Notes on three conifericolous desiccation-tolerant discomycetes frequently encountered in Austria

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Abstract: Three desiccation-tolerant discomycetes, i.e. *Mellitiosporium propolidoides*, *Propolis hillmanniana* and *Propolis rhodoleuca*, were frequently encountered on coniferous branches in Austria, and are illustrated and discussed. The fact that they are common in various parts of Austria but have rarely been reported from elsewhere indicates that fungi with this specific ecology have largely been overlooked by mycologists. Those three species, among certain other ascomycetes, appear to have very specific ecological preferences and are thus often found together in the same location and sometimes even on the same branches.
Keywords: Ascomycota, ecology, *Marthamycetaceae*.

Zusammenfassung: Die drei trockenheitstoleranten Discomyceten *Mellitiosporium propolidoides*, *Propolis hillmanniana* und *Propolis rhodoleuca* wurden regelmäßig auf Nadelholzästen in Österreich festgestellt. Sie werden diskutiert und mit Fotos illustriert. Die drei Arten sind in Teilen Österreichs häufig, werden aber nur selten berichtet, was darauf hindeutet, dass Pilze mit diesen ökologischen Ansprüchen von Mykologen oft übersehen werden. Diese Arten, sowie einige weitere Schlauchpilze, haben anscheinend sehr ähnliche ökologische Vorlieben, weshalb sie oft gemeinsam an derselben Lokalität oder sogar auf denselben Ästen beobachtet werden können.
Schlüsselwörter: Ascomycota, Ökologie, *Marthamycetaceae*.

Introduction

While searching for desiccation-tolerant ascomycetes on decorticated branches and bark of coniferous trees in montane to subalpine areas in Austria, we repeatedly collected a number of discomycetes which are apparently quite common but often overlooked due to their specific ecology. One such example is *Cryptodiscus muriformis* Fdez.-Brime, Olariaga, Baral, Friebes, Jaklitsch, Senn-Irlet & Wedin, which was only recently newly described from Sweden, Austria, Switzerland and the USA, and was found to be growing on decorticated branches of *Picea abies* in Europe (Fernández-Brime *et al*., 2018). This species can frequently be encountered in certain parts of Austria if one looks for it specifically on still attached *Picea* branches, but also on branches recently fallen to the ground (pers. obs.). Since suitable habitats for *C. muriformis*, i.e. humid middle-aged to old *Picea* forests, are fairly wide-spread in Europe, the fact that it has only been described so recently is one of the indicators of the lack of knowledge in this ecological group of fungi. Another similar example is *Mellitiosporium propolidoides* (Rehm) Rehm, which is described as "rare" by Senn-Irlet (2014), whereas it proved to be a rather common fungus in montane to subalpine conifer forests in Austria.

To shed some light on these often overlooked ascomycetes, three species that in our experience are characteristic for decorticated coniferous branches in montane to subalpine areas of Austria, and most likely other parts of (Central) Europe, i.e. *Mellitiosporium propolidoides*, *Propolis hillmanniana* Kirschst. and *Propolis rhodoleuca* (Sommerf.) Fr., are illustrated and discussed below.

Material and methods

The species discussed here are generally well visible on decorticated coniferous branches, hence only branches which had at least one of these species growing on them were collected and studied. Since these branches were often dry when collected they were either rehydrated by putting them in a moist box or directly with a spray bottle with tap water. All microscopic photos and observations were made in tap water. Methods of microscopy included stereomicroscopy using Olympus SZX10 and Euromex Novex RZ 65.560, and light microscopy using Olympus BX51 and Euromex XHR MIC 62. The examined collections are either kept in the personal fungarium of the author (GF) or in the herbarium of Universalmuseum Joanneum in Graz (GJO).

Results and discussion

Mellitiosporium propolidoides (Rehm) Rehm, *Rabenhorst's Kryptogamen-Flora, Pilze – Ascomyceten,* 1(3): 125 (1888). Plate 1, a–d.

Collections examined:

Austria, Styria, Bruck-Mürzzuschlag, Karlschütt ca. 2 km NNW of Innerzwain, 15°08'38" E, 47°34'25" N, 870 m, on decorticated branch of *Pinus sylvestris* on the ground, 24 October 2009, *leg.* G. Friebes (GF20100042). Styria, Deutschlandsberg, Koralpe, near Grünangerhütte, 15°00'49" E, 46°48'51" N, 1554 m, on decorticated branch of *Picea abies* on the ground, 10 May 2014, *leg.* G. Friebes (GF20140028). *Ibid*., shortly NE of Grünangerhütte, at the trail to Grünangerhütte, 15°00'47" E, 46°48'51" N, 1550 m, on dead, decorticated branches of *Picea abies* ca. 1.5 m above the ground, 16 May 2015, *leg.* G. Friebes (GF20140028b, sent to J. Karakehian, FH). *Ibid*., 400 m W of Grünangerhütte, at the trail to Bärentalalm, 15°00'25" E, 46°48'45" N, 1620 m, on a decorticated branch of *Picea abies*, covered with lichens, about 1.5 m above the ground, soc. *Cryptodiscus muriformis*, *Orbilia alpigena* Baral nom. prov., *Propolis rhodoleuca*, 6 May 2016, *leg.* G. Friebes (GF20160115). *Ibid*., 300 m NE of Grünangerhütte, at the trail to Grünangerhütte, 15°00'52"E, 46°48'52"N, 1540 m, on decorticated branches of *Picea abies*, 17 April 2017, *leg.* G. Friebes (GJO 85614), soc. *C. muriformis*, *O. alpigena*, *P. rhodoleuca*. Styria, Murau, Kreischberg, ca. 300 m W of Kreischbergwirt, 14°02'53" E, 47°04'36" N, 1756 m, on dead, decorticated branch of *Picea abies* ca. 1.5 m above the ground, 16 August 2019, *leg.* G. Friebes *et al*.. (WU). Carinthia, Spittal an der Drau, 4.5 km WNW of Mallnitz, Tauerntal, N of the parking area at the end of the toll road, 13°06'39" E, 47°00'10" N, 1680 m, on decorticated branches of *Picea abies* ca. 1.2–1.8 m above the ground, soc. *O. alpigena*, 23 September 2016, *leg.* G. Friebes (GF20160173). Tyrol, Lienz, St. Jakob in Defereggen, Oberhauser Zirbenwald, 12°13'10" E, 46°56'48" N, 1850 m, on decorticated, still attached branch of *Pinus cembra*, soc. *P. rhodoleuca*, 26 August 2017, *leg.* G. Friebes (GF20170169).

Discussion:

Mellitiosporium propolidoides is described and discussed in detail by Senn-Irlet (2014). We have encountered it in Austria most frequently on *Picea abies*, which is also the host reported for all three collections by Senn-Irlet, but we have also found it multiple times on *Pinus sylvestris*. It could also be observed once on *Pinus cembra* in Carinthia, which is the same host reported by Rehm (1888) from Tyrol. Rehm (1882) originally described *Pleiostictis propolidoides* Rehm, the basionym of *M. propolidoides*, from the Retezat Moun-

Fig. 1 – A humid *Picea abies* forest at approx. 1650 m a.s.l. as a prime example for a habitat rich in conifericolous desiccation-tolerant ascomycetes, such as *M. propolidoides*, *P. hillmanniana* and *P. rhodoleuca* (location: Styria, Deutschlandsberg, Koralm). These three species, among others, have been collected in this area repeatedly on decorticated branches still attached to the trees. Photo M. Friebes.

tains in Romania. In two of the areas cited under "Collections examined", i.e. the Koralm area and Karlschütt, the species proved to be particularly common and was observed repeatedly over several years. The species has also been reported from Carinthia by Friebes (2017) on decorticated, still attached branches of *Pinus sylvestris*.

While *M. propolidoides* undoubtedly develops on branches still attached to the tree, it could be observed that the species is able to survive a prolonged period of time on fallen branches. This was evidenced by the presence of living ascomata on such branches that had already been covered by grass and debris, which indicated that they had been lying on the ground for quite some time.

In the field *M. propolidoides* can typically be recognized by the black apothecia surrounded by bleached host material. In dry state they slightly close to an oculiform shape but are round when hydrated. Microscopically, the one-spored asci with brown, cylindrical and many-septate ascospores are characteristic. Senn-Irlet (2014) noted that no "description or record note in the search for literature" more recent than that by Rehm (1888) had been found (although a collection presented on the website "Ascofrance" was acknowledged by the author in the Addendum). While some more recent collections of *M. propolidoides* do exist — e.g. one published by Hausknecht *et al.*. (2003) from East Tyrol — they are indeed rather scarce. Given its very striking characters and common occurrence in parts of Austria it is surprising that it has not been reported more frequently, especially considering that it is included in the popular book on microfungi by Ellis & Ellis (1997).

Propolis hillmanniana Kirschst., *Annales Mycologici*, 33 (3–4): 203 (1935). Plate 1, e–h, k, l.

Collections examined:

Austria, Styria, Deutschlandsberg, Koralpe, 950 m W of Grünangerhütte, at the trail to Bärentalalm, 14°59′57″ E, 46°48′43″ N, 1660 m, on a dead, decorticated branch of *Picea abies* still attached to a lying trunk, ca. 1 m above the ground, soc. *Cryptodiscus muriformis*, 30 May 2014, *leg.* G. Friebes (GF20140029, GJO 85613). *Ibid*., 16 May 2015, *leg.* G. Friebes (GF20140029b). *Ibid*., shortly NE of Grünangerhütte, at the trail to Grünangerhütte, 15°00′47″ E, 46°48′51″ N, 1550 m, on a decorticated branch of *Picea abies* covered with lichens, ca. 1.5 m above the ground, soc. *C. muriformis*, *Orbilia alpigena*, *O. euonymi*, 6 May 2016, *leg.* G. Friebes (GF20160114). Styria, Deutschlandsberg, Hebalm, Freiländer Alm, 15°03′23″ E, 46°54′51″ N, 1433 m, on decorticated branches of *Picea abies*, 3 May 2017, *leg.* G. Friebes (GJO 86305), soc. *C. muriformis*, *O. alpigena*, *Propolis rhodoleuca*.

Discussion:

This is probably the least conspicuous of the three species reported here. Its apothecia are often rather small and whitish to greywhite and it often seems to produce rather few ascomata per branch (although this, as well as the size, may vary). It can readily be told apart from similar species by its large, multiguttulate ascospores.

Vetlesen (2017) observed both *P. hillmanniana* and *P. rhodoleuca* in Norway on bark of dead *Juniperus communis* and a decorticated branch of the same host, respectively. This again indicates the very similar ecological requirements of these species, which are also highlighted by the various collections cited in the present paper in which both species occurred in the same localities and sometimes even on the same branches.

Propolis hillmanniana was originally described by Kirschstein (1935) from bark of *Picea abies* from Schwarzwald (Germany). Baral (2015), in his comprehensive and well-illustrated key on broad-spored propoloid fungi, points out that the type material, examined by him, has longer ascospores than recent collections (given as 40–50 × 10–14 µm by Kirschstein, and as 43–55 µm long by Baral on the

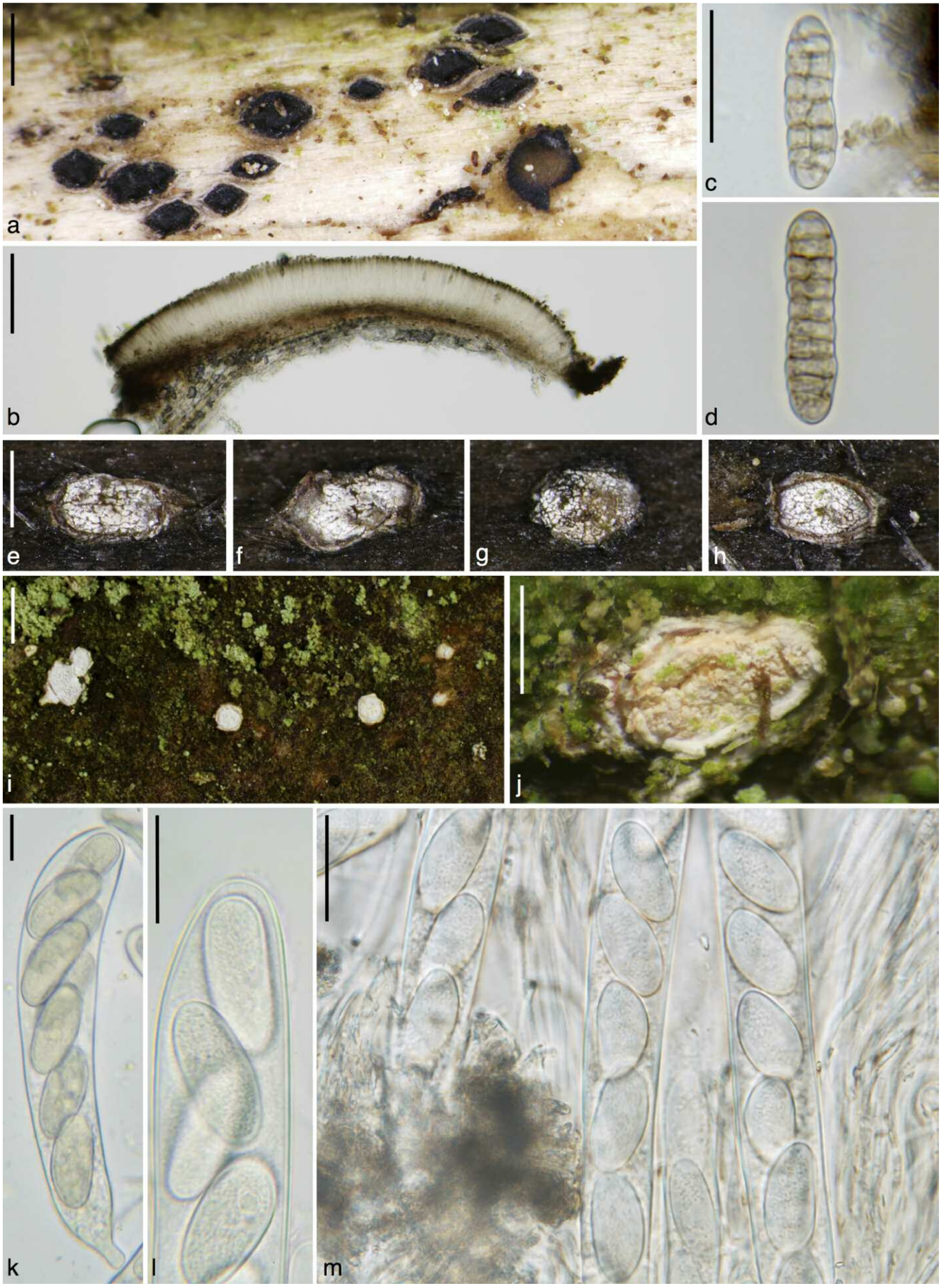

Plate 1 – a–d: *Mellitiosporium propolidoides*. a: apothecia. b: section of an apothecium. c, d: ascospores. e–h, k, l: *Propolis hillmanniana*. e–h: apothecia. k, l: asci with ascospores. i, j, m: *Propolis rhodoleuca*. i, j: apothecia. m: asci with ascospores. a–d: GF20140028b. e–h: GF20140029b. i, m: GF20180088. j: GF20160115. k, l: GF20160114. Scale: a, i: 1 mm. b: 100 µm. c, d, k–m: 20 µm. e–h, j: 500 µm.

website Ascofrance.com). The ascospores of GF20140029b measured 40.5-45.6 × 14.6-16.8 µm in living state and were thus slightly shorter than in the type material, but probably still within the normal range of *P. hillmanniana*. The ascospore size given by Vetlesen (2017) deviates even further from the type material, with measurements of "(25.9)28.8–33.2(36.5) × (9.5)11–13.4(14.3) µm".

Propolis rhodoleuca (Sommerf.) Fr., *Summa veg. Scand., Sectio Post.*: 372 (1849). Plate 1, i, j, m.

Collections examined:

Austria, Styria, Deutschlandsberg, Koralpe, 400 m W of Grünangerhütte, at the trail to Bärentalalm, 15°00'25" E, 46°48'45" N, 1620 m, on a decorticated branch of *Picea abies*, covered with lichens, about 1.5 m above the ground, soc. *Mellitiosporium propolidoides*, *Orbilia alpigena*, 6 May 2016, *leg.* G. Friebes (GF20160115). *Ibid*., 300 m NE of Grünangerhütte, at the trail to Grünangerhütte, 15°00'52" E, 46°48'52" N, 1540 m, on decorticated branches of *Picea abies*, soc. *Cryptodiscus muriformis*, *M. propolidoides*, *O. alpigena*, 17 April 2017, *leg.* G. Friebes (GJO 85614). Styria, Deutschlandsberg, Hebalm, Freiländer Alm, 15°03'23" E, 46°54'51" N, 1433 m, on decorticated branches of *Picea abies*, 3 May 2017, *leg.* G. Friebes (GJO 86305), soc. *C. muriformis*, *O. alpigena*, *P. hillmanniana*. Styria, Deutschlandsberg, Reinischkogel, Sommereben, 370 m NW of Gasthof Klugbauer, 15°09'11" E, 46°56'51" N, 1071 m, on bark of living *Picea abies*, 30 March 2018, *leg.* G. Friebes (GF20180088). Tyrol, Lienz, St. Jakob in Defereggen, Oberhauser Zirbenwald, 12°13'10" E, 46°56'48" N, 1850 m, on decorticated, still attached branch of *Pinus cembra*, soc. *M. propolidoides*, 26 August 2017, *leg.* G. Friebes (GF20170169).

Discussion:

In our experience the often abundantly growing, strikingly white to slightly pink coloured apothecia provide a good hint for this species in the field. One collection from bark of living *Picea abies* differed macroscopically from collections on decorticated branches by somewhat smaller and more roundish apothecia (GF20180088; plate 1, i).

The collections cited above have been identified as *P. rhodoleuca* using the key by Baral (2015). As pointed out in that paper there appear to be collections of *P. rhodoleuca* with smaller and larger ascospores, which might partly be linked to the substrate, with the larger-spored ones occurring on pine cones. Further studies might reveal that more than one species is included under the current concept of *P. rhodoleuca*. See also Chlebická (2014) for a detailed description and discussion of *P. rhodoleuca* and other similar species.

So far we have only found one more *Propolis* species on coniferous branches in montane to subalpine areas, i.e. *Propolis betulae* Fuckel. It differs from *P. hillmanniana* by slightly more slender ascospores with 1–2 large lipid bodies, and from *P. farinosa* (Pers.) Fr. [= *P. versicolor* (Fr.) Fr.] by much larger ascospores (Baral, 2015). Since it does not appear to be as confined to decorticated coniferous branches as the other three species mentioned in this paper (it was described from *Betula* by Fuckel, 1871; see also Baral, 2015 with further records on deciduous wood) it is not discussed here separately. We have collected it three times, once on a fallen trunk of *Pinus sylvestris* (Friebes, 2017) and twice on decorticated branches of *Picea abies* (Styria and Carinthia, deposited in the author's personal fungarium).

The superficially similar *Propolis farinosa* is known from various substrates, including coniferous wood (pers. obs.; Baral, 2015), but we have never observed it on decorticated, still attached coniferous branches in higher altitudes.

All three species presented here have been observed to occur in very close proximity to each other and sometimes even on the same branches, which are often around 2 cm in diameter, and are very frequently accompanied by *Cryptodiscus muriformis* and *Orbilia alpigena*, but also *Pseudographis* spp., *Capronia* spp. and various other ascomycetes.

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