New lichenicolous fungi from Eurasia

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Five lichenicolous ascomycetes, *Polycoccum ventosicola*, *Pronectria protopannariae*, *Skyttea dacampiae*, *Stigmidium leprariae* and *Sphaerellothecium soechtingii*, are described as new to science from Norway. *S. soechtingii* is also present in Russia and Austria.

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In August 2003, during an excursion of the Nordic Lichen Society to Norway, Troms County, Storfjord Municipality of the Skibotn area, in the boreal and alpine vegetation zones, five new species of lichenicolous fungi were collected and are herein described. Additional specimens of one of the species were later found in collections from Siberia and Austria.

**Materials and Methods**

Materials were examined using standard microscopic techniques and LOMO microscopes MBS-1 and MBR-3. Microscopic characters were studied using hand-made sections or squash preparations in water, 10 % KOH (K), erythrosin, Congo red (CR), or lactophenol cotton blue (LCB). Amyloid reactions were tested in 1% Lugol’s Iodine solution, directly (I) and after a KOH pre-treatment (K/I). A 1 % solution of Brilliant Cresyl blue (BCr) was used to study metachromatic reactions of the asci, ascospores, peridium and vegetative hyphae. Micrographs were taken with the use of a Nikon Coolpix 5400 digital camera. Asci and ascospores measurements and length/breadth (l/b) ratios are given as: (min.–){X–SD}–X–{X+SD}–(–max.) rounded to the nearest 0.5 µm, where min. and max. are the extreme values, X the arithmetic mean, and SD the corresponding standard deviation. Specimens examined are housed in the Komarov Botanical institute herbarium (LE), unless otherwise indicated.

**The species**

**Polycoccum ventosicola** Zhurb. sp. nov.

Fungus in thallis et apotheciis lichenis *Ophioparma ventosa* parasiticus. Similis *Polycoccum minutulum*, sed ab ea imprimis differt peritheciis minoribus, ascosporis latoribus, cecidiis non producentibus, et hospite diverso.

Type: Norway, Troms, Storfjord, Skibotn, between Luhcavarri and E part of Davimus Viessogasgaisi, 69º15’N, 20º24’E, alt. 800 m, mountain slope with siliceous boulders among dwarf-shrub-lichen-moss tundra, on apothecia and thallus of *Ophioparma ventosa* growing on a boulder, 9 Aug. 2003, Zhurbenko 03248 (LE, holotype).

Fig. 1.
Vegetative hyphae pale to dark olive-brown, flexuose, 2–4 µm diam., immersed. Perithecia subglobose, 40–80 µm diam., ostiolate, more or less immersed. Peridium olive-brown, turning olive in KOH. Hamathecium composed of septate, branched-anastomosed filaments 1–1.5 µm diam. Hymenial gelatine I–. Asci subcylindrical to elongate-clavate, with thick wall and short stalk, 45–60 × 14–16 µm, with short ocular chamber, 8-spored, 1–. Ascospores broadly soleiform, with rounded apices, 1-septate, with a larger upper cell, constricted at the septum, coarsely verruculose, halo not seen, at first almost colourless but soon medium olive to finally dark brownish olive (turn olive in KOH), (12–)13–14–15 × (6–)6.5–7–7.5(–8) µm, l/b = 1.8–2–2.2(–2.5) (n = 37, in water), irregularly biseriate. Anamorph not found.

Matrix and biology. The fungus grows on thalli and apothecia of Ophioparma ventosa. It is clearly pathogenic, since it causes conspicuous dark infection spots on the host thallus.

Distribution. Known from two localities in Northern Norway.

Additional specimen examined: Norway. Troms: Storfjord, Skibotn, Skibotn River, 700

Discussion. Polycoccum ventosicola is very similar to P. minutulum Kocourk. & F.Berger (Kocourková & Berger 1999) growing on Trapelia placodioides, but differs by its smaller perithecia, wider ascospores, the absence of gall-formation, and different host (Ophioparmaceae R.W.Rogers & Hafellner vs. Trapeliaceae M.Choisy ex Hertel, both within Lecanorales). Polycoccum rugulosarium (Linds.) D.Hawksw. is similar to P. ventosicola in its ascospore size and small perithecia, but differs by having broader interascal filaments and more or less equal-celled ascospores. It also grows on different hosts (Caloplaca spp.) and is known only from the Southern Hemisphere (Hawksworth & Diederich 1988). Just two other lichenicolous fungi have been previously reported on Ophioparma ventosa: Muellerella ventosicola (Mudd) D.Hawksw., which is not uncommon on the host, and Taeniolella pertusariicola D.Hawksw. & H.Mayrhofer; however, the latter report is somewhat uncertain (Alstrup & Hawksworth 1990).
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Proiectria protopannariae Zhurb. sp. nov.

Fungus in thallis et apotheciis lichenis Protopannaria pezizoides parasiticus. Speciei Proinctria leptalea similis, sed ab ea imprimis differt ascosporis partim simplicibus, majoribus, (9.5–)10.5–12–13(–15) × (6.5–)6.5–7.5–8.5(–9.5) μm, et hospite diverso.

Type: Norway, Troms, Storfjord, Skibotn, between Luhcajavri and Stuoraoaivi, 69º16'N, 20º25'E, alt. 700 m, mesic gravelly roadside, on Protopannaria pezizoides (thallus and apothecia), associated with Cercidospora punctillata, 8 Aug. 2003, Zhurbenko 03126 (LE, holotype).

Fig. 2.

Perithecia narrowly obpyriform, 400 μm high and 200–250 μm diam. with a truncate, non-setose papillae c. 100 μm wide; carmine to wine red, exposed parts more intensively pigmented; immersed with only the ostiole protruding to sessile (wall rough when exposed). Peridium c. 50 μm thick, composed of two layers, inner layer of thin-walled, elongate cells, orange in squash preparation, K+ purple, getting yellow in lactic acid. The ostiolate canal with numerous periphyses. Asci unitunicate, cylindrical, 80–89–100(–110) × 7–8–9.5(–10) μm (n = 7, in water), 8-spored, 1–, K/I–. Ascospores symmetrical, mostly 1-septate and ellipsoidal to broadly ellipsoidal, and usually slightly constricted at the septum, sometimes simple and subglobose, wall smooth to tuberculate with age, colourless or occasionally pale brownish grey when old, with conspicuous, sometimes bulging guttules, (9.5–)10.5–12–13(–15) × (6.5–)6.5–7.5–8.5(–9.5) μm, l/b = (1.1–)1.4–1.6–1.9(–2.3) (n = 58, in

**Figure 2. Pronectria protopannariae.** holotype.

water, phloxin or K), uniseriate and sometimes slightly overlapping in ascus. Anamorph not found.

Matrix and biology. The fungus grows on healthy-looking Protopannaria pezizoides, mostly in thallus, occasionally in the hymenium. No pathogenic effect was observed.

Distribution. The species is known only from the type locality which is within the alpine zone. The species has also been searched for on host material (about 100 specimens) from the Arctic (mainly from Sibiria), but as no specimen has been found, it may be rare or absent in that zone.

Discussion. After Rossman et al. (1999), the new species is closest to Pronectria leptalea (J. Steiner) Lowen (= Xenonectriella leptaleae (J. Steiner) Rossman & Lowen). However, that species differs from Pronectria protopannariae by always having 1-septate and smaller ascospores (8–12 × 6.5–8 µm) and by different host family (Physciaceae Zahlbr. vs. Pannariaceae Tuck.). The present work follows that of Diederich (2003) by referring the species to Pronectria, rather than to Xenonectriella. Previously known nectrioid fungi on the Pannariaceae are: Paranectria affinis (Grev.) Sacc. on Fuscopannaria ahlneri, Paranectria oropensis (Ces.) D.Hawksw. & Piroz. on Parmeliella atlantica and Nectriopsis lecanodes (Ces.) Diederich & Schroers on Degelia plumbea.

Skyttea dacampiae Zhurb. sp. nov.

Fungus in thallis lichenis Dacampia hookeri incolens. Skyttea thelotrematis similis, sed ab ea imprimis differt ascomatibus sessilibus, pilis excipularibus longioribus, et hospite diverso.

Type: Norway, Troms, Storfjord, Skibotn, between Luhcavarri and E part of Davimus Viessogasgaisi, 69º16'N, 20º24'E, alt. 900 m, top of a mountain, mesic to dry calcareous fellfield with Dryas-lichen-moss tundra, on thallus of Dacampia hookeri, 9 Aug. 2003, Zhurbenko 0388 (LE, holotype).

Fig. 3.
Ascomata apothecioid, initially closed except for a pore-like opening, urceolate at maturity with an opening up to 0.15 mm diam., applanate-globose, sessile, markedly constricted at the base, 0.15–0.35 mm diam., about 0.2 mm tall, aggregated to contiguous, blackish with white striate rim around the pore produced by excipular hairs. Excipular hairs colourless, cylindrical, simple, straight to somewhat flexuose, 2–2.5 µm diam. and up to 40 µm long, with smooth and uniformly thin (not refractive) wall, bordering all lateral exciple and protruding around the pore. Epihymenium pale glaucous green. Hymenium colourless, 30–40 µm tall. Subhymenium pale brownish olive, c. 5 µm tall. Exciple massive, composed of subglobose cells 3–8 µm diam. at the base and of elongate cells laterally, aeruginose green, but with an olivaceous hue in the basal part. All parts of apothecial sections HNO 3–, K–, or exciple K+ more olivaceous; paraphyses I+ (and K/I+) yellow; ascoplast I+ orange; exciple partly I+ orange. Paraphyses filiform, straight, not branched, apically not enlarged, 1–1.5 µm diam. Asci subcylindrical, long-stalked, apices usually rounded or rarely flattened, unitunicate, thin-walled except for being apically thickened to 3 µm, ocular chamber not seen, opening by a pore, 27–45 × 4–6 µm, 8-spored, without any amyloid reaction. Ascospores colourless, fusiform, straight, simple, with a few large guttules, smooth-walled, (7–)7.5–8.5–10(–11) × 2–2.5 µm, l/b = 3.2–4.2–5.1(–5.5) (n = 10, in water), overlapping biseriate in ascus. Anamorph not found.

Matrix and biology. The fungus grows on healthy-looking thallus of Dacampia hookeri. No pathogenic effect was observed.

Discussion. According to Diederich & Etayo (2000), this new species is closest to Skyttea thelotrematis Diederich & Etayo, but the latter differs in its initially immersed, later erumpent ascomata, shorter excipular hairs which are up to 16 µm long, thicker paraphyses (1.5–2 µm diam.), higher hymenium, thicker and colourless subhymenium and a different host (Thelotrema lepadinum). Other previously known fungi on this host are Stigmidium schaereri (A.Massal.) Trevis., which is more common, and S. allogenum (Nyl.) D.Hawksw.

Sphaerellothecium soechtingii Zhurb. & Alstrup sp. nov.


Type: Russia, Siberia, Taimyr Peninsula, Byrranga Mts., at Levinson-Lessing Lake, boulder field among dwarf shrub-lichen-moss tundra, 74°24'N, 98°49'E, alt. 100 m, on thallus of Arthrorhaphis alpina, associated with Cercidospora soror, 30 July 1995, Zhurbenko 95231 (LE, holotype).
Etymology. Dedicated to the Danish lichenologist Ulrik Søchting.

Vegetative hyphae conspicuous, blackish, c. 5 µm diam., forming a hyphal net, moderately branched, flexuose, superficial to submersed, with occasional upright branchlets; in squash preparations brown, pale and smooth or dark, verruculose and unevenly pigmented, BCr+ blue to blue-green. Perithecia evenly brownish black, glossy, globose, ostiolate, 30–60 µm diam., semi-immersed to occasionally nearly sessile, scattered. Peridium brown, of textura angularis, consisting of polyhedral cells 5–10 µm across, BCr+ dark blue, becoming more olive in K. Hymenial gel I–, K/I–. Interascal and ostiolar filaments not seen. Asci bitunicate, ellipsoidal to subglobose, tholus to 3 µm thick, with no or a short foot, (21–)26.5–31–35.5(–41) × (12–)14–16.5–19(–22) µm (n = 37, in water), 8-spored, K/I–, wall BCr–, plasma BCr+ blue. Ascospores narrowly soleiform (skittle-shaped), lower cells narrower than the upper ones, (1–)3(–5)-transseptate or rarely submuriform, constricted at the septa, particularly at the central one, at first colourless then often pale olive-brown, smooth-walled, without halo, (10–)11.5–13–14.5(–15) × (3.5–)4–4.5–5 µm, l/b = (2.5–)2.7–3–3.3(–3.7) (n = 65, in water, BCr, or K), plasma BCr+ blue to blue-green, irregularly 2–3-seriate. Anamorph not found.

Matrix and biology. The fungus grows on the thalli of Arthrorhaphis alpina. It is a mild pathogen, since the host thallus turns grey with heavy infections.

Distribution. Known from the Alps (Austria) and northern Eurasia (Norway, Siberia).

Discussion. Sphaerellothecium species generally have 1-septate or sometimes 3-septate ascospores and submuriform ascospores have not before been reported. The spores of S. soechtingii are markedly constricted at the median septum, which is untypical for the genus. A key to the six species of lichenicolous fungi, formerly known on Arthrorhaphis, is presented in Hafellner & Obermayer (1995).
The one most similar to the new species is *Stigmidium arthrorhaphidis* Hafellner & Obermayer, known from the mountains of China and Nepal. However, it differs from *Sphaerellothecium soechtingii* in the absence of a superficial net of dark hyphae and 1-septate ascospores.


**Stigmidium leprariae** Zhurb. sp. nov.

Fungus lichenicolae in thalli generis *Lepraria* crescens. Hyphae, hamathecium et conidiomata non observata. Ascomata perithecioidea, subglobose, sometimes conical above, ostiolate, 50–80 µm diam., semi-immersa vel sessilia, dispersa. Peridium olivaceo-fuscum, of textura angularis, consisting of unevenly pigmented polyhedral cells 3–8 µm across, K–, BCr+ blue-green. Hymenial gel I–, K/I–. Interascal and ostiolar filaments indistinct. *Asci* bitunicate, ellipsoidal to gradually clavate, sometimes with c. 5 µm thick tholus and long ocular chamber, stalk short or rather long, sometimes absent, 30.5–36.5–42.5(–50) × (10–)11–12.5–14(–15) µm (n = 8, in water), 8-spored, K/I–, wall BCr+ pale violet, plasma in immature asci BCr+ blue. *Ascospores* colourless to often pale grey-olive, narrowly soleiform (skittle-shaped), lower cell often slightly narrower than the upper one, occasionally fusiform, apices rounded or sometimes acute, 1(–3)-septate, not or slightly constricted at the septum, (12–)12.5–14(–17) × 4–4.5–5(–5.5) µm, l/b = (2.2–)2.7–3.1–3.5(–4.3) (n = 64, in water), distinctly guttulate, smooth-walled, without halo, BCr+ violet, overlapping and irregularly 2–3-seriate. *Anamorph* not found.

Type: Norway, Troms, Storfjord, Skibotn, between a road and Grustavsvingen River, 69°17’N, 20°29’E, alt. 160 m, slope with siliceous rocks and boulders in sparse deciduous forest, on thallus of *Lepraria neglecta* growing on soil, 7 Aug. 2003, Zhurbenko 03254 (LE, holotype).

Vegetative hyphae not observed. Perithecia evenly black, glossy, subglobose, sometimes somewhat conical above, ostiolate, 50–80 µm diam., semi-immersed to sessile, scattered. Peridium olive-brown, of textura angularis, consisting of unevenly pigmented polyhedral cells 3–8 µm across, K–, BCr+ blue-green. Hymenial gel I–, K/I–. Interascal and ostiolar filaments indistinct. *Asci* bitunicate, ellipsoidal to gradually clavate, sometimes with c. 5 µm thick tholus and long ocular chamber, stalk short or rather long, sometimes absent, 30.5–36.5–42.5(–50) × (10–)11–12.5–14(–15) µm (n = 8, in water), 8-spored, K/I–, wall BCr+ pale violet, plasma in immature asci BCr+ blue. *Ascospores* colourless to often pale grey-olive, narrowly soleiform (skittle-shaped), lower cell often slightly narrower than the upper one, occasionally fusiform, apices rounded or sometimes acute, 1(–3)-septate, not or slightly constricted at the septum, (12–)12.5–14(–17) × 4–4.5–5(–5.5) µm, l/b = (2.2–)2.7–3.1–3.5(–4.3) (n = 64, in water), distinctly guttulate, smooth-walled, without halo, BCr+ violet, overlapping and irregularly 2–3-seriate. *Anamorph* not found.

**Matrix and biology.** The fungus grows on the thallus of *Lepraria neglecta*. It is most probably parasymbiotic, since no damage to the host thallus was seen.

**Distribution.** The species is known only from the type locality.
Discussion. To the best of my knowledge, no Stigmidium or Sphaerellothecium species have been described from Lepraria as a host genus. Seven of 66 Stigmidium species known to me (S. bellemerei Cl.Roux & Nav.-Ros., S. degelii R.Sant., S. frigidum (Sacc.) Alstrup & D.Hawksw., S. icmadophilae R.Sant., S. mycobilimbiae Cl.Roux, Triebel & Etayo, S. rivulorum (Kernstock) Cl.Roux & Nav.-Ros., S. xanthoparmeliarum Hafellner) are similar to S. leprariae by their ascomata and ascospore sizes, metachromatic reactions (where known), negative reaction of the hymenial gel (where known), and hamathecial elements (where known) (Santesson 1984 & 1993, Hafellner 1994, Roux & Triebel 1994, Ihlen 1995, Zhurbenko & Santesson 1996, Molitor & Diederich 1997, Ihlen 1998, Roux et al. 1998, Calatayud & Triebel 1999, Sérusiaux et al. 1999). Stigmidium icmadophilae, S. rivulorum, and S. xanthoparmeliarum differs from S. leprariae by their pathogenicity. The remaining four species differ from S. leprariae by their permanently colourless ascospores. Within the species group, only Stigmidium mycobilimbiae and S. xanthoparmeliarum have 1(–3)-septate ascospores, similar to those of S. leprariae; the others having just 1-septate ascospores.

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Figure 5. Stigmidium leprariae, holotype. Above. Habitus. Upper right. Asci. Lower right. Ascospores. Bars: Above = 0.25 mm, Upper right = 20 µm, Lower right = 10 µm.
References


