

Notes on *Arthrorhaphis* and its Lichenicolous Fungi in Greenland

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Abstract. *Three yellow colored Arthrorhaphis-taxa (Arthrorhaphis alpina, A. citrinella, and A. vacillans) are floristically treated for Greenland. A key and a distribution map are included. In addition, short descriptions are provided for these taxa as well as for three lichenicolous fungi on Arthrorhaphis — Cercidospora soror, C. tryptetheliza, and Merismatium decolorans, all of which are reported as new to Greenland.*

The taxa of the genus *Arthrorhaphis* in Europe and Greenland have previously been revised by Obermayer (1994). Ihlen (1998) treated the Norwegian taxa. Three species—*Arthrorhaphis alpina*, *A. citrinella*, and *A. vacillans*—all of them yellow-colored due to the occurrence of rhizocarpic acid, were recognized for Greenland. The last-mentioned species (syn. *Bacidia anziana* Lynge) has also been discussed by Lynge (1940) and Hansen and Poelt (1987). A map outlining the distribution of *Arthrorhaphis vacillans* and *A. alpina* in the American Arctic has recently been presented by Thomson (1998). With the intention of mapping the Greenland occurrences of these species in detail, we investigated the available material.

The four non-yellow (rhizocarpic acid lacking) species of *Arthrorhaphis*, *A. aeruginosa* R. Sant. & Tønsberg, *A. grisea* Th. Fr., *A. muddii* Obermayer, and *A. olivacea* R. Sant. & Tønsberg have so far not been found in Greenland.

MATERIAL AND METHODS

About 200 specimens from the herbaria C and GZU (including representative material of duplicates from herbarium O) have been studied with Zeiss light microscopes. The cited material is kept in C and GZU.

KEY TO THE SPECIES OF ARTHRORHAPHIS CONTAINING RHIZOCARPIC ACID

1. Thallus without apothecia 2
1. Thallus with apothecia 4
2. Thallus containing white Ca-oxalate crystals in the medulla (if thallus sorediate then crystals beneath the soredia, if thallus crateriform then crystals at least at bottom of cavern) 3
2. Thallus and medulla without Ca-oxalate crystals *A. citrinella*
3. Thallus sorediate or crateriform at top *A. alpina*
3. Thallus of compact areoles *A. alpina* and *A. vacillans*

4. Spores mostly with 3 septa ($16\text{--}23 \times 3 \mu\text{m}$); thallus never sorediate *A. vacillans*
4. Spores commonly with more than 3 septa; most of the spores longer than $25 \mu\text{m}$; thallus sorediate or not 5
5. Thallus with Ca-oxalate crystals in the medulla (see above); at least part of asci with spores reaching different heights; spores $(20\text{--})25\text{--}50\text{--}(65) \times 3.0\text{--}4.5 \mu\text{m}$ *A. alpina*
5. Thallus without white Ca-oxalate crystals; spores mostly at the same height in ascus, $(40\text{--})50\text{--}95\text{--}(110) \times 2.5\text{--}3.5 \mu\text{m}$ *A. citrinella*

RESULTS AND DISCUSSION

ARTHRORHAPHIS ALPINA (Schaer.) R. Sant.

Arthrorhaphis alpina is characterized by the $(20\text{--})25\text{--}50\text{--}(65) \mu\text{m}$ long and 6–9(–14)-septate spores and by the granular-sorediate to compact areolate, yellow-colored thallus with Ca-oxalate crystals in the medulla (Obermayer 1994, 1996). However, a great part of the fertile *Arthrorhaphis* samples from Greenland does not show well-developed ascospores, and many asci are without spores. The presence or absence of Ca-oxalate crystals in the medulla has been the formal separating character to separate *Arthrorhaphis alpina* from *A. citrinella*, as most of the Greenland *Arthrorhaphis* specimens are sterile. Fertile specimens belong to *A. alpina* var. *alpina*. (separating characters for *A. alpina* var. *jungens* are given in Obermayer 1995). Sterile material of *A. vacillans* is included in *A. alpina*, because we do not consider the compact thallus structure of *A. vacillans* to be a significant character.

Arthrorhaphis alpina is widely distributed in Greenland (Fig. 1). Many previous reports on “*A. citrinella*” from this area in fact refer to *A. alpina*. Contrary to *A. citrinella*, *A. alpina* is fairly common in Northeast Greenland, where it grows on

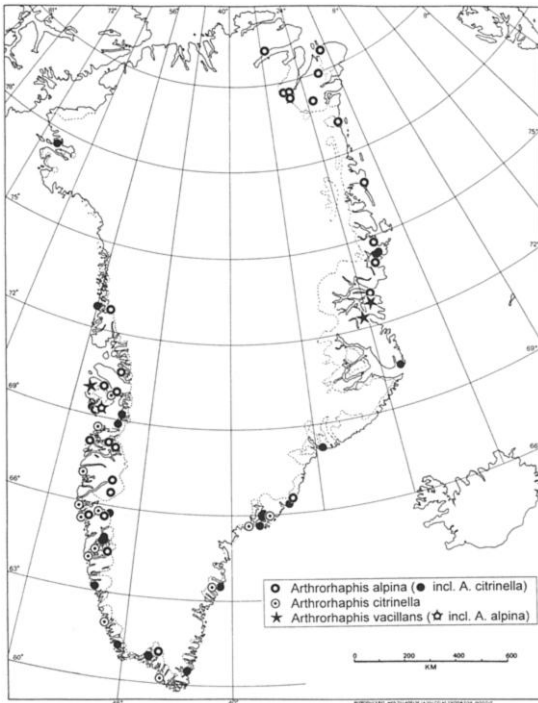


FIGURE 1. *Arthrorhaphis alpina*, *Arthrorhaphis citrinella*, and *Arthrorhaphis vacillans*. Known distribution in Greenland.

open, dry ground in dwarf shrub heaths and fell-fields together with, for example, *Caloplaca tominii*, *Flavocetraria nivalis*, *Megaspora verrucosa*, *Phaeorrhiza nimbosea*, and *Rinodina mniaraea* (Hansen 1994, 1996). Occasionally it occurs on moist soil near snow patches. *Arthrorhaphis alpina* has been found growing both on soil rich in Ca and Mg (Peary Land, Kronprins Christian Land) and soil with low contents of these minerals (Lambert Land, the fjords north of Tasilaq). The species extends deeper into the great fjords, for example, Tunugdliarfik, Godthåb fjord, and Søndre Strømfjord in Southwest Greenland and Arfersiorfik fjord in Centralwest Greenland, than *A. citrinella*, which is more common at coastal localities (Hansen 1978a).

Arthrorhaphis alpina has been collected at elevations above 1,000 m elevation on Cassiopefjeld and Steenstrups Bræ in Southeast Greenland (Hansen 1978b), while *A. citrinella* has only been found up to 1,000 m elevation. On Aucellabjerg and Theodolit-plateau in Northeast Greenland, *A. alpina* extends to 400 and 700 m elevation, respectively (Hansen 1996). However, the greater part of the Greenland collections of *Arthrorhaphis* is from localities situated in the lowlands. The distribution of the Greenland *Arthrorhaphis* species is supposed to depend on edaphic rather than of climatic factors.

Fertile specimens of *A. alpina* have been found as far northwards as 80°N (Romer Sø).

Selected specimens examined.—WEST GREENLAND. Narssarssuaq, Andersen & Hansen 199 (C); Avalergup tassersuaq, Alstrup 77297 (C); Qeqertarsuaq, Hansen 10984 (C); Sarqaq, Gelting, October 29, 1949, (C). EAST GREENLAND. Qingertuaq, Hansen 203 (C); Tugtilik, Hansen 164 (C); Zackenberg Elv, Hansen L. Gr. Exs. 565 (C); Campanuladal, Alstrup & Daniëls 5475 (C); Romer Sø, Hansen 10285 (C); Station Nord, Hansen L. Gr. Exs. 342 (C).

ARTHRORHAPHIS CITRINELLA (Ach.) Poelt

Arthrorhaphis citrinella is characterized by the yellow-colored thallus without any Ca-oxalate crystals in the medulla and by long, acicular, (5–)7–9(–16)-septate spores ((40–)50–95(–110) × 2.5–3.5 μm). The Greenland distribution of *Arthrorhaphis citrinella* (Fig. 1) appears to confirm the statement of Obermayer (1994, 1996) that it is the most acidophilous species of the three taxa. *Arthrorhaphis citrinella* is comparatively common in Southeast Greenland, which is dominated by Archaean gneisses (Hansen 1978a). Numerous collections are available from the Tasiilaq area. *Arthrorhaphis citrinella* is also widely distributed in Southwest Greenland (Hansen 1993, 1998). It has a more scattered occurrence in Centralwest Greenland, and it appears to be rare in the basaltic area on Disko (Lynge 1937). The northernmost finds of *A. citrinella* are from Qaanaaq in West Greenland (Hansen 1989) and Clavering Ø in East Greenland (Hansen 1996). The north coast of Greenland has been incompletely investigated lichenologically, and it cannot be excluded that both *A. citrinella* and *A. alpina* occur in the area between Thule and Peary Land.

Selected specimens examined.—WEST GREENLAND. Qeqertarsuatsiaat, Hansen 1080 (C); Maniitsoq, Hansen 734 (C); Qaersutsiaup gulaa, Alstrup 77412 (C); Ilulissat, Hansen 953 (C); Upernavik, Hansen 929 (C); Qaanaaq, Hansen 55 (C). EAST GREENLAND. Tasiilaq, Hansen 1368 (C); Mikis Fjord, Hansen 995 (C); Ittoqqortoormiit, Hansen 689 (C); Kap Tobin, Hansen 987 (C); Theodolit-plateau, Hansen 2002 (C).

ARTHRORHAPHIS VACILLANS Th. Fr.

The most important diagnostic characters for *Arthrorhaphis vacillans* are short (16–23 × 3 μm), 3(–5)-septate spores and the non-sorediate thallus (Obermayer 1994, 1996). Like *A. alpina*, it has Ca-oxalate crystals in the medulla. In Greenland it is known from three localities on Disko in Centralwest Greenland (Alstrup 1979; Hansen & Poelt 1987) and three localities in the area between 72° and 73°N in East Greenland (Lynge 1940). The three specimens from the latter area have previously been studied by the first author. They are housed

in herbarium *o*. Most collections of *A. vacillans* are from the lowland; however, the species was found growing at an elevation of 250 m at Nordfjord, Northwest Disko. Here it occurs together with *Peltigera venosa*, *Solorina bispora*, and *S. octospora* (Alstrup 1979). *Arthrorhaphis vacillans* apparently prefers neutral to slightly alkaline soils that are common in, for example, Northeast Greenland, where additional fertile specimens should be searched for. It ought to be noted that Thomson (1998) has mapped additional localities of *A. vacillans* between 72° and 75°N. The species also appears to be fairly common in central Siberia (Zhurbenko 1996). It has recently been reported as new to Svalbard (Ihlen 1997) and Iceland (Orange 1990).

Selected specimens examined.—WEST GREENLAND. Singifik, Poelt & Ullrich, August 2, 1982 (GZU); Kugsinersuaq, Gelting, August 23, 1950 (C); Perdlertuut kuaat, Alstrup 105 (C).

LICHENICOLOUS FUNGI ON ARTHRORHAPHIS

Three fertile lichenicolous fungi—*Cercidospora soror*, *C. tryptetheliza*, and *Merismatium decolorans*—were found on *Arthrorhaphis* during our revision of the Greenland material of this genus. They appear to be new to Greenland. A key to the lichenicolous fungi on *Arthrorhaphis* has recently been published by Hafellner and Obermayer (1995). [Note: this paper does not include a rather frequently occurring hyphomycete (?*Taeniolella*) covering the thallus surface with a net of brownish-black hyphae (also in Greenland).]

Cercidospora soror Obermayer & Triebel

Cercidospora soror has mostly immersed pseudothecia (situated on the lamina of the host thallus) with a greenish-black ostium-area and 4-spored asci with colorless, 4-celled ascospores ((13–)16–22(–26) × 5–7 μm). It has previously been reported from Asia, Europe, and South America (Hafellner & Obermayer 1995).

Specimens examined.—On *Arthrorhaphis alpina*: WEST GREENLAND. Kapisigdlit, Hansen 1029 (C). EAST GREENLAND. Ittoqqortoormiit, Hansen 492 (C). On *Arthrorhaphis citrinella*: EAST GREENLAND. Ittoqqortoormiit, Hansen 157 (C).

Cercidospora tryptetheliza (Nyl.) Hafellner & Obermayer

Cercidospora tryptetheliza (formerly treated as a lichen named *Neonorrlinia tryptetheliza* (Nyl.) Sydow) is characterized by laminally located pseudothecia (totally or partly sunken in the host thallus) with a greenish-black ostium and 8-spored asci with colorless, 2-celled ascospores ((13–)15–

17(–19) × 4.5–5.5 μm). This lichenicolous fungus is previously known from Asia, Europe, and Australasia (Hafellner & Obermayer 1995). Geographically closest reports to Greenland come from the Færøes Islands (Alstrup et al. 1994).

Specimens examined.—On *Arthrorhaphis alpina*: WEST GREENLAND. Narssaq Fjeld, Alstrup 243926c (C); Karra, Alstrup 766224 (C); Qeqertarsuaq, June 9, 1953. EAST GREENLAND. Qingertuaq, Hansen 211 (C). On *Arthrorhaphis citrinella*: WEST GREENLAND. Alákariaq, Alstrup 54 (C); Qaanaaq, Alstrup 1108 (C). EAST GREENLAND. Ittoqqortoormiit, Hansen 110 (C).

Merismatium decolorans (Arnold) Triebel

Merismatium decolorans is mainly characterized by marginal located perithecia and brown, (2–)4-celled (12–15 × 5 μm) ascospores (rarely with one longitudinal septum). The fungus has previously been reported from Asia, Europe, and North America (Esslinger & Egan 1995; Hafellner & Obermayer 1995; Triebel 1989).

Specimens examined.—On *Arthrorhaphis citrinella*: EAST GREENLAND. Sieraq, Hansen 945 (C).

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