

New and noteworthy records of Pezizomycetes in Sweden and the Nordic countries

IBAI OLARIAGA and KAREN HANSEN

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Pezizomycetes are poorly known in Sweden compared to the rest of the Nordic countries. Field inventories to improve the knowledge of Pezizomycetes in Sweden were therefore carried out during 2008–2010 in selected areas. Nine new or remarkable species are included in this first contribution, among which five are new to Sweden and two to the Nordic countries. *Byssonectria fusispora* has not previously been known or accepted in the Nordic countries. We compare it directly to *B. terrestris* using fresh material and give distinguishing characters. *Chalazion sociabile* is new to Sweden and this is the first report outside Norway. Three *Scutellinia* species are presented for the first time for Sweden, *S. citrina*, *S. macrospora* and *S. torrentis*. A deviant *S. torrentis* collection with larger and finely ornamented spores is described in detail and compared to other collections of *S. torrentis* (including an isoelectotype) and *S. superba*. The report of *S. superba* is the second for Sweden. The first Nordic and second European record of *Paratrachophaea michiganensis* is presented. The genus *Spooneromyces* is reported for the first time in Sweden, with *S. helveticus* as new to the Nordic countries, and *S. laeticolor* new to Sweden. Detailed descriptions are provided, drawing attention to *in vivo* characters, with colour macro- and microscopic photos of the species. Species delimitations are discussed, and ecology and known distribution for each species are given.

Key words: Ascomycetes, Pezizales, Pyronemataceae, operculate discomycetes, vital taxonomy, biodiversity

Ibai Olariaga, Department of Cryptogamic Botany, Swedish Museum of Natural History, P.O. Box 50007, SE-104 05, Stockholm, Sweden; e-mail: ibai.olariaga@nrm.se

Karen Hansen, Department of Cryptogamic Botany, Swedish Museum of Natural History, P.O. Box 50007, SE-104 05, Stockholm, Sweden; e-mail: karen.hansen@nrm.se

Introduction

The class Pezizomycetes (operculate discomycetes) is relatively well known in the Nordic countries, compared to the rest of the world. Species have been collected and studied in Denmark, Norway and Finland by several mycologists during the last 45 years (e.g. Dissing 1966, Eckblad 1968, Schumacher 1979, Dissing & Sivertsen 1983, Schumacher & Jenssen 1992, Kristiansen 2006, Harmaja 2009). In Sweden, however, no specialist has focused on this group, although Nannfeldt published a number of smaller papers (Nannfeldt 1937, 1938, 1949, 1966). Recently, in a checklist of the non-lichenized ascomycetes of

Sweden, 276 Pezizomycetes species were reported for the country (Eriksson 2009). Compared to the number of species recorded from the Nordic countries (i.e. Denmark, Finland, Iceland, Norway and Sweden), ca 470 species (Dissing et al. 2000), many are still to be found in Sweden, considering the country's large size and wide range of habitats. To improve the knowledge of the diversity and distribution of Pezizomycetes in Sweden, broad field-inventories were initiated in 2008 under the research project "Pezizomycetes in Sweden, focusing on Pezizaceae and Pyronemataceae", funded by the Swedish Taxonomy Initiative. The fieldwork targeted areas that potentially could have a high diversity

of taxa of Pezizomycetes, e.g. calcareous and/or disturbed ground (with a high pH and often low content of organic matter; Petersen 1985) and areas only little or not previously explored. This paper presents the first nine of these new or rarely reported species discovered from Sweden or the Nordic countries. Although higher-level relationships have been clarified within Pezizomycetes (see Hansen & Pfister 2006), many problems remain to be solved at generic and species level.

The aim of this paper is to contribute to the understanding of the limits and variability of these scarcely known species, by providing detailed morphological descriptions and photographs, including more complete information on characters in living condition, especially guttulation and pigmentation in spores and paraphyses (vital taxonomy; Baral 1992), and information on ecology and distribution.

Materials and methods

Apothecia were studied using bright field optics and differential interference contrast (DIC) light microscopy. Macro- and microscopic descriptions, except for the excipulum structure and hairs, were made from fresh material, and were completed later from dried material rehydrated in H₂O for at least 3 hours. Mature spores, discharged from the asci without applying external pressure on the cover slip, were measured from fresh and rehydrated material in H₂O. Unless otherwise stated, the spore dimensions (excluding ornamentation) and the calculated mean values are based on 20 spores measured from each collection ($\times 1000$ magnification): mean length (L_m), mean width (W_m) and length : width ratio ($Q_m = L_m / W_m$). "n" refers to the number of collections that the statistics are based on. Extreme values are given in parentheses. Mounting reagents used were Congo red in ammonia (CR), Cotton blue in lactic acid (CB) and Melzer's reagent (MLZ). The symbol * refers to fresh material and † to dried, rehydrated material. Microanatomical terminology follows Korf (1973). Geographic coordinates in decimal grades, obtained from Google maps, are given for some of our collections. The newly collected material will be deposited in the Swedish Museum of Natural History (S).

Results and discussion

Byssonectria fusispora

– Fig. 1, a-d

Byssonectria fusispora (Berk.) Rogerson & Korf in Korf, *Phytologia* 21: 202. 1971.

≡ *Peziza fusispora* Berk., *London J. Bot.* 5: 5. 1846.

Apothecia 1–5 mm diam, initially globose, cleistohymenial, opening prior to spore maturation, then urniform and finally shallowly cup-shaped, sessile, gregarious to weakly caespitose. Margin distinct, with remnants from the opening of the excipular roof, in young apothecia appearing rimmed. Hymenium bright reddish orange. Outside furfuraceous, with small scale-like tufts, especially evident in younger apothecia. Subiculum formed by sparse hyphal threads, more conspicuous among densely clustered apothecia. *Asci* cylindrical, thin-walled, 8-spored, 201–230 \times 10–13 μ m, base pleurorhynchous. *Ascospores* uniseriate, fusiform, inequilateral, smooth, †21–24.5 \times 7–8.5 μ m ($L_m=22.8$, $W_m=7.7$, $Q_m=2.94$, $n=1$) [*23–25.5 \times 7–8 μ m, $L_m=23.6$, $W_m=7.6$, $Q_m=3.10$]. *Content with two large guttules and many small ones, wall thickened and refractive at the poles. *Paraphyses* simple, 3.5–4.5 μ m broad, gradually enlarged towards apices, up to 5–8 μ m broad, narrowly claviform to claviform, straight to very slightly bent, sparsely septate. *Content of very small, deep reddish orange guttules, sometimes leaving a hyaline area at the apex, with more sparse guttules towards the base, turning bluish-greenish black in MLZ. *Medullary excipulum* not clearly differentiated, composed of thin-walled, hyaline, angular – elongated cells, 18–43 \times 10–20 μ m, with abundant yellow – orange vacuoles. *Ectal excipulum* ca 80–100 μ m thick, of *textura globulosa-angularis*, cells 23–55 μ m diam, thin-walled, hyaline, clearly reddening in MLZ. Hyphal hairs arising from outermost globose cells of the outer excipulum, cylindrical, straight, hyaline, thick-walled except at apices, 109–360 \times 9.5–12 μ m. *Anchoring hyphae* similar to the excipular hairs, but longer. *Subiculum hyphae* cylindrical, slightly sinuous, thin-walled to thick-walled, with scarce septa, hyaline to light yellowish, smooth, 7–13 μ m diam, slightly reddening in MLZ.

Specimens studied: SWEDEN. Södermanland. Österhaninge, Tyresta National Park, N59.179996, E18.293116, in path on sandy acidic ground, in open area that burned in 1999, 27.IV.2010 *Olariaga*, KH.10.01 (S); same locality, 2.V.2010 *Olariaga*, KH.10.06 (S).

Specimens studied for comparison. *B. terrestris*: SWEDEN. Uppland. Jumbils, Styggekärrs naturreservat, Hasseldalarna, in *Picea* forest, amongst elk dung, 9.V.2010 Hansen & *Olariaga*, KH.10.05 (S).

Byssonectria P. Karst. is characterized by cleistohymenial development (Fig. 1b) of the apothecia that open during the mesohymenial phase, fusiform spores with thickened walls at the poles (Fig. 1c, e), the presence of a more or less developed subiculum and the occurrence in nitrogen-rich places or on burned ground. Except for *B. terrestris* (Alb. & Schwein.) Pfister, species of the genus appear to be rare and rather poorly known.

Byssonectria fusispora has been treated as a separate species from the well-known *B. terrestris* (syn. *Byssonectria aggregata* [Berk. & Br.] Rogerson & Korf) by some authors (Svrček 1969, Pfister 1993, Yao & Spooner 1996), although Yao & Spooner (1996) questioned the distinguishing characters. Pfister (1993) separated *B. fusispora* from *B. terrestris* on the basis of poor development of the subiculum, larger spores and apothecia (up to 6 mm diam), and occurrence on soil, particularly in areas with charred wood, in contrast to dung and plant debris where animals have urinated. Yao & Spooner (1996) stated that the development of the subiculum depends on the substratum; on soil a very weak subiculum will develop, whereas on plant litter or debris the subiculum will be strikingly thick. Rifai (1968) recognized only one variable species of *Byssonectria* (as *Inermisia*), based on examination of type material of several names, including *B. fusispora* from Tasmania (Berkeley 1846) and *B. aggregata* from England (Berkeley & Broome 1866), and additional collections. As Pfister (1993) we consider Rifai's concept too heterogeneous. Measured from the illustration of the type of *B. fusispora* (Rifai 1968: Fig. 220), the spore ranges ($25.3\text{--}27.3 \times 8.3\text{--}9.7 \mu\text{m}$) are within those mentioned by Pfister ($23\text{--}28 \times 7.2\text{--}11 \mu\text{m}$). Nevertheless, Yao and Spooner (1996) claimed the spores of the type to be mostly $21\text{--}23 \times 8\text{--}9 \mu\text{m}$. Studies of fresh material and freely discharged spores have been called for to solve or interpret the species boundaries of *B. fusispora* and *B. aggregata* (Pfister 1993, Yao & Spooner 1996).

During the spring of 2010 we were able to study fresh material that was attributed to both species, and thus to make a direct comparison of delimiting characters. *Byssonectria fusispora* differed from *B. terrestris* (Fig. 1e-f) in having larger, reddish, shallowly cup-shaped apothecia (Fig. 1a); longer and narrower spores (Fig. 1c); along with straight paraphyses with darker reddish orange guttules (Fig. 1d). The subiculum of *B. fusispora* was very weakly developed and mostly visible among tightly growing fruitbodies, while it was very conspicuous and thick in *B. terrestris*. As Benkert (1987) and Yao & Spooner (1996) claimed, this could be related to the substrate. For a summary of the differences see Table 1. Boudier's (1905-10) pl. no. 394 illustrates *B. fusispora* well. Although more fresh collections should still be studied and the boundaries assessed by molecular data, our material of *B. fusispora* agrees with the descriptions provided by Pfister (1993) and Yao & Spooner (1996), and we agree with these authors that *B. fusispora* and *B. terrestris* constitute two separate species. Spore measurements of *B. fusispora* obtained from dried material, however, are smaller than those cited by Pfister (1993) and inferred from Rifai (1968).

Only one species of *Byssonectria*, *B. terrestris*, has been known in the Nordic countries following Dissing et al. (2000). Eriksson (2009) listed *B. fusispora* as a synonym of *B. terrestris*. According to Pfister (1993), *B. terrestris* seems to be exclusively boreal or high montane, whereas *B. fusispora* occurs most often in middle latitudes. Thus, *B. fusispora* may be rare in the Nordic countries which could explain why only one species has been recognized or accepted so far. *Byssonectria terrestris* is, on the other hand, occasional to common in the Nordic countries (Dissing et al. 2000).

Chalazion sociabile

– Fig. 1, g-j
Chalazion sociabile Dissing & Sivertsen, Norweg. J. Bot. 22: 2. 1975.

Apothecia up to 500 μm diam, pulvinate, sessile, gregarious. Margin inconspicuous, light greyish white, when dry light yellowish ochre. Outside glabrous. *Asci* clavate, thin-walled to slightly thick-walled, 8-spored, with a large operculum, $125\text{--}158 \times 30\text{--}40 \mu\text{m}$, base very short, narrow, pleurorhynchous. *Ascospores* uniseriate or bise-

riate, narrowly ellipsoid, sometimes inequilateral having a straight side, with hemispherical warts, up to 3 μm high, sometimes coalescing (up to 4 μm long), cyanophilic, $\dagger 30\text{--}34 \times 14\text{--}16 \mu\text{m}$ ($L_m = 32.1$, $W_m = 15.2$, $Q_m = 2.12$) [$*32\text{--}34 \times 14.5\text{--}16.1 \mu\text{m}$, 4 spores]. *Content of many small and refractive guttules; \dagger with one or two large guttules and many smaller ones. De Bary bubbles not observed. *Paraphyses* gradually enlarged at apices (6.3–8.5 μm broad) and slightly bent, *content hyaline, with some little refractive guttules; \dagger with condensed, collapsed content. *Medullary excipulum* ca 40 μm thick, formed by cylindrical to subglobose cells, forming subparallel rows, thin-walled, yellowish, with refractive guttules, 2–8 μm diam. *Ectal excipulum* only present at the basal part of the apothecia, of *textura subglobulosa*, cells yellowish, with refractive content, 8–18 μm diam, not reacting in MLZ. Hairs absent.

Specimens studied: SWEDEN. Jämtland. Östersund, Ångsjön naturreservat, N63.177608, E14.583755, on rich mull under tall herbs in a clearing by a *Picea* forest, 26.VIII.2009 Hansen & Olariaga, KH.09.70 (S).

Chalazion Dissing & Sivertsen produces very small fruitbodies for a soil-inhabiting member of the Pezizomycetes (Fig. 1g), which is probably the reason why it is extremely rarely detected in the field and only few records exist. *Chalazion sociabile* was the first species described in the genus, from Mo i Rana (Dissing & Sivertsen 1975). Some years later a second species, *C. helveticum* Dissing, was described from the Alps (Dissing 1980). The latter species seems more widespread than *C. sociabile*, since it has been reported from Denmark (Dissing 1983) and eight additional localities in Norway (Kristiansen 1990). On the contrary, *C. sociabile* has only been recorded once after it was described (Kristiansen 1990). This is the first find outside Norway and the third locality for the species. A third species, *C. erinaceum* Doveri, Yei Z. Wang, Cacialli & Caroti has not been reported since it was described (Doveri et al. 1998). It is distinguished by a coprophilous ecology and smaller spores.

The Swedish locality is a clearing by a *Picea* forest, where the rich mull had been turned up some time ago, under e.g. *Aconitum septentrionale*, *Chaerophyllum*, *Geranium sylvaticum*, *Tussilago farfara*, *Urtica dioica* and *Filipendula ulmaria* (Fig. 2). Several other *Pezizales* species

were found at the site, namely *Ascobolus viridis* Curr., *Marcelleina persooni* (P. Crouan & H. Crouan) Brumm. and *Trichophaea hybrida* (Sow.) T. Schumach., before discovering *Chalazion sociabile*.

The relationships of *Chalazion* are still uncertain. It has been considered a member of *Pezizales*, with a unique position, and was indirectly suggested to belong to *Thelebolaceae* (Dissing & Sivertsen 1975) or *Pyronemataceae* (Dissing 1980). Van Brummelen thought it best placed in *Pezizales incertae sedis*, but alternatively suggested it be moved to *Thelebolaceae*, because of the ascus structure (in Dissing & Schumacher 1994), as Eriksson (1999) did. Molecular data has confirmed the placement within *Pezizales* (Landvik et al. 1998, Hansen et al. 2005); it nested within a larger group along with *Ascodesmidaceae*, *Glaziellaceae* and *Pyronemataceae*, but without support for an exact placement. Following this it was placed in *Pyronemataceae* by Eriksson (2000). Our preliminary molecular results suggest it is closely related to *Coprotus* Korf & Kimbr. and *Boubovia* Svrček outside the core of *Pyronemataceae* (Hansen & Olariaga in prep.).

Paratrachophaea michiganensis – Fig. 3, a–e
Paratrachophaea michiganensis (Kanouse)
Pfister, Mycologia 80: 519. 1988.

≡ *Trichophaea michiganensis* Kanouse, Mycologia 50: 138. 1958.

Apothecia up to 2 mm diam, disc-shaped, sessile. Margin indistinct, with long, stiff, brown hairs, extending far beyond the hymenium. Hymenium greyish or brownish white. Outside concolourous, with abundant long, brown hairs, appressed to erect. *Asci* cylindrical, thin-walled, 4-spored, with 4 aborted spores. *Ascospores* uniseriate, ellipsoid, smooth, with an irregular gelatinous sheath, $\dagger 19\text{--}21.5 \times 11\text{--}12.5 \mu\text{m}$, 13 spores [$*19\text{--}22 \times 11\text{--}12.5 \mu\text{m}$, 5 spores]. *Content homogeneous, with central nucleus seen; similar when dried. *Paraphyses* of uniform width (2–3 μm), straight, septate. *Content hyaline, appearing slightly refractive, without guttules. Subhymenium not distinct from the medullary excipulum, with slightly more swollen hyphae. *Medullary excipulum* of *textura intricata*, $\dagger 70\text{--}100 \mu\text{m}$ thick, with vaguely parallel arranged

hyphae, thin-walled, hyaline, 2–4.5 µm, turning light blue in MLZ. *Ectal excipulum* of *textura globulosa-angularis*, 80–130 µm thick, cells of 22–45 µm diam, thin-walled, hyaline to yellowish. *Hairs* arising from the medullary excipulum or seldom superficial, acute at the apex, straight, often ventricose, especially hairs at or towards the margin, with simple or sometimes bifurcate bases, receptacular hairs towards the base of the apothecia with bulbous bases (25–33 µm), arising from the outer excipulum, dark brown, thick-walled (2.5–4.5 µm), with 2–9 septa, 150–618 × 17.5–22 µm.

Specimen studied: SWEDEN. Skåne. Verum, Peninsula to Möllerödsnäs, Bokelund, N56.111628, E14.336391, on decomposing *Fagus* leaves, on rich mull, along forest path, 22.IX.2010 Hansen, Gillen & Olariaga, KH.10.244 (S).

The Swedish material belongs to *Paratrichophaea* Trigaux, a genus not previously known from the Nordic countries. It is characterized by eguttulate, smooth spores and simple excipular hairs (Fig. 3b–e), which arise from the medullary excipulum (Pfister 1988). The genus *Trichophaeopsis* Korf & Erb is distinguished by two-pronged hairs (a long branch pointing upwards and a shorter one pointing downwards), which arise superficially.

Within *Paratrichophaea*, *P. michiganensis* has been separated from *P. boudieri* (Grelet) Bronckers (syn. *P. macrocystis* Trigaux) on the basis of the 4-spored asci (Pfister 1988, Bronckers 2003). Kanouse (1958) described it, in addition, with smaller apothecia (up to 1 mm diam) and hairs up to 700 µm long (compared to 900 µm in *P. boudieri*), none arising from marginal cells. Kanouse (1958), studying also *P. boudieri* (sub *Trichophaea*), pointed out that she had not encountered any other species of which *P. michiganensis* could be a four-spored variant. If indeed the number of spores in the asci is the only separating character, it is likely that *P. michiganensis* is a 4-spored form of *P. boudieri*. This should be tested using molecular data.

In our material, each ascus consistently contains 4 well-developed spores and 4 aborted spores. The original description gives smaller spores (16–18 × 8–10 µm, Kanouse 1958), but upon re-examination of the holotype Pfister (1988) gave larger spores (21–23 [–25] × 11–13 µm). The spores in our material agree with those provided by the latter author. The present report of *P. michiganensis* is the second in Europe; it

was first reported from the Netherlands (Bronckers 2002). The Dutch collection was found on horse dung, whereas our collection was on degrading leaves, the same substrate as the holotype (Kanouse 1958).

Scutellinia citrina

– Fig. 3, f–j

Scutellinia citrina (Masse & Crossl.) Y.J. Yao & Spooner, Mycotaxon 53: 472. 1995.

≡ *Sphaerospora citrina* Masse & Crossl., Naturalist, Hull: 4. 1904.

= *Ciliaria trechispora* var. *paludicola* Boud., Icon. Mycol., Sér. 3, Livr. 11: pl. 225. 1906. – *Scutellinia paludicola* (Boud.) Le Gal, Bull. Soc. Mycol. France 82: 307. 1966.

Apothecia 2–5(8) mm diam, disc-shaped, sessile, gregarious, often forming groups. Margin indistinct, with short, dark brown hairs. Hymenium bright orange-red to red. Outside pale orange-red, covered with short, brown, appressed hairs. **Asci** cylindrical, mostly 8-spored, sometimes with only 2 to 7 spores fully developing, 319–380 × 33–37 µm, base pleurorhynchous. **Ascospores** uniseriate, globose, seldom subglobose, †(19.5) 22–30.5 × (19) 23–30 µm ($L_m = 23.6\text{--}27.4$, $W_m = 23.5\text{--}27.3$, $Q_m = 1.03$, $n=2$) [*26.5–29.5 × 26.5–29.5 µm, 9 spores], with hemispherical warts, smaller warts intermixed with big, rarely united and elongated, up to 2.8 µm high. *Content composed of many small refractive guttules; †appearing similar, de Bary bubbles present but scarce in MLZ. **Paraphyses** 4.3–5.7 µm broad, enlarged at apices to 7.5–16 µm broad, narrowly claviform to claviform, sometimes forked above, straight to slightly curved, septate. *Content with sparse bright orange acicular crystalized matter at the apex, with pale vacuoles, at the base with small orange guttules, more abundant downwards; †with refractive small guttules, light yellowish, collapsed. **Medullary excipulum** of *textura intricata*, composed of cylindrical to slightly swollen hyphae, thin-walled, hyaline, containing refractive colourless vacuoles, 6.5–16 µm. **Ectal excipulum** of *textura globulosa*, 100–150 µm thick, cells of 30–60 µm, thin-walled, hyaline to light brown. **Marginal hairs** acute, straight or slightly curved, often bent at the apex, simple at the base, dark brown and sometimes hyaline at the apex, thick-walled, without a lumen at the apex, 0–4-septate, 126–300 × 15–18 µm. Receptacular hairs similar

to those of the margin, thick-walled, deeply rooting, 0–3 -septate, $168\text{--}241 \times 10\text{--}14\ \mu\text{m}$.

Specimens studied: SWEDEN. Gotland. Stenkyrka, Lickershamn, Jungfruklint, N57.827548, E18.507736, by the sea, in wet chalky bare ground, 23.IX.2009 Hansen & Olariaga, KH.09.197 (S). Bål, Hejnum kallgate, N57.670991, E18.6787, on wet, chalky and clayey, bare soil, upturned and/or compressed by cow hooves, 27.IX.2009 Hansen & Olariaga, KH.09.223, KH.09.226 (S); same locality, 29.IX.2009 Hansen & Olariaga, KH.09.237, KH.09.239 (S); same area, 57.671318, 18.677562, on wet, chalky and clayey, bare soil, upturned and/or compressed by cow hooves, 1.X.2010 Hansen, Gillen & Olariaga, KH.10.303 (S).

Scutellinia citrina is characterized by short hairs (Fig. 3g) and globose, warty ascospores (Fig. 3i–j). According to the previous records, wetlands like fens and seeping springs are the suitable habitats for *S. citrina* (Le Gal 1966, Schumacher 1990). The two Swedish localities were disturbed, very moist, bare, chalk-rich, clayey grounds. In one of them (Hejnum kallgate) a large number of fruitbodies were encountered.

Scutellinia paludicola is the name most often applied to this taxon (Le Gal 1966, Schumacher 1990, Dissing et al. 2000). Yao & Spooner (1995) considered the type of *Sphaerospora citrina* to be conspecific with *S. paludicola* and made the combination in *Scutellinia*. As the latter authors noted, the protologue of *S. citrina* describes the hymenium colour as “*amoene lutea*” (Masse & Crossland 1904). After having observed a few hundred fruitbodies, we have only seen orange red to bright red fruitbodies, as Yao & Spooner (1995) did. At this point, despite the deceiving name, we agree with the latter authors that the colour differences are not enough to consider *S. citrina* and *S. paludicola* as distinct species.

Scutellinia citrina has previously been reported from one locality in Denmark and is considered rare in Norway (Dissing et al. 2000). We report it here as new to Sweden. In accordance with the Norwegian records (Schumacher 1993), the Swedish collections were made in a lowland coastal area.

Scutellinia macrospora – Fig. 4, a–f
Scutellinia macrospora (Svrček) Le Gal, Bull. Trimestr. Soc. Mycol. France 80: 123. 1964.
≡ *Lachnea lusatieae* var. *macrospora* Svrček, Sborn. N.r. Mus. v Praze, Řada B, Př.r. Vědy 6: 58. 1948.

Apothecia 1.8–5 (8) mm diam, disc-shaped, seldom shallowly cup-shaped, sometimes slightly umbilicate in the centre, sessile, gregarious, forming small groups. Margin distinct, hyaline to pale brown, with short, dark brown hairs. Hymenium bright red to orange-red. Outside orange-red, covered with short, brown, appressed hairs. Anchoring hyphae abundant at the base, white. *Asci* cylindrical, thin-walled, 8-spored, $230\text{--}266 \times 15\text{--}18\ \mu\text{m}$, base pleurorhynchous. *Ascospores* uniseriate, ellipsoid to fusoid, often inequilateral, with small, low rounded warts, sometimes coalescing, up to $1\ \mu\text{m}$ high, $\dagger 26.5\text{--}30 \times 12\text{--}14$ (14.5) μm ($L_m = 25.9\text{--}27.6$, $W_m = 12\text{--}13.6$, $Q_m = 1.94\text{--}2.15$; $n=8$) [$\ast 25\text{--}29 \times 12\text{--}14\ \mu\text{m}$, 32 spores]. *Content composed of small refractive guttules; \dagger often with one or two large guttules, de Bary bubbles observed but scarce in MLZ, perispore not loosening when heated in CB. *Paraphyses* simple, $3\text{--}4.5\ \mu\text{m}$ broad, enlarged at apices to $5\text{--}11\ \mu\text{m}$, narrowly claviform to claviform, straight, septate. *Content with red acicular matter at the apex, pale to bright, with abundant orange-reddish guttules at the base; \dagger with refractive small guttules, colourless, collapsed. *Medullary excipulum* of *textura intricata*, composed of cylindrical to slightly swollen hyphae, $7\text{--}16\ \mu\text{m}$, thin-walled, hyaline, with abundant refractive colourless vacuoles. *Ectal excipulum* of *textura subglobulosa*, up to $150\ \mu\text{m}$ thick, cells of $17\text{--}45\ \mu\text{m}$, thin-walled, hyaline to light brown. *Marginal hairs* acute, straight, rarely bent at the apex, simple or forked at the base, light to dark brown, thick-walled ($0.5\text{--}2\text{--}[4]\ \mu\text{m}$), 0–6 -septate, $121\text{--}365 \times 14\text{--}27\ \mu\text{m}$. Receptacular hairs similar to those of the margin, simple or forked, 0–5 -septate, $145\text{--}290 \times 12\text{--}19\ \mu\text{m}$.

Specimens studied: SWEDEN. Jämtland. Åre, Handöl, on the way from Norder-Tvärån to cliffs between Tväråklumparna, alpine tundra, on a moist bank with mosses, 19.VIII.2008 Hansen & Santos JS.08.36 (S); on soil with mosses, with *Salix* and *Betula*, on a bank, Santos & Hansen, KH.08.36 (S). Lappland. Jukkasjärvi, Abisko, Låktatjåkka, N68.419697, E18.341718, in a wet place, on bare ground and mosses, 14.VIII.2009 Hansen & Olariaga, KH.09.19 (S); Kopparåsen, N68.423852, E18.478382, 17.VIII.2009 Hansen & Olariaga, KH.09.47 (S). Tärna, Vindenfjällen naturreservat, Drottningleden, N65.815412, E15.127852, deeply placed in mosses, 17.VIII.2010 Hansen, Gillen & Olariaga, KH.10.61 (S); Gierevaartoe, calcareous area, ground with mosses and somewhat bare ground, 20.VIII.2010 Hansen, Gillen & Olariaga, KH.10.95 (S); same area, calcareous area, ground with mosses and somewhat bare ground,

N65.774167, E15.083333, 20.VIII.2010 Hansen, Gillen & Olariaga, KH.10.96 (S); same locality, among *Salix herbacea* in a snow bed, among mosses, 22.VIII.2010 Hansen, Gillen & Olariaga, KH.10.123 (S); Tängvatendalen, N65.877812, E14.630785, slope by the river, on bare mull, 23.VIII.2010 Hansen, Gillen & Olariaga, KH.10.137 (S).

Additional specimens studied: CANADA. Québec. Richmond Gulf area, 56°08'N, 76°34'W, N-facing creek, without trees, *Oxyria digyna* abundant, site with running water, on ground, 31.VIII.1982 Huhtinen 82/574 (TUR).

Scutellinia macrospora can be recognized by the large ellipsoid to fusoid spores (Fig. 4d-f) and rather short, uniform hairs (Fig. 4b-c). *Scutellinia mirabilis* Dissing & Sivertsen is considered to be a closely related species. It can easily be distinguished from *S. macrospora* by spores with a loosening perispore in heated CB. Both species belong to *Scutellinia* sect. *Minutae* along with *S. superba* (Velen.) Le Gal and *S. torrentis* (Rehm) T. Schumach. (presented below).

In spite of having studied several collections in fresh state, the content of the spores was always multiguttulate in our collections (Fig. 4f). Schumacher (1990) described the spores as "at first multiguttulate, then with two large internal guttules", without specifying if such an observation was made on living or dead material. Likewise, Jeannerot (2011) cites biguttulate spores, this time undoubtedly based on dead material collected by H. Dissing.

Our survey proved *S. macrospora* to be a rather widespread species in the Swedish mountains, as it is in Norway (Schumacher 1990). It has an arcto-boreal distribution in Norway, being frequently collected in snow beds and moist habitats in the mountains, and a montane-alpine distribution in Europe (Schumacher 1993). Nevertheless, this is the first report of the species from Sweden.

Scutellinia torrentis – Fig. 4, g-l
Scutellinia torrentis (Rehm) T. Schumach., Opera Bot. 101: 97. 1990.
≡ *Lachnea torrentis* Rehm, Ann. Mycol. 5: 212. 1907.

Apothecia 1–3 mm diam, disc-shaped, seldom almost umbilicate in the centre, sessile, gregarious to weakly caespitose, forming small groups. Margin indistinct, with short, dark brown hairs. Hymenium bright orange-red. Outside orange-

red, covered with short, brown, appressed hairs. *Asci* cylindrical, thin-walled, in general 8-spored, sometimes with aborted spores, 198–252 × 14–16 µm, base pleurorhynchous. *Ascospores* uniseriate, broadly ellipsoid, with low rounded warts (seen on surface, not in outline), sometimes coalescing and forming small ribs, up to 0.5 µm high, †17–20.5 × 10–12.5 µm ($L_m=18.8$, $W_m=11.5$, $Q_m=1.64$; n=1) [*17.8–20.7 × 10.6–12.8 µm, 26 spores]. *Content of refractive granules, central nucleus seen; †with the small guttules forming one big guttule, de Bary bubbles not seen in MLZ, with loosening perispore in heated CB. *Paraphyses* simple, 4–6.5 µm broad, enlarged at apices to 8–11 µm, narrowly claviform to claviform, straight to slightly curved, septate. *Content with red acicular crystalized matter at the apex, hyaline towards the base, or with a few orange-reddish guttules; †with refractive small guttules, light yellowish, collapsed. *Medullary excipulum* of *textura intricata*, composed of cylindrical to slightly swollen hyphae, thin-walled, hyaline, with refractive vacuoles, up to 16 µm. *Ectal excipulum* of *textura subglobulosa*, 100–140 µm thick, cells of 15–55 µm diam, thin-walled, light brown. *Marginal hairs* acute, straight, sometimes bent at the apex, simple at the base, dark brown, thick-walled (2.5–4 µm), without a lumen at the apex, 0–3 septate, 200–375 × 19.3–22.8 µm. Excipular hairs similar to those of the margin, with 1–2 roots, 2–4-septate, 152–254 × 13–17 µm.

Specimen studied: SWEDEN. Gotland. Bål, Hejnum kallgate, N57.670925, E18.679306, on bare ground, upturned and/or compressed by cow hooves, small fruit-bodies forming a dense group, in area with *S. citrina*, 27.IX.2009 Hansen & Olariaga, KH.09.231 (S).

Additional specimens studied. FINLAND. Uusimaa. Pornainen. Laukkoski, Sopenmetsä, forest road, 26.X.1995 Höijer 1844 (TUR). **Porvoo mlk.** Kaarenkylä, clayey forest road, 5.X.1991 Höijer s.n. (TUR); sandy soil, 8.IX.1995 Höijer 1667 (TUR). **GERMANY. Algäuer Hochalpen.** Bei Spielmannsau, auf feinem sand im Sperrbach-Tobel, VII.1906 Krieger F6080 (Rehm's Ascomycetes 1724, isoelectotype of *Scutellinia torrentis*, S). **SWEDEN. Lappland.** Villhemina, Satsfjället, bare ground with some mosses, 24.VII.2010 Schumacher; KH.10.13 (S).

Scutellinia superba

– Fig. 4, o

Scutellinia superba (Velen.) Le Gal, Bull. Trimestr. Soc. Mycol. France 80(1): 123. 1964.

≡ *Lachnea superba* Velen., Monogr. Discomyc. Bohem. 1: 305. 1934.

Specimens studied: CANADA. Québec. Kuujuarapik (= Great Whale River, Poste-de-la-Baleine), 55°17'N, 77°, 46'W, at the rapids, on clay, 11.VIII.1982 *Huhtinen 82/311* (TUR). SWEDEN. Härjedalen. Ljusnedal, V. Ruvallen, on soil, old *Picea* forest on calcareous soil (previously grazed forest), 7.IX.2008 *Hansen KH.08.91* (S).

Here we report two, morphologically very close, species of *Scutellinia*, *S. torrentis* and *S. superba*. Both belong to *Scutellinia* sect. *Minutae* due to the ellipsoid spores with a loosening perispore in heated CB and short hairs (Schumacher 1990). The description above of *S. torrentis* is based on collection KH.09.231 from Gotland. Within section *Minutae*, the Gotland collection can only be assigned to *S. torrentis* or *S. superba*, distinguished from each other mainly in spore size and shape. The Gotland collection, however, has spores that deviate from both of these species sensu Schumacher (1990), i.e. the spores are slightly larger than those of *S. torrentis*, and too small for *S. superba*. Additional material, including an isoelectotype of *S. torrentis*, was therefore examined for comparison. The material revealed a rather high variability in the size and shape of the spores of *S. torrentis*, with a considerably broad range of $L_m = 16.7\text{--}18.7\ \mu\text{m}$ and $Q_m = 1.70\text{--}1.95$ (Table 2). Nonetheless, all the collections had spores in the range given by Schumacher in 1990 (*S. torrentis*: $15.6\text{--}19.2 \times 7.8\text{--}11.5\ \mu\text{m}$; *S. superba*: $19.0\text{--}23.8 \times 11.0\text{--}15.8\ \mu\text{m}$). The Gotland collection possesses slightly longer spores with higher Q_m than the *S. torrentis* material used for comparison, but still shorter and with lower Q_m than those of the Swedish *S. superba* collection (Table 2).

Schumacher (1990) treated *Scutellinia convexa* (Velen.) Švrček as a synonym of *S. torrentis*, but was not able to examine type material. The spore measures of the type obtained by Gamundí (1975, $16.8\text{--}20 \times 10.6\text{--}12\ \mu\text{m}$), are larger than the ones given by Schumacher (1990), but very similar to our Gotland material. Schumacher (1990) concluded that *S. convexa* is conspecific with *S. torrentis* in spite of the difference in spore size.

Additional characters were searched for, in order to support the identification of the material.

The spore ornamentation of the typical *S. torrentis* collections proved to be very variable even inside one single ascus, ranging from minutely warted to incompletely and coarsely reticulate (e.g. Fig. 4m, n). The typical *S. superba* –collection (KH.08.91) had a similar variable pattern of spore ornamentation (Fig. 4o). The Gotland collection showed spores with a more regular, finely warted ornamentation (Fig. 4k–l), while coarsely warted or interconnected ribs were absent. The hairs of *S. torrentis* and *S. superba* appear to be almost identical.

We tentatively assign our KH.09.231 –collection to *S. torrentis* based on the spore characters. The Swedish collection KH.08.91 is a typical collection of *S. torrentis*, in agreement with the type collection and in the sense of Schumacher (1990). *Scutellinia torrentis* is reported as new to Sweden.

Scutellinia superba appears to be a rare species with only few finds reported in the world, e.g. in Norway, Denmark, the frequency and distribution in Finland is unknown (Dissing et al. 2000), Canary Islands (Korf & Zhuang 1991) and Italy (Medardi 2007). The material of *S. superba* reported here is the second find in Sweden (Eriksson 2009). Huhtinen (1985) reported it from Canada, but we have been unable to verify the loosening perispore in his collection and also found the Q_m (1.31) value of the spores to differ from *S. superba*, being broader and shorter. It would be interesting to study this material using DNA sequences and explore the species boundaries of *S. superba* and *S. torrentis* further.

Spooneromyces helveticus

– Fig. 5, a–h

Spooneromyces helveticus J. Breitenb. & F. Kränz. in T. Schumach. & J. Moravec, Nordic J. Bot. 9: 428. 1989.

Apothecia 5–18 mm diam, shallowly cup-shaped, sessile, gregarious, forming a small group. Margin distinct, raised, with distinct, short, projecting, brown hairs. Hymenium bright orange. Outside concolorous and paler towards the base, with gradually shorter hairs towards the base. Anchoring hyphae sparse at the base. **Asci** cylindrical, thin-walled, 8-spored, $210\text{--}218 \times 11\text{--}12\ \mu\text{m}$, base pleurorhynchous. **Ascospores** uniseriate, ellipsoid, inequilateral, with crests that form a large-meshed reticulum, crests $2.2\text{--}3.3\ \mu\text{m}$ high at the poles, perispore loosening slightly at the

poles, $\dagger 18\text{--}20.5 \times 8.5\text{--}9 \mu\text{m}$ ($L_m = 19.3$; $W_m = 8.8$; $Q_m = 2.2$, $n=1$) [$\ast 17\text{--}19.2 \times 8.7\text{--}9.8 \mu\text{m}$, 9 spores]. \ast Content of groups of dense granules at the poles, with central *nucleus* seen; \dagger with a guttule at each pole; de Bary bubbles present in MLZ. *Paraphyses* 3–4 μm broad, enlarged at apices to 4.5–7 μm , often branched above, straight, sparsely septate. \ast Content of refractive guttules only at the tips, intermixed with fine orange granules that are distributed all over the paraphyses, turning green in MLZ; \dagger with refractive small guttules, greenish, collapsed. Subhymenium as a dense layer of subparallel hyphae, turning green-blue in MLZ. *Ectal excipulum* of *textura globulosa*, 200–220 μm thick, cells of 10–65 μm , thin-walled, hyaline. *Marginal hairs*, straight, acute, arising from outermost cells of the ectal excipulum, with simple bases, most basal cells isodiametric, reddish-brown, hyaline at the base, with guttules inside when fresh, thick-walled (1–1.5 μm), 4–12-septate, $123\text{--}380 \times 18\text{--}24 \mu\text{m}$. Receptacular hairs similar to those of the margin, scarcer, shorter. Hyphal hairs intermixed with receptacular hairs, filiform, flexuous, slightly thick-walled (up to 1 μm), hyaline, septate, 4–9 μm diam.

Specimen studied: SWEDEN. Jämtland. Åre, Handöl, Vålådalens naturreservat, near Kronstugan by Ännsviken, under *Picea* in rich soil, with remains of elk hairs, 18.VIII.2008 Santos & Hansen, JS.08.30 (S).

Spooneromyces laeticolor

Spooneromyces laeticolor (P.Karst.) T. Schumacher & J. Moravec, Nordic J. Bot. 9: 427. 1989.

Specimen studied: SWEDEN. Pite Lappmark. Arvidsjäurs, Ävlångbäcken Allmänningreservat, 8 Km VNV Järvträsk, 330 m a.s.l., rich *Picea* forest, on needle litter, 11.IX.2009 Karström 0939 (S).

The genus *Spooneromyces* T. Schumacher & J. Moravec was described to accommodate species with bright orange apothecia, moderately thick-walled, non-fasciculate, multiseptate, acute hairs that arise from the outer cells of the excipulum (Schumacher & Moravec 1989). Two species were initially included in the genus, *S. helveticus* and *S. laeticolor*. Two additional species have since then been assigned to *Spooneromyces*, namely *S. daliensis* (W.Y. Zhuang) W.Y. Zhuang (2005) and *S. microsporus* Jamoni (2008).

Here we report *Spooneromyces* as a genus new for Sweden, with two species new for the

country: *S. helveticus* and *S. laeticolor*. Originally described from Switzerland (Breitenbach & Kränzlin 1984 as *Melastiza* sp., Schumacher & Moravec 1989), *S. helveticus* has subsequently been recorded from a second Swiss locality (Badiano et al. 2000), France (Moyne et al. 2010) and Germany (Benkert 2010). This is the first record of *S. helveticus* for the Nordic countries. The material conforms to the original description in every aspect. In addition, the subhymenium and medullary excipulum turn strikingly greenish blue when mounted in MLZ. Interestingly, the same reaction was observed in Swedish material of *S. laeticolor*, and Zhuang (2005) reported it for *S. daliensis*. This reaction has not been consistently checked in related genera, and further observations should be made before evaluating its taxonomical value.

Spooneromyces laeticolor seems to be a rare species, reported only a few times in e.g. England (Spooner 1981, sub *Melastiza asperula*), Finland, Norway, Denmark, Spain (Schumacher & Moravec 1989) and Austria (Jeannerot 2010). The Swedish record is the northernmost occurrence so far.

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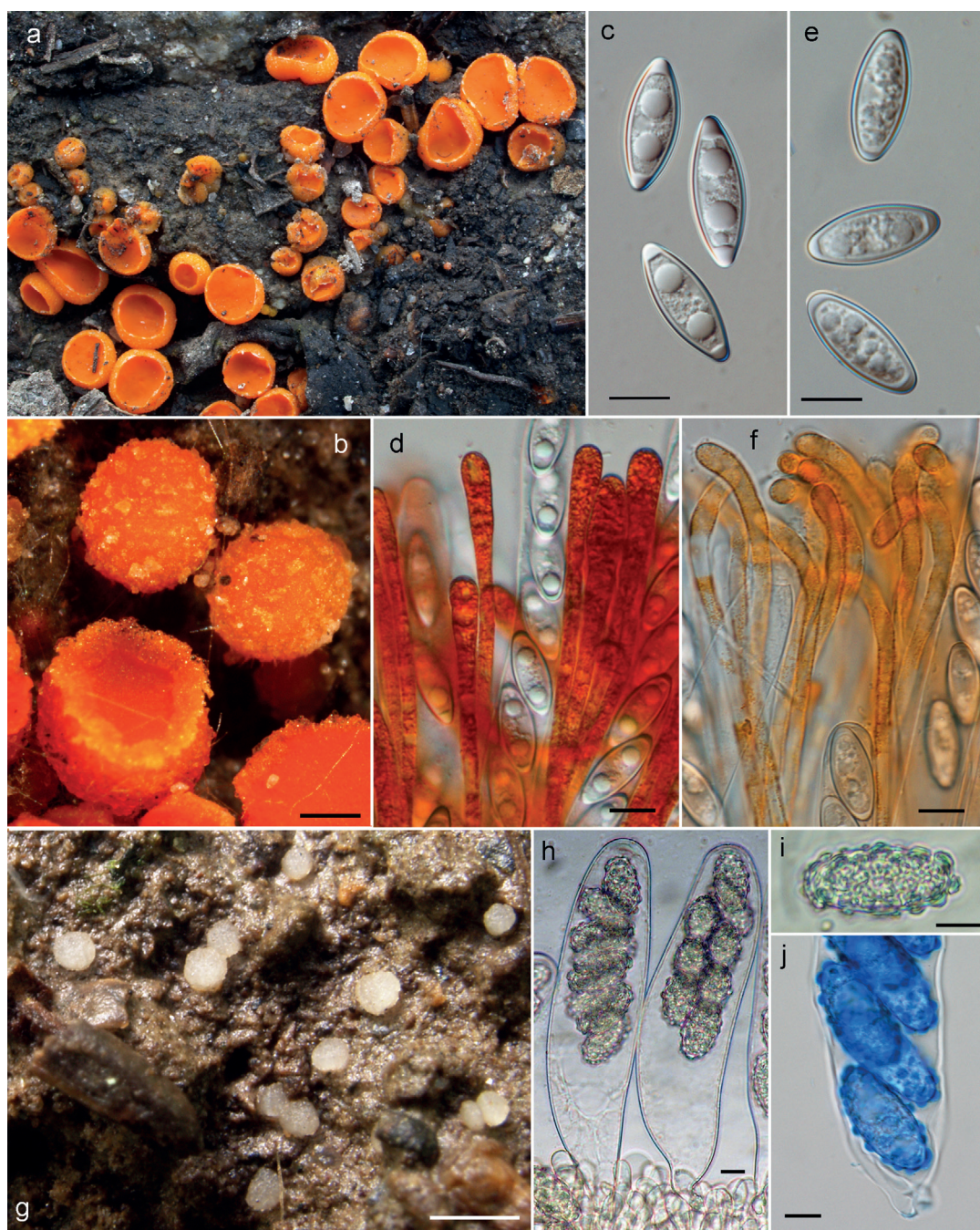


Fig. 1. *Byssonectria* and *Chalazion*. a-d = *B. fusispora* (KH.10.06, except a = KH.10.01), a = apothecia, b = young apothecia, two still closed and one open showing the hymenium and rimmed margin, with small scales on outside, c = *spores in DIC, d = *paraphyses. – e-f = *B. terrestris* (KH.10.06). e = *spores in DIC, f = *paraphyses. – g-j = *C. sociabile* (KH.09.70), g = apothecia, h = *clavate asci, i = *free spore, j = †short pleurorhynchous base of ascus with spores in CB. Scale = 10 μ m, except b (0.2 mm) and g (ca 1 mm). Photos: a, c, d, g-i Olariaga; b, e, f, j Hansen.



Fig. 2. Collecting site of *Chalazion sociabile* (KH.09.70). The arrow indicates the exact spot where the apothecia were collected. Photo: Olariaga.

Table 1. Distinguishing characters of *Byssonectria fusispora* and *B. terrestris*

	<i>B. fusispora</i>	<i>B. terrestris</i>
Growth manner	Gregarious to weakly caespitose	Densely caespitose
Apothecia shape as mature	Shallowly cup-shaped	Turbinate and disc-shaped
Subiculum	Inconspicuous hyphal threads	Thick and white mat
Ascospore size*	23-25.5 x 7-8 μ m	21.5-23 x 8.5-9.5 μ m
Ascospore size†	21-24.5 x 7-8.5 μ m	21.5-24 x 8.2-9.5 μ m
Paraphyses shape	Straight to slightly bent	Bent
Ecology	Old burnt area on acidic ground	Urine and dung of elk

Table 2. Statistics of dried spore measurements of *Scutellinia torrentis* and *S. superba*.

Species	Coll. no.	Lm (μ m)	Wm (μ m)	Qm	No. spores
<i>S. torrentis</i>	KH.09.231	18.8	11.5	1.64	20
<i>S. torrentis</i>	TUR 153426	17.7	9.9	1.79	13
<i>S. torrentis</i>	TUR 153436	18.7	9.6	1.95	14
<i>S. torrentis</i>	F-6080	18.2	10.7	1.70	20
<i>S. torrentis</i>	TUR 153438	18.5	10.0	1.85	20
<i>S. torrentis</i>	KH.10.13	16.7	9.6	1.74	20
<i>S. superba</i>	KH.08.91	21.0	14.3	1.47	20

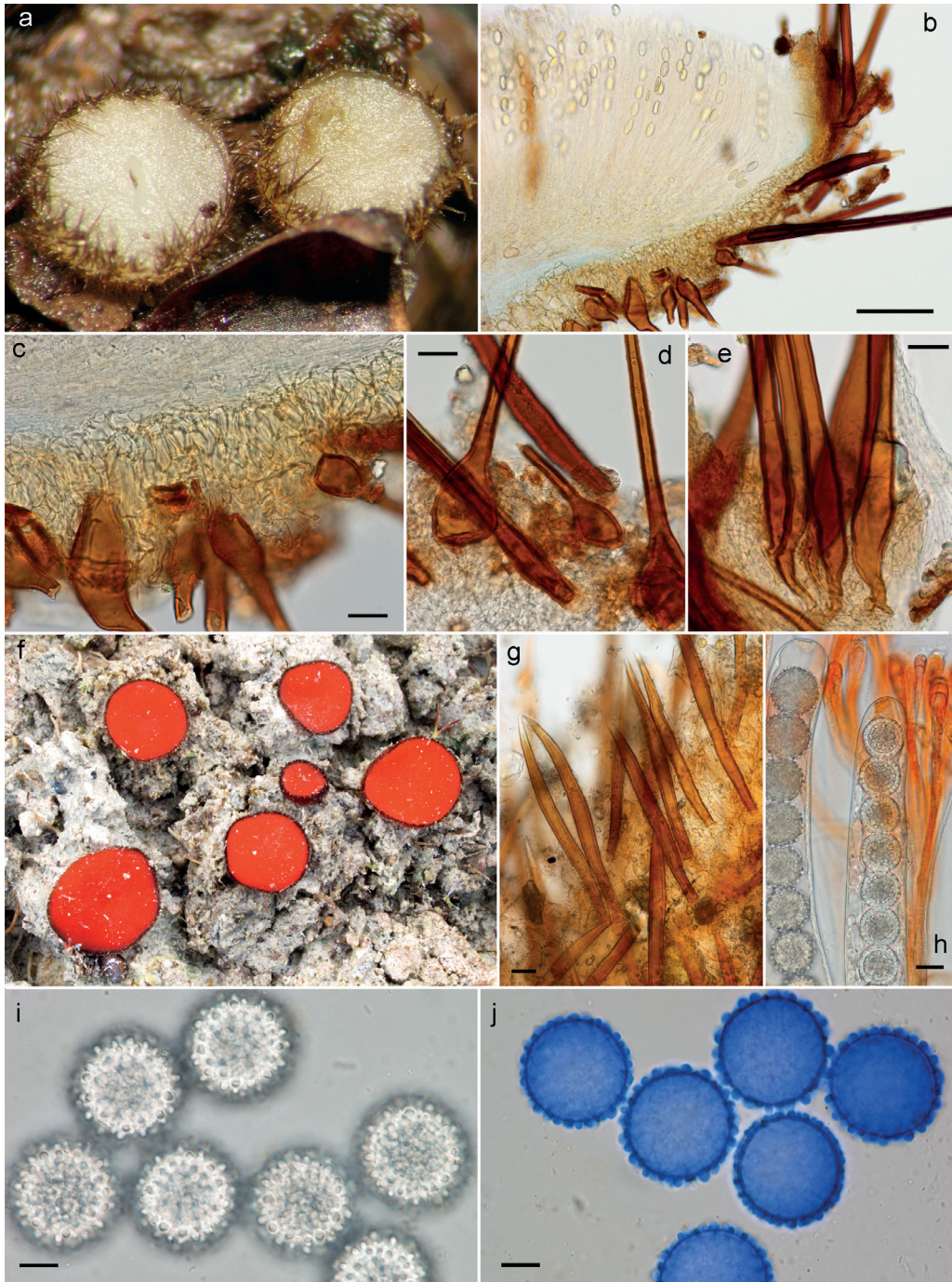


Fig. 3. *Paratrachophaea* and *Scutellinia*. a-e = *P. michiganensis* (KH.10.244), a = apothecia, b = †transverse section of an apothecium, showing the margin, c = †section of the ectal excipulum showing rooting hairs and weakly blueing medullary excipulum in MLZ, d = †hairs with bulbous bases in a piece taken from the outside, towards the base of an apothecium, e = †simple bases of hairs. – f-j = *S. citrina* (KH.09.223, except f=KH.09.237), f = apothecia, g = †short excipular hairs, h = *asci with immature and mature spores and paraphyses, i = *free spores, j = spores in CB, in outline. Scale = 10 µm, except c, d, e, g 20 µm. Photos: a, d-f Olariaga; b, c, g-j Hansen.

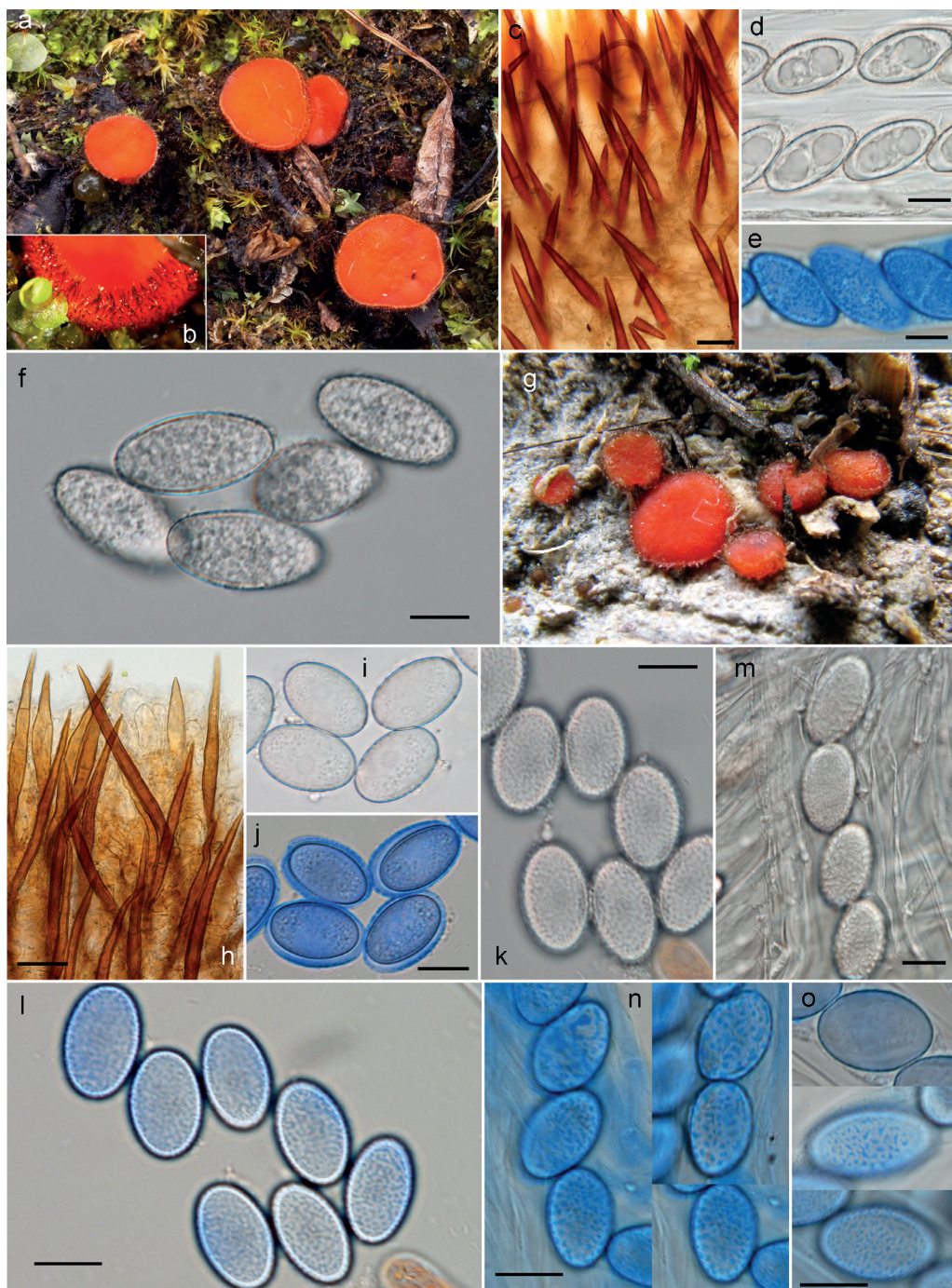


Fig. 4. *Scutellinia*. a-f = *S. macrospora* (JS.08.36, except a = KH.09.96; b, f = KH.08.36), a = apothecia, b = close-up of short marginal hairs, c = short hairs, d = †spores with 2 large guttules, e = †spores in CB showing fine warts, f = *multi-guttulate free spores. – g-l = *S. torrentis* (KH.09.231, except m, n = S F-6080, isolectotype), g = apothecia, h = short hairs, i = *spores with small guttules, outline, j = spores with loosening perisore in heated CB, k = *spores, ornamentation, l = spores with cyanophilous ornamentation in CB, m = †spores in DIC, ornamentation, n = spores, in part with loosening perisore (photo on the left), in heated CB. – *S. superba* (KH.08.91), o = †spores in CB. Scale = 10 µm, except c, h 50 µm. Photos: a, c, d, n, o Olariaga; b, e, f-m Hansen.



Fig. 5. *Spooneromyces helveticus* (JS.08.30), a = apothecia, b = close-up of marginal, projecting hairs, c = †base of receptacular hairs and hyphal hairs in between, †d = receptacular hairs arising from the outermost cells of the ectal excipulum, e = *paraphyses apices, with refractive guttules and tiny orange granules, f = *spores showing the ornamentation in DIC, g = *spore content, h = spore with cyanophilous ornament in CB. Scale = 10 µm, except c, d 20 µm. Photos: a Juan Santos; b, e-h Hansen; c, d Olariaga.

References

- Baiano, G., Garofoli, D. & Filippa, M. 2000: Ascomiceti interessanti del Nord Italia. – *Fungi non Delineati* 12: 1–74.
- Baral, H.O. 1992: Vital versus herbarium taxonomy: Morphological differences between living and dead cells of Ascomycetes, and their taxonomic implications. – *Mycotaxon* 44: 333–390.
- Benkert, D. 1987: Bemerkenswerte Ascomyceten aus der DDR. IX. Die Gattung *Byssonectria*. – *Gleditschia* 15: 173–187.
- Benkert, D. 2010: Seltene und kritische Pezizales-Funde (Ascomycota) aus der Bundesrepublik Deutschland. – *Zeitschrift für Mykologie* 76: 27–58.
- Berkeley, M.J. 1846: Decades of fungi. Decade XI. – *The London Journal of Botany* 5: 1–6.
- Berkeley, M.A. & Broome, C.E. 1866: Notices on British fungi. – *Annals and Magazine of Natural History*, Ser. 3, 18: 121–129.
- Boudier, J. L. É. 1905–10: *Icones Mycologicae*. 4 vols. – Paul Klincksieck, Paris.
- Breitenbach, J. & Kränzlin, F. 1984: *Fungi of Switzerland*. Volume 1. Ascomycetes. – Verlag Mykologia. Luzern. Switzerland.
- Bronckers, R.J.C. 2002: *Paratrachophaea macrocystis* en *Paratrachophaea michiganensis*, twee zeldzame pelsbekertjes op mest van grote grazers in Zuild-Limburg. – *PSL Nieuws* 9: 5–9.
- Bronckers, R.J.C. 2003: Een sleutel tot de Europese soorten van de genera *Trichophaea*, *Trichophaeopsis* en *Paratrachophaea*. – *Sterbeekia* 23: 9–27.
- Dissing, H. 1966: The genus *Helvella* in Europe with special emphasis on the species found in Norden. – *Dansk Botanisk Arkiv* 25: 1–172.
- Dissing, H. 1980: *Chalazion helveticum* (Pezizales), a new species from Graubünden, Switzerland. – *Sydowia* 33: 29–32.
- Dissing, H. 1983: Tre nye bægersvampe (Pezizales) i Danmark. – *Svampe* 7: 43–45.
- Dissing, H. & Sivertsen, S. 1975: Operculate Discomycetes from Rana (Norway) 1. *Chalazion sociabile* gen. nov., sp. nov. – *Norwegian Journal of Botany* 22: 1–4.
- Dissing, H. & Sivertsen, S. 1983: Operculate Discomycetes from Rana (Norway) 4. *Octospora hygrophynophila*, *Peziza prosthetica* and *Scutellinia mirabilis* spp. nov. – *Nordic Journal of Botany* 3: 415–421.
- Dissing, H. & Schumacher, T. 1994. Pezizales. – In: Hawksworth, D.L. (ed.). *Ascomycete systematics: problems and perspectives in the nineties*, 397–401. Plenum Press, New York.
- Dissing, H., Eckblad, F.-E. & Lange, M. 2000: Pezizales Bessey. – In: Hansen, L. & Knudsen, H. (eds.). *Nordic Macromycetes*. Vol. 1. Ascomycetes, 55–127. Nord-svamp, Copenhagen.
- Doveri, F., Yei-Zeng, W., Cacialli, G. & Vincenzo, C. 1998: Una nuova specie di *Chalazion* dalla Toscana, Italia. Contributo allo studio dei funghi fomicoli. XXVIII. – *Rivista di Micologia* 3: 203–209.
- Eckblad, F.-E. 1968: The genera of the Operculate Discomycetes. A Re-evaluation of their Taxonomy, Phylogeny and Nomenclature. – *Nytt Magasin for Botanikk* 15: 1–191.
- Eriksson, O. E. (ed.). 1999: Outline of Ascomycota. – *Myconet* 3: 1–88.
- Eriksson, O. E. (ed.). 2000: Notes on ascomycete systematics. Nos 2940–3127 – *Myconet* 5: 1–35.
- Eriksson, O.E. 2009: The non-lichenized ascomycetes of Sweden. – Umeå University. Sweden.
- Gamundi, I.J. 1975: Flora criptogámica de Tierra del Fuego. Orden Pezizales. Tomo X. Fascículo 3. – Fundación para la Educación, la Ciencia y la Cultura. Buenos Aires. Argentina.
- Hansen, K., Perry, B.A. & Pfister, D.H. 2005: Phylogenetic origins of two cleistothecial fungi, *Orbicula parietina* and *Lasiobolidium orbiculoides*, within the operculate discomycetes. – *Mycologia* 97: 1023–1033.
- Hansen, K. & Pfister, D.H. 2006 [2007]: Systematics of the Pezizomycetes – the operculate discomycetes. – *Mycologia* 98: 1031–1041.
- Harmaja, H. 2009: Studies in Otidea (Pezizales). – *Karstenia* 48: 33–48.
- Huhtinen, H. 1985: Mycoflora of Poste-de-la-Baleine, Northern Québec. Ascomycetes. – *Naturaliste Canadien* 112: 473–524.
- Jamoni, G. 2008: Una nuova entità dalla Valsesia: *Spooneromyces microsporus* sp. nov. – *Funghi e Ambiente* 108: 5–9.
- Jeannerot, B. 2010: Notes on scutellinoid fungi in collections of the Vienna University herbarium (WU). – *Österreichische Zeitschrift Für Pilzkunde* 19: 19–29.
- Jeannerot, B. 2011: Sur deux récoltes de *Scutellinia macrospora* effectuées par Henry Dissing. – *Ascomycete.org* 2(4): 23–26.
- Kanouse, B.B. 1958: Some species of the genus *Trichophaea*. – *Mycologia* 50: 121–140.
- Korf, R. 1973: Discomycetes and Tuberales. – In: Ainsworth, G.C., Sparrow, F.K. & Sussman, S. (eds.). *The fungi. An advanced treatise*. Vol. 4A: 249–319. Academic Press. New York.
- Korf, R.P. & Zhuang, W.-Y. 1991: A preliminary discomycete flora of Macaronesia: Part 1, Otideaaceae, Scutellinioideae. – *Mycotaxon* 40: 79–106.
- Kristiansen, R. 1990: New records of species of the genus *Chalazion* (Pezizales) in Norway with emphasis on their ecology. – *Agarica* 19–20: 83–97.
- Kristiansen, R. 2006: Miniaturbægersopper nye for Norge. – *Agarica* 26: 69–77.
- Landvik, S., Winka, K. & Schumacher, T. 1998: Long-time storage of fresh fungal tissue in DNA preparation buffer. – *Proceeding of the Asia-Pacific Mycological Conference on Biodiversity and Biotechnology*: 177–181. Thailand.
- Le Gal, M. 1966: Contribution à la connaissance du genre *Scutellinia* (Cooke) Lamb. emend. Le Gal (1^{re} Étude). – *Bulletin Trimestriel de la Société Mycologique de France* 82: 301–334.
- Massee, G.E. & Crossland, C. 1904: *Sphaerospora citrina* Mass. et Crossl. (sp. nov.). In: Anonymous, *New Fungi*. – *Naturalist*, London, Huddersfield, Hull 564: 4–5 pp.
- Medardi, G. 2007: Il genere *Scutellinia* in Italia – *Mycologia Montenegrina* 10: 119–164.
- Moyne, G., Chaillet, P., Moingeon, P.-M., Frund, C. & Page, C. 2010: Deux ascomycètes rares, nouveaux pour la France: *Smardaea purpurea* et *Spooneromyces helveticus* (Ascomycota, Pezizales). – *Bulletin mycologique et botanique Dauphiné-Savoie* 196: 7–15.

- Nannfeldt, J.A. 1937: Contributions to the mycoflora of Sweden 4. On some species of *Helvella*, together with a discussion of the natural affinities within *Helvellaceae* and *Pezizaceae* trib. *Acetabuleae*. – *Svensk Botanik Tidskrift* 31: 47–66.
- Nannfeldt, J.A. 1938: Contributions to the mycoflora of Sweden. 5. On *Peziza catinus* Holmskj. ex Fr. and *P. radiculata* Sow. ex Fr. with a discussion of the genera *Pustularia* Fuck. emend. Boud. and *Sowerbyella* Nannf. n. gen. – *Svensk Botanik Tidskrift* 32: 108–120.
- Nannfeldt, J.A. 1949: Contributions to the mycoflora of Sweden 7. A new winter discomycete, *Urnula hiemalis* Nannf. n. sp., and a short account of the Swedish species of *Sarcoscyphaceae* – *Svensk Botanik Tidskrift* 43: 468–484.
- Nannfeldt, J.A. 1966: On *Otidea caligata*, *O. indivisa* and *O. platyspora* (Discomycetes Operculatae). – *Annales Botanici Fennici* 3: 309–318.
- Petersen P.M. 1985: The ecology of Danish soil inhabiting *Pezizales* with emphasis on edaphic conditions. – *Opera Botanica* 77: 1–38.
- Pfister, D.H. 1988: *Paratrachophaea* (Pezizales) in North America. – *Mycologia* 80: 515–519.
- Pfister, D.H. 1993: A synopsis of the North American species of *Byssonectria* (Pezizales) with comments on the ontogeny of two species. – *Mycologia* 85: 952–962.
- Rifai, M.A. 1968: The Australasian *Pezizales* in the herbarium of the Royal Botanic Gardens Kew. – *Verhandlungen der Koninklijke Akademie van Wetenschappen. Afdeling Natuurkunde* 57: 1–295.
- Schumacher, T. 1979: Notes on taxonomy, ecology and distribution of operculate discomycetes (Pezizales) from river banks in Norway. – *Norwegian Journal of Botany* 26: 53–83.
- Schumacher, T. 1990: The genus *Scutellinia* (Pyrone-mataceae). – *Opera Botanica* 101: 1–107.
- Schumacher, T. & Moravec, J. 1989: *Spooneromyces*, a new genus to accommodate *Peziza laeticolor* and the new species *S. helveticus*. – *Nordic Journal of Botany* 9: 425–430.
- Schumacher T. & Jenssen, K.M. 1992: Discomycetes from the Dovre mountains, Central South Norway. In *Arctic and alpine fungi* – 4. – 66 pp. Soppkunsulenten A/S. Oslo.
- Schumacher, T. 1993: Ecology and distribution of the genus *Scutellinia* in Norway. In: Petrini, O. & Laursen, G.A. (eds.). *Arctic and alpine Mycology* 3. – *Bibliotheca Mycologica* 150: 215–233.
- Spooner, B.M. 1981: New records and species of British microfungi. – *Transactions of the British Mycological Society* 76: 265–301.
- Svrček, M. 1969: Nové rody operculatních diskomycetu (Pezizales). – *Česká Mykologie* 23: 83–96.
- Yao, Y.-J. & Spooner, B.M. 1995: New combinations in *Melastiza* and *Scutellinia* (Pezizales). – *Mycotaxon* 52: 467–477.
- Yao, Y.-J. & Spooner, B. M. 1996: Notes on British species of *Byssonectria*. – *Mycological Research* 100: 881–882.
- Zhuang, W.-Y. 2005: Some new species and new records of discomycetes in China. – *Mycotaxon* 93: 99–104.