix* in woodlands, on *Quercus* in a wide range of habitats, on *Sarothamnus* in dune areas, on branches of shrubs (*Vaccinium*), and also on decorticated trunks, wooden constructions and fence posts. The holotype on *Vaccinium* is accompanied only by *Scoliciosporum umbrinum*, which has just a few apothecia. It has been found mainly in western Europe, with the most eastern collection from Italy. In the Benelux countries this species has sometimes been identified as *Lecanora piniperda* (= *L. albellula*) and was also recorded under this name in Diederich & Sérusiaux (2000) and Sérusiaux *et al.* (2003). However, all these specimens were misidentified.

**Notes.** *Lecanora subsaligna* occurs in similar habits as *L. albellula*, but differs in its conidia (for measurements see Table 1), somewhat smaller ascospores, thinner margin of the apothecia, less warted thallus and an epruinose apothecial disc. It has been found more often in lowland areas than *L. albellula*. It is easily mistaken for *L. hagenii*, small and not well-developed *L. saligna*, or a *Lecania* species. The only specimen from the USA is rather small, so that it is difficult to confirm its identity, but we found a small amount of isousnic acid and the characteristic, falcate macroconidia. Several specimens, mainly from southern Europe, have a somewhat similar habitus, but even after extensive study we could find only leptocnidia, so that we are not sure of their status and have excluded them here from *L. subsaligna*.

**Selected specimens examined.** **Norway:** Sogn-Fjordane: Askvoll, Fureneset, near Planteskole, 5°2.79'E, 61°17.58'N, large trees in garden, near coast, on *Acer*, 2003, *M. Brand* 48107 (hb. Brand).—**Denmark:** Mandoe: village, N part, 8°32.2'E, 55°16.6'N, on wood of poles on dune, 1977, *M. Brand* 7126b (hb. Brand).—**The Netherlands:** Utrecht: Darthuizen, grid ref. 39–13; in *Pini sylvestri*, s.d. (19th century), *H. C. van Hall* H254 (NBV). Friesland: Vlieland, Kooislied, 5°2.4'E, 53°17.6'N, on dead *Salix repens* in dune area, 1977, *M. Brand* 6374 (hb. Brand); 6 km WNN van

Winschoten, Midwolda, 6°59.3'E, 53°11.8'N, on apple tree in garden, 1991, *M. Brand* 25865 (hb. Brand). Groningen: 26 km NE of Groningen, Oosteinde, near churchyard, on *Acer*, 1993, *P. van den Boom* 15191 (hb. v.d. Boom). Drenthe: Spier, (Beilen), 6°28.0'E, 52°49.1'N, on *Tilia* along road in front of hotel, 1976, *M. Brand* 3331 (hb. Brand). Flevoland: Oostelijk Flevoland, Roggebotzand, 5°48.6'E, 52°34.1'N, on *Salix* (20 years old), 1981, *M. Brand* 9562b (hb. Brand); Dronten, Abbert (W side), 5°49.7'E, 52°29.6'N, on old *Salix alba* in open woodland with dense low shrubs of a.o. *Rubus*, 1991, *M. Brand* 26665b (hb. Brand); Zuidelijk Flevoland, N van Kitsweg, 1.2 km WSW van Knardijk, 5°24.3'E, 52°27.1'N, *Salix* woodland with *Salix alba*, *S. triandra* and *S. alba*, 1990, *M. Brand* 22529 (hb. Brand); woodland near pumping engine "Block van Kuffeler", 5°14.1'E, 52°25.1'N, on young *Salix* in swamp, 1985, *M. Brand* 12636 (hb. Brand).—**Belgium:** Liège: Hoge Venen, S side of Soor valley, on decaying *Picea* stump in young reforestation, 500 m, 1978, *H. Sipman* 10270 (B). Luxembourg: 2 km SE of Bertrix, 5°17'E, 49°50'N, 400 m, at side of road, open, among fields, on *Tilia*, 1989, *M. Brand* 22272 (hb. Brand).—**Luxembourg:** Oesling: 2 km WNW of Troisvierges, Bois de Biwisch, *Picea* forest (J8.22), 475 m, on young *Acer*, 1992, *P. van den Boom* 12574 (hb. v.d. Boom); 11 km WSW of Esch sur Sure, Moulin de Bigonville, SW side of Sure, 5°48'E, 49°52'N, 325 m, branches of *Sarothamnus* on S-exposed rocky ridge, 1992, *M. Brand* 27193 (hb. Brand); Hoscheid, Banzenhuuscht, road to Goebelsmühle, roadside trees, on *Tilia*, 480 m, 1995, *P. van den Boom* 16813 (hb. v.d. Boom); W Hoffelt, Kalebur (J8.31), on wood, 1987, *P. Diederich* 7778 (hb. Diederich). Gutland: Mamer, Tosseberg (M8.14), on *Sambucus*, 1997, *P. Diederich* 12876 (hb. Diederich). Lorrain: W Steinfort, berge de l'Eisch (L8.51), 1984, *Diederich* 5165, (hb. Diederich).—**Germany:** Niedersachsen: Waddensee island Juist (E-side), near airfield, 7°2.8'E, 53°41.2'N, *Sambucus* on S-slope in dune area, 1977, *M. Brand* 7006 (hb. Brand); Norderney, near Postbake, 7°16.6'E, 53°42.9'N, *Sambucus* in dune area, 1977, *M. Brand* 6943b (hb. Brand). Brandenburg: W of Berlin, Döberitzer Heide (nature reserve), open grassy heathland, on horizontal surface of wood of fence post, 50 m, 2004, *P. van den Boom* 32077, 32079, 32080 & *H. Sipman* 51568, 51573 (B, hb. v.d. Boom).—**Czech Republic:** Ústecký Kraj: N of Prague, Lužické Hory, NE of Diččín, Národní park, České Švicarsko, E of Hřensko, N of Vysoká Lipa, unpaved road along field and open places in woodland, with sandstone outcrops, on branch of *Quercus*, 350 m, 2005, *P. van den Boom* 34750 (hb. v.d. Boom).—**France:** Pyrénées Occidentales: St. Engrâce, Arpideko Ibarra, near Sc. d'Harricagna, 0°47.6'W, 42°59.4'N, 820 m, *Fagus* trees in open wood on N-slope, on rotting wood on soil, 1992, *M. Brand* 28033 (hb. Brand). Cantal: W of Murat, 3 km NW of Puy Mary, *Abies Fagus* forest, on *Abies*, 1140 m, 1998, *P. van den Boom* 21065 (hb. v.d. Boom).—**Italy:** Liguria: c. 5 km NW of Monte Penna, at road to Rezzaglio, 9°26'E, 44°30'N, c. 1000 m, *Quercus*, scattered in hay fields, 1993,



*M. Brand* 30095b (hb. Brand).—**Portugal:** *Tras-os-Montes:* SW of Mogadoura, road (315) from Meirinhos to Estiais, near Quinta das Quebradas, *Olea* orchard, on wood of *Olea* trunk, 500 m, 1999, *P. van den Boom* 22810 (hb. v.d. Boom); Serra do Gerês, NE of Cabril, 2.5 km N of Zertelo, near Lapela, E slope with a few mature *Quercus robur* in the field, on exposed root of *Quercus*, 650 m, 1999, *P. van den Boom* 23288 (hb. v.d. Boom). *Minho:* ENE of Braga, Povoia de Lanhoso, monumental castle with mixed trees in the surrounding, on *Olea europaea*, 380 m, 2005, *P. van den Boom* 35055 (hb. v.d. Boom). *Beira Alta:* NW of Viseu, S of Sao Pedro do Sul, Termas de S. Pedro do Sul, centre of village, *Quercus* and *Corylus* along parking lot, on *Quercus*, 195 m, 2005, *P. van den Boom* 35441 (hb. v.d. Boom); Serra da Estrela, W of Manteigas, south route to Penhas Dousadas, small road with slope and mixed trees, on young *Castanea* tree, 1100 m, 1997, *P. van den Boom* 19016 (hb. v.d. Boom). *Alentejo:* Serra de Mamede, Natural Park, SE of Marvão, N of Pitaranha, near border of Spain, E slope with exceptionally big granite outcrops, on *Rubus*, 540 m, 2003, *P. van den Boom* 31389 (hb. v.d. Boom); NE of Cercal, Barragem de Campilhas, shaded slope with schistose outcrops, near bridge, on *Quercus suber*, 125 m, 1997, *P. van den Boom* 19176 (hb. v.d. Boom).—**Spain:** *Lérida:* Pireneos, Aigües Tortes natural park, S-side of lake S. Mauricio, 1°0.2'E, 42°34.7'N, 1940 m, on old, free standing *Abies* on N-slope, 1983, *M. Brand* 32761 (hb. Brand). *Extremadura:* 41 km ENE of Placencia, N of Jarandilla, c. 2 km N of Guijo de Santa Bárbara, trail along river 'Jaranda', on *Sarothamnus*, 1400 m, 1989, *P. van den Boom* 8873 (hb. v.d. Boom). *Mallorca:* ENE of Soller, Sierra Torrellas, E of Son Torella, meadow with calcareous outcrops and mature *Pinus* trees, 975 m, 1997, *P. van den Boom* 18591 (hb. v.d. Boom).—**USA:** *California:* San Luis Obispo, S of Morro Bay, State Park road, N of Museum of Natural History, among mature *Cupressus macrocarpa* trees beside beach, on stump, on sloping sawn surface, 2 m, 2002, *P. & B. van den Boom* 29447 (hb. v.d. Boom).

## Descriptions of some related species

### *Lecanora albellula* Nyl. var. *albellula*

*Not. Sällsk. Fauna Fl. Fenn. Förh.* 8: 147 (1866); type: Russia, Lapponia Inandrae, prope Kantalaks, 1863, *Fellman* 129 (H-Nyl.26472—lectotype!).

*Lecanora piniperda* Körb., *Parerg. Lich.* 81 (1859), nom illeg.

(Fig. 8A)

*Thallus* small to effuse, up to 4 cm wide, mostly smaller, often forming continuous, warted patches, warts 0.15–0.2 mm wide, rounded to sublobate, convex to semi-globose, sometimes very thin to endoxylic,

50–600 µm thick; cortex not clearly developed, thallus filled with granules, mainly at the upper layer and in patches or only near apothecia and pycnidia; upper surface whitish grey, pale grey to brownish grey, matt to more or less shiny. *Photobiont* chlorococcoid, algal cells 8–20 µm diam., scattered throughout the thallus. *Prothallus* not detected.

*Apothecia* situated in the centre of the thallus or dispersed, sessile and often constricted at the base, c. 0.25–0.55°–0.7 mm diam.; margin relatively thick, initially prominent above the disc, becoming thin and level with the disc, concolorous with the thallus, entire to crenulate, to 0.08 mm wide; disc plane to convex, becoming sub-globose, then with excluded margin, pale beige to dark grey, pale to dark greyish brown or pale to reddish brown, slightly to densely whitish to pale yellowish pruinose. *Thalline excipulum* with a cortex which is best developed in the lower part; chondroid, c. 10–30 µm thick, with thick, conglutinated cell margins, lumina not clear, often reduced, algae c. 14–18 × 10–12 µm, with haustoria, with granules at the outer surface of the cortex and in anticlinal stripes. *Parathecium* sometimes visible, small, to 30 µm wide and brownish pigmented at the outer rim. *Epihymenium* yellowish, pale brownish to greyish brown, interspersed with fine granules of c. 3 µm, N+ reddish violet. *Hymenium* hyaline, with granules mainly in the upper part, c. 35–55 µm high. *Hypothecium* hyaline to pale yellowish, to 90 µm high. *Paraphyses* simple, branched to sometimes anastomosing, ± septate, rarely constricted at the septum, in a gelatinous matrix, 1.5–2 µm wide, top often slightly widened to 4(–5) µm, mainly hyaline, or with a brownish, bluish grey or greenish blue outer tip. *Ascospores* ellipsoid to broadly ellipsoid, simple, rarely 1-septate, 8.5–11.5 (–12.5) × 3.1–4.2 µm.

*Macropycnidia* often present but not abundant, immersed or semi-immersed in the thallus or on the apothecium (epihymenium as well as margin), top brown or hyaline, c. 70–120 × 60–100 µm; *macroconidia* slightly curved (–45°) with roundish (obtuse) tips,



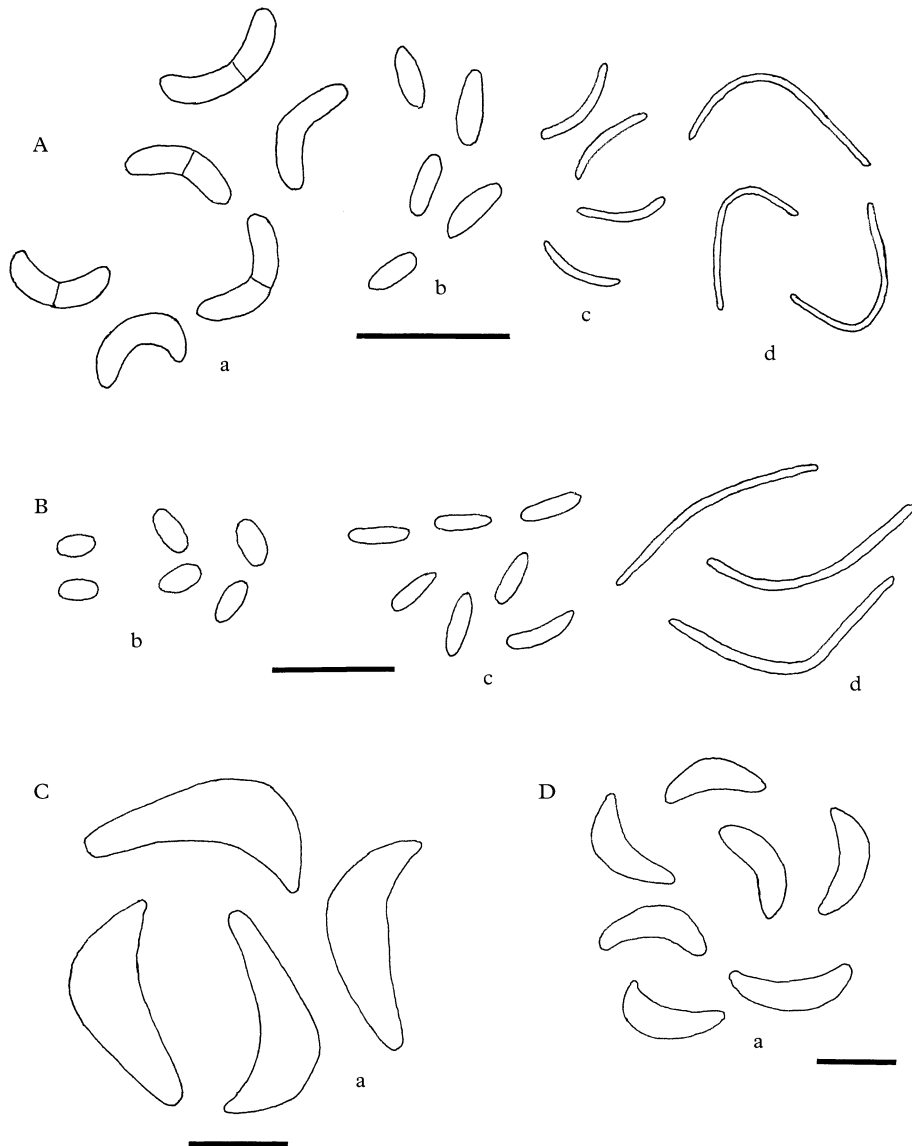


FIG. 8. *Lecanora saligna* group, conidia. A, *L. albellula*; B, *L. sarcopidoides*; C, *L. subravida*; D, *L. saligna*. a=macroconidia; b=mesoconidia; c=microconidia; d=leptoconidia. Scales: A & B=10 µm; C & D=5 µm.

1-septate, rarely to 3-septate, *c.*  $7\text{--}10.5 \times 1.8\text{--}2.2$  µm. *Micropycnidia* not rare, immersed, *c.* 50 µm; *microconidia* slightly to strongly curved, simple,  $5.6\text{--}9.8 \times (0.8\text{--}) 0.9\text{--}1.3$  µm. *Mesopycnidia* rare, small, mostly with a brown pigmented top; *mesoconidia* ellipsoid-bacilliform, straight with rounded apices,  $2.9\text{--}5.1 \times 1.6\text{--}2.1$ . *Lepto-*

*pycnidia* rare, immersed; *leptoconidia* rather variable in length, curved,  $10\text{--}15 \times 0.7\text{--}1$  µm.

*Chemistry.* K-, C-, KC-, P-. Isosusnic acid (± major), ± usnic acid (trace); rarely 7-O-methylnorascomatic acid (minor) and only in apothecia (TLC & HPLC).

*Ecology and distribution.* On the bark of trunks and branches of a wide range of phorophytes such as *Acer*, *Corylus*, *Fagus*, *Larix*, *Picea*, *Pinus*, *Salix* and *Sambucus*, as well as on decorticated trunks and more rarely on wood and timber. This species is widely distributed in western Europe, from northern Scandinavia (Santesson *et al.* 2004) to northern Spain. We have seen several exsiccate specimens from central Europe.

*Notes.* *Lecanora albellula* s. str. is closely related to *L. albellula* var. *macroconidiata* but they differ principally in the size of their macroconidia; 1(–3)-septate and 7–10.5 × 1.8–2.1 µm in the former and 1–3-septate, 12.4–14 × 1.8–2.3 µm in the latter. Further differences are discussed above under *L. albellula* var. *macroconidiata*.

*Lecanora albellula* s. str. can be distinguished from *L. saligna* by its more dispersed thallus warts and apothecia which are often aggregated in the centre of the thallus; its macroconidia, microconidia and chemistry are also different. Although both species contain isousnic acid as a major substance, usnic acid and 7-O-methylnorascomatic acid (rare in *L. albellula* s. str.) have never been found in *L. saligna*. *L. albellula* s. str. differs from *L. subsaligna* by its warted thallus, strongly convex apothecia and smaller macroconidia (much longer and falcate in *L. subsaligna*). The dark greyish brown, often slightly pruinose, young flat, as well as strongly convex old, apothecia are also typical. We have studied the very scanty (lecto)type specimen and, of the four known types of conidia, have found only macroconidia and mesoconidia. Their measurements agree well with other specimens studied in the literature. While in the most recent and extensive description (Printzen 2001) pycnidia are not mentioned, they are recorded as 7–14 × 1–2 µm (Clauzade & Roux 1985); as macroconidia, 7–10 × 1–2 µm, and microconidia, 3–5 × 1 µm (Hawksworth & Dalby 1992); as macroconidia, 7–14 × 1–2 µm (curved), or microconidia 3–5 × 1 µm (straight) (Wirth 1995); and 7–11 × 1 µm (Hinteregger 1994), all

without remarks about septation. This variation, most probably, can be explained by the many misidentifications we have found during our study. We have studied various collections of '*L. piniperda*' and found several to belong to *L. saligna*, *L. subsaligna*, *L. subintricata* or another genus, including those recorded from Luxemburg and Belgium (Sérusiaux *et al.* 2003). Thus in our opinion, the occurrence of *L. albellula* in Belgium is not confirmed.

In an investigation of more than ten specimens treated by Hinteregger (1994: 221) as *Lecanora* sp. 1 (aff. *saligna*), in which isousnic- and usnic acid were present, the same three types of conidia as described from *L. albellula* s. str. were found, so that we are convinced that this material belongs in this species. This material is mainly from bark of *Rhododendron ferrugineum* or more rarely from *R. hirsutum*.

*Selected specimens examined.* **Great Britain:** *Scotland:* V.C. 105, West Ross: Torridon, Rubha, na h-Airde Glaise, coast to north, 18/80.56, on lignum of branch, of *Salix*, 1994, B. J. Coppins 16454, A. M. Fryday & A. M. O'Dare (E). *England:* V.C. 57, Derbyshire: Chatsworth Old Deer Park, 43/26.68, on *Quercus* stump, 1991, B. J. Coppins 15669 & O. L. Gilbert (E).—**The Netherlands:** *Friesland:* Terschelling, Oosterend, Kopjesplak, *Betula* forest, So of 'Jan Thijssenduin', 5°25.1'E, 53°24.6'N, on mature *Betula* in open woodland, 1997, M. Brand 35987 (hb. Brand); Vlieland, Kooislid, 5°2.4'E, 53°17.6'N, dead *Salix repens* in dune area, 1977, M. Brand 6374, 6375 (hb. Brand). *Flevoland,* Noordoostpolder, Kuinderbos (N side), on wood of barrier, 1979, M. Brand 7943 (hb. Brand); Oostelijk Flevoland, Roggebotzand, 5°48.6'E, 52°34.1'N, on *Salix* (20 years old), 1981, M. Brand 9562 (hb. Brand); Zuidelijk Flevoland, N of Kitsweg, c. 1.2 km WSW of Knerdijk, on old *Salix triandra* in woodland, 1990, M. Brand 22540, 22552 (hb. Brand).—**Germany:** *Niedersachsen:* Norderney, NE of Grohde, on *Sambucus* in dune area, 1977, M. Brand 6945 (hb. Brand); Hohes Venn, W of Monschau near Belgian border, 6°10.8'E, 50°33.3'N, 600 m, wood of *Picea* trunks, in felled woodland, 2004, M. Brand 50489 (hb. Brand).—**France:** *Cantal:* SW of Murat, Albepierre, W side of village, campsite, trees along stream, and meadow, on wood of fence post, 1050 m, 1998, P. van den Boom 20626 (hb. v. d. Boom).—**Switzerland:** *Valais:* S of Evolène, SE of Les Hauderes, along La Borgne, N-facing slope with *Acer* in meadow and well-lit schist, on trunk of *Acer*, 1540 m, 1990, P. van den Boom 10071 (hb.v. d. Boom); Val d'Hérens, 0.7 km N of Arolla, 7°27.3'E, 46°1.7'N, 2120 m, twigs of *Larix* in open *Larix-Pinus cembra* wood on E slope, 1990, M. Brand 24880 (hb. Brand); SW of

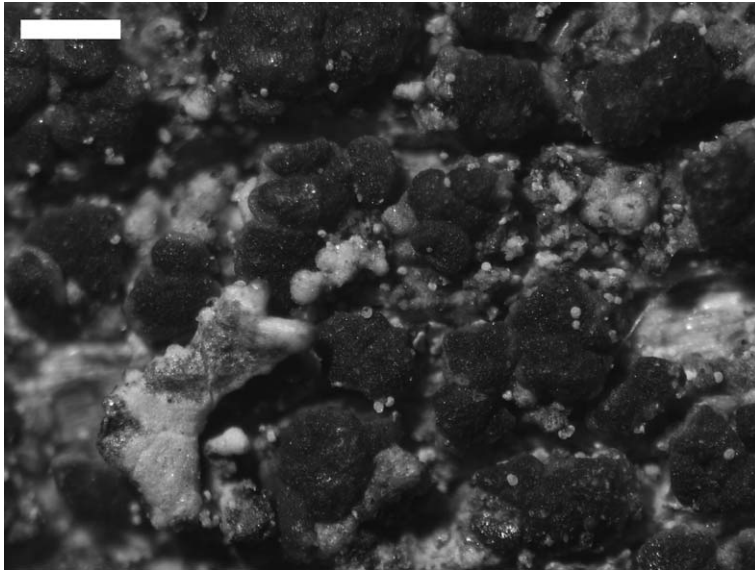


FIG. 9. *Lecanora hypoptoides*, habitus °Equipo 1878 (MAF). Scale: 0.5 mm.

Brig, SSE of Visp, Visperterminen, 1 km E of village, path W of small lake, to Simplonpass and Gibidumpass, 2050 m, on shrub, on vertical bank of path, 1996, *P. van den Boom* 17803 (hb. v. d. Boom); Graubünden, Engadin, Val Susauna, 9°59.5'E, 46°38.9'N, 1690 m, isolated *Larix* near stream in open valley, 1977, *M. Brand* 6687, 6690 (hb. Brand).—**Austria:** Tirol: SW von Mittelberg im Pitztal, Taschach-alpe, Kraftwerk am Bach, oberhalb der Strasse Richtung Taschachferner, NW-Hang, MTB 9031/1, on *Rhododendron ferrugineum*, c. 1810 m, 8 viii 1986, *E. Hinteregger* s.n. (GZU); Ötztaler Alpen, Platzal, im Zirben wald S von Obergurgl, N-Hang, MTB 9132/1, on *R. ferrugineum*, 2000 m, 1 vii 1986, *E. Hinteregger* s.n. (GZU). Steiermark: Schladminger, Tauern, Kleinsölkta-Obertal, Lempkar über der Putzentalm, on *R. ferrugineum*, 1830–1880 m, 17 vii 1986, *H. & M. Mayrhofer & Ch. Scheuer* s.n. (GZU). Kärnten: Karnische Alpen, 4 km S of Hermagor, 1 km WNW of Egger Alm, forest on SW slope, on wood of dead branch of *Acer*, 13°22.1'E, 46°35.2'N, 1350 m, *M. Brand* 31534 (hb. Brand).—**Spain:** Lérida: Pireneos, Aigües Tortes National Park, S-side of lake S. Mauricio, 1°2'E, 42°34.7'N, 1940 m, on old, free standing *Abies* on N-slope, 1983, *M. Brand* 32761 (hb. Brand).—**Italy:** Parma: NE of Passo del Pelizzone, 9°42'E, 44°40'N, 1050 m, *Corylus* in scrub on limestone near mountain ridge, 2001, *M. Brand* 42348 (hb. Brand). Calabria: Sila, N of Lago Arvo, Silvana Mansio, 16°32'E, 39°18'N, 1475 m, on *Pinus*, 1986, *M. Brand* 52926 (hb. Brand).—**Portugal:** Alentejo: SE of Sines, NE of Cercal, Barragem de Campilhas, near bridge, field with *Cistus ladanifer* and schistose outcrops and *Quercus suber*, on *Q. suber*, 125 m, 1997, *P. van den Boom* 19176 (hb. v. d. Boom). Algarve: NE of Albufeira, road Benafim Grande to Salir,

3 km W of Salir, *Olea* orchard along road, on decorticated trunk of *Olea*, 400 m, 1993, *P. van den Boom* 14360 (hb. v. d. Boom).—**USA:** New Hampshire: Coos County, White mts, nat. forest, Presidential Dry River Wilderness Area, one mile SW of Mt. Crawford along Davis path, at edge of ridge with balsam fir, birch and black spruce, 2600 ft., 1988, *C. Wetmore* 61973 (GZU). Colorado: Boulder county, one mile west of Ward, along Lefthand Canyon, east of red rock Lake, Spruce-fir forest, 9800 ft, 1967, *C. Wetmore* 16022 (GZU). California: Tulare, Sequoia National Park, ridge S of Little Badly, on E facing slope of ridge in fir and pine forest with some incense cedar, on conifer log, 6800 ft, 1984, *C. Wetmore* 51091 (GZU).

*Exsiccata examined:* Arnold, *Lich. exs.* 665 (L, GZU); Arnold, *Lich. Mon. exs.* 235, 380, 472, 515 (L); Körber, *Lich. Sel. Germ.* 215 (BR); Magnusson, *Lich. sel. scan. exs.* 403 (B); Malme, *Lich. suec. exs.* 435 (B); Rabenhorst, *Lich. Europ.* 640 (BR); Vězda, *Lich. sel. exs.* 2189 (B, LG); [all as *Lecanora piniperda*]; Rabenhorst, *Lich. Europ.* 784 (BR) [as *Lecanora varia* var. *glauccella*].

### *Lecanora hypoptoides* (Nyl.) Nyl.

*Flora* 55: 249 (1872);—*Lecidea hypoptoides* Nyl., *Flora* 50: 371 (1867); type: Finland, Tavastia, 1866, *J. P. Norrlin* 507 (H-Nyl. 26529—holotype!).

(Fig. 9)

*Thallus* corticolous or lignicolous, epi- to endosubstratal, effuse, in patches of up to

2 cm wide, sometimes aggregating, sometimes diffusely covering larger surfaces, warted, warts  $\pm$  subglobose and to 0.25 mm diam., sometimes disintegrated and nearly sorediate, c. 100–350  $\mu\text{m}$  thick; cortex poorly developed, not clearly differentiated, filled with minute oil droplets ( $<0.4 \mu\text{m}$  diam.), without granules; epinecral layer poorly developed, to 10  $\mu\text{m}$  high; algal layer or medulla not differentiated; algal cells covered by relatively thick hyphae of 2.5–5  $\mu\text{m}$  and thick walled, surface of hyphae covered with a fine granular substance not or weakly visible in polarized light and soluble in KOH and acetone; upper surface pale grey to dark grey, pale yellowish brown to moderately brown, matt to slightly shiny. *Photobiont* chlorococcoid, cells 8–20  $\mu\text{m}$  and thick walled. *Prothallus* not developed.

*Apothecia* appressed to sessile, sometimes constricted at the base, 0.4–0.6 mm diam.; margin level with the disc or slightly raised, entire to irregular or crenulate, often becoming excluded, concolorous with the thallus, 0.04–0.12 mm wide; disc plane to slightly convex, rarely subglobose, pale or reddish brown, dark greyish brown to dark brown, epruinose. *Thalline excipulum* initially raised and conspicuous, becoming excluded; in section cortex mainly visible at the lower part of the apothecia, to 20–35  $\mu\text{m}$  wide, with minute granules; algal layer clearly differentiated, to 90  $\mu\text{m}$  high;  $\pm$  I+ bluish. *Parathecium* poorly to well developed, to 50  $\mu\text{m}$  wide at the outer rim, pseudo-parenchymatous cells sometimes visible. *Epihymenium* pale to medium reddish brown or medium to dark brown or brownish-spotted, sometimes slightly olivaceous, without granules, mostly with minute oil droplets ( $<0.4 \mu\text{m}$  diam.), N+ reddish violet. *Hymenium* hyaline, with a few orange granules, 35–60  $\mu\text{m}$ . *Hypothecium* hyaline, 45–55  $\mu\text{m}$  high. *Paraphyses* mostly branched and anastomosing,  $\pm$  septate, 2–2.5  $\mu\text{m}$  wide in the middle, the apices sometimes widened up to 4(–5)  $\mu\text{m}$  wide, hyaline to greyish dark brown. *Asci* *Lecanora*-type, broadly ellipsoid, 25–35  $\times$  12–17. *Ascospores* ellipsoid, simple or rarely 1-septate, 9.6–13.3  $\times$  3.1–4.0  $\mu\text{m}$ .

*Microspycnidia* rather rare, inconspicuous, immersed, c. 50–80  $\mu\text{m}$  diam.; *microconidia* bacilliform to slightly curved, 4.8–5.7  $\times$  0.9–1.1  $\mu\text{m}$ . *Mesopycnidia* sometimes abundant, immersed, globose, c. 150  $\mu\text{m}$  diam., dark brown to bluish green in upper part, hyaline below; *mesoconidia* tear drop-shaped, 2.7–3.9  $\times$  1.4–1.8  $\mu\text{m}$ .

*Chemistry.* K–, C–, KC–, Pd–. Paraensic acid D (major), paraensic acid C (minor) (TLC and HPLC).

*Ecology and distribution.* *Lecanora hypoptoides* occurs on the bark of *Castanea*, *Larix*, *Pinus* and also on decorticated wood, often with *Hypocenomyce scalaris* and *Pseudevernia furfuracea*.

It is known from mountain areas in southern Europe (400–1800 m) and from boreal Europe (Santesson *et al.* 2004). According to Wirth (1995) it is known from SW Germany and Switzerland (Haute Vienne).

*Notes.* *Lecanora hypoptoides* is easily mistaken for a member of the *L. saligna* group, such as *L. albellula* var. *macroconidiata*. However, this variety has a more warted, thinner and shiny, more yellowish brown thallus, which is sometimes sublobulate with more strongly convex (subglobose) warts, macrospycnidia with relatively large macroconidia which are mostly 3-septate, and it contains 7-O-methylnorascomatic acid. The last two characters are lacking in *L. hypoptoides*. *Lecanora hypoptoides* can also be mistaken for *L. albellula* s. str. or *L. sarcopidoides*, but both these species often have (slightly) pruinose apothecia. *Lecanora hypoptoides* is somewhat similar in appearance to *L. hypoptella* (Nyl.) Grummann, but the latter species has smaller, darker brown apothecia and a thinner thallus. Although the mesoconidia in *L. hypoptoides* and *L. hypoptella* are somewhat similar, the microconidia, rather rare in both species, are clearly shorter in the latter. *Lecanora hypoptella* is a poorly understood species and is currently being revised (Z. Palice pers. comm.).

The chemistry and the rather uniformly coloured apothecial discs at all states of



development are typical for *L. hypoptoides*. The holotype is in very poor condition, but the chemistry agrees with other specimens in good condition. Several exsiccate specimens of *Lecanora ochrostoma* and *L. piniperda* var. *ochrostoma* are referred to this species, but the type of *L. piniperda* var. *ochrostoma* belongs to *Lecania fuscella* (Printzen 2001). The collection by Equipo (MAF 1878), listed below, was originally identified as *Lecanora sarcopidoides* and is infected by a most probably undescribed *Phoma* sp., with pycnidia, 150–190 × 100–140 µm, and tear drop-shaped conidia, 3–4 × 1.6–2 µm.

*Additional specimens examined.* **Norway:** Oppland: Sel: Horgesetrene, W above Rosten, towards Mt. Horgensoi, 61°52'N, 9°22'E, c. 1000 m, *Betula nana-Cladina*-heath, on hill ridge just above tree limit, on isolated *Betula* tree trunk, 1999, *H. Sipman* 44164 (B).—**Finland:** Laponia inarenensis: parish Utsjoki: valley of Kevojoki river, 1–2 km before outlet into Lake Kevojärvi, W of Kevo Scientific Station, light mossy *Betula* forest in valley, on E-facing slope, on dead branchlets of *Pinus* tree, 100 m, 1988, *H. Sipman* 23155 (B).—**Germany:** Niedersachsen: Harz mts., along the Rehberger Graben, N of the Goetheplatz, Staatsfort Andreasberg, N of St. Andreasberg, MTB1. 4229/3, *Picea* forest with scattered *Acer pseudoplatanus*, on steep E-facing slope, on wood of *Picea* stump, 750 m, 1984, *H. Sipman* 17523 (B).—**Italy:** Calabria: Sila Greca, M. Altare (col in road Longobucco-Lago di Cecita), 16°33.3'E, 39°25.2'N, 1500 m, *Fagus* in wood on top of mountain ridge, 2001, *M. Brand* 42937 (hb. Brand).—**Spain:** Navarra: Pireneos, 3.5 km ENE of Isaba, Baranco de Belabarce, on *Pinus*, 1000 m, 1992, *M. Brand* 28538 (hb. Brand). Madrid: Serra Guadarrama, Pto. Cotos, on trunk of *Pinus sylvestris*, 1850 m, 1981, *Equipo* 1878 (MAF).

*Exsiccata examined:* Arnold, *Lich. Mon. exs.* 395, 434, 495 (B,L,M) [as *L. piniperda* var. *ochrostoma* or *L. ochrostoma*]; Hepp, *Flecht. Eur.* 387 (BR, M) [as *L. ochrostoma*]; Malme, *Lich. suec. exs.* 212 (B).

### **Lecanora mughicola** Nyl.

*Flora* 55: 248 (1872); type: Italy, ad nudos exsiccatorum Mughorum ramos in alpbibus Rhaeticis. Anzi, *Lich. Lang.* 376 (H-Nyl. 26738—holotype; M—isotype).

*Thallus* epixylic to partly endoxylic, sometimes effuse, to 5 cm wide, or in smaller, ± delimited patches, with scattered warts to areolate, up to 0.3(–0.5) mm thick; areoles angular, to 2 mm wide, plane to convex;

cortex up to 80 µm high, often poorly developed, with granules in upper part of the thallus, epinecral layer sometimes present, to 25 µm high; upper surface pale to dark grey or yellowish grey, smooth and somewhat shiny with a waxy appearance. *Photobiont* chlorococcoid, cells 8–17 µm, often forming a clearly differentiated layer. *Prothallus* not observed.

*Apothecia* abundantly present, broadly appressed, c. 0.7–1.1 mm diam.; margin conspicuous, persistent, 0.06–0.1 mm wide, concolorous with the thallus, smooth or warty, flexuose or sometimes crenulate, matt or slightly shiny; disc flat, initially pale yellowish brown, reddish brown or mostly dark blue-grey to intensively blackened, epruinose to rarely slightly greyish or pale bluish pruinose. *Thalline excipulum* corticate, with 15–35 µm wide cortex, rather equal in thickness or reduced at the top, chondroid or with many granules and then with an indistinct structure, algal layer clearly differentiated from the cortex; algae present to the upper outer rim, algae c. 16 × 11 µm. *Parathecium* slightly widened, at the outer rim to 40 µm, hyaline, pseudoplectenchymatous cells c. 2–4 µm. *Epithymenium* yellowish brown to olive-brown, with many, relatively large, yellowish granules, N+ reddish violet. *Hymenium* hyaline, with orange-brown granules, 50–70 µm high. *Hypothecium*, hyaline to pale yellowish, 60–100 µm high. *Paraphyses* branched and anastomosing, (1–)1.5–2 µm, abundantly septate, ± widened at the top, up to 6 µm diam., more or less brown or green to bluish-grey pigmented in upper cell. *Ascospores* ellipsoid, simple, 10–13.8 × 4.4–5.2 µm.

*Micropycnidia* inconspicuous, immersed, rare; *microconidia* bacilliform to slightly curved, 6–9 × 0.8–1.1 µm. *Leptopycnidia* usually present, immersed, brown or green blue-black above, hyaline below, 100–130 µm high × 60–110 µm; *leptoconidia* mostly strongly curved, not septate, 13–16 × 0.8–1 µm.

*Chemistry.* K–, C–, KC–, P–. Iso-usnic acid (major) (TLC).

*Ecology and distribution.* *Lecanora mughicola* is known from wood of conifers such as *Larix* and *Pinus uncinata*, from dry, non-rotten decorticated wood of trees, dead branches and worked timber. It occurs mostly in the subalpine zone between 1700 and 2400 m, but we have also seen a collection from c. 800 m. We have studied specimens from western, central as well as eastern Europe.

*Notes.* *Lecanora mughicola* is a conspicuous species because of its often blackish apothecia with a pale yellow margin. It differs from *L. saligna* by its smaller microconidia and by the absence of macroconidia, which are abundant in *L. saligna*. The apothecia are darker pigmented in *L. mughicola* and the ascospores are larger than in *L. saligna*. We have never found these two species growing together possibly because the distribution of *L. saligna* is restricted to lowland areas. In Printzen (2001), conidia are described as  $4\text{--}5.5 \times 1\text{--}1.5 \mu\text{m}$ , which is somewhat different from our observations, and probably relates to mesoconidia.

*Selected specimens examined.* **Norway:** *Oppland:* Leirdalen, Ytterdalsseter,  $8^{\circ}11.3'E$ ,  $61^{\circ}39.6'N$ , 1000 m, on scattered *Betula* trees near tree line, 1975, *M. Brand* 5719 (hb. Brand).—**Great Britain:** *Scotland:* **V.C. 105**, West Ross: Coulin Forest SSSI, high ground between Allt na Luib and An Leth-allt, on lignum of decorticated *Pinus* branch, c. 230 m, NG(18)993.555, 2004, *A. M. & B. J. Coppins* 21658 (E); Loch Maree, Eilean Subhainn,  $18/91(-)2.72$ , on exposed, dry lignum of *Pinus* branch, 1999, *B. J. Coppins* 18517 & *V. J. Giavarini* (E); Kinlochhewe, Beinn Eighe NNR, Coille na Glas-leitir, valley of Allt a'Chuirn, S side, 28/00.60, on decorticate branch of mature *Pinus*, 170 m, *A. M. & B. J. Coppins* 19821 (E). **V.C. 96**, Easternness: Rothiemurchus Forest, N to NE of Airgoid-meall, 28/96(-)7.07, on exposed lignum of *Pinus* branches, 430–500 m, 1989, *B. J. Coppins* 13210 & *T. Duke* (E).—**Switzerland:** *Valais:* val d'Hérens, 0.7 km N of Arolla,  $7^{\circ}27.3'E$ ,  $46^{\circ}1.7'N$ , 2120 m, decayed wood of dead log in open *Larix-Pinus cembra* wood on E slope, 1990, *M. Brand* 24875, 24876 (hb. Brand).—**Austria:** *Steiermark:* Schladminger Tauern, Stubneralm, Kleinsölkta, Kleinsölk-Obertal, steile felsige S-Abhänge des Säulecks, on *Rhododendron ferrugineum*, 1800 m, 1975, *H. Mayrhofer & P. Remler* (GZU); *Alpes orientales*, Gurktaler Alpen, Estiria, Frauenalm sur de Murau, bosque subalpino de *Picea* y *Larix* pasado refugio Murauer Hütte, on wood, 1700 m, 1981, *A. Crespo & L. Sancho* (MAF). *Tirol:* SE of Innsbruck,

Patscherkofel, between Bosschede and Isshütte,  $11^{\circ}27'E$ ,  $47^{\circ}12'N$ , 1900 m, dead branch of *Pinus cembra*, 1981, *M. Brand* 31809, (hb. Brand). *Kärnten:* Kreuzeckgruppe, Hochtristen, SW of Sattleggerhütte,  $13^{\circ}9.3'E$ ,  $46^{\circ}46.2'N$ , 1700 m, on wood of roof of disused hay shed, 1994, *M. Brand* 31104 (hb. Brand); Gailtaler Alpen, Weissbriach, road at S-side of Schwarzenbach, 0.4 km from main road,  $13^{\circ}14.9'E$ ,  $46^{\circ}40.9'N$ , 800 m, wood of railing of camping place, 1994, *M. Brand* 31423 (hb. Brand); *Karnische Alpen*, c. 2.3 km W of Nassfeldpass, W of Madritschen,  $13^{\circ}14.8'E$ ,  $46^{\circ}33.5'N$ , isolated *Larix*, 1994, *M. Brand* 31335b (hb. Brand); SW of Hermagor, 1.2 km W of Nassfeld, path 403, Madritschen, *Larix* forest with Kreuzeckgruppe, 3 km NW of Greifenburg, 0.5 km S of Emberger Alm, SE slope with log-cabin in meadow, on wood of roof, 1725 m, 1994, *P. van den Boom* 15856 (hb. v.d. Boom).—**Slovakia:** *Vysoke Tatry:* 1.5 km S of Skalnaté Pleso along Traranske Magistrale,  $20^{\circ}13.6'E$ ,  $49^{\circ}10.4'N$ , 1630 m, *Pinus mugho* in scrub on SE slope, decorticated wood, 2006, *M. Brand* 53596 (hb. Brand).—**France:** *Savoie:* Briançon, 0.9 km NNE of Col du Galibier,  $6^{\circ}25'E$ ,  $45^{\circ}4'N$ , 2480 m, on exposed calcareous rock on gentle N-slope, 1984, *M. Brand* 11575 (hb. Brand). *Vercors:* Plateau Veymont, de la Maison forestière de la Cloche vers la Grande Cabane, Pâturages avec sapins disséminés, 1400–1500 m, viii 1986, *E. Sérusiaux* s.n. (LG). *Pyrénées Atlantiques:* E of Col de la Pierre St. Martin,  $0^{\circ}45.8'W$ ,  $42^{\circ}57.9'N$ , 1800 m, stunted *Pinus uncinatus* at tree line, on wood of decorticated trunk, 1992, *M. Brand*, 28288 (hb. Brand); 14 km W of St. Lary-Soulan, Lac d'Aumar, crête d'Estibère,  $0^{\circ}9'E$ ,  $42^{\circ}50'N$ , 2350 m, on old *Pinus uncinatus*, on N-slope, 1985, *M. Brand* 12814 (hb. Brand); 49 km SW of Pau, 4.6 km SE of St Engrâce, along trail to Pic d'Arlas, on decorticated wood of *Pinus* trunk, 1760 m, 1992, *P. van den Boom* 13157, 13129 (hb. v. d. Boom). *Pyrénées Orientales:* Pic Carlit, W of Lac de Bouillouses,  $1^{\circ}59.5'E$ ,  $42^{\circ}33.8'N$ , 2100 m, on trunk of old, thick *Pinus*, 1983, *M. Brand* 32665 (hb. Brand).—**Spain:** *Aragón:* Huesca, Benasque, Ibón de Paderna (bajo) desde La Renclusa, on *Pinus uncinata*, 2240 m, 2004, *J. Etayo* 21732 (hb. Etayo). *Teruel:* Javalambre, 6 km NNE of top,  $0^{\circ}59.32'W$ ,  $40^{\circ}8.94'N$ , 1690 m, wood of dead *Juniperus*, 2005, *M. Brand* 52041 (hb. Brand). *Navarra:* Col de Arette-Pierre-St-Martin, 1550 m, on wood of *Pinus*, 1989, *P. James, Rose, Etayo & Sérusiaux* 10598 (LG, hb. v. d. Boom). *Lérida:* Pireneos, Aigües Tortes National Park, E-side of Val de Subenuix,  $0^{\circ}59.8'E$ ,  $42^{\circ}34.5'N$ , 2150 m, on dead wood of *Pinus* cf. *uncinata* in open valley, 1983, *M. Brand* 32769 (hb. Brand). *Soria:* Puerto de Piqueras,  $2^{\circ}32.2'W$ ,  $42^{\circ}3.2'N$ , 1700 m, wood of snow fence, 2003, *M. Brand* 50335 (hb. Brand). *Madrid:* Serra Guadarrama, Pt Cotos, on *Pinus sylvestris*, 1850 m, 1981, *Equipo* 1888 (MAF).—**Italy:** *La Spezia:* E of Passo di Cento Croci,  $9^{\circ}38.1'E$ ,  $44^{\circ}24.7'N$ , 1100 m, wood of posts of fence on mountain ridge, 2001, *M. Brand* 42385 (hb. Brand). *Lazio:* pr. Frosinone, road Pontecorvo-Castrocielo, S of railway,  $13^{\circ}40'E$ ,  $41^{\circ}30'N$ , 100 m, old *Quercus* along main road in flat fields, 2001, *M. Brand* 42621 (hb.

Brand).—**Greece:** *Kentriki Makedonia:* W of Litochoro, Mt. Olympus, near refuge A, on decorticated trunk of mature *Pinus*, 2100 m, 1984, P. van den Boom 1992 (hb. v. d. Boom).

### **Lecanora quercicola Coppins & P. James**

*Lichenologist* 11: 145–149 (1979); type: Anglia, V.C. 11, Hampshire: New Forest, Beaulieu, Stubbs Wood, Hawk Hill, 41/35.03, ad apricam faciem trunci *Quercie margine sylvae*, 2 xii 1975, P. W. James (BM—holotypus).

*Thallus* forming small patches of c. 1 cm, or effuse and up to 3 cm wide, uneven, slightly verrucose or granular-areolate to rimose-areolate, thin to relatively thick, up to c. 250 µm, sometimes endophloeodal; cortex poorly developed, algal cells scattered over the thallus, with granules at the upper surface; upper surface grey to yellowish grey or pale brownish grey, matt to slightly shiny. *Photobiont* chlorococcoid, cells 6–18 µm diam. *Prothallus* not observed.

*Apothecia*, broadly appressed, slightly constricted at base, 0.2–0.5 mm diam.; margin elevated, persistent, 0.06–0.09 mm wide, somewhat paler than the thallus, often uneven; disc flat or slightly convex, pale to greyish brown, or reddish brown, ± slightly pruinose. *Thalline excipulum* without cortex, or with pseudocortex, outer rim c. 20 µm wide, filled with granules, algae in the margin c. 9–12 µm diam. *Parathecium* often present, yellowish to yellow brown and c. 30–70 µm at outer rim, cells of inner part pseudoplectenchymatous. *Epihymenium* yellowish to pale brown, greyish brown to sometimes dark brown, filled with yellowish granules, N<sup>-</sup>. *Hymenium* hyaline, sometimes with orange-brown granules, 40–50 (–60) µm high. *Hypothecium* hyaline to yellowish, somewhat gelatinized in the lower part, 60–100 µm. *Paraphyses* simple to branched, sometimes constricted at the septa, mostly covered by a gelatinous sheath, (1.5–)2–2.5 µm diam., rarely slightly thickened towards the top and 3 µm wide, not pigmented, or wider, up to 3.5 µm and brown pigmented. *Asci* c. 45 × 14 µm; tholus amyloid, without or with a small ocular

chamber, with small axial body and clear, strongly amyloid cylinder around axial body. *Ascospores* ellipsoid, simple, 8.6–10 × 4.3–4.8 µm.

*Macropycnidia* always present, immersed, upper part not pigmented or brown, ostiole sometimes gaping and pigmented dark red-brown inside, up to 170 µm high × 100 µm; *macroconidia* weakly curved, non-septate, 8.5–9.3 × (2.5–)2.7–3.0 (–3.2) µm. *Micro-pycnidia* sometimes present, only a few and hard to find, c. 90 µm wide, upper part pale brown; *microconidia* c. 10–11 × 1.1 µm.

*Chemistry.* K<sup>-</sup>, C<sup>-</sup>, KC<sup>-</sup>, P<sup>-</sup>. Iso-usnic acid (major), ±neousnic acid (minor) (TLC).

*Ecology and distribution.* *Lecanora quercicola* is known from old trunks of *Quercus* in open places in forests. In Bentheim (Germany) it has been found associated with *Lecanora sublivescens*, *Caloplaca lucifuga*, *Pyrrhospora quercea*, *Calicium salicinum*, *Ochrolechia subviridis* and *Lepraria incana*; in Brittany (France) with *Opegrapha viridis*, *Rinodina roboris*, *Fuscopannaria* cf. *mediterranea* and *Frullania tamarisci*. In southern Portugal and Spain (including Mallorca) well-developed material has been collected. Here the species has also been found growing on the bark or decorticated wood of *Olea europaea* trunks, accompanied by a few lichens, such as *Lecanora* aff. *horiza*, *L. subsaligna*, *Lecidella achristera* and an unidentified sorediate crust.

*Notes.* *Lecanora quercicola* is distinguished from *L. saligna* by a less granular thallus and larger macroconidia (only 6.0–8.1 × 2.0–2.4 µm in *L. saligna*). Furthermore, the ecology of *L. quercicola* is characteristic, being found mainly on the sides of vertical to leaning very old *Quercus* or *Olea* trees in rich lichen communities. In Coppins & James (1979) the measurements for macroconidia are given as 8–12 × 3–4 µm, but they are only 8.8–9.5 × 2.6–2.9 µm in their drawing, which fits well with our measurements. *Lecanora quercicola* as well as *L. saligna* can both have slightly pruinose apothecia, but

*L. saligna* has more irregular conidiogenous cells,  $5.5\text{--}8 \times 2\text{--}3 \mu\text{m}$ , whereas, according to the drawing in Coppins & James (1979), the conidiogenous cells of *L. quercicola* are more cylindrical and  $8.5\text{--}13 \times 2.4\text{--}3.3 \mu\text{m}$ . A further type of conidium ( $8\text{--}13 \times 0.4 \mu\text{m}$ ) is also recorded by Coppins & James (1979), which was not observed by us.

*Selected specimens examined. Germany: Niedersachsen:* Benthheim, Bad,  $7^{\circ}10'E$ ,  $52^{\circ}19'N$ , on old mature *Quercus* at S-side of building in park, 1976, *M. Brand* 6032 (hb. Brand).—**France:** *Morbihan:* 27 km ENE of Lorient, Forêt de Camors, 1 km E of Lambel,  $3^{\circ}1.0'W$ ,  $47^{\circ}50.0'N$ , 100 m, one old *Quercus* (circumf. 3 m), on road cross in rather young woodland, 1988, *M. Brand* 18457 (hb. Brand); 27 km ENE of Lorient, Forêt de Camors, 1 km E of Lambel, on mature *Quercus*, 110 m, 1988, *M. Brand* 18457 (hb. Brand).—**Spain:** *Mallorca:* N of Palma, along road C-710, 3 km W of Deia, small orchard with *Olea* trees, on *Olea*, 200 m, 1997, *P. van den Boom* 18422 (hb. v. d. Boom); W of Palma, N of Andratx, 5 km N of Coll de Sa Gremola, W side of road C-710, *Olea* orchard, on *Olea*, 300 m, 1997, *P. van den Boom* 18298 (hb. v. d. Boom). *Galicia:* Pontevedra, 4 km SE of Lalín,  $8^{\circ}5.23'W$ ,  $42^{\circ}38.01'N$ , 650 m, on old *Quercus* in open forest, 2003, *M. Brand* 49275 (hb. Brand).—**Portugal:** *Minho:* Serra Do Geres, W of Cabril, along road to Pincães, scattered mature *Quercus robur*, on trunk of *Quercus*, 450 m, 1999, *P. van den Boom* 23197 (hb. v. d. Boom). *Estremadura:* Serra dos Candeeiros, S of Leiria, SE of Porto de Mós, Zambujal de Alcária near crossing to Alvalados, *Olea* orchard, on *Olea*, 1995, *P. van den Boom* 17194, 17215 (hb. v. d. Boom). *Alentejo:* Évora SE of Alvitto, on *Olea*, *P. van den Boom* 17035 (hb. v. d. Boom); Serra de S. Mamede Natural Park, E of Portalegre, S of Pico de Serra de Mamede, near Ribeira de Arronches, mature *Castanea* trees in garden, on trunk of *Castanea sativa*, 680 m, 2003, *P. & B. van den Boom* 31436 (hb. v. d. Boom).

### *Lecanora saligna* (Schrad.) Zahlbr.

*Cat. Lich. Univ.* 5: 536 (1928).—*Lichen salignus* Schrad. *Spic. Fl. Germ.* 1: 84. (1794). (?LE—holotypus, not seen) [material requested but not received].

*Lecanoropsis saligna* (Schrad.) M. Choisy, *Bull. Mens. Soc. Linn. Lyon* 18: 143 (1949).

(Fig. 8D)

*Thallus* often effuse, in patches to 8 cm, uneven, slightly to strongly warted, granular to warted-areolate, warts sometimes aggregated, if on wood sometimes partly endoxyllic, up to c. 300  $\mu\text{m}$  thick, without cortex, with granules mainly on the upper surface, algal layer and medulla not differentiated;

upper surface grey, whitish grey, yellowish grey, to pale brownish grey, smooth. *Photobiont* chlorococcoid, cells 7–20  $\mu\text{m}$  diam. *Prothallus* not observed.

*Apothecia* broadly appressed, scattered to crowded and deformed, 0.4–0.7(–1.1) mm diam.; margin persistent, 0.04–0.1 mm wide, concolorous with the thallus or paler, often uneven, persistent, sometimes flexuose; disc flat to very weakly convex, pale to deep red-brown, epruinose to sometimes slightly pale yellowish pruinose. *Thalline excipulum* abundantly filled with granules, cortex clearly developed,  $\pm$  chondroid, algae abundantly present throughout the thalline excipulum, often reaching the outer rim. *Parathecium* often present, rather narrow, up to 20  $\mu\text{m}$  wide at outer rim and pigmented medium brown. *Epihymenium* yellowish brown, reddish brown or medium brown, with yellowish granules, N–. *Hymenium* hyaline or pale yellowish with pale orange-brown granules, 40–60  $\mu\text{m}$  high. *Hypothecium* hyaline or rarely weakly yellowish pigmented, to 100  $\mu\text{m}$  high. *Paraphyses* simple, branched or anastomosing, 1.5–2(–2.5)  $\mu\text{m}$  wide, mostly covered by a gelatinous sheath, abundantly septate, often slightly constricted at septa to more rarely nearly moniliform, apically only scarcely widened up to 3.5  $\mu\text{m}$ , rarely brownish pigmented in upper cell. *Ascospores* simple, ellipsoid, c.  $8\text{--}10 \times 4.1\text{--}4.8 \mu\text{m}$ .

*Macropycnidia* always abundant, immersed, upper part hyaline, reddish brown, brown or bluish black, 90–150  $\mu\text{m}$  high  $\times$  60–110  $\mu\text{m}$ ; *macroconidia* always weakly curved, not septate,  $6.0\text{--}8.1 \times 2.0\text{--}2.4 \mu\text{m}$ . *Micropycnidia* scarce and hard to find, moderately brown in upper part, hyaline below, c.  $50 \times 40 \mu\text{m}$ ; *microconidia* always slightly curved,  $8.4\text{--}10.5 \times 0.9\text{--}1.2 \mu\text{m}$ . *Mesopycnidia* rare and hard to find; *mesoconidia* bacilliform,  $3\text{--}5 \times 1.1\text{--}1.5 \mu\text{m}$ .

*Chemistry.* K–, C–, KC–, P–. Iso-usnic acid (major), neousnic acid (found in c. 50% of the specimens),  $\pm$  atranorin (minor) and  $\pm$  zeorin (minor), the latter two have been found only very rarely (TLC & HPLC).



**Ecology and distribution.** *Lecanora saligna* is a very common species in lowland areas throughout Europe. It grows on not too strongly acidic, dead wood (e.g. impregnated by dust or shifting sand), on fence posts, fallen branches and stumps. We have found it also on bark of trees, such as *Betula*, *Malus*, *Salix*, *Populus*, *Quercus*, *Robinia*, often in *Xanthorion* communities with *Amandinea punctata*, *Lecanora expallens*, *Micarea denigrata*, *Placynthiella dasaea*, *Strangospora pinicola* and *Xanthoria parietina*. *Buellia schaeereri* has rarely been found as an accompanying species. Although *L. saligna* is essentially a lowland species, we have studied specimens from altitudes of 1150 m in France and 1400–1600 m in Russia.

**Notes.** This is the most common of the species in western Europe treated here. It is characterized by brownish apothecia with a yellowish, persistent margin, and by the typical, weakly curved macroconidia measuring  $6.0\text{--}8.1 \times 2.0\text{--}2.4 \mu\text{m}$ , found in the usually abundant reddish to dark-brown macropycnidia. While Hawksworth & Dalby (1992) record that this species grows on “wood, worked timber and more rarely on dead bark”, the records in Printzen (2001) are mainly from wood and the bark of conifers. However, we have collected it from the less acidic bark of *Populus*, *Salix* and *Sambucus* so that its ecological amplitude is even wider. Populations on living bark have been found mostly on bases of tree trunks, only more rarely on higher parts of the trunks. The species can appear in large populations up to several  $\text{dm}^2$ .

Most characters of this species are rather constant, for example, the macroconidia, which we measured from many specimens were  $6.0\text{--}8.1 \times 2.0\text{--}2.4 \mu\text{m}$ . However, all more or less recent publications report variable measurements:  $6\text{--}11 \times 1\text{--}3 \mu\text{m}$  (Clauzade & Roux 1985),  $7\text{--}8 \times 2\text{--}2.5 \mu\text{m}$  (Diederich 1989),  $7\text{--}8(-9) \times 1.5\text{--}2.5 (-3) \mu\text{m}$  (Hawksworth & Dalby 1992),  $4\text{--}7.5 \times 1.0\text{--}1.5 \mu\text{m}$  (Printzen 2001), and  $10\text{--}12 \times 0.7\text{--}1.2$  or  $6\text{--}8(-11) \times 1.5\text{--}3 \mu\text{m}$  (Wirth 1995). Some of these measurements refer to microconidia which are scarce, or

they include two kinds of conidia. In well-developed specimens macroconidia are always present; only in a few (scanty) specimens, mostly with a reduced thallus are pycnidia lacking. The conidia in the specimen Sérusiaux 6495, are  $10\text{--}12 \times 0.5 \mu\text{m}$ , as annotated by B. J. Coppins, but we were unable to find such conidia.

The lichenicolous fungus *Lichenodiplis lecanorae* growing on apothecia and thalli was present in many collections. Infections by *Pseudodiplodia lichenis* Vouaux, *Unguiculariopsis lesdainii* (Vouaux Etayo & Diederich) or *Taeniolella delicata* M.S. Christ. & D. Hawksw. are rare.

**Selected specimens examined.** **Great Britain:** *England:* **V.C. 14**, East Sussex: S of London, Lewes, on timber, s.d. Crombie s.n. (B). **V.C. 36**, Hereford: Kentchurch Deerpark, in parkland, on tree bole of *Populus*, 100 m, 1974, Sipman 6599 (B).—**The Netherlands:** *Friesland:* Vlieland, Kroonspolders,  $4^{\circ}57.9'E$ ,  $53^{\circ}15.3'N$ , piece of wood near the beach, 1973, M. Brand 3015 (hb. Brand); Ameland, Hollum, Lange Duinen, small woodland with *Sambucus* and *Hippophae*, on *Sambucus*, 1995, P. van den Boom 17518 (hb. v. d. Boom). *Drenthe:* W of Emmen, Sleen, brink,  $6^{\circ}48.2'E$ ,  $52^{\circ}46.5'N$ , on mature *Quercus* tree, 1976, M. Brand 6318 (hb. Brand); ENE of Mantinge, N of Balingerbosch, meadow with *Alnus* trees, on *Alnus*, 1999, P. van den Boom 23645 (hb. v. d. Boom). *Noord-Holland:* Bergen aan zee (N),  $4^{\circ}38'E$ ,  $52^{\circ}40'N$ , on dead fallen trunk of tree in dune area, 1975, M. Brand 5221 (hb. Brand). *Flevoland:* Noordoostpolder, Urk, along ‘Staart’ reserve,  $5^{\circ}37'E$ ,  $52^{\circ}40'N$ , *Salix alba* along road, 1979, M. Brand 7904 (hb. Brand). *Overijssel:* Twente, De Lutte, Bloemenbeek,  $7^{\circ}2'E$ ,  $52^{\circ}19.1'N$ , wood of fence post along meadow, 1976, M. Brand 6033 (hb. Brand). *Zuid-Holland:* Voorne, Oostvoorne, v. Itersonbos,  $4^{\circ}4.0'E$ ,  $51^{\circ}54.6'N$ , on *Populus* in dune area, open woodland, 1971, M. Brand 1738 (hb. Brand). *Gelderland:* Herwijnen, decoy at Detsteeg,  $5^{\circ}6.7'E$ ,  $51^{\circ}51.2'N$ , dead wood of *Salix*, 1975, M. Brand 5201 (hb. Brand); Winterswijk (NW), farm ‘Kleuverskamp’, S of Korenburg,  $6^{\circ}40.2'E$ ,  $51^{\circ}58.7'N$ , *Quercus* along unpaved road, 1992, M. Brand 29097 (hb. Brand). *Zeeland:* NW of Sas van Gent,  $3^{\circ}48.7'E$ ,  $51^{\circ}14.0'N$ ; on base of pollard-willow, along ditch in meadow, 1972, M. Brand 2373 (hb. Brand). *Noord Brabant:* Biesbos, W van Noorderplaat, Biezenegors beoosten 130, S bank of gully,  $4^{\circ}47.4'E$ ,  $51^{\circ}44.8'N$ , *Salix dasyclados* in neglected, low willow-ground, 1990, M. Brand 22600 (hb. Brand); SSW of Leende, Groote Heide, S of unpaved road, *Calluna* heathland, on solitary *Sambucus* shrub, 2005, P. van den Boom 35694 (hb. v. d. Boom); *ibid.*, on large *Pinus* stump, 2005, P. van den Boom 35684 (hb. v. d. Boom). *Limburg:* Nieuw Bergen, E of Meeuwenven, at picnic place, on wood of plaything,  $6^{\circ}4.3'E$ ,  $51^{\circ}36.4'N$ , 1992, M. Brand 29060 (hb.

Brand); SW of Reuver, Beesel, 'Het Broek', damp *Populus* woodland, on *Populus*, 1992, *M. Brand* 29027 (hb. Brand).—**Belgium:** *Antwerpen:* NW of Kalmthout, Kalmthoutse Heide, *Calluna* heathland, on rotting wood, 2000, *P. van den Boom* 24012 (hb. v. d. Boom). *Limburg:* N of Lommel, Blekerheide, former heathland with *Pinus* forest, along maize field, on *Salix*, 1999, *P. van den Boom* 22706 (hb. v. d. Boom). *Liège:* Angleur, Parc de 'La Vieille Montagne' (Umicore), rive gauche de l'Ourthe, on *Aesculus*, iv 2005, *E. Sérusiaux* s.n. (LG). *Luxembourg:* Straimont, Martilly, bord du chemin de Gribomont, à la sortie du village, sur tronç de *Fraxinus*, 1965, *J. Lambinon*, 65/B/929 (LG); Rochehaut, Route descendant vers la Semois par le Moulin du Bochet, on *Acer*, 1984, *E. Sérusiaux* 6908 (LG); 2 km WSW of Durbuy, 1.5 km SSE of Septon, W above Fond du Bois, shaded calcareous outcrops in *Quercus fagus* forest, on fence post, 200 m, 1989, *P. van den Boom* 8214 (hb. v. d. Boom); 2.5 km N of Virton, 0.2 km N of Croix St. Jacques, 5°31.9'E, 49°35.4'N, 290 m, on old *Quercus* at crossroads in wood, 1991, *M. Brand* 25447 (hb. v. d. Boom). *Lorraine:* SE of Florenville, S of Pin, Forêt d'Orval, path along stream 'Frere Simon', mixed forest on N exposed slope (L6.58), on wood of fence post, 250 m, 1998, *P. van den Boom* 20053 (hb. v. d. Boom).—**Germany:** *Hamburg:* Am Elbufer bei Kittenbergen, on *Sambucus*, 25 ix 1932, *C. Erichsen* (GZU). *Brandenburg:* SE of Berlin, 8 km S of Storkow, E of Bugk, W side of small lake, *Pinus* forest, on stump, 40 m, 2002, *P. van den Boom* 21065, 21203 & *H. Sipman* (hb. v. d. Boom). *Nordrhein-Westfalen:* near Münster, Welbergen, on wood of an old barrier, viii 1862, *Lahm?* s.n. (B). *Rheinland-Pfalz:* Hamm, bei dem Punkt 'Schöne Aussicht', on *Malus*, 18 ii 1984, *V. John* s.n. (hb. John); Saarland, Entre Lautenbach et Dörrenbach, on *Malus*, 1984, *P. Diederich* 5776 & *V. John* (hb. Diederich).—**Luxembourg:** *Gutland:* route Berdorf vers le Mullerthal au Sud, Prestigstull, on *Quercus*, 1984, *P. Diederich* & *E. Sérusiaux* 6495 (LG). *Ardenne:* SWW of Boulaide (K7.47), on wood in a forest, 1987, *P. Diederich* 8494 (hb. Diederich); 0.5 km SSE of Hoscheid, 6°5.0'E, 49°56.5'N, 465 m, old *Fraxinus* at side of former high road on plateau with arable land, 1989, *M. Brand* 20203 (hb. Brand). *Lorraine:* NNW of Contern, Weierboesch (M8.27), on *Quercus*, 1987, *P. Diederich* 8938 (hb. Diederich); E of Emerange, berge de la Gander (M8.58), on *Salix*, 1987, *P. Diederich* 8614 (hb. Diederich); SW of Ettelbruck (K8.54), on wood, 1987, *P. Diederich* 7811 (hb. Diederich); Berschbach (L8.35), on *Salix*, 1893, *Felgen* 15 (LUX); *ibid.*, SW of Septfontaines, W of Sauerwisen (L8.42), on *Pyrus*, 1979, *P. Diederich* 1957 (hb. Diederich).—**Austria:** *Salzburg:* N of Radstadt, road from Ebe to Filzmoos, near Ploimühle, *Picea* forest with *Alnus incana*, on *Picea*, 860 m, 2002, *P. van den Boom* 28420 (hb. v. d. Boom).—**Finland:** *N Karelia:* Koli, 0.5 km SE of Kotaniemi, 29°52.5'E, 63°2.8'N, 100 m, wood of fence along meadow, 1980, *M. Brand* 9708 (hb. Brand).—**Sweden:** *Götland:* Öland, Mörbylång Kirka, 16°23.5'E, 56°30.8'N, old *Fraxinus* in churchyard, 1989, *M. Brand* 21333 (hb. Brand).—**Denmark:** *Jutland:* Rømø, Toftum, near museum,

8°33.4'E, 55°9.9'N, on old *Malus*, 1977, *M. Brand* 7079 (hb. Brand).—**Hungary:** *Bacs Kiskun:* 35 km SE of Budapest, Csévharaszt, 19°2'E, 47°56'N, 100 m, dunes of lime rich sand, on rabbit pellets, 1981, *M. Brand* 10541 (hb. Brand).—**France:** *Vosges:* 10 km WSW of Munster, 0.1 km W of Kastelbergwasen, 7°0.4'E, 48°7'N, 1150 m, on free standing old *Fagus* in open meadow, 1984, *M. Brand* 11776 (hb. Brand); SE of Kantelberg, S of Honeck, on old freestanding *Fagus* trunk, 1200 m, 1984, *H. Sipman* 17586. *Jura:* S of Besançon, SSE of Champagnole, Cornu, 800 m, on base of *Picea* and on fence post, 1986, *P. van den Boom* 3833 (hb. v. d. Boom).—**Austria:** *Steiermark:* Seetaler Alpen, Neumarker Sattel, 3 km NW von Neumarkt, Strasse von Hoferdorf, Richtung Moar am Berg, 940 m, Pfosten einer Holzbrücke, 1989, *Obermayer* 2609 (GZU).—**Italy:** *Toscana:* 6 km WNW of Cortona, NW of S. Caterina, 11°54'E, 43°17'N, 300 m, *Cupressus* along road through fields, flat land, 2001, *M. Brand* 43725 (hb. Brand). *Lazio:* Frosinone, c. 1 km S of Strangolagalli, 13°29'E, 41°35'N, 100 m, wood of poles supporting vines, blue by Cu-compounds, 2001, *M. Brand* 42617 (hb. Brand).—**Russia:** *Caucasus distr.:* Ochamchira, vicinitas latior pagi mons Bardunakravar, 1400–1600 m, 14 vi 1981, *V. Vašák* s.n. (B).—**Spain:** *Galicía:* 34 km ESE of Ourense, E of Paredes, 7°27.0'W, 42°16.1'N, 1070 m, on rotting wood of fence post in meadow, 2003, *M. Brand* 49308 (hb. Brand).—**Portugal:** *Tras-os-Montes:* N of Vila Real de Santo Antonio, Reserva Natural do Sapal de Castro Marim, W of Leziria, unpaved road among orchard with *Olea europaea* and *Ceratonia siliqua*, 110 m, on wood of trunk of mature *Olea*, 2006, *P. & B. van den Boom* 36086 (hb. v. d. Boom).

*Exsiccata examined:* Arnold, *Lich. exs.* 472 [as *L. piniperda*] (B); Arnold, *Lich. Mon. exs.* 159 [as *L. piniperda*] (B); Hillman, *Lich. exs.* 2568 (B); *Plant. Graec. exs.* 149 [as *L. subintricata*] (B); *Plant. Graec. exs.* 404 (B); Poelt & Hafellner, *Lich. exs.* 317 (B); Schade, Stolle & Riehmer, *Lich. exs.* 547 [as *L. metaboloides*] (B); Tobolewski, *Lich. Polonica Fasc. IX*, X (B).

## Lecanora sarcopidoides (A. Massal.)

### A. L. Sm.

*Bihang till Kgl. Svensk Vetensk. Akad. Handl.* 18: 47 (1892).—*Biatora sarcopidoides* A. Massal. *Ricerch. Auton. Lich.* (1852); type: Italy, prov. Veronensis, et Vicentina, ad nudos, et marcescentes castaneorum truncos, ?1851, leg. A. Massal. Anzi, *Lichenes variores Veneti exs.* 61 (M—lectotype, selected here).

*Lecanora sarcopidoides* (A. Massal.) Hedl. var. *hypnophaga* Poelt, *Mittel. der Bot. Staatssammlung München* 2(17–18): 386–399 (1957); type: Germany, Bayern, Isarwinkelgebirge, Gergwald zw. Benediktbeuren und der Hausstatalpe, on *Hypnum cupressiforme filiforme*, on *Picea*, c. 900 m, ?1956, *J. Poelt* s.n. (M—holotype!).

(Figs 8B & 10)

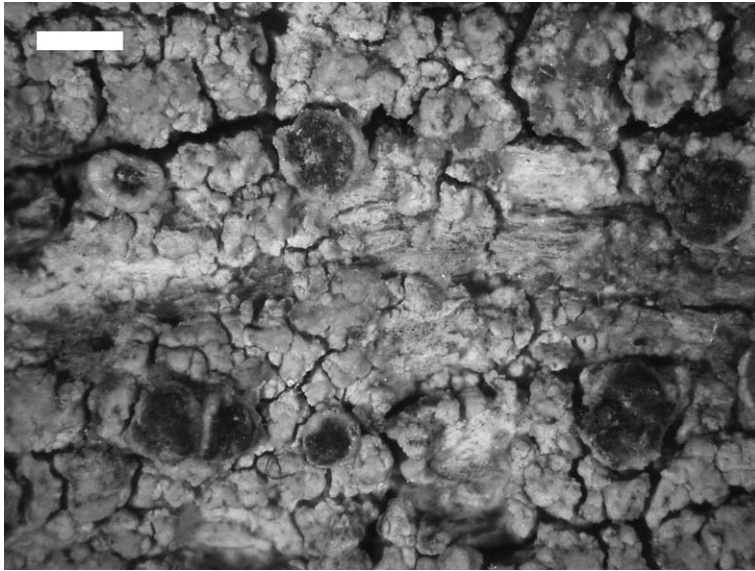


FIG. 10. *Lecanora sarcopidoides*, habitus (M. Brand 6224). Scale: 0.5 mm.

*Thallus* effuse, to 4 cm wide, endosubstratal to episubstratal, mostly thin, 0.05–0.3 mm high; areolate, areoles irregularly warty; wartsc. 0.5 mm wide, sometimes aggregated; cortex not well developed, mainly at the lower part of the apothecium, below the excipulum; epinecral layer not developed, algal layer to 80  $\mu$ m, granules present in all parts of the thallus, more often in the upper layer of up to 60  $\mu$ m high; upper surface grey, greyish brown, pale yellowish brown, matt. *Photobiont* chlorococcoid, cells 8–17  $\mu$ m diam. *Prothallus* not observed.

*Apothecia* broadly appressed to sessile, slightly constricted at the base, 0.25–0.5 (–0.7) mm diam.; margin thin, 0.05–0.07 mm wide laterally, initially clearly raised, becoming level with the disc, mostly persistent, concolorous with the thallus to concolorous with the disc; disc initially plane to slightly convex becoming strongly convex to subglobose; pale yellowish brown to sometimes dark greyish brown to bluish grey and becoming black, often slightly to densely whitish pruinose, in older apothecia often epruinose. *Thalline excipulum* corticated, chondroid, up to 70–130  $\mu$ m high, upper part diffuse brown, sometimes reduced, algal

layer reaching the upper surface, granules in anticlinal rows in apothecial cortex and partly in the algal layer. *Parathecium* reddish brown or sometimes pigmented bluish green in outer part and up to 20  $\mu$ m wide, pseudo-parenchymatous. *Epihymenium* yellowish brown, olive brown to more rarely dark brown, N+ reddish violet, with a mix of smaller and larger (1–5  $\mu$ m) hyaline granules reaching the parathecium and the outer rim of the excipular cortex. *Hymenium* upper part  $\pm$  diffuse reddish brown, sometimes spotted and changing to blue grey, 40–45  $\mu$ m high. *Hypothecium* hyaline, to 100  $\mu$ m high. *Paraphyses* simple to branched, sometimes irregularly septate, rarely constricted at septa, 1–2  $\mu$ m wide, not or rarely widened above, apices hyaline, rarely olive-brown pigmented,  $\pm$  conglutinated. *Asci* clavate, *Lecanora*-type, 20–27  $\times$  7–12  $\mu$ m. *Ascospores* ellipsoid, simple, rarely 1-septate, 8–10  $\times$  3.3–3.7  $\mu$ m.

*Micropycnidia* not often found, mostly immersed, ostiole brown or greenish black, 70  $\mu$ m high  $\times$  70–80  $\mu$ m; *microconidia* bacilliform, 4.0–5.7  $\times$  1.0–1.2  $\mu$ m. *Mesopycnidia* often present, immersed, ostiole pale brown, c. 110  $\times$  80  $\mu$ m; *mesoconidia* ellipsoid, 2.7–



3.7(–4.1) × (1.1)–1.3–1.7 µm. *Leptopycnidia* very rare, immersed, ostiole greenish black, c. 150 × 110 µm; *leptoconidia* slightly to strongly curved, c. 19 × 0.7 µm.

**Chemistry.** Pseudoplacodiolic acid (major), placodiolic acid (trace), usnic acid (trace); K–, C–, KC– yellow, P± pale yellow (TLC & HPLC).

**Ecology and distribution.** *Lecanora sarcopidoides* is known from lowland and upland areas up to 2000 m, on dead, rotting wood or the bark of conifers (*Abies*, *Picea*, *Pinus*), and also on *Quercus* in the montane zone (500–1500 m), often accompanied by calicioid lichens such as *Calicium glaucinum*, *C. salicinum* and *Chaenotheca brunneola*. *Lecanora conizaeoides* and *L. varia* have also been found growing nearby.

**Notes.** Although *L. sarcopidoides* is a very characteristic species, it is one of the most easily confused species in the *L. saligna* group. However, the combination of pseudoplacodiolic acid, placodiolic acid and usnic acid is unique in the group and distinguishes it from all known related species. The first compound is not known from any of the other species treated here. *Lecidea leprarioides* Tønsb. has pseudoplacodiolic acid, a sorediate thallus, black lecideine apothecia and unknown pycnidia (Tønsberg 1992), but it is not related to the *Lecanora saligna* group. *Lecidea turgidula* Fr. also has placodiolic acid, but differs in having black lecideine apothecia, paraphyses with dark brownish apices up to 5 µm wide, and an epithecium with a bluish green pigment (several specimens in the herbaria of the authors have been studied). Young and well-developed specimens of *L. sarcopidoides* have pruinose apothecia, but in (over)mature apothecia pruina is lacking and then the apothecia are darker. Well-developed specimens can have a thickish, areolate thallus, for example Brand 6224. This last specimen contains three types of pycnidia of which macropycnidia are the most common and the associated species are *L. conizaeoides*, *L. varia* and *Chaenotheca brunneola*.

The closest relative is *L. subintricata*, which has microconidia of somewhat similar size, however it has smaller ascospores, a more yellowish thallus and apothecia and the thallus is thinner, less warted and with smaller areoles. In addition, the chemistry is different, with usnic acid being the major compound. Conidial sizes of 6–11 × 1–3 µm (Clauzade & Roux 1985), 3–7 × 1–1.5 µm (Wirth 1995) and 3–7 × 1–1.5 µm (Hawksworth & Dalby 1992) are reported in the literature so these measurements apparently refer to microconidia. *Lecanora sarcopidoides* is easily confused with *L. pseudosarcopidoides*, especially specimens with pruinose apothecia, and in these cases conidial and chemical characters are necessary for identification. Many collections of *L. sarcopidoides* have been found in herbaria under the name *Lecanora piniperda*.

*Lecanora sarcopidoides* seems to be a rather rare species. According to Hawksworth & Dalby (1992) it is a poorly understood species in the British Isles. We have studied the type of *L. sarcopidoides* var. *hypnophaga*, described by Poelt (1957), and, although it is the only specimen we have seen growing on mosses, we did not find any relevant differences in either morphology, or in chemistry, so we regard this variety as belonging to *L. sarcopidoides* s.str.

**Additional specimens examined.** **Sweden:** Värmland, 12 km NW of Sunne, Gettjärn, 12°56.9'E 59°53.5'N, 150 m, 2003, M. Brand 47210 (hb. Brand).—**Great Britain:** Scotland, V.C. 89, East Perthshire: Enochdhu, Kindrogan Field Centre, 37/05.62, on lignum of standing decorticated conifer trunk, c. 250 m, 2001, B. J. Coppins 20208 (E).—**Ireland:** V.C. H33, Fermanagh: Crom, Crom Castle Deer Park, 23/36.24 on exposed decorticated stump, 60 m, 1993, A. M. & B. J. Coppins 15898 & A. M. O'Dare (E).—**The Netherlands:** Noord Brabant: between Nieuwkuik and Helvoirt, on *Pinus*, ?1904, J. H. Wakker s.n. (L).—**Belgium:** Liège: Hautes Fagnes, Sourbrodt, Nesselö, edge of bog, wood of dead tree, 6°8.6'E, 50°29.8'N, 565 m, 1976, M. Brand 6224 (hb. Brand). **Luxembourg:** W of Bouillon, W of Corbion, Le Tabourin, on wood of fence post along *Picea* woodland, 360 m, 1999, P. van den Boom 21870 (hb. v. d. Boom); 3.5 km SE of Herbeumont, Fotêt d'Herbeumont, SE of Pavillon de chasse, along Semois, at E steep acidic outcrop (L6.26), on dead standing *Quercus* trunk, 300 m, 2006, P. & B. van den Boom 37126 (hb. v. d. Boom).—**Germany:** Schleswig-Holstein: Eichenpfähle im Prökeltmoor bei Wellingsbüttel,

20 iii 1904, *F. Erichsen* s.n. (B); Flensburg, on stump of *Quercus*, 10 xi 1929, *W. Saxen* s.n. (B).—**Austria:** *Steiermark*: Salzburger Alpen, Ennstal, 5 km NW of Irdning, valley with limestone outcrops, on wood of *Picea* trunk, 14°2'E, 47°31'N, 700 m, 1981, *M. Brand* 31775 (hb. Brand).—**France:** *Pyrénées atlantiques*: St. Engrâce, 2.5 km NNE of Senta, S slope of Pic d'Issarbe, 0°48.0'W, 43°4'N, 1500 m, wood of standing, dead *Abies* in *Abies-Fagus* wood on SW slope, 1992, *M. Brand* 28699 (hb. Brand).—**Czech Republic:** *Western Bohemia*: SSE of Klatovy, Národní park, E of Srni, NW of Turnerova Chata, E side of Vydra, well-lit relict pine forest, SW exposed scree, with stumps and *Betula* trees at edge of forest, on vertical side of stump, 750 m, 2003, *P. van den Boom* 31701 & *Z. Palice* (hb. v. d. Boom).—**Italy:** *Trentino-Alto Adige*: prov. Bolzano, 54 km WSW of Merano, NP Stilsfer Joch, SW of Trafoi, S slope with *Pinus* trees and stumps, on *Pinus* stump, 1960 m, 1990, *P. van den Boom* 10793 (hb. v. d. Boom).

*Exsiccata examined*: Anzi, *Lich. merid. rar.* 175 (M) [as *L. varia* var. *saepincola*]; Arnold, *Lich. exs.* 708 (B, GZU, H-Nyl, L) [as *L. metaboloides*]; Hepp, *Flecht. Europ.* 69 (L) [as *L. piniperda*]; H. Olivier, *Lich. exs.* 230 (LUX) [as *L. piniperda*]; Rehm, *Lich. exs.* 34 (L) [as *L. piniperda*]; Zwack, *Lich. exs.* 116 (L) [as *L. varia* var. *saepincola*].

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

*Lichenogr. Scand.* 1: 265 (1871).—*Lecanora varia* var. *subintricata* Nyl., *Flora* 51: 478 (1868); type: Russia, Kola, super corticem *Betulae*, 1863, *N. I. Fellman* [Fellman, *Lichenes arctici* 133] (H-Nyl. 26661—holotype).

*Lecanoropsis subintricata* (Nyl.) Choisy, *Bull. Mens. Soc. Limn. Lyon* 18: 143 (1949).

*Thallus* mostly endosubstratal, sometimes episubstratal, up to several cm wide, of dispersed, c. 0.15 mm wide warts, without cortex and epinecral layer, with granules in the upper part of the thallus, algae dispersed over the thallus, reaching the upper side; upper surface yellow grey, yellow green to pale yellowish brown, matt or sometimes shiny. *Photobiont* chlorococcoid, cells to 25 µm wide. *Prothallus* not observed.

*Apothecia* appressed to sessile, juvenile apothecia erumpent, at first ± gyalectoid, 0.4–0.6 mm diam.; margin initially prominent, concolorous with the thallus, turning inward and irregular, becoming ± excluded, more or less biatorine and concolorous with the disc, 0.03–0.06 mm wide; disc plane to convex, yellowish beige or grey, moderately brown, pale yellowish brown, to olive-

brown, sometimes slightly white or bluish pruinose. *Thalline excipulum* corticate, cortex 20–30 µm thick, regular in thickness, chondroid, with antical hyphae. *Parathecium* sometimes visible, small, 10–30 µm and brownish at the outer rim, filled with granules especially in the outer part. *Epihymenium* pale yellowish brown, medium to dark brown, sometimes olive pigmented, with many fine and more stout, yellowish granules, N+ reddish violet. *Hymenium* hyaline, with orange-brown granules, 30–50 µm. *Hypothecium* hyaline to rarely slightly yellowish, to 120 µm high. *Paraphyses* simple to branched and anastomosing, top hyaline to rarely brown and bluish grey, up to c. 3 µm wide. *Ascospores* ellipsoid, simple, 6.7–8.4 (–10.2) × 3.1–3.6 µm.

*Micropycnidia* rarely present, immersed, top free and brown to greenish blue, 40–90 × 40–60 µm; *microconidia* short-bacilliform, 4.8–6.2 × 1.0–1.3 µm. *Mesopycnidia* often present, black at least in upper half, sessile, 120–130 × 100–110 µm; *mesoconidia* ellipsoid to short cylindrical 2.8–3.4 × 1.4–1.6 µm.

*Chemistry*. K± yellow, C–, KC+ yellow Pd–. Usnic acid (major); ± brialmontin 1 (minor) (TLC & HPLC).

*Ecology and distribution*. *Lecanora subintricata* occurs mainly on bark or decorticated wood of conifers (*Pinus cembra*, *P. nigra*, *Larix*) mainly in the montane and subalpine zones (1000–2000 m) in Europe. Accompanying species are often *Hypogymnia physodes*, *Lecanora varia*, *Parmelia sulcata*, *Parmeliopsis ambigua* and *Pseudevernia furfuracea*, and sometimes *Hypocenomycete scalaris*, *Trapeliopsis flexuosa* and *Xylographa vitiligo*.

*Notes*. *Lecanora subintricata* is distinguished from all the other species mentioned in this study by the presence of usnic acid as a major compound. However, according to Printzen (2001) *Lecanora albellula* found in North America can have usnic acid as a major component. Furthermore *L. subintricata* differs from other species with usnic acid by its much smaller ascospores



(except *L. coppinsii* and the western American species *L. latens*), smaller apothecia and shorter microconidia or mesoconidia.

The measurements of conidia reported in the literature: 4–7 × 1 µm (Clauzade & Roux 1985; Wirth 1995); 3–7 × 1–1.5 µm (Hawksworth & Dalby 1992) and 5–8 × 1 µm (Hinteregger 1994) most probably refer to microconidia or a mixture of micro- and mesoconidia. Although the specimens we studied have ascospores <8.5 µm (very rarely 8.5–9.5 µm) long, Hinteregger (1994) recorded them as 8–11.5(–13) µm long and sometimes 1-septate. However, we have never found septate ascospores in *L. subintricata* and cannot explain these measurements. In one British specimen, *Ellis* L235, both microconidia and mesoconidia were found and their measurements agree with those in our description. However the specimen is poorly developed and we could not detect any lichen substance by TLC. Isousnic acid has been reported from most American specimens (Printzen 2001); this compound is probably identical with the compound formerly named by us as ‘subintricata unknown’ and subsequently identified by J. A. Elix as brialmontin 1.

*Selected specimens examined.* **Norway:** *Oppland:* Rondane, 3 km E of Doralseter, open fjell, on dead wood of *Betula*, 9°51'E, 62°0.6'N, 1000 m, 2003, *M. Brand* 47408 (hb. Brand); Sel, Horgesetrene, W above Rosten, towards Mt. Horgenosi, 9°22'E, 61°52'N, 1000 m, *Betula nana*-*Cladina*-heath, just above tree limit, on isolated *Betula* tree trunk, 1999, *H. Sipman* 44165 (B). *Buskerud:* Hemsedal, Mörkedalen, W slope of Slettind, on twigs of *Salix glauca*, 8°9.6'E, 60°58.2'N, 1100 m, 2003, *M. Brand* 48205 (hb. Brand).—**Sweden:** *Torne Lappmark:* Kiruna, near Jieprenjakkstugan hut, on N shore of Lake Torneräsk, subalpine *Betula tortuosa* forest, on trunk of *Betula*, 18°52'E, 68°27'N, 350 m, 1986, *H. Sipman* 21385 (B).—**Finland:** *Lapponia enontekiensis:* Pallastunturi, S of Pallaskero, 24°6.4'E, 68°1.6'N, 400 m, *Salix capraea* on wet place in *Pinus* forest, 1980, *M. Brand* 9873, 9869 (hb. Brand); 19 km NE of Muonio, area Matkailukeskus, open heathland with scattered *Betula* and *Picea*, on wood of sauna house, 470 m, 1988, *P. van den Boom* 7394 (hb. v. d. Boom). *Lapponia inarenensis:* parish Utsjoki, valley of Kevojoki river, 1–2 km before outlet into Lake Kevojärvi, 100 m, light mossy *Betula* forest in valley on E slope, on dead wood of fallen tree, 1988, *H. Sipman* 23550, *Tan & E. Reiniko* (B).—**Great Britain:** *Scotland:* NO 483788, Aspen stand, in

pasture close to north banks of the River Esk, nr East Migvie, on *Populus tremula*, 200 m, 2004, RBGE Aspen Epiphyte Project, C. *Ĵ. Ellis* L235 (E).—**Switzerland:** *Valais:* Val d'Hérens, 0.5 km SW of Evolène, 7°29.4'E, 46°6.6'N, 1400 m, *Larix* at edge of forest, *M. Brand* 24365 (hb. Brand); 0.7 km N of Arolla, 7°27.3'E, 46°1.7'N, 2120 m, decayed wood of dead log in open *Larix-Pinus cembra* wood on E slope, 1990, *M. Brand* 24876 (hb. Brand). *Valais:* 7 km S of Kandersteg, S edge of Sagiwald, on decorticated wood of *Pinus mugo*, 2000 m, 1990, *M. Brand* 24031 (hb. Brand). *Graubünden:* Engadin, Val Susauna, 9°59.5'E, 46°38.9'N, 1690 m, on rotten wood in meadow near edge of forest; 1977, *M. Brand* 6685b (hb. Brand).—**Austria:** *Tirol:* Innsbruck, Patscherkofel, between Boschede and Isshütte, *Pinus cembra* forest on N slope, 11°27'E, 47°12'N, on dead branch, 1900 m, 1981, *M. Brand* 31808 (hb. Brand). *Styria:* S of Trieben, W of Hohentauern, trail in *Picea* forest, on stump, 1350 m, 2002, *P. & B. van den Boom* 28616, 28627 (hb. v. d. Boom). *Carinthia:* Gailtaler Alpen, 12 km NW of Hermagor, area of Weissbriach, *Alnus* woodland, on wood of bird observation post, 820 m, 1994, *P. van den Boom* 15728 (hb. v. d. Boom).—**Italy:** *Lombardia:* Como, 7.5 km W of Gravedona, Val S. Iorio, 9°12'E, 46°9'N, 1500 m, *Larix* in *Fagus-Larix* forest, just under timberline, 1993, *M. Brand* 30263 (hb. Brand). *Trentino-Alto Adige:* Bolzano, 54 km WSW of Merano, NP Stilsfer Joch, road Prad-Stilsferjoch, SW of Trafoi, SE slope, with *Picea* wood and outcrops, on *Picea*, 1850 m, 1990, *P. van den Boom* 10836 (hb. v. d. Boom).—**France:** *Hautes Alpes:* c. 27 km SE of Briançon, near Fontgillarde, 6°52'E, 44°43'N, 1970 m, on *Larix* in open wood on N slope, 1984, *M. Brand* 11678b (hb. Brand). *Alpes Maritimes:* 1.6 km ESE of Col de Cayolle, *Pinus* and *Larix* in open wood near tree line, 6°45.9'W, 44°15'N, 2000 m, 2002, *M. Brand* 45336 (hb. Brand). *Pyrénées Atlantiques:* St Engrâce, 0.5 km N of Calla, 0°49.3'W, 43°6.0'N, 600 m, 1992, *M. Brand* 28205 (hb. Brand).—**Spain:** *Navarra:* Pireneos, 3.5 km ENE of Isaba, Barranco de Belabarce, on *Pinus*, 1000 m, 1992, *M. Brand* 28537 (hb. Brand).—**Slovakia:** *Hautes Tatras:* Tichá Dolina, partie super. de la vallée, tronc mort de *Picea*, dans la pessière claire, 1300 m, 1966, *Ĵ. Lambinon* 66/T/1100 (LG); the Carpathians, Muránska planina plateau, Mt Kl'ak, N-NE facing slope, nearby Machnatá cave, 19°58'E, 48°47'N, on hard wood of a stump, 1300 m, 2000, *A. Guttová, Ĵ. Halda, V. Orthová & Z. Palice* 4819 (hb. Palice, hb. v.d. Boom).

*Exsiccata examined:* Lumbsch & Feige, *Lich. exs.* 92 (B); Magnusson, *Lich. exs.* 404 (B); Räsänen, *Lich. Fenn.* 474 (B). Schade, Stolle & Riehmer, *Lich. sax. exs.* 489 (B); Vezda, *Lich. selec. exs.* 1858 (B).

### **Lecanora subruida Nyl.**

*Flora* 55: 250 (1872); type: Switzerland, Schaer. *Lich. Helv.* 544 (M—lectotype, designated here; M—isolectotype!).

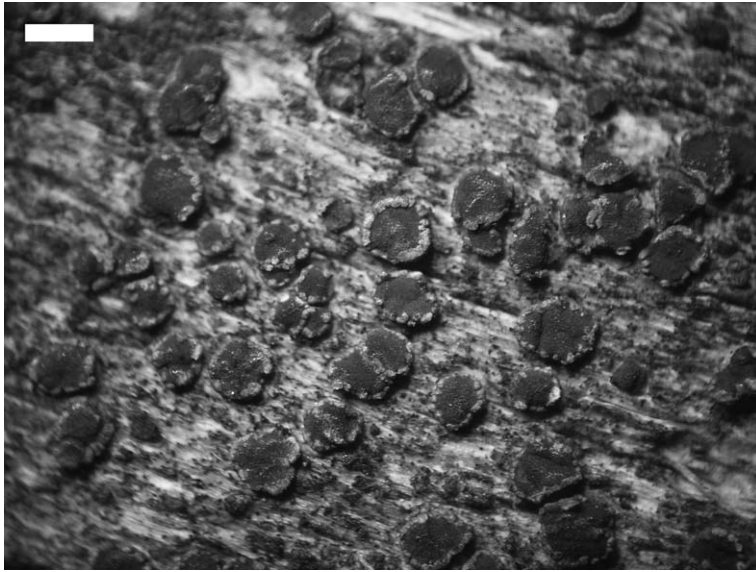


FIG. 11. *Lecanora subbravida*, habitus (isolectotype). Scale: 0.5 mm.

(Figs 8C & 11)

*Thallus* endosubstratal, rather large, patches to 8 cm wide or with scattered small, warted parts, warts to 0.1 mm, in section thin, up to *c.* 80  $\mu\text{m}$  thick, without a clear cortex and with granules throughout the thallus, upper surface yellowish brown-grey, matt. *Photobiont* chlorococcoid, cells *c.* 12–15  $\mu\text{m}$  diam. *Prothallus* not observed.

*Apothecia* rather large, constricted at the base, *c.* 0.5–0.8 mm diam.; margin conspicuous, clearly separated, persistent, *c.* 0.04–0.1 mm wide, in older apothecia knobby or folded; disc plane, persistent, pale to medium brown, epruinose. *Thalline excipulum* well developed, *c.* 160–190  $\mu\text{m}$  high in section (from upper margin of the parathecium); cortex lacking at the upper part of the excipulum, strongly developed at the lower part, chondroid, with anticlinal, conglutinated hyphae, hyaline, *c.* 40–80  $\mu\text{m}$  thick, medulla of excipulum filled with algae and rather large granules. *Parathecium* not developed. *Epihymenium* pale brown, with fine yellowish granules at the upper surface, N<sup>-</sup>. *Hymenium* hyaline, orange-brown granules lacking, *c.* 50–65  $\mu\text{m}$  high. *Hypoth-*

*ecium* hyaline, 50–70  $\mu\text{m}$  high. *Paraphyses* simple to rarely branched,  $\pm$  constricted at septum, 1.5–2  $\mu\text{m}$  diam., midhymenial cells 6–12  $\mu\text{m}$  long, partly orange-brown pigmented at apices. *Asci* *Lecanora*-type, *c.* 45–65  $\times$  12–14  $\mu\text{m}$ . *Ascospores* broadly ellipsoid, simple, 9.4–11.0  $\times$  5.0–6.0 (–6.2)  $\mu\text{m}$ .

*Macropycnidia* rare, semi-immersed, hyaline at base, dark bluish green-grey *c.* 120–140  $\times$  90–120  $\mu\text{m}$ ; *macroconidia* curved, pointed at both ends, non-septate (falcate), 12.5–13  $\times$  2.8–3.0  $\mu\text{m}$ . *Microspycnidia* very rare, immersed, *c.* 50–70  $\mu\text{m}$  diam.; *microconidia*, curved, *c.* 7–8  $\times$  0.8  $\mu\text{m}$ . *Leptopycnidia* abundant, globose, outer rim partly brown, towards the top bluish green-grey pigmented, *c.* 80  $\mu\text{m}$  diam.; *leptoconidia* curved, *c.* 10.8–11  $\times$  0.7–0.9  $\mu\text{m}$ .

*Chemistry.* K<sup>+</sup> yellow, KC<sup>+</sup> yellow, P<sup>-</sup>; usnic acid (major/minor); placodiolic acid (major/minor),  $\pm$ isousnic acid (minor/trace), squamatic acid (minor), (TLC and HPLC).

*Ecology and distribution.* *Lecanora subbravida* occurs on bark or wood, sometimes on rotting trunks of mature *Picea*, in Germany and

Switzerland (19th century collections). Nylander (1872) reported that he knew this species from Switzerland, Bayern and Savoye (Saubaudia, France). The only recent collection (*P. v. d. Boom* 8487) is lignicolous on a stump.

*Notes.* *Lecanora subravida* is clearly a distinct taxon, not readily confused with any other species in the *Lecanora saligna* group. Its habitus sometimes resembles *L. varia*, but that species is never endoxylic, and it even resembles *L. conizaeoides*, for example, by the well-developed cortex in the apothecia. Its macroconidia are comparable with those of *L. quercicola*, although these are more attenuate and longer in *L. subravida*. The ascospores are clearly wider than in all related species. In the recent literature the name *L. subravida* has appeared only in the checklist for Germany (Scholz 2000). *Lecanora subravida* was described by Nylander (1872: 250) who gave only a very short description and noted that the exsiccatum (*Lich. Helv. Exs.*) Schaerer 544 differs from *L. sarcopis* Wahlenberg, but he referred to Arnold (1872: 76), who described *L. hageni* var. *sarcopis* Schaerer non Wahlenb. as "spora ovales 12 µm long, 6–7 µm lat.; spermatia acicularia curvata 12–15 × 1 µm". Printzen (2001) regarded *L. subravida* Nyl. (1872) as a nom. nud. and cited *Lecanora varia* var. *subravida* (Nyl.) Nyl. (in Malbranche, *Bull. Soc. Amis. Scienc. Nat. Rouen* 1881: 120.) as the first valid description of the epithet. However, Nylander (1872) made an indirect reference to Arnold (1872) who gave a brief description without publishing a new name for it. This affects the choice of a lectotype, which has to be chosen from material in M seen by Arnold and not from H-Nyl. The measurements of the ascospores and the leptconidia are somewhat larger in Arnold's description than our own. Studying more material, could probably give a wider range of measurements.

Squamatic acid has been detected in *L. subravida*, which is a very rare compound in the *L. saligna* group and has never been found in any other related species.

*Specimen examined.* **France:** *Vauchuse*: NE of Mt. Ventoux, 5 km E of Bédoin, E of St. Colombe, in *Quercus* forest, on stump, 475 m, 1989, *P. van den Boom* 8487 (hb. v. d. Boom).

*Exsiccata specimens examined.* Arnold, *Lich. Mon.* 32 (L) [Alter Fichtenstrunk im Walde östlich zwischen Gauting und Mühlthal. München, 18 viii 1889, leg. Arnold]; Arnold, *Lich. Mon.* 1384 (L) [Am morschen Holze alter Fichtenstrunke im Walde nördlich von Hohenbrunn bei München, 13 v 1888, leg. Arnold]; *Krypt. exs. Vindob.* 2758 (BR). Schaerer, *Lich. Helv.* 544 (H-Nyl.26246).

### Notes on the chemistry of the *L. saligna* *subintricata* agg. [mainly major substances]

There are differences in acetone extracts which may be useful for identification. They may be even more suitable for spot tests and clearer than spot tests on the thallus, especially for the 'major' substances. In this section some notes and additional techniques are described to check the identification of some important substances.

Isousnic acid: acetone extract weakly gelatinous, with broadened, clustered granules to spiny globules (growing as crystals from within a droplet); K– yellowish, KC– P–, FeCl<sub>3</sub>+ red-brown; in light weakly yellowish, UV–. In GE, elongate broadened yellow granules (Huneck & Yoshimura 1996, fig. 48).

Usnic acid: acetone extract ± dry, with clearly feather-shaped crystals; K+ yellow, C–, KC+ yellow, P–; in light yellowish, UV–. In GE, straight yellow needles (Huneck & Yoshimura 1996, fig. 50).

Pseudoplacodiolic acid: acetone extract ± comparable with isousnic acid, less gelatinous with broadened, clustered, elongated granules; K+ yellow, C–, KC++ yellow, P–, FeCl<sub>3</sub>+ red-brown; in light weakly yellowish, UV–. In GE, hexagonal prisms (Huneck & Yoshimura 1996, fig. 66).

Neousnic acid: always together with isousnic acid, extract not different; in light yellowish, UV–.

7-*O*-methylnorascomatic acid: UV+ white, Squamatic acid: acetone extract with prisms, FeCl<sub>3</sub>+ purple. In GE rhombic prisms (Huneck & Yoshimura 1996, fig. 35). It is a very rare compound in the *L. saligna*-group.

Paraensic acid D (major), paraensic acid C (minor): acetone extract with non-polarizing, radiating pattern; in the thallus and apothecia visible as very small oil droplets (<4 µm).

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