

## Two New Species of *Dactylospora* (Dactylosporaceae, Lecanorales), with a Key to the Known Species in Scandinavia

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**Abstract.** *Dactylospora aeruginosa* Holien & Ihlen, sp. nov. is described from Norway and U.S.A. and *D. borealis* Holien & Ihlen, sp. nov. is described from Norway, Sweden, and U.S.A. Both species are lichenicolous, but *D. aeruginosa* is also saprobic on wood and bark of *Picea abies* and *Juniperus communis*, whereas *D. borealis* is only rarely growing on bark of *P. abies*. Notes are given on their ecology and distribution. A key to the known lichenicolous species of *Dactylospora* occurring in Scandinavia is included. *Lichenodiplis lecanorae* is suggested to be the anamorph of *D. borealis*.

**Keywords.** *Dactylospora*, lichenized ascomycetes, *Lichenodiplis*, lichenicolous fungi, Trøndelag phytogeographic element.

During fieldwork carried out by the authors in Norway (HH, TT), Sweden (PGI), and the Pacific northwest of U.S.A. (TT), two species of *Dactylospora* Körb. (Dactylosporaceae, Lecanorales) were discovered. One contained hyaline to light brown, 1-septate ascospores, and a blue-violet color of the exciple and epihymenium reacting K<sup>+</sup> aeruginose, and was found lichenicolous on several lichens and saprobic on *Picea abies* and *Juniperus communis*. The other, with 3-septate ascospores and an orange brown epihymenium reacting K<sup>+</sup> purple, was also found lichenicolous and once directly on bark of *Picea abies*. As these two species do not agree with any of the species included in the major taxonomic treatments of *Dactylospora* (e.g., Hafellner 1979; Triebel 1989) or, to our knowledge, in any other paper dealing with *Dactylospora*, they are described as new below.

On a worldwide scale, *Dactylospora* contains about 37 species (Kirk et al. 2001; Lawrey & Diederich 2003; Sarrión et al. 2002). As 20 lichenicolous species, including the two species described here, are presently known from Scandinavia (Alstrup 1991; Santesson et al. 2004), we found it appropriate to include a key to these species. It should be noted that non-lichenicolous taxa such as *Dactylospora epimyces* (Tobisch) Hafellner on the fungus *Tubulicrinis glebulosus* (Hafellner 1979), *D.*

*heimleri* (Zukal) Döbb. & Triebel on several liverworts (Döbbeler & Triebel 1985), and *D. stygia* var. *stygia* on various deciduous trees, e.g., *Acer*, *Alnus*, *Carpinus*, *Carya*, *Frangula*, *Fraxinus*, *Liriodendron*, *Populus*, *Quercus*, and *Salix* (see Hafellner 1979), are not included in the key.

### MATERIAL AND METHODS

In addition to the specimens of *Dactylospora aeruginosa* and *D. borealis* collected in the field, several specimens were found by examining herbarium specimens (in BG and TRH) of their hosts. For anatomical studies, a Zeiss light microscope with magnifications of  $\times 400$ ,  $\times 630$ , and  $\times 1,000$ , equipped with a blue filter, was used. Microscopic examinations required sections, mostly 15–20  $\mu\text{m}$  thick, cut with a freezing microtome. The estimated values of the sizes of the ascospores have been given as: (min.–) arithmetic mean–1.0 SD–arithmetic mean + 1.0 SD (–max.) where min. and max. are the extreme values and SD the corresponding standard deviation of the sample. All measurements were done in water, except for the sizes of the ascospores and the thickness of the paraphyses that were done in K (i.e., a 10% solution of potassium hydroxide). The measurements in K were done in order to observe details in these structures more clearly, e.g., ornamentation of the ascospores and the branching of the paraphyses. Each species keyed out has been followed by one selected literature reference for further information on morphology, distribution, and ecology.

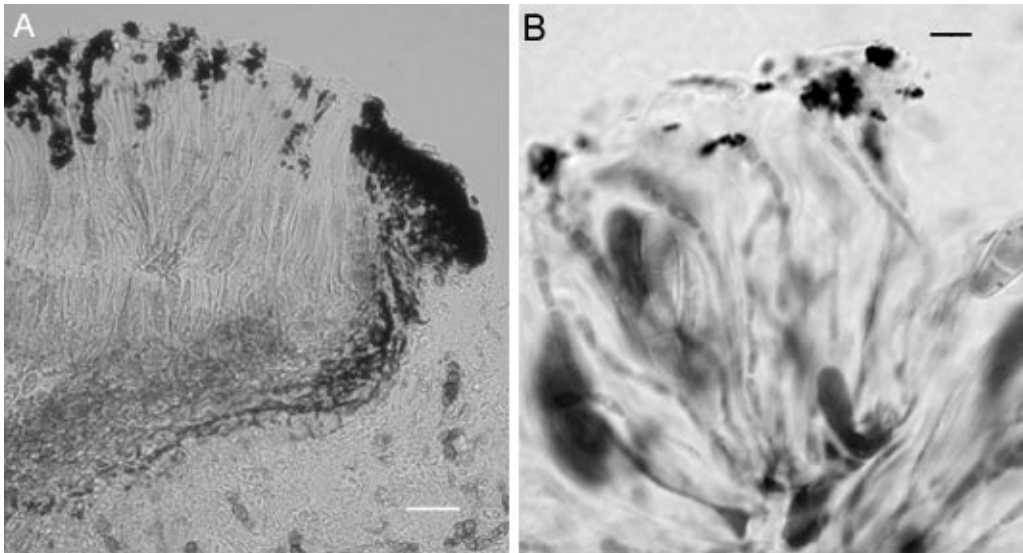


FIGURE 1. *Dactylospora aeruginosa* (holotype). — A. Section of ascoma (in water) with patches of pigments in the epihymenium. — B. Paraphyses (in LCB). Scales: A = 23.0  $\mu\text{m}$ ; B = 5.0  $\mu\text{m}$ .

**DACTYLOSPORA AERUGINOSA** Holien & Ihlen, *sp. nov.* FIG. 1

Fungus lichenicolus et saprofiticus. Excipulum et epihymenium violaceum, K plus aeruginosum. Ascospores, 1-septatae, hyalinae ad dilutus brunnescens, (9.0–)11.0–14.5(–16.0)  $\times$  (3.0–)3.5–5.5(–7.0)  $\mu\text{m}$ .

TYPE: NORWAY. SØR-TRØNDELAG, Orkdal, E of Svorkmo, N-facing slope of Sprangåsen, UTM<sub>ED</sub>: NR 40 03–04, elevation ca 260–270 m, saprobic on *Juniperus communis* in old forest, 9 June 1993, Holien 5622 (TRH, holotype; UPS, isotype).

*Apothecia* (Fig. 1A) rounded, 0.3–0.7 mm in diameter; disc flat, brown; margin distinct, concolorous or darker than disc; upper part of exciple in section (15–)30–80  $\mu\text{m}$  thick, inner part light brown, K–, outer part violet-blue, K+ aeruginose, N–, exciple in section in lower part (8.0–)15–50  $\mu\text{m}$  thick, cells polygonal, violet-blue, K+ aeruginose, N–. *Hymenium* (Fig. 1A) hyaline to light orange brown, K–, with patches of violet-blue, K+ aeruginose, (50–)70–120(–140)  $\mu\text{m}$  high; epihymenium hyaline to light brown K–, with densely arranged patches of violet-blue, K+ aeruginose. *Hypothecium* light brown, K–. *Paraphyses* (Fig. 1B) slightly branched, 1.5–2.0  $\mu\text{m}$  thick, usually with swollen and pigmented apical caps or sometimes with indistinct apical caps. *Asci* with a K/I+ blue outer layer, 8-spored. *Ascospores* hyaline to light brown, ellipsoid, smooth, 1-septate (9.0–)11.0–14.5(–16.0)  $\times$  (3.0–)3.5–5.5(–7.0)  $\mu\text{m}$  ( $n = 20$ ); perispore present, 1.5–2.0  $\mu\text{m}$  thick.

*Ecology*.—In Scandinavia, *Dactylospora aeruginosa* has been collected on thalli of different crustose lichens, such as *Biatora efflorescens* (Hedl.) Erichsen, *Japewia tornoënsis* (Nyl.) Tønberg, *Lo-*

*padium disciforme* (Flot.) Kullh., and *Micarea prasina* s. lat. and saprobic on twigs, wood, and bark of *Picea abies* and twice on partly decayed wood of *Juniperus communis*. When growing lichenicolous, the hosts were found lignicolous and corticolous on twigs and trunks of *Picea abies* (9 specimens), and corticolous on *Alnus incana* (4), *Betula* sp. (1), *Juniperus communis* (5), *Prunus padus* (1), *Salix caprea* (1), and *Sorbus aucuparia* (2). Many specimens were from old *Picea* forests. Closely associated lichen taxa (found on the same small piece of substrate) observed in the Scandinavian material included for example *Biatora toensbergii* Holien & Printzen, *Catinaria atropurpurea* (Schaer.) Vězda & Poelt, *Cavernularia hultenii* Degel., *Lecanora farinaria* Borrer, *Lobaria scrobiculata* (Scop.) D. C., *Micarea cinerea* (Schaer.) Hedl., *Ochrolechia juvenalis* Brodo, *Parmeliella parvula* P. M. Jørg., and *Pseudocyphellaria crocata* (L.) Vain. In U.S.A., *D. aeruginosa* was collected on thalli of *Biatora efflorescens* and once on *Japewia subaurifera* growing corticolous on *Alnus crispa* ssp. *sinuata*. Associated lichen species included *Lopadium disciforme*, *Micarea cinerea*, *Ochrolechia* sp., and *Ramalina roesleri* (Schaer.) Hue.

*Distribution*.—*Dactylospora aeruginosa* is so far known from the provinces Hordaland, Møre og Romsdal, Sør-Trøndelag, Nord-Trøndelag, and Nordland in Norway and from Alaska in U.S.A. Its elevation ranged in Scandinavia from about sea level to 270 m, and in Alaska from sea level to 20–39 m.

*Discussion*.—*Dactylospora aeruginosa* is distinct by the 1-septate, hyaline to light brown as-

cospores, with a thin perispore; 8-spored asci; and the violet-blue color of the exciple, also present as patches in the hymenium and epihymenium, turning K<sup>+</sup> aeruginose. Several *Dactylospora* species contain 1-septate ascospores produced in 8-spored asci (see key). Two of these, *D. athallina* (Müll. Arg.) Hafellner and *D. purpurascens* Triebel, might resemble *D. aeruginosa*, but they can be separated from that species by their brown epihymenium reacting K<sup>+</sup> purple and the distinctly brown ascospores (see e.g., Ihlen 1998; Triebel 1989). Other *Dactylospora* species containing a violet-blue color in the exciple and/or the epihymenium are *D. deminuta* (Th. Fr.) Triebel and *D. urceolata* (Th. Fr.) Arnold. However, *D. deminuta* is easily separated from *D. aeruginosa* by its 3-septate and even submuriform ascospores (Triebel 1989), whereas *D. urceolata* has long (15–23 µm), up to 7-septate ascospores (Foucard 2001).

Although found on several lichen species as well as being found as a saprobic, *Dactylospora aeruginosa* seems in Scandinavia to be predominantly restricted to the humid spruce forests of central Norway where it occurs on *Picea abies* as well as on deciduous trees mixed in the forest. Due to its presence among several oceanic lichen species e.g., *Cavernularia hultenii*, *Parmeliella parvula*, and *Pseudocyphellaria crocata*, it may prove to be a further member of the “Trøndelag phytogeographic element” (Holien & Tønsberg 1996). The occurrence of *D. aeruginosa* in the humid forests of coastal Alaska supports this view.

*Paratypes*.—NORWAY. HORDALAND. Lindås, Luro (Lygra), NW of Utluro, near hill 42, 1995, *Tønsberg 21755b* (BG). SØR-TRØNDELAG. Orkdal, E of Svorkmo, N-facing slope of Sprangåsen, 1992, *Holien 5496* (TRH); 1993, *Holien 6062* (TRH); Sprangåsen, 1992, *Holien 5489* (TRH); *Holien 5497* (TRH); NE-facing slope of Haugåsen, 1993, *Holien 5886a* (TRH). NORD-TRØNDELAG. Namsos, Sævik, by river Barstadelva, 1993, *Holien 6075* (TRH). Overhalla, W of Foss, 1997, *Holien 7098* (TRH). Steinkjer, S of Tønne by Våsetbukta, 1997, *Holien 7293* (TRH).

*Specimens examined labelled* *Biatora efflorescens*.—NORWAY. HORDALAND. Voss, Flatlandsmoen, 1987, *Tønsberg 10128* (BG). MØRE OG ROMSDAL. Aure, Vinsternes, 1983, *Tønsberg 8279a* (BG). SØR-TRØNDELAG. Trondheim, Byneset, just SE of Hangran, 1980, *Tønsberg 5237* (BG); Høgstein, 1980, *Tønsberg 5191* (TRH), *5196* (BG), *5198* (BG). Åfjord, Tørresengåsen, along river Norddalselva, 1988, *Holien 3167* (TRH). NORD-TRØNDELAG. Flåtanger, Gaupdalen, 1990, *Holien 3731* (TRH); Mt. Røythaugfjellet, 1981, *Tønsberg 5494* (BG). Grong, W of river Gartlandelva, 1995, *Holien 6869* (TRH). Namsos, 0.5 km E of Kjerstivik, 1980, *Tønsberg 4913a* (BG). Nærøy, along river Åvikelva, 1980, *Tønsberg 4657*, *4665* (BG). NORDLAND. Brønnøy, Tilrem, 1985, *Tønsberg 9226* (BG); Hemnes, Hemnesberget, towards Geitvika, 1984, *Øvstedal* (BG). U.S.A. ALASKA. Kodiak Island Borough, Near Island, 2001, *Tønsberg 29482*, *29483*, *29491*, *29492*, *29493* (BG). A total of 29 specimens seen.

## DACTYLOSPORA BOREALIS Holien & Ihlen *sp. nov.*

FIG. 2

Fungus lichenicolus in *Mycoblasto affini* et *M. sanguinario*. Epihymenium brunnescens, in K purpurascens. Ascosporae 3-septatae, maturae verrucosae.

TYPE: NORWAY. NORD-TRØNDELAG. Overhalla, W of Foss, 64°28.8' N, 11°59.7' E, UTM<sub>ED</sub>: UM 555 540, elevation ca 80 m, corticolous on *Picea abies* in old forest; host: *Mycoblastus affinis*, 13 March 1997, *Holien 7092* (TRH, holotype; UPS, isotype).

*Apothecia* (Fig. 2A, B) rounded, 0.2–0.8(–1.0) mm in diameter; disc flat, dark brown; margin distinct, concolorous with disc; upper part of exciple in section 20–40 µm thick, brown, K<sup>–</sup>, N<sup>–</sup>, sometimes greenish brown in inner part; cells in lower part of exciple in section polygonal, 5–15 µm in diameter, brown, K<sup>–</sup>. *Hymenium* (Fig. 2B) hyaline to light orange brown, (40–)70–110(–130) µm high, orange pigment K<sup>+</sup> purple; epihymenium brown to orange brown, K<sup>+</sup> purple, N<sup>–</sup>. *Hypothecium* green, then K<sup>+</sup> brown, or greenish brown to brown or orange, then K<sup>+</sup> purple. *Paraphyses* (Fig. 2C) branched in upper part, 1.5–2.0 µm thick, with swollen and brown apical caps. *Asci* with a K/I+ blue outer layer, 8-spored. *Ascospores* (Fig. 2D) brown, ellipsoid, ornamentation granulate at maturity, 3-septate, rarely 4-septate or submuriform, (15.0–)15.5–19.5(–23.0) × (4.5–)6.0–7.5(–9.0) µm (*n* = 20); perispore present.

*Ecology*.—*Dactylospora borealis* has been found frequently in Scandinavia on thalli, rarely on apothecia, of *Mycoblastus affinis* (Schaer.) T. Schauer and *M. sanguinarius* (L.) Norman, and rarely on *Japewia tornoënsis*, *Loxospora elatina* (Ach.) A. Massal., and *Ochrolechia androgyna* (Hoffm.) Arnold. In one collection (Nord-Trøndelag, Grong, *Holien 6869*, TRH), *D. borealis* occurred directly on bark of *Picea abies* adjacent to a thallus of *Biatora efflorescens* infected by *D. aeruginosa*! In Alaska, it occurred on *Mycoblastus affinis* and *M. sanguinarius*. The hosts were found on twigs, wood, and bark of *Picea abies*, and, more rarely, corticolous on *Sorbus aucuparia* and *Ulmus glabra*. In Alaska it occurred on *Betula* and *Picea sitchensis*. *Dactylospora borealis* has mainly been found in old, shaded *Picea* forests, frequently close to rivers or streams. Closely associated lichen taxa (found on the same small piece of substrate) observed in the Scandinavian material were *Biatora efflorescens*, *Bryoria capillaria* (Ach.) Brodo & D. Hawksw., *Lecanora circumborealis* Brodo & Vitik., *Loxospora elatina*, *Nephroma parile* (Ach.) Ach., and *Ochrolechia microstictoides* Räs. In Alaska *Mycoblastus sanguinarius* was a close associate.

*Distribution*.—*Dactylospora borealis* is so far known from the provinces Sør-Trøndelag, Nord-Trøndelag, and Nordland in Norway and Jämtland

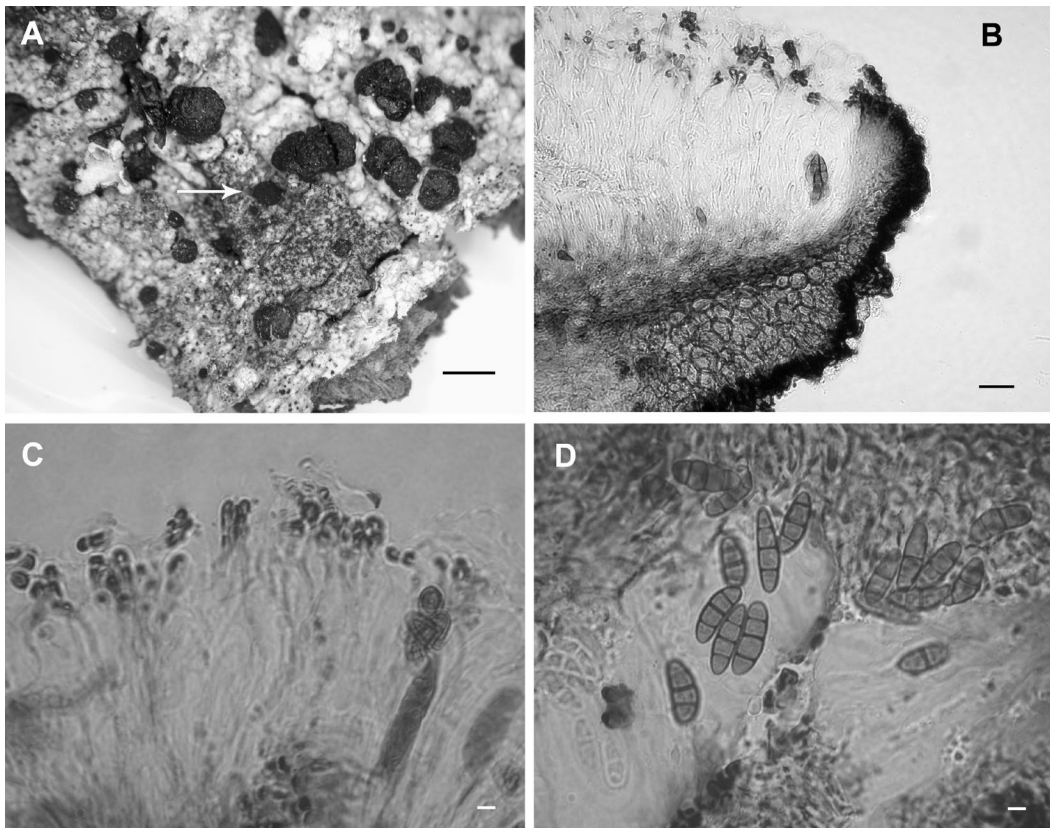


FIGURE 2. A. *Mycoblastus affinis* (large ascomata), *Dactylospora borealis* (arrow), and *Lichenodiplis lecanorae* (dark area on the host thallus) (Ihlen 1443). — B–D. *Dactylospora borealis* (holotype). — B. Section of ascoma. — C. Paraphyses with pigmented end cells. — D. Ascospores. Scales: A = 1.0 mm, B = 18.0  $\mu\text{m}$ , C and D = 5.0  $\mu\text{m}$ .

and Åsele Lappmark in Sweden, at elevations ranging from 80 m in Overhalla (Norway) to 600 m in Krokomb (Sweden). In U.S.A., it has been found in the coastal lowlands of SE Alaska.

*Note.*—In eight out of the 28 specimens of *Dactylospora borealis* examined, the pycnidia of *Lichenodiplis lecanorae* (Vouaux) Dyko & D. Hawksw. (Hawksworth & Dyko 1979) were observed on the same discolored spots as, and close to, the ascomata of *D. borealis* (Fig. 2A).

*Discussion.*—*Dactylospora attendenda* (Nyl.) Arnold, *D. borealis*, and *D. parasitica* (Flörke) Zopf, all occurring in Scandinavia, can easily be recognized by having predominantly 3-septate ascospores. However, *D. borealis* is distinct from *D. attendenda* and *D. parasitica* by the brown to orange brown epihymenium reacting K+ purple (in *D. attendenda* it is brown and K– or K+ dull brown). An examination of the isotype of *D. parasitica* revealed that it has a dark brown epihymenium reacting K–. Furthermore, *D. borealis* has larger ascospores, in *D. attendenda* they are (7.0–)9.5–12.5(13.0)  $\times$  (3.0–)4.0–6.5(8.5)  $\mu\text{m}$  (Ihlen 1998) and in *D. parasitica* they are 9.0–15.0  $\times$

3.5–5.0  $\mu\text{m}$  (Hafellner 1979). *Dactylospora pseudourceolata* Sarrión & Hafellner (see Sarrión et al. 2002), might because of the reddish brown epihymenium and ornamented ascospores, also resemble *D. borealis*. However, in that species the epihymenium and hypothecium are K–, the apothecia are slightly lichenized, and it is saprobic. *Dactylospora crassa* Sarrión & Hafellner (see Sarrión et al. 2002) is also similar to *D. borealis*, but it is distinct in having smooth and narrower ascospores (3.5–4.5  $\mu\text{m}$ ). *Dactylospora rostrupii* Alstrup, described from the Faroe Islands on *Pertusaria dactylina* (Ach.) Nyl., can be separated from *D. borealis* by its smooth and larger ascospores, measuring 19–22  $\times$  5.0–8.0  $\mu\text{m}$ , and a brown epihymenium (Alstrup et al. 1994).

*Dactylospora borealis* appears to be a species of humid *Picea*-dominated forests, and like *D. aeruginosa*, it may prove to be a further member of the “Trøndelag phytogeographic element” (Holien & Tønsberg 1996). The presence of *D. borealis* in the humid forests of coastal Alaska supports this view. However, *D. borealis* is probably wider distributed than *D. aeruginosa*, as it has also been found in the

more eastern and drier provinces of Scandinavia (Jämtland and Åsele Lappmark).

The observation of the pycnidia of *Lichenodiplis lecanorae* on the same discolored spots as, and close to, the ascomata of *Dactylospora borealis* (Fig. 2A), indicates an anamorph-teleomorph relationship. Consequently, we propose that *L. lecanorae* is the anamorph of the teleomorph *Dactylospora borealis*.

*Paratypes*.—NORWAY. SØR-TRØNDELAG. Bjugn, S-facing slope by end of lake Skjervatnet, Snøholet, 1994, *Holien 6385* (TRH). Meldal, Urvatnet forest reserve, 1991, *Holien 4743* (TRH). Orkdal, SE of Svorkmo, NE-facing slope of Haugåsen, 1993, *Holien 5887* (TRH); E of Svorkmo, N-facing slope of Sprangåsen, 1993, *Holien 6063* (TRH). Rissa, Stadsbygd, on the southern side of lake Vatnagårdsvatn, 1961, *Santesson 14299b* (UPS). NORD-TRØNDELAG. Overhalla, W of Foss, 1995, *Holien 6973* (TRH); 1997, *Holien 7645* (TRH). Steinkjer, Struktadmyra, 2004, *Holien 9862* (TRH). SWEDEN. JÄMTLAND. Åre, west side of lake Kallsjön, by river Öster-Kjolan, 2003, *Ihlen 1443* (UPS); near waterfall Tännforsen, 2003, *Ihlen 1447* (UPS). Krokum, near lake Långtjärn, NW of place Gravbränna, 10 km S of Föllinge, 2003, *Ihlen 1450* (UPS), *1451* (UPS); between place Lakavatnet and Mt Skakafjället, 2003, *Ihlen 1455* (UPS). ÅSELE LAPPMARK. Borgafjället, 2004, *Hagner* (UPS); Vilhelmina, Borkan, vid nordvästra sidan av Borkasjön, 2004, *Hagner* (UPS). U.S.A. ALASKA. Haines Borough, NW of Haines, Chilkat Peninsula, along and E of main road to Chilkat State Park, at Mount Riley Trail trailhead, 2003, *Tønsberg 33212* (BG).

*Specimens examined labelled Biatora efflorescens*.—NORWAY. NORD-TRØNDELAG. Grong, W of river Gartlandelva, 1995, *Holien 6869* (TRH).

*Specimens examined labelled Loxospora elatina*.—NORWAY. SØR-TRØNDELAG. Malvik, Høybydalen, Slättmyrdalen, 1987, *Holien 2620* (TRH). Trondheim, Bymarka, E-facing slope by lake Skjellbreia, 2000, *Holien 8473* (TRH).

*Specimens examined labelled Mycoblastus affinis* or *M. sanguinarius*.—NORWAY. SØR-TRØNDELAG. Bjugn, Stjørna, Fisdal, Brandhaug, 1952, *Rui* (*M. sanguinarius*; TRH). Klæbu, Moan, 1979, *James & Tønsberg* (*M. affinis*; BG). Rissa, E of Osavatnet, 1980, *Tønsberg 4615* (*M. sanguinarius*; BG). Trondheim, Bymarka, Geitkind, 1936, *Høeg* (*M. sanguinarius*; TRH). NORD-TRØNDELAG. Leksvik, S slope of Tinghaugen, 1981, *Tønsberg 5866* (*M. sanguinarius*; BG). Namdalseid, S of Altvatn, 1981, *Tønsberg 5434a* (*M. sanguinarius*; BG). Namsos, Almdalen, 1981, *Tønsberg 5581* (*M. affinis*; BG). NORDLAND. Grane, NE of Trofors, E-facing slope S of lake Almvatnet, 2001, *Holien 8784* (*M. affinis*; TRH). U.S.A. ALASKA. Kodiak Island Borough, Kodiak Island E, Middle Bay, 1991, *Tønsberg 15343* (*M. affinis*; BG). A total of 28 specimens seen.

*Exsiccate specimen of Dactylospora parasitica used for comparison*.—Floerke, Deutsche Lichenen, 101 (UPS!, lectotype).

#### KEY TO THE LICHENICOLOUS SPECIES OF DACTYLOSPORA IN SCANDINAVIA

1. Asci multi-spored ..... 2
1. Asci 8-spored ..... 3
2. Ascospores 1-septate, 4–5(–7) × 2–3 µm. On *Megalaria pulverea* ..... *D. microspora* Etayo 1991
2. Ascospores 1-septate, sometimes 3-septate, 7–11 × 4–6 µm. On *Pertusaria aspergilla* .....  
..... *D. pertusariicola* (Tuck.) Hafellner 1979
3. Ascospores always 1-septate ..... 4
3. At least some ascospores more than 1-septate or submuriform ..... 14
4. Ascospores hyaline to light brown, epihyemium with patches of violet-blue pigment turning K+ aeruginose ..... *D. aeruginosa* Holien & Ihlen
4. Ascospores distinctly brown, epihyemium without patches of violet-blue pigment, K– or K+ purple ..... 5
5. Epihyemium brown, K+ purple ..... 6
5. Epihyemium brown, not K+ purple ..... 7
6. Ascospores 9–13 × 4–7 µm, hyemium 55–65 µm high. On *Baeomyces rufus* .....  
..... *D. athallina* (Müll.Arg.) Hafellner 1979
6. Ascospores 12–19 × 4–8 µm, hyemium 55–90 µm high. On *Amygdalaria*, *Pilophorus dovrensis*, and *Porpidia glaucophaea* .....  
..... *D. purpurascens* Triebel 1989
7. On thalli of foliose lichens (*Lobaria*, *Pannaria*, or *Parmeliella*) ..... 8
7. On thalli and ascomata of crustose lichens ..... 9
8. Excipulum reddish brown, ascospores with granular ornamentation. On *Lobaria pulmonaria* .....  
..... *D. lobariella* (Nyl.) Hafellner 1979
8. Excipulum brown, ascospores smooth. On *Parmeliella* and *Fuscopannaria praetermissa* .....  
..... *D. protohallina* (Anzi) Hafellner 1979
9. Apothecia without stalk. Hypothecium not black ..... 10
9. Apothecia slightly stalked (ca 50 µm high). Hypothecium dark brown to almost black. On *Amygdalaria panaeola*, *Lecanora*, and *Pleopsisidium chlorophanum* .....  
..... *D. rimulicola* (Müll. Arg.) Hafellner 1979
10. Hypothecium hyaline to light brown or olivaceous green ..... 11
10. Hypothecium medium to dark brown, reddish brown or almost black ..... 12
11. Ascospores >5–6 µm broad, on *Pertusaria* and *Ochrolechia* .....  
..... *D. saxatilis* (Schaer.) Hafellner 1979
11. Ascospores <5–6 µm broad, on *Lecanora*, *Protoparmeliopsis muralis*, and *Tephromela atra* .....  
..... *D. homoclinella* (Nyl.) Hafellner 1979
12. Ascospores usually 1-septate, sometimes 3-septate, hyaline to brown, 6–8 µm broad. On *Bryodina rhypariza* .....  
..... *D. rhyparizae* Arnold, see Keissler (1930)
12. Ascospores 1-septate, brown, 3–6 µm broad ..... 13
13. Ascospores 9–13 × 4–6 µm. On *Porpidia con-traponenda* and *P. macrocarpa* .....  
..... *D. australis* Triebel & Hertel, see Triebel (1989)
13. Ascospores 7–11 × 3–6 µm, On *Amygdalaria* .....  
..... *D. amygdalariae* Triebel 1989
14. Ascospores up to 3-septate ..... 15
14. Ascospores 3 to 7-septate or submuriform ..... 19
15. Hypothecium medium brown to reddish brown, orange, or greenish brown ..... 16
15. Hypothecium light brown. On *Ochrolechia par-ella* .....  
..... *D. parellaria* (Nyl.) Arnold, see Clauzade et al. (1989)

16. Epiphymenium orange brown, K+ purple. On *Mycoblastus* ..... *D. borealis* Holien & Ihlen
16. Epiphymenium light to dark brown or reddish brown, K-, K+ dull brown, or K+ greenish brown ..... 17
17. Ascospores brown, sometimes hyaline, 5–7  $\mu\text{m}$  broad. On *Bryodina rhypariza* .....  
.....*D. rhyparizae* Arnold, see Keissler (1930)
17. Ascospores brown, never hyaline, <5–6  $\mu\text{m}$  broad ..... 18
18. Epiphymenium brown to reddish brown. On *Ochhrolechia* and *Pertusaria* .....  
.....*D. parasitica* (Flörke) Zopf, see Hafellner (1979)
18. Epiphymenium light brown to dark brown. On *Amygdalaria consentiens*, *A. pelobotryon*, *Icmadophila*, *Pilophorus cereolus*, *P. dovrensis*, *Porpidia melinodes*, and *P. ochrolemma* .....  
.....*D. attendenda* (Nyl.) Arnold, see Triebel (1989)
19. Apices of paraphyses 3–5  $\mu\text{m}$  broad. Ascospores 5 to 7-septate to submuriform, on *Brigantiaea fuscolutea* and *Protothelenella sphinctrioides* .... 20
19. Apices of paraphyses 2–3  $\mu\text{m}$  broad. Ascospores 3 to 7-septate to submuriform, on various lichens .....  
..... *D. diminuta* (Th.Fr.) Triebel 1989
20. Epiphymenium brown, often with a violet tinge, ascospores up to 7-septate. On *Protothelenella sphinctrioides* .....  
.....*D. urceolata* (Th.Fr.) Arnold, see Triebel (1989)
20. Epiphymenium greenish brown, ascospores 7-septate to submuriform. On *Brigantiaea fuscolutea* .....  
..... *D. frigida* Hafellner 1985

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