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Degelia cyanoloma (Schaer.) H. H. Blom & L. Lindblom *comb. et stat. nov.*, a distinct species from western Europe

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Abstract: *Degelia cyanoloma* (Schaer.) H. H. Blom & L. Lindblom is resurrected from synonymy and elevated from varietal rank to species. The taxon was earlier referred to *D. plumbea* (Lightf.) P. M. Jørg. & P. James, however, several discontinuous character states distinguish the two species. *Degelia cyanoloma* is characterized morphologically by having a large thallus that is pale greyish when dry, lobes that are composed of consecutive trough-shaped segments with an upper surface without squamules, no isidia or soredia, and apothecia discs that are dark reddish brown to blackish. *Degelia cyanoloma* has a euoceanic distribution and is known from western Europe (Norway, France, Great Britain, Ireland, Portugal, Spain). Based on results from studies of morphology, we hypothesize that *D. atlantica* (Degel.) P. M. Jørg. & P. James is the closest relative of *D. cyanoloma* among the European species of the genus whereas *D. plumbea* is closely related to *D. ligulata* P. M. Jørg. & P. James.

Key words: lichen-forming ascomycetes, *Lobarion* community, *Pannariaceae*, taxonomy

Introduction

Three species of *Degelia* are known from Europe, *viz. D. atlantica*, *D. ligulata* and *D. plumbea*. Of these, *D. atlantica* and *D. ligulata* have narrow euoceanic distributions and little morphological variation, whereas *D. plumbea* has a much wider suboceanic distribution and morphological variation in several characters has been described for this species (Jørgensen 1978; James & Purvis 1992).

During field work on the Norwegian west coast we became aware that two morphs, both referable to *D. plumbea*, were quite easily distinguished in the field. They frequently grow together on trees and rocks and are often found intermixed. Moreover, both morphs commonly occur together with *D. atlantica* in aspen-oak forests and aspen stands in the study area in Hordaland. Although character states of both morphs are included in the description of *D. plumbea* (Jørgensen 1978; James & Purvis 1992), one of them differs in several characters from the description of *D. plumbea* in Norway (Krog *et al.* 1994).

Studies of herbarium material from all regions of Norway and a number of specimens from other parts of western Europe confirmed that the differences between the two morphs are consistent throughout a much broader geographical range and we concluded that they should be recognized as two different species. Having examined type material of *D. plumbea* and its synonyms (Jørgensen 1978), we found that the most widespread morph in Norway is taxonomically identical with the type specimen of *D. plumbea*, whereas the other corresponds morphologically only to the type specimen of *Pannaria plumbea* var. *cyanoloma* Schaer.

Material and Methods

Specimens were collected from localities in Hordaland county, western Norway, and will be deposited in herbarium BG. Additional material from BG and FR as well as type material from G and PC (collections formerly deposited in CN) was studied. The collections were examined using a stereomicroscope and light

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microscope. Measurements given in millimetres were taken under the stereomicroscope and measurements in micrometres were made under the light microscope on material mounted in water.

The Species

Degelia cyanoloma (Schaer.) H. H. Blom & L. Lindblom, comb. et stat. nov.

Pannaria plumbea var. *cyanoloma* Schaer., *Enum. Criticae Lich. Eur.*: 36 (1850); type: [France, Normandie], in sylva Briquebec, *Delise*, undated (G — lectotype, selected by Jørgensen 1978: "Briquebec, Delise").

Note: For a discussion of the epithet *cyanoloma* and the specimens collected by Delise, see Jørgensen (1978).

(Fig. 1A, B & E)

Thallus foliose, forming rosettes, mostly *c.* 5 –15 (–25) cm diam., composed of concave, successive segments each ending in a transverse curved ridge-like structure (resembling a lobe margin), fine radiating striae present towards thallus margin, squamules absent, lobes (1·1–)3·0(–5·0) mm wide, thallus margin blue-black, ascending, thick, smooth, glossy; upper surface light to pale grey or pale bluish-grey. Thallus heteromerous, *c.* 200–250 µm thick, with a (24–)32(–44) µm thick paraplectenchymatous upper cortex of anticlinal hyphae; photobiont layer close to the upper cortex, (32–)48(–88) µm; medulla colourless, of densely conglutinate, periclinal hyphae, (48–)92(–108) µm; hypothallus prominent, greyish to blackish, not or slightly extending beyond the thallus margins.

Apothecia common, sparse to abundant, but sometimes lacking, often aggregated; disc dark red-brown to blackish, occasionally bright red, (0·6–)1·1(–2·0) mm diam., margin smooth, blackish. *Hymenium* colourless, 120 – 160 µm tall; *paraphyses* simple, tips up to *c.* 5 µm wide, slightly swollen. *Asci* clavate-cylindrical, 8-spored. *Ascospores* simple, ellipsoid, colourless, with or without oil droplets, (15–)16·7(–20) × *c.* 6–8 µm.

Conidiomata pycnidia, present in about one third of thalli studied, laminal, immersed, wart-like, ostiole pale. *Conidia* bacilliform, *c.* 3–6 × 1 µm.

Ecology and distribution. Degelia cyanoloma grows on bark, but frequently also on rock. *Populus tremula* L. is by far the most important phorophyte in western Norway but the species is also recorded growing on *Corylus avellana* L., *Fraxinus excelsior* L. and occasionally on *Alnus glutinosa* (L.) Gaertn. Typical habitats are oak-aspen forests or aspen stands on humid E- and N-facing slopes close to the sea and in coastal coves. Usually it grows together with species of the *Lobarion* community (see Rose 1988), and among them *Degelia atlantica*, *Lobaria pulmonaria* (L.) Hoffm., *L. virens* (With.) J. R. Laundon and *Pannaria rubiginosa* (Ach.) Bory are the most frequent companion species in our study area.

Degelia cyanoloma is a large lichen, and in all the sites studied where it grows together with *D. atlantica* and *D. plumbea*, it is distinctly larger than these species. Judging from situations on aspen trees, where numerous, both juvenile and large adult thalli of the three species could be studied together, we conclude that growth in *D. cyanoloma* is faster than in the two other species.

In western Norway *D. cyanoloma* is known from coastal areas and westernmost fjord districts from Rogaland county north to Sogn og Fjordane county, mostly in areas with a January mean temp above 0°C. Thus its Norwegian distribution is quite similar to that of *D. atlantica* (Krog *et al* 1994: fig. 32). Outside Norway we have studied specimens from Great Britain (Scotland), Ireland, France (Normandy), Portugal and Spain (see list of specimens studied), and *D. cyanoloma* seems to belong to the group of euoceanic species (Jørgensen 1996).

Notes. The combination of large size, pale greyish thallus (not or very slightly bluish when dry) composed of successive concave, trough-shaped segments, and the dark apothecia is indicative of *D. cyanoloma* in the field. The species is usually found with apothecia, lacks isidia, and is clearly most likely to be confused with *D. plumbea* as it has been in the past. The thallus is thicker and more robust than that of *D. plumbea*, and the lobes are wider. The thallus surface of *D.*

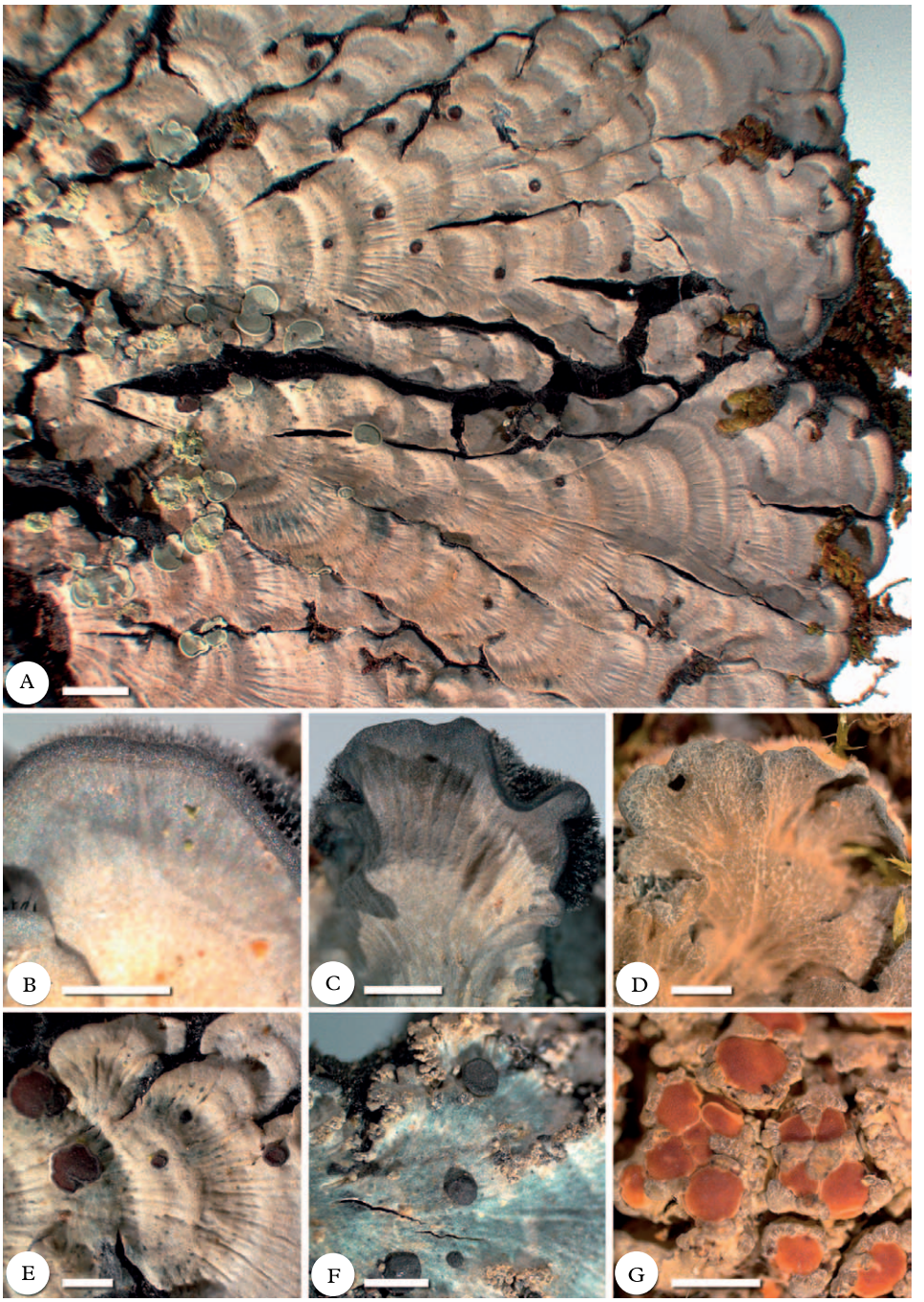

FIG. 1. *Degelia* species, morphology. A, B & E, *D. cyanoloma*; A, habitus (*Lindblom & Blom* L421), thalli of *Normandina pulchella* (Borrer) Nyl. are often observed growing on *D. cyanoloma*, as shown here; B, lobe tip (*Lindblom & Blom* L420); E, apothecia (*Lindblom & Blom* L421). C & F, *D. atlantica*; C, lobe tip (2005, *Knutsen*); F, apothecia (2008, Blom); D & G, *D. plumbea*; D, lobe tip (*Tønsberg* 3876); G, apothecia (2000, *Krumsvik*). All material in BG Scales: A = 2 mm; B – G = 1 mm.

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TABLE 1. *Morphological characters that can be used for separating* Degelia atlantica, D. cyanoloma *and* D. plumbea.

	D. atlantica	*D. cyanoloma*	*D. plumbea*
Thallus colour	greyish blue	pale grey to bluish grey	bluish grey with yellow-brown tones, rarely olivaceous
Thallus thickness	thin, appressed	thick, loosely attached	thin, appressed
Lobe margins	thick, smooth, glossy	thick, smooth, glossy	thin, dull, irregular and divided
Lobe width, 1 mm from tip*	(1·6–)2·6(–3·5) mm	(2·4–)3·0(–3·5) mm	(1·0–)1·8(–2·4) mm
Squamules (central part of thallus)	absent	absent	present
Isidia	present	absent	absent but isidia-like squamules often present
Texture of upper surface	longitudinally striate	longitudinally striate	network of linear maculae
Frequency of apothecia	very rare, not found mature	common (> 70%)	very common (> 90%)
Colour of apothecia disk	dark red	dark red to black	light red to red-brown

*Measurements are given as (min. value obs.–) arithmetic mean obs. (–max. value obs.).

cyanoloma appears quite smooth (Fig. 1A & E) compared with the rough thallus surface of *D. plumbea* owing to the presence of squamules (Fig. 1G) and coarse radiating ridges, often with thick knob-like squamules in the latter species. In *D. cyanoloma* the thallus surface is distinctly, but finely striate (Fig. 1A & E), whereas an irregular network of narrow whitish maculae is characteristic of the thallus surface in *D. plumbea*, particularly towards the lobe margins (Fig. 1D). A further useful field character is found in the thallus lobes: in *D. cyanoloma*, the lobe margin is thick and swollen, distinctly glossy, and quite smooth (Fig. 1B) whereas in *D. plumbea*, the lobe tips are thinner, quite dull, and the margin is mostly irregular owing to presence of narrow incisions or finger-like lobules (Fig. 1D). The apothecial discs of both *D. cyanoloma* and *D. plumbea* are reddish when wet. However, in dry material, the very dark red-brown or blackish discs of *D. cyanoloma* is a good character distinguishing it from *D. plumbea* in Norwegian populations.

Clearly, previous descriptions of *D. plumbea* include characteristics also of *D. cyanoloma* in our sense. The scallop-like appearance, partly a result of the presence of transverse, crescent-shaped ridges, was included in the descriptions of both *D. atlantica* and *D. plumbea* by Jørgensen (1978). However, this character is more pronounced in *D. cyanoloma* (Fig. 1A & E) than in *D. atlantica*, but absent or indistinct in *D. plumbea*. The segments between the transverse ridges are distinctly concave (trough-shaped) in *D. cyanoloma* but flatter in *D. atlantica* and, particularly, in *D. plumbea*. These characteristics give *D. cyanoloma* a strong resemblance to species of the genus *Coccocarpia* (see Arvidsson 1982). The most important morphological characters separating *Degelia atlantica*, *D. cyanoloma* and *D. plumbea* in Norway are summarized in Table 1.

In qualitative anatomical characters *D. cyanoloma* is very similar to *D. plumbea* and *D. atlantica*, but differs from both species in the thicker thallus. *Degelia cyanoloma* has been included in *D. plumbea,* the type species of *Degelia* sect. *Amphiloma*, and obviously belongs here (*cf.* Jørgensen & James 1990). However, it shares more morphological character states with *D. atlantica* than with *D. plumbea*. The overall structure of the thallus surface including the lack of squamules and the thick even lobe margins, distinguish both *D. cyanoloma* and *D. atlantica* from *D. plumbea*. Further, both species lack the pale brownish, yellowish-brown or dull olivaceous secondary colours of the thallus surface that are characteristic of *D. plumbea*.

On the other hand, such thallus colours are found in the rare species *D. ligulata*. Moreover, *D. ligulata* possesses a network of whitish maculae on the thallus surface similar to that found in *D. plumbea*, and the diagnostic schizidia resemble the coarse knob-shaped squamules seen in many specimens of *D. plumbea*. Accordingly, based on morphology, we hypothesize that *D. cyanoloma* is more closely related to *D. atlantica* than to *D. plumbea*, whereas *D. plumbea* and *D. ligulata* are closely related.

Herbarium specimens labelled *D. plumbea* from Macaronesia (in BG and FR) are not readily referred to either *D. cyanoloma* or *D. plumbea*. They need further study, preferably including molecular methods, and may represent an additional taxon. We have studied only a single specimen labelled *D. plumbea* from North America (Canada, Newfoundland, 2007 *Mac Pitcher*; BG) and it clearly belongs to that species.

Selected specimens examined (all in BG). **Norway:** *Rogaland*: Finnøy, Talgje, 2001, *Johnsen* s. n.; Vindafjord, Stråtveit, 1997, *Gaarder* 2308; Strand, Ramnås, 2000, *Krumsvik* s. n. (with *D. plumbea*). *Hordaland*: Austevoll, Klumra, 2007, *Blom* s. n.; Bømlo, Spissøya, 2005, *Knutsen* s. n.; Andal, 2005, *Knutsen* s. n.; Tysnes, Smievoll, Pollen, 2007, *Lindblom & Blom* L407; Tysnes, Beltestadknappen, 2008, *Lindblom & Blom* L421; Os, Storomsvågen, 2008, *Lindblom & Blom* L420. *Sogn og Fjordane*: Flora, Gruvla, 1991, *Gaarder* 373; Hyllestad, Lekva, 1992, *Gaarder* 685. —**Great Britain:** *Scotland:* **V.C. 98**, Argyll: Seil, Ballachuan, 1980, *Botnen* Sk113; **V.C. 97**, Westerness: Glen Nevis, 1925, *Lid* s. n.—**Ireland: V.C. H16**, West Galway: Kylemore Abbey, 1982, *Schindler* s. n.—**Portugal:** Algarve, N of Monchique, 1980, *Jones* s. n. —**Spain:** Caaveiro, 1986, *coll. ignot*.

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