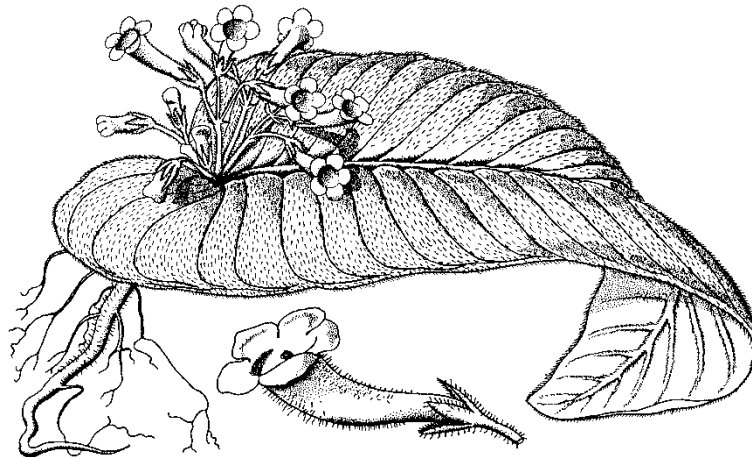


# FRITSCHIANA

94



Veröffentlichungen aus dem  
Institut für Biologie, Bereich Pflanzenwissenschaften  
der Karl-Franzens-Universität Graz

Josef HAFELLNER

**A reinvestigation of *Microthelia umbilicariae* results in  
a contribution to the species diversity in *Endococcus***

**Lichenicolous Biota (Nos 301–320)**

Graz, 18. Dezember 2019

Hofrat Prof. Dr. Karl FRITSCH  
(\* 24.2.1864 in Wien, † 17.1.1934 in Graz)

Karl FRITSCH studierte nach einem Jahr in Innsbruck an der Universität Wien Botanik und wurde dort 1886 zum Dr.phil. promoviert; 1890 habilitierte er sich. Nach Anstellungen in Wien wurde FRITSCH 1900 als Professor für Systematische Botanik an die Universität Graz berufen, wo er aus bescheidenen Anfängen ein Institut aufbaute. 1910 wurde er Direktor des Botanischen Gartens, 1916 wurde das neu errichtete Institutsgebäude bezogen. Aus der sehr breiten wissenschaftlichen Tätigkeit sind vor allem drei Schwerpunkte hervorzuheben: Floristisch-systematische Studien, besonders zur Flora von Österreich, monographische Arbeiten (besonders über *Gesneriaceae*) und Arbeiten zur systematischen Stellung und Gliederung der Monocotylen. An Kryptogamen interessierten ihn besonders Pilze und Myxomyceten.

Nachrufe: KNOLL F. 1934: Karl Fritsch. - Berichte der Deutschen Botanischen Gesellschaft 51: (157)–(184) [mit Schriftenverzeichnis]. — KUBART B. 1935: Karl Fritsch. - Mitteilungen des Naturwissenschaftlichen Vereins für Steiermark 71: 5–15 [mit Porträt]. — TEPPNER H. 1997: Faszination versunkener Pflanzenwelten. Constantin von Ettingshausen - ein Forscherportrait. - Mitteilungen Geologie und Paläontologie am Landesmuseum Joanneum 55: 133–136. — Im übrigen vgl. STAFLEU F.A. & COWAN R.S. 1976, Taxonomic Literature 1: 892 und BARNHART J.H. 1965: Biographical Notes upon Botanists 2: 12.

Graz, November 1997

Herwig TEPPNER

Die Serie FRITSCHIANA wurde als Publikationsorgan für die zahlreichen Aktivitäten im Zusammenhang mit der botanischen Sammlung des Institutes für Biologie (vormals Institut für Pflanzenwissenschaften bzw. Institut für Botanik) der Karl-Franzens-Universität Graz (GZU) gegründet. Vor allem Schedae-Hefte der von den Mitarbeitern herausgegebenen Exsiccatenwerke sollten hier erscheinen, aber auch Exkursionsberichte sowie Listen und Indices besonders wertvoller Bestände in GZU. Das Spektrum wurde mittlerweile auf floristische und kleinere taxonomische Arbeiten (zwischenzeitlich auch auf das Samentauschverzeichnis des Botanischen Gartens) ausgeweitet. Die Schedae-Hefte des von Prof. Dr. Josef POELT begründeten, inzwischen abgeschlossenen Exsiccatenwerkes *Plantae Graecenses* sind die Vorläufer dieser Schriftenreihe.

Gesamtredaktion:

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NAWI Graz, Holteigasse 6, 8010 Graz, Österreich/Austria

ISSN 1024-0306

Key title = Abbreviated title: Fritschiana (Graz)

Umschlagsbild: *Carolofritschia diandra* ENGL. (= *Acanthonema strigosum* HOOK.f.); nach einer Zeichnung in HUTCHINSON J. & HEPPER F.N. 1963: Flora of West Tropical Africa, Ed. 2, Vol. II: 382.

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Neubeschreibung in diesem Heft / description of a new taxon in this issue:

***Endococcus freyi*** Hafellner **species nova** (page 12)

MycoBank number: MB 833721

Neukombinationen in diesem Heft / new combinations in this issue:

***Endococcus umbilicariae*** (Linds.) Hafellner **combinatio nova** (page 9)

MycoBank number: MB 833719

***Didymocyrtis peltigeræ*** (Fuckel) Hafellner **combinatio nova** (page 10)

MycoBank number: MB 833720

***Sphaerellothecium arnoldii*** (A.Massal.) Hafellner **combinatio nova** (page 27)

MycoBank number: MB 833734

ISSN 1024-0306

Key title = Abbreviated title: Fritschiana (Graz)

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Date of publication: 18 December 2019

Printed by: Druckservice, Wirtschaftsabteilung der Karl-Franzens-Universität, Attemsgasse 8/I,  
8010 Graz, Austria

# A reinvestigation of *Microthelia umbilicariae* results in a contribution to the species diversity in *Endococcus*

Josef HAFELLNER\*

HAFELLNER Josef 2019: A reinvestigation of *Microthelia umbilicariae* results in a contribution to the species diversity in *Endococcus*. - Fritschiana (Graz) 94: 1–23. - ISSN 1024-0306.

**Abstract:** A set of morphoanatomical characters and the amyloid reaction of the ascomatal centrum indicates that *Microthelia umbilicariae* Linds. belongs to *Endococcus* (Verrucariales). *Endococcus freyi* Hafellner, detected on *Umbilicaria cylindrica* (type locality in Austria), is described as new to science. The new combinations *Endococcus umbilicariae* (Linds.) Hafellner and *Didymocyrtis peltigerae* (Fuckel) Hafellner are introduced.

**Key words:** Ascomycota, key, *Lasallia*, lichenicolous fungi, *Umbilicaria*, Verrucariales, Pleosporales

\*Institut für Biologie, Bereich Pflanzenwissenschaften, NAWI Graz, Karl-Franzens-Universität, Holteigasse 6, A-8010 Graz, AUSTRIA.  
e-mail: josef.hafellner@uni-graz.at

## Introduction

The genus *Microthelia* Körb. dates back to the classical period of lichenology when for the first time sufficiently powerful light microscopes opened the universe of fungal spores and their characters to researchers interested in fungal diversity (KÖRBER 1855). Over the time, 277 species and infraspecific taxa have been assigned to *Microthelia*, now a rejected generic name against the conserved genus *Anisomeridium* (Müll.Arg.) M.Choisy.

In the second half of the 19<sup>th</sup> century also several lichenicolous fungi have either been described in *Microthelia*, namely by the British mycologist William Lauder Lindsay (1829–1880), or have been transferred to *Microthelia* by combination. A comprehensive revision of all taxa ever treated in *Microthelia* has been published by HAWKSWORTH (1985). Due to nomenclatural conflicts mentioned above, none of the species could be retained in that genus. For most of them HAWKSWORTH (l.c.) could make convincing proposals for better generic placements. For a set of additional taxa possible relationships have been discussed. Therefore, e.g. for *Microthelia umbilicariae* Linds., Hawksworth proposed a transfer to *Polycoccum*, a view repeated by HAWKSWORTH & DIEDERICH (1988), and the generic placement in that genus has been

accepted up to now. In the historical literature, on the other hand, an inclusion of that species in *Phaeospora* and *Leptosphaeria* had already been proposed (see below).

In a phylogenetic analysis, ERTZ et al. (2015) have shown that *Polycoccum* in the circumscription commonly applied contains at least two clades, *Polycoccum* s.str. and a second one, for which the widely neglected genus *Didymocyrtis* Vain. had to be resurrected as it was found to constitute the oldest available generic name. Furthermore, the authors could show that the taxonomic position of *Polycoccum* s.str. is different (Dothideomycetes–Trypetheliales–Polycoccaceae) from the previous concepts based on morphoanatomical characters, when it was treated in the branch Dothideomycetes–Pleosporales–Dacampiaceae (e.g., CANNON & KIRK 2007: 98, HYDE et al. 2013: 73–77).

In connection with these comparative studies of further polycoccoid lichenicolous fungi, also *Microthelia umbilicariae* invading occasionally *Lasallia (pustulata)* was among the candidates for an alternative and better taxonomic placement. Other than expected, morphoanatomical and biochemical characters have shown that the species belongs to *Endococcus*. Based on some additional collections, two of them rich enough to be distributed in the exsiccata “Lichenicolous Biota”, a detailed treatment of this species is presented below. Furthermore, an additional *Endococcus* species has been detected on *Umbilicaria (cylindrica)* which is described here as new to science. I am herewith able to present a further contribution to a better understanding of the species diversity of *Endococcus*.

## Material and methods

Dried herbarium specimens cited together with the treatments of the species have been examined. External morphology was studied with a dissecting microscope (WILD M3, 6.4–40×). Anatomical studies of the thallus and the ascomata were carried out under the light microscope (LEICA DMRE, 100–1000×). Sectioning was performed with a freezing microtome (LEITZ, sections of 12–15 µm) but squash preparations were also used, especially for ascus analysis and staining experiments. Preparations were mounted in water. When necessary, contrasting was performed by a pretreatment with lactic acid-cotton blue (MERCK 13741). Amyloid reactions in hymenia were observed by the use of Lugol's reagent (I) (MERCK 9261). Sections and squash preparations were not pretreated with KOH (K) unless otherwise stated (K/I). Measurements refer to dimensions in tap water.

The photographs were taken with a light microscope ZEISS Axioskop equipped with a digital camera system AxioCam MTC5.

Abbreviations for institutional herbaria follow Index Herbariorum (HOLMGREN et al. 1990, THIERS 2019+). Abbreviations of nomenclatural authors are those proposed by BRUMMITT & POWELL (1992). Geographic units are defined and named according to HOLLIS & BRUMMITT (1992) or BRUMMITT (2001).

Taxonomic notes and discussions are based on the outline of lichenicolous fungi published by DIEDERICH et al. (2018).

Material studied for comparison (T = type host):

***Endococcus rugulosus* Nyl.** (type species of *Endococcus*)

Hosts: *Verrucaria macrostoma* (T), *Verrucaria nigrescens* agg. (1), *Verrucaria* spec. (2)

**Austria:** Steiermark (Styria), Zentralalpen, Murberge, Stolzalpe NE ober Murau, kurz SE der Kapelle, 47°07'10"N / 14°11'25"E, ca. 1180 m alt., GF 8851/3, Lichtung im Koniferen-Mischwald, bodennah an niederen Kalkschrofen, (1), 13. V. 1999, leg. J. Hafellner no. 53540 (herb. Hafellner). – Steiermark (Styria), [Gurktaler Alpen], „am Fuß der Seetalen Alpen“, 4 km S von Neumarkt, [kurz E von] Hohe Brücke, am S-Ufer des St. Veiter Baches, [47°02'20"N / 14°25'40"E], 760–800 m alt., GF 8952/4, Phyllitabisse im Hangwald, auf feuchten Vertikalflächen, (2), 28. IV. 1989, leg. W. Obermayer no. 1940 (GZU). – Steiermark (Styria), Steirisches Randgebirge, Grazer Bergland, Rote Wand ca. 3 km E von Mixnitz, SW-Rücken, oberhalb der S-exponierten Abbrüche, 47°19'45"N / 15°24'05"E, ca. 1400 m alt., GF 8658/3, niedere Kalkausbisse, auf Neigungsflächen, (1), 30. X. 2005, leg. J. Hafellner no. 64544 (herb. Hafellner). – Steiermark (Styria), Steirisches Randgebirge, Grazer Bergland, Gösser E von Arzberg, etwas W vom Gipfel am oberen Rand der SW-exponierten Abbrüche, 47°15'00"N / 15°32'05"E, ca. 980 m alt., GF 8759, niedere Kalkschrofen und einzelne Bäume, auf Neigungsflächen niederer Kalkschrofen, (1), 4. VII. 2009, leg. J. Hafellner no. 74765 (herb. Hafellner). – Steiermark (Styria), Steirisches Randgebirge, Grazer Bergland, Gösser E von Arzberg, am W Rand der SW-exponierten Abbrüche, 47°15'00"N / 15°31'55"E, ca. 950 m alt., GF 8759, niedere Kalkschrofen an der Geländekante, auf S-exp. Neigungsflächen, (1), 13. IX. 2009, leg. J. Hafellner no. 74831 (GZU). – Steiermark (Styria), Steirisches Randgebirge, Grazer Bergland, Raabklamm NW von Weiz, orographisch linke Hänge S unter Schachen, markante S-exp. Felsrippe NW gegenüber vom Lehbauersteg, 47°14'15"N / 15°33'05"E, ca. 580 m alt., GF 8759/3, Kalkschrofen mit Felsrasen und einzelnen Rotföhren, auf Neigungsflächen der Schrofen auf den Felsgrat, (1), 11. IX. 2009, leg. J. Hafellner no. 74786 (GZU).

***Endococcus stigma* (Körb.) Stiz.** (syn. *Discothecium stigma* (Körb.) Zopf, type species of *Discothecium*)

Hosts: *Acarospora* spec. (1, T, sub "*Lecidea lamprophora*"), *Acarospora fuscata* (2), *Acarospora freyi* (3)

**Austria:** Kärnten (Carinthia), Nationalpark Hohe Tauern, Schober-Gruppe, Klammer Scharte zwischen dem hintersten Gößnitztal und dem hintersten Gradental, [46°57'50"N / 12°46'20"E], 2930 m alt., GF 9042/2, auf Gneisfelsen, (1), 9. VII. 1988, leg. J. Hafellner no. 21818 & M. Walther (GZU, herb. Hafellner). – Kärnten (Carinthia), Ostalpen, Hohe Tauern, Kreuzeck-Gruppe, Knoten Berg NE vom Hochtristenhaus, [46°46'55"N / 13°06'45"E], 2150–2210 m alt., GF 9244/2, [N-seitige] Abbrüche aus Glimmerschiefer, (1), 15. VII. 1978, leg. J. Poelt (GZU). – Kärnten (Carinthia), Steirisches Randgebirge, Korralpe E von Wolfsberg, Seespitz, N-Rücken gegen den Sattel zur Kote 2005, sanft geneigte NW-Hänge in das Große Kar, 46°47'30"N / 14°58'47"E, ca. 2030 m alt., GF 9255/2, Fläche mit kleinen, losen Felsplatten (Plattengneis) in offener, alpiner Vegetation, auf kleinen Schieferplatten, (1), 11. X. 2008, leg. J. Hafellner no. 72644 (GZU). – Salzburg, Pinzgau, Hohe Tauern, Glockner-Gruppe, Bergkamm NW vom Kitzsteinhorn, E-Hänge der Hinteren Rettenwand ca. 2 km W ober der Krefelder Hütte, [47°12'35"N / 12°40'50"E], ca. 2600 m alt., GF 8742/3, kalkhaltiger Grünschiefer, auf E-exponierten Schrofen, (1), 20. VII. 1996, leg. J. Hafellner no. 38281 & H. Wittmann (GZU). – Salzburg, Hohe Tauern, [Glockner-Gruppe], W der Krefelder Hütte, über Kaprun, ca. 2250–2350 m alt., GF 8742/3, auf Kalkschiefer-Schrofen, (1), 31. VII. 1973, leg. J. Poelt (GZU). – Salzburg, Nationalpark Hohe Tauern, Ankogel Gruppe, Greilkopf, knapp N unter dem Westgrat, E ober der Hagener Hütte, [47°01'30"N / 13°05'50"E], 2500 m alt., GF 8944/4, alpine Matten über Glimmerschiefer, auf niederen Glimmerschieferschrofen, (1), 27. VIII. 1994, leg. J. Hafellner no. 32981 (GZU). – Steiermark (Styria), Niedere Tauern, Wölzer

Tauern, Planneralpe, nach NE abfallende Geländerippe NE der Karlspitze, bei den großen Blöcken am Grat (Hunnengrab), [47°23'45"N / 14°10'40"E], ca. 1950 m alt., GF 8651/1, auf Granatglimmerschieferschrofen, (2), 21. VII. 1988, leg. J. Hafellner no. 20511 (herb. Hafellner). – Tirol (Tyrol), Osttirol, Nationalpark Hohe Tauern, Glockner-Gruppe, Ködnitztal NE ober Kals, kurz N ober der Lucknerhütte, 47°02'35"N / 12°41'30"E, ca. 2300 m alt., GF 8942/3, niedere Kalkschieferschrofen und Rasen am Westhang, Lesesteinmauer, auf Glimmerschiefer, (1), 4. IX. 1998, leg. J. Hafellner no. 46863 (GZU). – **Italy**: Trentino-Alto Adige, Südtirol, [Ostalpen, Ötztaler Alpen], Langtauferer Tal E des Reschenpasses, E von Melag, [46°50'10"N / 10°39'40"E], 1920 m alt., Fe-hältige Blöcke, (3), 18. IV. 1984, leg. J. Hafellner no. 12387 (GZU). – Trentino-[Alto Adige], Prov. Trento, [Südalpen], Catena dei Lagora, N-exponierte Hänge des Berges Tognazza S vom Passo di Rolle, 46°17'35"N / 11°47'15"E, ca. 2050 m alt., auf Porphyrböcken, (1), 26. X. 1984, leg. J. Hafellner no. 41627 (GZU). – Trentino-[Alto Adige], Prov. Trento, [Südalpen], Val di Moena S von Cavalese, [46°15'40"N / 11°27'15"E], 1100–1200 m alt., an Silikatblöcken, (1), 27. X. 1984, leg. J. Poelt (GZU). – Friuli-Venezia Giulia, Prov. Udine, [Südalpen], Karnische Alpen, Monte Crostis N von Comeglians, am Grat W vom Gipfel, [46°34'20"N / 12°53'20"E], ca. 2240 m alt., alpine Matten und Schrofen, auf niederen Silikatschrofen, (1), 17. VIII. 1994, leg. J. Hafellner nos. 36792, 36795 (GZU). – **Sweden**: Torne Lappmark, Umgebung von Abisko, wenig S über dem Torneträsk, unterhalb der Naturvetenskapens Station, [68°21'10"N / 18°50'00"E], ca. 360 m alt., auf einem Schieferblock, (1), 19. VII. 1967, leg. J. Poelt no. 4707 (GZU). – **Switzerland**: Kanton Tessin, [Westalpen], Adula Alpen, Val Piora, E-exponierte Abhänge S des Passo del Camoghe über dem Ritomsee, [46°32'20"N / 08°40'15"E], 2050–2150 m alt., auf Amphibolitfelsen, (1), 30. VIII. 1984, leg. H. Mayrhofer no. 4411 (GZU).

### ***Endococcus propinquus*** (Körb.) D.Hawksw.

Hosts: *Porpidia tuberculosa* (1, T), *Porpidia crustulata* (2), *Porpidia macrocarpa* (3), *Porpidia cinereoatra* (4), *Porpidia spec.* (5), *Stenhammarella turgida* (6)

**Austria**: Kärnten (Carinthia), [Eastern Alps], Nationalpark Hohe Tauern, Ankogel Gruppe, am Westgrat des Greilkopf E ober der Hagener Hütte, [47°01'35"N / 13°05'55"E], ca. 2500 m alt., GF 8944/4, alpine Matten über Glimmerschiefer, auf niederen Glimmerschieferschrofen, (1), 27. VIII. 1994, leg. J. Hafellner no. 33024 (herb. Hafellner). – Kärnten (Carinthia), Nationalpark Hohe Tauern, Schober-Gruppe, Gradental W von Döllach, SW der Graden Alm, [46°58'05"N / 12°48'50"E], ca. 1750 m alt., GF 9042/2, auf großen Gneisblöcken im lichten Lärchenwald, (1), 10. IX. 1988, leg. J. Hafellner no. 21888 & M. Walther (herb. Hafellner). – Kärnten (Carinthia), Hohe Tauern, Kreuzeck-Gruppe, Schwarzsteinwände (Südwände des Schwarzsteins) E der Hochtristen, N der Turgger Alm, [46°47'55"N / 13°09'10"E], 1950–2150 m alt., GF 9244/2, auf Grünschieferblöcken, (2), 17. VII. 1978, leg. J. Hafellner no. 4139 (GZU). – Kärnten (Carinthia), [Südalpen], Karnische Alpen, Raudenspitze E ober dem Hochweißsteinhaus, Bergkuppe NE vom Öfner Joch, 46°38'30"N / 12°44'50"E, ca. 2100 m alt., GF 9342/3, paläozoische Glimmerschiefer, auf niederen Schrofen, (1), 17. VIII. 1996, leg. J. Hafellner no. 39284 (GZU, under the name of the host). – Steiermark (Styria), [Eastern Alps], Eisenerzer Alpen, Leobner N von Wald am Schoberpaß, Sattel zwischen dem Gipfel und der Leobner Mauer, 47°29'50"N / 14°39'00"E, ca. 2000 m alt., GF 8553/2, lückige Windheiden über paläozoischem Schiefer (Blaseneckporphyroid), auf Lesesteinen, (2), 31. VII. 1997, leg. J. Hafellner no. 42514 (GZU). – Steiermark (Styria), Niedere Tauern, Schladminger Tauern, Großsölkta, 1,5 km NW vom Sölkpaß, W ober dem Unteren Kaltenbachsee, [47°16'40"N / 14°03'55"E], ca. 1980 m alt., GF 8750/1, schattig-feuchte, N-exponierte Abbrüche, auf steilen Felsschrofen, (6), 2. IX. 1993, leg. A. Wilfling no. 2853 & M. Möslinger (GZU). – Steiermark (Styria), Niedere Tauern, Schladminger Tauern, Eisenhut ca. 8 km NW von Baierdorf, am kurzen W-Rücken unterhalb des Gipfels, 47°14'06"N / 14°02'57"E, ca. 2400 m alt., GF 8750/3, auf Glimmerschieferblöcken, (1), 2. VIII. 2011, leg. M. Sebernegg & A. Atanassova, det. J. Hafellner (GZU). – Steiermark (Styria), Niedere Tauern, Wölzer Tauern, Hohenwart-Massiv [W von Pusterwald], E-Hänge des Hohenwart oberhalb der Mittagwand, im Bereich des Marmorzuges, [47°19'45"N / 14°14'25"E], ca. 2220 m alt., GF 8651/3, Schrägflächen schwermetallhaltiger Silikatschrofen, (4), 18. VIII. 1993, leg. M. Möslinger no. F68, J. Hafellner & A.



Wilfling (GZU). – Steiermark (Styria), Niedere Tauern, Wölzer Tauern, Hohenwart-Massiv W von Pusterwald, am Steig zum Pölseckjoch, E unter dem Gipfel, [47°19'45"N / 14°14'30"E], ca. 2200 m alt., GF 8651/3, NE-exponierte intermediäre Marmorschrofen, (5), 18. VIII. 1993, leg. A. Wilfling, J. Hafellner & M. Möslinger (GZU). – Steiermark (Styria), Niedere Tauern, Wölzer Tauern, Aufstieg vom Kleinen Zinken zum Hohen Zinken, 2,5 km N von Lachtal, 2 km NW der Klosterneuburger Hütte, [47°16'20"N / 14°21'00"E], ca. 2140 m alt., GF 8752/1, SE-exponierte Marmorschrofen, auf feinkristallinem, kompaktem Marmor, (6), 7. XI. 1994, leg. A. Wilfling no. 2675, 2447 & F. Wilfling (GZU). – Steiermark (Styria), Niedere Tauern, Triebener Tauern, am oberen Ende der schmalen Rinne zwischen Hochleitenspitze und den Gamskögeln, [47°22'00"N / 14°32'45"E], ca. 2300 m alt., GF 8653/1, auf Gneisblöcken, (5), 18. III. 1990, leg. J. Hafellner no. 51800 (herb. Hafellner). – Steiermark (Styria), Niedere Tauern, Triebener Tauern, Griesmoar Kogel SW von Wald am Schoberpaß, am N-Rücken halbwegs zwischen dem Sattel zum Himmeleck und dem Gipfel, 47°25'15"N / 14°36'10"E, ca. 1950 m alt., GF 8553/4, niedere Ausbisse aus Glimmerschiefer, stellenweise mit Ca-Spuren, in alpinen Matten, auf Steiflächen von Glimmerschiefer, (5), 20. VIII. 2002, leg. J. Hafellner no. 59173 & J. Miadlikowska (GZU). – Steiermark (Styria), Niedere Tauern, Seckauer Tauern, Seckauer Zinken N von Seckau (SW von Mautern), auf dem Gipfel kurz W vom Gipfelkreuz, 47°20'20"N / 14°44'10"E, ca. 2395 m alt., GF 8654/3, Blockwerk quarzreichen Schiefers, auf S-exp. Neigungsflächen von Blöcken, (1), 5. X. 1997, leg. J. Hafellner no. 43791 & J. Kocourková (GZU). – Steiermark (Styria), Ostalpen, Gurktaler Alpen, NW-exponierte Abbrüche zwischen Kornock und Rinsenock über der Winkleralm, W der Turracherhöhe, 46°54'47–56"N / 13°51'07–18"E, 2160–2180 m alt., GF 9049/3, auf Silikatschrofen, (1), 12. IX. 1985, leg. H. Mayrhofer & J. Poelt, det. J. Hafellner (GZU). – Steiermark (Styria), Gurktaler Alpen, Kirbisch ca. 11 km SW von Murau, oberhalb von St. Lorenzen, NE-exponierte Hänge knapp unter dem Gipfel, 47°03'05"N / 14°03'05"E, ca. 2100 m alt., GF 8950/1, niedere Schrofen und Blockwerk aus paläozoischen Schiefen zwischen Zwergstrauchheiden, auf Neigungsflächen der Schrofen, (3), 24. VIII. 2003, leg. J. Hafellner no. 62436 (GZU). – Steiermark (Styria), Ostalpen, Seetaler Alpen, Zirbitzkogel E von Neumarkt, am Rücken von der Tonnerhütte zum Zirbitzkogel, 47°03'50"N / 14°33'40"E, ca. 2250 m alt., GF 8953/1, W-Hänge mit Silikatblockwerk und offenem *Caricetum curvulae*, auf Gneisblöcken, (1), 8. VII. 1985, leg. J. Hafellner no. 84268 (GZU). – Steiermark (Styria), Steirisches Randgebirge, Gleinalpe, Speikkogel S von St. Michael, oberste N Abhänge kurz N unter dem Gipfel, 47°13'40"N / 15°02'55"E, ca. 1980 m alt., GF 8756/3, Blockschutthalde und umgebende Zwergstrauchheiden, auf teilweise überdeckten, bergfeuchten Gneisblöcken, (1), 12. VIII. 2000, leg. J. Hafellner no. 57887, 57894, 84267 & A. Hafellner (GZU). – *Ibid.*, (3), 12. VIII. 2000, leg. J. Hafellner no. 57892 & A. Hafellner (GZU). – Steiermark (Styria), Sausal, Demmerkogel ca. 9 km W von Leibnitz, am Fuß der E-Hänge im hintersten Teil des Kroisgrabens unterhalb von Kitzeck, 46°47'20"N / 15°26'10"E, ca. 400 m alt., GF 9258/2, Mischwald, an der Steigböschung auf kleinen Ausbissen eines paläozoischen Schiefers, (2), 25. III. 2000, leg. J. Hafellner no. 60927 (GZU). – Tirol, Osttirol, [Eastern Alps], Nationalpark Hohe Tauern, Glockner-Gruppe, Dorfertal N von Kals, kurz S der Maireben Alm, 47°02'15"N / 12°37'30"E, ca. 1620 m alt., GF 8941/4, subalpine Weiderasen mit niederen Schieferblöcken, auf niederen Schieferblöcken, (2), 15. VII. 1997, leg. J. Hafellner no. 47033 (GZU). – **France**: Korsika, Dept. Haute-Corse: Forêt de Vizzavona, kurz NE unter der Paßhöhe des Col de Vizzavona, ca. 1150 m alt., Buchenwald, auf kleinen Felsblöcken am Ufer eines Bächleins, (2), 3. XI. 1993, leg. B. Wieser (GZU). – **Germany**: Bayern (Bavaria), Niederbayern, Bayerisch-Böhmischer Wald, Höllerbachgespreng am Großen Falkenstein bei Zwiesel, c. 900–1100 m alt., auf Granit, (1), 4. X. 1971, leg. J. Poelt no. 10576 (GZU). – **Great Britain / United Kingdom**: Scotland, Westernness (V.C. 97), N side of Loch Sunart, Resipola, ravine of Allt Mhic Chiarain, 50–150 m alt., on siliceous rock, (1), 19. VI. 1992, leg. B. Coppins, P. W. James & J. Poelt no. Sc92/448a (GZU). – Scotland, Westernness (V.C. 97), N side of Loch Sunart, 4–5 km W of Strontian, woodland S of the road W of Woodend, 0–40 m alt., on siliceous rocks, (1), 14. VI. 1992, leg. B. Coppins, P. W. James & J. Poelt no. Sc92/118a (GZU). – **Italy**: Friuli - Venezia Giulia, Prov. Udine, [Southern Alps], Carnic Alps, Monte Fleons (Raudenspitze), slopes NE above Giogo Veranis (Öfner Joch),

46°38'30"N / 12°44'50"E, ca. 2100 m alt., palaeozoic micaschists, on low outcrops, (1), 17. VIII. 1996, leg. J. Hafellner no. 39233 (GZU). – Emilia Romagna, Prov. Parma, Apennino, Lago Lagoni S above Corniglio, just E above the lake, 44°23'25"N / 10°02'50"E, ca. 1450 m alt., beech forest on gentle slope with big boulders, on boulders of sandstone in the shade, (5), 24. VII. 2001, leg. J. Hafellner no. 58363 (GZU). – **Spain**: Asturias, Prov. Oviedo, Parque Nacional de Muniellos S von Cangas de Narcea, Las Chabolas, c. 1150 m alt., Silikatblockwerk in lockerem Mischwald, auf Silikatblöcken, (1), 5. IX. 1980, leg. J. Hafellner no. 9785 (herb. Hafellner). – **Sweden**: Bohuslän, Uddevalla commune, Skredsvik par., ca. 1 km NE of Cederslund along road Skredsvik to Munkedal, alt. ca. 80 m alt., open Pinus forest, on NW-facing vertical rock faces, gneiss, (1), 27. VIII. 1992, leg. J. Hafellner no. 30432 (GZU, under the name of the host).

***Polycoccum trypethelioides*** (Th.Fr.) R.Sant. (heterotypic synonym of *Polycoccum sauteri* Körb., the type species of *Polycoccum*)

Hosts: *Stereocaulon condensatum* (T), *Stereocaulon alpinum* (1), *Stereocaulon* spec. (2)

**Franz Josef Land** archipelago (Russian Federation): Ziegler Island, north-western part, c. 600 m WNW of the camp, SW of a small lake, 81°04'22"N / 56°15'50"E, 58 m alt., moist flat area dominated by mosses and *Phippisia algida*, (2), 10. VIII. 1996, leg. H. Pauli no. 1-54a, det. J. Hafellner (GZU). – **Austria**: Tirol (Tyrol), [Ostalpen, Rhätische Alpen], Samnaun-Gruppe, Furgler W ober Serfaus, am Grat zwischen dem Furgler Joch und dem Gipfel, [47°02'40"N / 10°30'50"E], 2800–2900 m alt., GF 8929, Windheiden im unteren Teil des Grates, auf Rohboden, (1), 2. IX. 1991, leg. J. Hafellner no. 30184 (herb. Hafellner).

***Didymocytis peltigerae*** (Fuckel) Hafellner

Host: *Peltigera canina* (T), *Peltigera praetextata* (thallus) (1), *Peltigera rufescens* (thallus) (2)

**Austria**: Steiermark (Styria), [Eastern Alps], Nördliche Kalkalpen, Ennstaler Alpen, Gesäuseberge, Reichenstein-Massiv ca. 7,5 km SE von Admont, Schneide zwischen Totenköpf und Pfarrmauer, S-Hänge N über der Mödlinger Hütte, 47°32'50"N / 14°33'00"E, 1950 m alt., GF 8453/3, kurze Felsrippe in alpinen Rasen, Triaskalk, auf Moosen und Pflanzenresten, (2), 22. IX. 2007, leg. J. Hafellner no. 69811, L. Muggia & A. Hafellner (herb. Hafellner). – Steiermark (Styria), [Eastern Alps], Niedere Tauern, Wölzer Tauern, Kasofen 2 km N von Pusterwald, Marmore direkt im Gipfelbereich, [47°19'30"N / 14°22'55"E], ca. 1890 m alt., GF 8652/3, auf Erde und Moosen, (2), 17. IX. 1993, leg. A. Wilfling no. 616 & M. Möslinger, det. A. Wilfling (GZU). – Tirol (Tyrol), [Eastern Alps], Stubai Alpen, c. 2 km S of Kühteil, soil deposit north below of the concrete dam of the storage lake "Speicher Finstertal". 47°12'N, 11°02'E, alt. c. 2300 m alt., (2), 4. VIII. 1996, leg. et det. P. Scholz (Triebel, Microfungi Exsiccati 282) (GZU). – **Sweden**: Uppland, Estuna par., Norr Malma, Bybacken, on a mossy rock in an oak forest, (1), 30. IX. 1959, leg. et det. J. Santesson no. 13603 (Santesson, Fungi Lichenicoli exs. No. 68) (GZU).

## Results

***Endococcus*** Nyl., Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg 3: 193 (1855).

**Type**: *Endococcus rugulosus* Nyl. (holotype) (see note 1 further below!)

= *Discothecium* Zopf, Nova Acta. Abhandlungen der Kaiserlichen Leopoldinisch-Carolinischen Deutschen Akademie der Naturforscher 70(2): 131 (1897).

**Type**: *Discothecium stigma* (Körb.) Zopf [syn. *Tichothecium stigma* Körb.] (holotype) (see note 3 further below!)

= *Pseudoendococcus* Marchand, Énumération méthodique et raisonnée des familles et des genres de la classe des Mycophytes (Champignons & Lichens): 143 (1896) [nomen nudum, sub *Pseudo-Endococcus*].

**Type:** not indicated (see note 4 further below!)

**Full descriptions:** TRIEBEL (1989: 90–91); KAINZ & TRIEBEL (2004: 648).

**Key characters for identification of the genus:** Vegetative hyphae inconspicuous, intrathalline. Ascomata black, sphaerical to ovoid to ellipsoid, solitary or in groups but never in dense herds or laterally fusing, with apical ostiolum and ostiolar region often somewhat flattened, with dark brown to blackish peridial wall composed of few layers ± tangentially flattened hyphal cells with ± evenly pigmented hyphal walls. Hamathecium consisting of persisting crown of periphysoids, interascal filaments lacking in ascomata containing mature asci. Asci verrucarialesan, ventricose to clavate (not cylindrical), ascal wall bitunicate with an exoascus secreting hemiamyloid gelatinous matrix which is gradually pervading the hymenium with time, endoascus with distinct ocular chamber when young, 4- to 8-spored. Ascospores brown in various shades, narrowly fusiform to broadly ellipsoid, usually 1-septate, with two ± equal cells, with rounded or acute ends, with thin to moderately thick walls, perispore sheath frequently demonstrable in careful preparations but in most species inconspicuous, perispore rarely conspicuous but often forming a sculpture visible in LM with increasing age. Gelatinous cap surrounding the exoascus and hymenial gel I(Lugol)<sub>dilut.</sub> + bluish, I(Lugol)<sub>conc.</sub> + pale orange-red, K/I + blue.

**Frequently confused genera:** *Polycoccum*, *Didymocyrtis*, *Sphaerellothecium*.

**Number of accepted species:** c. 45 (compare DIEDERICH et al. 2018: 364–365). – A search of the MycoBank database yielded 79 legitimate names for taxa that have been treated at a certain point in the past as belonging to *Endococcus*.

**Species identification:** HAWKSWORTH (1979), CLAUZADE et al. (1989: 45–46); both keys including only a limited set of species recognized at that time; no comprehensive key available.

**Notes:** 1. Together with the protologue of the genus two species are mentioned (NYLANDER 1855), “*E. rugulosus* (Leight. sub Verruc.)” and “*E. perpusillus* Nyl.”, both lacking species descriptions. Whereas *Endococcus rugulosus* can be interpreted as a new name replacing *Verrucaria rugulosa* Borrer ex Leight. [1851] non Flörke [1808], *E. perpusillus* Nyl. has not been validly described earlier than 1857 (NYLANDER 1857). Therefore, there is no need to designate a lectotype but *E. rugulosus* de facto constitutes the holotype as it was the only validly described species at the time when the new genus was introduced.

2. For a long time the name *Endococcus rugulosus* has been applied in a broad sense for *Endococcus* species with thick-walled dark-brown ascospores with rounded ends and within a certain range of variation in size (c. 12–17 × 5–8 µm). Apart from the type host *Verrucaria macrostoma*, TRIEBEL (1989) included strains invading several only distantly related hosts including species of *Amygdalaria*, *Aspicilia*, *Ionaspis*, *Myriolecis*, *Placopsis*, and *Rhizocarpon*. Since the critical notes published by SÉRUSIAUX

et al. (1999), the name *E. rugulosus* is used in a restricted sense only for a strain invading species of the *Verrucaria nigrescens* group, occasionally also other Verrucariaceae.

3. When ZOPF (1897) introduced the new genus *Discothecium*, the only species assigned to the genus was *Discothecium stigma* (Körb.) Zopf. *D.* constitutes a younger heterotypic synonym of *Endococcus*, nevertheless it was used instead by various authors (e.g. VOUAUX 1913, KEISSLER 1930). The type host for the type species is given in the protologue as *Psora lamprophora*. TRIEBEL (1989) was able to show by direct comparison with other specimens of this rare saxicolous lichen species that this was a misidentification and the areoles on which the ascomata of the *Endococcus* had developed most likely belong to a sterile thallus of an unnamed *Acarospora* species. This is now generally accepted, as there is an *Endococcus* with exactly fitting characters (8-spored asci, ascospores with attenuated ends, etc.) regularly found on various *Acarospora* species.

4. The generic name *Pseudoendococcus* Marchand (sub *Pseudo-Endococcus*) was introduced together with *Pseudorimularia* Marchand (sub *Pseudo-Rimularia*) and *Pseudomycoporon* Marchand (sub *Pseudo-Mycoporon*), all of them without a generic description and without mentioning any species that should belong to these genera, which at the same time were assigned to a new family Pseudoverrucariaceae Marchand (sub Pseudo-Verrucariacés) (MARCHAND 1896). Therefore, *Pseudoendococcus* constitutes an invalidly published genus name (ICN Article 38.1.).

5. HAWKSWORTH (1979) presented a kind of revision of *Endococcus* but the generic concept applied in that publication is rather formal. As the author did not use hyphal wall chemistry for a better circumscription of *Endococcus* (and *Muellerella*), several taxa of superficially similar genera with phaeodidymosporous species are not clearly separated. Only a minority of the species treated treated by HAWKSWORTH (1979) definitely belongs to *Endococcus*.

6. It was TRIEBEL (1989) who for the first time offered a clear and consistent concept of the genus *Endococcus*, but the genus was assigned to Dothideales which under the insights gained in the meanwhile is apparently not the correct placement.

7. In specimens assigned to *Tichothecium stigma* (i.e. *Endococcus stigma*), SANTESSON (1960) has observed a wide variability in the iodine-reaction of the ascomatal centrum, ranging from I- to I+ blue then red (hemiamyloid) to I+ permanently blue (euamyloid). This might depend on a variable amount of ascal gel produced, the concentration of the reagent arriving at the structures to be tested, and the type of iodine-reagent applied (iodine, Lugol, Melzer) which was often not specified in the past but proved to be essential (see the assessment by BARAL 1987). The diagnostic reactive portion of the hymenial gel is that secreted by the outermost layer of the ascal wall and therefore the reactivity of the hymenial gelatinous matrix should be tested near ascus tips.

8. In spite of several contributions to a better understanding of various *Endococcus* species described in the past (e.g. MATZER 1993, SERUSIAUX et al. 1999, TRIEBEL 1989, this publication) and additional, previously not

distinguished species successively described as new (e.g. ALSTRUP 1993, ALSTRUP et al. 1994, BRACKEL & KOCOURKOVÁ 2006, DAVID & ETAYO 1995, ETAYO 2002, ETAYO & BREUSS 2001, ETAYO & SANCHO GARCIA 2008, HAFELLNER 1994, HAFELLNER et al. 2002, HAFELLNER et al. 2008, HALICI et al. 2007, HAWKSWORTH & ITTURIAGA 2006, KNUDSEN 2008, KOCOURKOVA & KNUDSEN 2011, SERUSIAUX et al. 1999, ZHURBENKO & PINO-BODAS 2015, ZHURBENKO et al. 2012, this publication), the genus is still in urgent need of a critical revision.

Additional species to be assigned to *Endococcus* and invading thalli of lichenized fungus species pertaining to the Umbilicariaceae:

### ***Endococcus umbilicariae* (Linds.) Hafellner combinatio nova**

MycoBank number: MB 833719

≡ *Microthelia umbilicariae* Linds., Transactions of the Royal Society of Edinburgh 25: 538 (1869).

≡ *Phaeospora umbilicariae* (Linds.) Arnold, Flora (Regensburg) 57: 151 (1874).

≡ *Leptophaeria umbilicariae* (Linds.) Sacc. & D.Sacc., Sylloge Fungorum 17: 731 (1905).

≡ *Polycoccum umbilicariae* (Linds.) D.Hawksw., Bulletin of the British Museum for Natural History 14(2): 171 (1985).

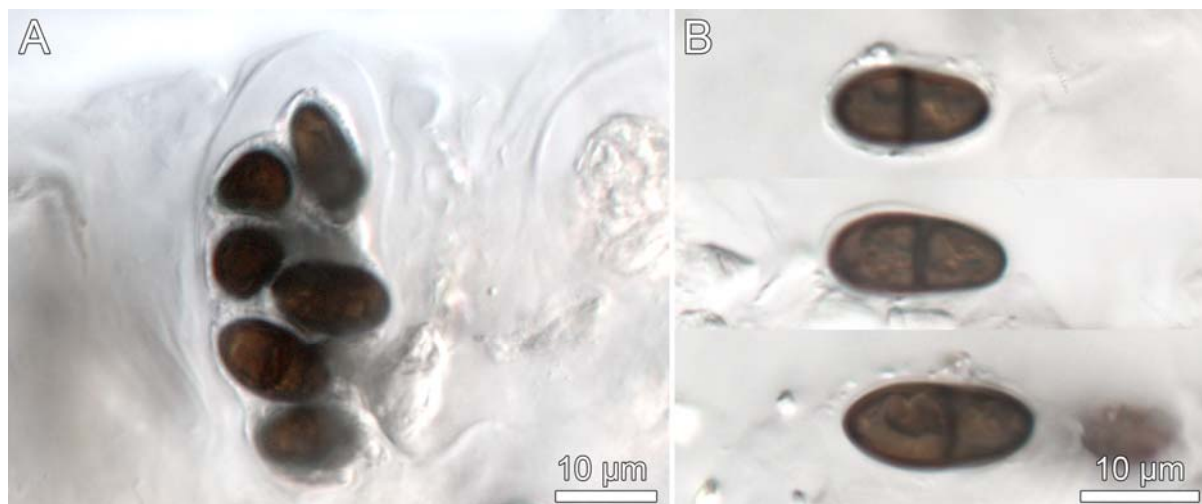
**Type:** Norway, without locality, separated from material collected as commercial "Pustulatus moss" (holotype in E) n. v. (restudied by HAWKSWORTH 1985: 171).

**Host of type:** *Lasallia pustulata* (thallus)

**Icon.:** LINDSAY (1869: plate XXIII Fig. 31 [coloured drawings of habit, cross section of infected thallus], plate XXIV Fig. 3 [coloured drawings of part of hymenium with indication of some details including one mature ascus with ascospores]); this publication Fig. 1 (photographs of ascus, ascospores).

**Description** (based on the protologue and own observations): Ascomata black, immersed to later protruding with the upper portion, smooth, with subconical to rounded ostiolar region and distinct apical ostiole, 200–300(–350) µm wide in longitudinal section. Ascomatal wall brown throughout, 40–50 µm thick, in longitudinal section with several layers of polygonal hyphal cells gradually tangentially flattened towards the centrum. Hamathecial filaments developed as periphysoids, forming a circumostiolar crown, 20–30 µm long, some with ramifications, consisting of only few cells, cells 5–10 µm long, lumina 1–2 µm wide, with gelatinized walls and outer delimitation therefore indistinct; interascal filaments not discernable in mature ascomata (for some time persisting empty ascal walls may be misinterpreted as hamathecial elements). Asci ventricose to broadly obclavate, 8-spored (some with reduced spore numbers together with aborted spores), (50–)60–75 × 20–26 µm, fissitunicate, verrucarialesan, i.e. cap of ascal gel surrounding exoascus hemiamyloid, I(Lugol)<sub>dilut.</sub> + bluish, I(Lugol)<sub>conc.</sub> + pale orange-red, K/I + persistently blue; endoascus I(Lugol) -, in young asci with broadly conical ocular chamber. Ascospores dark brown, 1-septate (but a considerable number of semi-mature spores still non-

septate), broadly ellipsoid, the two cells of  $\pm$  equal shape and size, hardly constricted at the septum, with rounded ends, with persisting perispore (but occasionally squeezed off from liberated spores in squash preparations), no sculpture visible in LM, (11–)12.5–14(–15.5)  $\times$  (6–)6.5–7.5  $\mu\text{m}$  (13.5–15  $\times$  (6–)6.5–7.5  $\mu\text{m}$  sec. HAWKSWORTH 1985, 11–14  $\times$  6–8  $\mu\text{m}$  sec. BOOM & ETAYO 2014).



**Figure 1:** *Endococcus umbilicariae* (Hafellner no. 48136; medium: tap water). – **A)** Ascus. – **B)** Ascospores. – Photos: Walter Obermayer.

**Notes:** 1. LINDSAY (1869) described what he thought to constitute paraphyses as “very delicate and indistinct” and interestingly noted a similarity with *Verrucaria*. Furthermore, he had correctly observed the positive iodine reaction of the ascomatal centrum.

2. Based on a set of characters observed in a collection from western Spain, already BOOM & ETAYO (2014) had concluded that the species belongs to *Endococcus* but refrained from making the formal combination. Furthermore, the authors had observed a retarded pigmentation and septum formation of the ascospores and they describe the ascospores as halonate.

3. When combining *Microthelia umbilicariae* to *Polycoccum*, HAWKSWORTH (1985) saw affinities to *Polycoccum peltigerae* (Fuckel) Vězda, a view I cannot share. These two species are only distantly related ascomycetes and in a phylogenetic reconstruction still to be performed I expect them to come out in clades differing on class level (Eurotiomycetes vs. Dothideomycetes).

4. The latter species is not a *Polycoccum* either but fits smoothly to *Didymocyrtis* Vain. Therefore, the following combination is introduced:

***Didymocyrtis peltigerae* (Fuckel) Hafellner **combinatio nova****

Mycobank number: MB 833720

$\equiv$  *Didymosphaeria peltigerae* Fuckel, Symbolae mycologicae: 140 (1869) = Jahrbücher des Nassauischen Vereins für Naturkunde 23-24: 140 (1869-1870).

$\equiv$  *Polycoccum peltigerae* (Fuckel) Vězda, Česká Mykologie 23(2): 109 (1969).

**Type:** [Germany, Hesse], „im Oestricher Wald, auf dem noch lebenden Thallus von *Peltigera canina*, sehr selten, im Frühling” (?G) n. v. (data from protologue, position of words changed). The Fuckel herbarium ought to be stored in Geneva, but the type could not be traced in the CJBG database.

5. DARMOSTYUK (2018) reported on a specimen identified as *Polycoccum umbilicariae* from the Carpathians in the Ukraine. As the host of the sample on which this record is based, is *Umbilicaria cylindrica*, and judging from the photographs of the ascospores (DARMOSTYUK 2018: 177, Fig. 1F–G), this finding is likely to belong to *Endococcus freyi* described as new further below.

**Hosts of *Endococcus umbilicariae*:** *Lasallia pustulata* (thallus) (1, T), *Lasallia hispanica* (thallus) (2). – Note: *Lasallia* has been reduced to subgeneric rank within *Umbilicaria* (compare DAVYDOV et al. 2017), but this is not generally accepted (see discussion further below).

**Ecology and distribution of the observed hosts:** A circumscription of the ecological requirements of *Lasallia pustulata* is given by various authors (e.g. WIRTH et al. 2013). It grows on siliceous rocks, predominantly on rough inclined slightly eutrophicated (e.g., by dust from sources in the surroundings) mostly sunny rock faces at lower elevation (in the Alps most frequently in the montane, only rarely in the upper montane belt where thalli are consistently smaller, but not above the treeline). Usually it occurs in rather late stages of succession. Surprisingly, the only record in the Polish Tatra Mts. is from the subnival belt (but there are a number of records from lower elevations in other parts of the Carpathian mountain chain (KRZEWICKA 2004). The required site conditions for *Lasallia hispanica* have been specified by SANCHO & CRESPO (1989). It preferably grows on sunny, often wind exposed xeric eutrophicated flat to slightly inclined surfaces of siliceous rocks and boulders and is said to co-occur not rarely with *L. pustulata*.

Various aspects of population ecology including modes of dispersal, gap dynamics, etc., in connection with the various modes of reproduction possible in *Lasallia pustulata* have been studied and discussed in detail by HESTMARK (1992, 1997).

*Lasallia pustulata* is widely distributed in Europe reaching also northern Africa and Macaronesia (with additional enclaves in orobiomes in Eastern Africa as well as North America). Further closely related species (*L. brigantium*, *L. hispanica*) occur in southwestern Europe (with *L. hispanica* extending to northern Africa) from mid elevations upwards and (*L. rossica*) in the east of the continent at higher altitudes (see e.g. SANCHO & CRESPO 1989).

**Known distribution and previous records of *Endococcus umbilicariae*:** For a long time, this relatively conspicuous species was only reported from Norway, based on the type that had been separated from lichen material collected for commercial purposes (LINDSAY 1869). In more recent years it has also been found in France (ROUX et al. 2014) and Spain (BOOM & ETAYO 2014), but the still very few localities from where *E. umbilicariae* is

known indicate that it is a rare species. Collections cited below constitute additions to the mycofloras of Finland as well as to offshore Africa (Canary Islands, Madeira). A preference for host populations growing under not too continental environmental conditions is evident.

A record from Ukraine (DARMOŠTYUK 2018, sub *Polycoccum umbilicariae* on *Umbilicaria cylindrica*) refers most likely to a closely related species, here treated under *Endococcus freyi* (see below).

**Exsiccata examined:** Hafellner, Lichenicolous Biota no. 303 (BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS). – Hafellner, Lichenicolous Biota no. 312 (BR, CANB, GZU, NY, UPS).

**Further specimens seen:** **Europe:** **Finland:** Alandia, Jomala, Södersunda, Degerberget, grid 27°, E: 6690:104, water seepage on W exposed cliff, 22. VIII. 1976, leg. Roland Skytén (GZU). – **Spain:** prov. de Madrid, Sierra de Guadarrama, Puerto de la Morcuera, 40°49'N / 3°45'W, elev. 1700 m alt., growing on north-facing granite rocks, (2), 4. VI. 2001, leg. L. G. Sancho & S. Pannewitz (separated from G. B. Feige & H. T. Lumbsch, Umbilicariaceae exs. no. 81) (GZU). – **Africa:** **Canary Islands:** Gran Canaria, a short distance N below the summit of Pico de las Nieves, 27°58'00"N / 15°34'20"W, c. 1870 m alt., conspicuous wall-like basaltic outcrop in pine forest, on steep rock faces exposed to the N, 26. II. 1994, leg. J. Hafellner no. 48136 - Lichenicolous Biota no. 303 (BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS). – **Madeira:** Pico Escalvado c. 1 km S of Pico do Arieiro, 32°43'00"N / 16°55'45"W, c. 1670 m alt., volcanic cliffs, on steep rock faces exposed to the N difficult to access, 20. II. 1990, leg. J. Hafellner no. 27351 & A. Hafellner - Lichenicolous Biota no. 312 (BR, CANB, GZU, NY, UPS).

### ***Endococcus freyi* Hafellner species nova**

Mycobank number: MB 833721

**Diagnosis:** Species *Endococco umbilicariae* similis sed ab eo differt ascomatibus minoribus et ascosporis majoribus atque apicibus ascosporarum subacutis. Forma ascosporarum ut in *E. stigma* sed ascosporae in magnitudine [(15–)17–20 × (6–)7–8.5 μm vs. 11–14 × 5.5–7 μm in *E. stigma*] differentes. Habitat in thallis *Umbilicariarum* in regionibus frigidis holarcticis.

**Type:** **Austria:** Kärnten (Carinthia), [Eastern Alps, Hohe Tauern], Kreuzeckgruppe, [NW über Dellach im Drautal], oberhalb der Hugo-Gerbers-Hütte, [46°49'05"N / 13°01'45"E], ca. 2400 m alt., GF 9144/3, auf Amphibolitfels, 2. XI. 1986, leg. W. Petutschnig [holotype in GZU].

**Host of type:** *Umbilicaria cylindrica* (thallus)

**Icon.:** This publication Fig. 2 (photographs of part of ascomatal cavity with mature asci, ascus tips, ascospores)

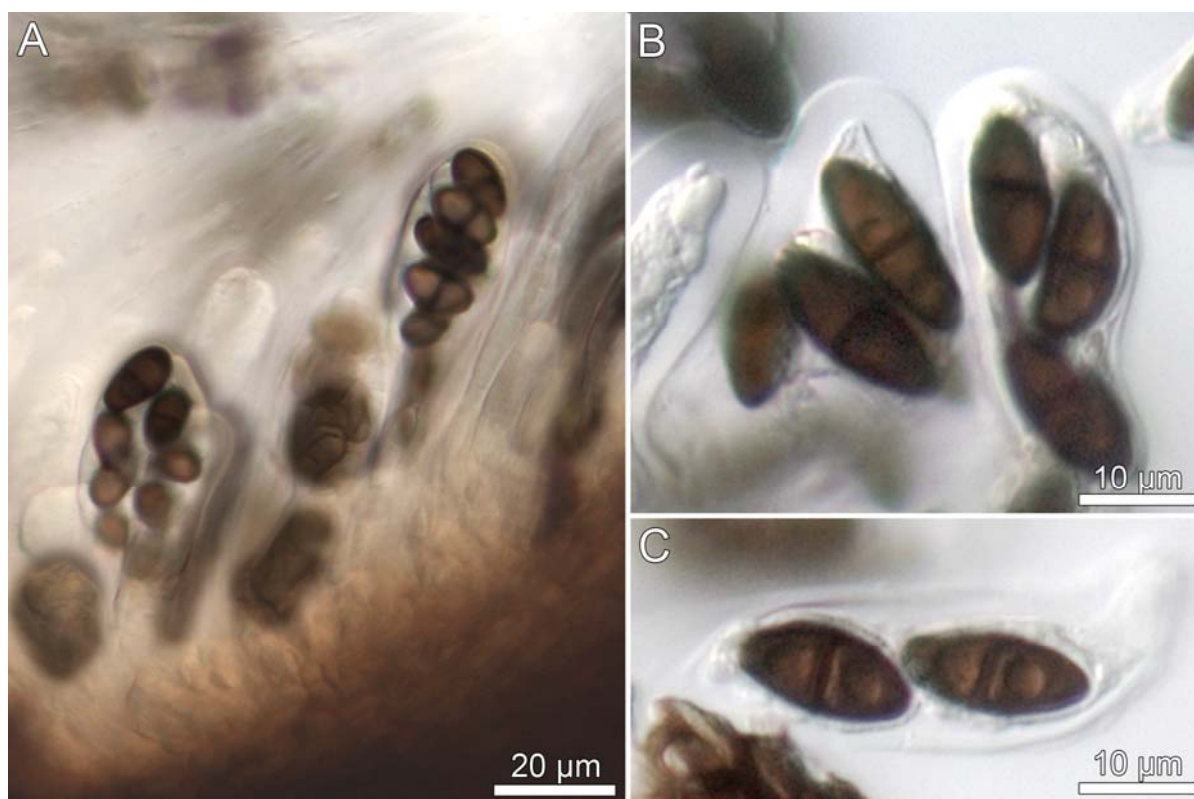
**Etymology:** Named after the Swiss teacher Eduard Frey (1888–1974), mountaineer and one of the outstanding lichenologists working in the Alps, at that time also the leading expert in *Umbilicaria* taxonomy.

**Description:** Infection not causing severe damage to the host thallus but slight bleaching in areas where the ascomata of the lichenicolous fungus develop might occur. Vegetative hyphae inconspicuous. **Ascomata** black, semi-immersed, smooth, with rounded to broadly conical ostiolar region, (170–)200–250 μm. Ascomatal wall brown throughout, 30–40 μm thick, in



longitudinal section with several layers of polygonal hyphal cells, more tangentially flattened towards the centrum, Hamathecial filaments developed as **periphysoids**, forming a circumstolar crown, 18–25  $\mu\text{m}$  long, some with ramifications, consisting of only few cells, cells 5–10  $\mu\text{m}$  long, lumina 1–2  $\mu\text{m}$  wide, with gelatinized walls and outer delimitation therefore indistinct; interascal filaments not discernable in mature ascomata. **Asci** broadly clavate, 8-spored (some with reduced spore numbers together with aborted spores), 50–70  $\times$  16–22  $\mu\text{m}$ , fissitunicate, verrucarialean, i.e. gelatinous cap secreted namely in the apical region of exoascus and gradually pervading the entire hymenium hemiamyloid, I(Lugol)<sub>dilut.</sub> + bluish, I(Lugol)<sub>conc.</sub> + pale orange-brown, K/I + persistently blue. **Ascospores** brown, 1-septate (some non-septate spores intermixed and semi-mature spores occasionally also still non-septate), ellipsoid, the two cells of  $\pm$  equal shape and size, not or hardly constricted at the septum, with somewhat pointed ends (shape similar to spores of *Endococcus stigma*), with persisting perispore (but occasionally squeezed off from liberated spores in squash preparations), no sculpture visible in LM, (15–)17–20  $\times$  (6–)7–8.5  $\mu\text{m}$  (the paratype from the Canadian Arctic with many spores near the lower limits).

**Hosts:** *Umbilicaria cylindrica* (thallus) (1, T), *Umbilicaria crustulosa* coll. (thallus) (2)



**Figure 2:** *Endococcus freyi* (holotype; medium: tap water). – **A**) Part of ascatal cavity with mature asci. – **B**) Ascus tips of mature asci. – **C**) Ascospores. – Photos: Walter Obermayer.

**Notes:** 1. The semiimmersed ascomata of *Endococcus freyi* are rather conspicuous under a dissecting microscope. Nevertheless, they are difficult to distinguish from the ascomata of the apparently much more common *Stigmatidium gyrophorarum* (these usually somewhat smaller, less protruding

and often on distinctly bleached areas) and from the pycnidia of the host lichen which are also regularly present. The latter are hardly protruding, often provided with a thalline collar and are concentrated in the healthy marginal zone. So *Endococcus freyi* might be easily overlooked unless its presence becomes evident in a section or a squash preparation.

2. The other *Endococcus* on Umbilicariaceae, *E. umbilicariae*, has smaller ascospores of a different shape. The morphoanatomically most similar species, also occurring on siliceous rocks in arctic to temperate-alpine environments in the Holarctic region are: *Endococcus propinquus* (ascospores with similar wall thickness but of different shape and of smaller size), *Endococcus brachysporus* (ascospores of different shape and of smaller size, compare SÉRUSIAUX et al. 1999), and *E. stigma* (ascospores with similar wall thickness and equally with subacute ends but of smaller size).

3. The two *Umbilicaria* species on which *Endococcus freyi* has so far been recorded belong to different clades (subgenera?) as circumscribed in the phylogenetic reconstruction of Umbilicariaceae performed by DAVYDOV et al. (2017). Whereas the type host, *Umbilicaria cylindrica*, is a member of clade “*Umbilicaria*”, the second host, *U. crustulosa* coll., is a member of clade “*Gyrophora*”.

**Known distribution and previous records:** Known from the Eastern Alps in Austria and the Canadian Arctic. A recent record of a similar lichenicolous fungus from the Carpathian Range in the Ukraine (DARMOSTYUK 2018, sub “*Polycoccum umbilicariae*” on *Umbilicaria cylindrica*) might also belong here.

**Exsiccata examined:** –

**Further specimens seen:** **Europe:** **Austria:** Tirol, Osttirol, Nationalpark Hohe Tauern, Venediger-Gruppe, Osthänge kurz SE unter der Essener-Rostocker-Hütte, 47°03'15"N / 12°18'00"E, ca. 2100 m alt., GF 8939/2, Schieferabbrüche und alpine Rasen, auf teilweise Ca-hältigen Schieferabbrüchen, (2), 9. IX. 1989, leg. J. Hafellner no. 84290 & A. Hafellner (herb. Hafellner). – **Northern America:** **Canada:** North-Western Territory [now Nunavut]: Baffin Island region [now Qikiqtaaluk Region], Broughton Island [now Qikiqtarjuaq] E of Baffin Island, Cumberland Peninsula, Old Broughton settlement site [Qikiqtarjuaqruluk], c. 5 m alt., snow melt streams and boggy water accumulation areas, (1), 1.–22 VII. 1974, leg. Catherine LaFarge L-61641a, det. J. H. (GZU).

## Discussion

### Taxonomy of *Endococcus* and related genera

Some very divergent proposals for a placement of *Endococcus* have been made in the past. In the recent outline by DIEDERICH et al. (2018), *Endococcus* has been assigned to Eurotiomycetes–Chaetothyriomycetidae–Verrucariales–Verrucariaceae, whereas JAYASIRI et al. (2016) concluded from morphoanatomical similarities that *Endococcus [rugulosus]* should belong to Dothideomycetes–[Dothideomycetidae]–[Lichenotheliales]–Lichenotheliaceae(!) which sounds a little bizarre for a mycologist familiar with a wide range of lichenicolous fungi. Previously, TRIEBEL (1989) had also assigned *Endo-*

*coccus* to Dothideales but with unclear relationship, whereas *Muellerella* was placed in Verrucariales.

A relatively close relationship between the genera *Endococcus*, *Muellerella*, *Phaeospora*, and *Merismatium* p.p. (i.e. *Halospora*) was occasionally noticed in the past (e.g. ARNOLD 1874, 1877, 1881, 1895, KEISLER 1930, HAWKSWORTH 1979), resulting in a considerable number of proposed transfers of species to one or the other genus in various directions. The delimitation of phaeo-didymosporous *Endococcus* [1855] from phaeo-phragmosporous *Phaeospora* [1879] and phaeo-dictyosporous *Halospora* [1952] is still rather formal. Equally, the delimitation of oligosporous *Endococcus* [1855] from polysporous *Muellerella* [1862] – in this genus namely from the *M. pygmaea* group – needs a critical reevaluation as is the justification of a segregated genus *Bellemerella* [1997], said to be closely related to *Muellerella*. Probably only a phylogenetic reconstruction based on sequence data of a larger set of taxa and including also all relevant type species will show if the phenotypic characters “ascospore number per ascus” and “ascospore septation” do have taxonomic value above species level in this group of ascomycetes. But this appears to be a difficult task, because of all these genera only a non-type *Endococcus* has so far been successfully sequenced, and even this one without repeat. It is questionable if the separation of all these genera is justified. In case that a phylogenetic reconstruction recommends the extreme conclusion to merge all these genera, *Endococcus* would take priority over all the other generic names mentioned above. Therefore, such conclusions would not have an effect on our results concerning the species treated here. But some dozens of species of lichenicolous fungi would require a complete re-arrangement.

In a hierarchical taxonomic arrangement of all genera with lichenicolous species (DIEDERICH et al. 2018), the genera here in focus are assigned to two orders within Chaetothyriomycetidae. Whereas *Muellerella* was assigned to Chaetothyriales inc. sed., the other genera here in discussion were included in Verrucariales-Verrucariaceae. This is at least partly based on a phylogenetic reconstruction including species of other genera here in focus, performed by MUGGIA et al. (2015) who were able to demonstrate that the *Muellerella lichenicola* group and connected *Lichenodiplis*-type anamorphs belong to a sister clade of *Epibryon* in Chaetothyriales. The so far unanswered question is, whether the *Muellerella lichenicola* group, the *Muellerella pygmaea* group, and the type species *Muellerella polyspora* are definitely so closely related which in our opinion is not at all sure. A so far hardly discussed possibility is that in a systematic arrangement of phaeosporous Chaetothyriomycetidae some phenotypic characters have not been correctly weighted so far. On the one side, ascospore number and septation might have been over-emphasized, whereas on the other side ascospore wall thickness – noted occasionally in species delimitations but possibly a more significant character linking entire species groups across current generic concepts – has been widely neglected. So far thin-walled and thick-walled species groups are scattered over all genera here in focus but, e.g., the very first key character for the recognition of *Halospora* species among true *Meris-*

*matium* species was the very different ascospore wall thickness between these two genera (HAFELLNER 2011) which TRIEBEL (1989) had already realized and perfectly depicted. But in this case, she had not drawn the necessary taxonomical conclusions.

### **Taxonomy of *Umbilicariaceae***

For the Swiss lichenologist Eduard Frey the Umbilicariaceae were one of his favorite research topics. In two papers he dealt in some detail with the systematics of *Umbilicaria* (FREY 1929, 1936) and alluded to several problems and aspects (e.g. value of various phenotypic characters for *Umbilicaria* taxonomy, such as ascospore septation, surface of apothecial discs, thalline characters), but altogether he did not publish a comprehensive taxonomic synopsis at that time. Only in the treatment of Umbilicariaceae for the Rabenhorst Flora (FREY 1932–1933), he was forced to offer an overall view of his concept, at least for the species occurring in Central Europe. Later, in a kind of summary of the insights he had gained over the years, he presented an overview (FREY 1949) classifying all *Umbilicaria* species in a single genus in which he accepted three subgenera (*Lasallia*, *Gyrophoropsis*, *Gyrophora*) with *Gyrophora* subdivided in 4 sections (*Velleae*, *Polymorphae*, *Glabrae*, *Anthracinae*).

More or less at the same time SCHOLANDER (1934) has presented an alternative concept. He had regarded ascomatal subdivision during ontogeny resulting in different surface types of the apothecial disc as a distinguishing character important enough to accept four genera (*Umbilicaria*, *Omphalodiscus*, *Gyrophora*, *Actinogyra*). This idea was later on taken up and elaborated by LLANO (1950). However, already FREY (1936) has pointed out that intermediate types as well as changes from one type to the other in aging ascomata frequently occur, making this concept hardly practicable. And as it has been shown later, such a subdivision definitely does not result in monophyletic groups (see below).

A first attempt for a taxonomy of Umbilicariaceae using sequence data has been presented by IVANOVA et al. (1999). Their results showed *Umbilicaria spodochoa* in a basal position of the branch to be excluded in order to get two monophyletic clades (*Lasallia*, *Umbilicaria*). In a later study, DAVYDOV et al. (2010) have shown a monophyletic clade *Lasallia*, if *Umbilicaria caroliniana* (a species with thallus pustules not always present) is transferred to *Lasallia*. The most recent and comprehensive study has been presented by DAVYDOV et al. (2017) who identified 6 major clades in *Umbilicaria*. Based on their reconstruction of Umbilicariaceae phylogeny, acceptance of *Lasallia* would make the rest (*Umbilicaria*) paraphyletic. In order to escape this problem, *Lasallia* has been reduced to subgeneric rank within a broader defined genus *Umbilicaria* (compare DAVYDOV et al. 2017: 1287, Fig. 2). Furthermore, in this study *Umbilicaria spodochoa* did not come out in a basal position but in the *U. vellea* group in subgen. *Gyrophora* which is also reasonable from its morphoanatomy. In case that the phylogenetic reconstruction performed by DAVYDOV et al. (2017) will be confirmed by future repeats with

different species sets and/or genes, it would be worth to consider, as an alternative to their concept, a split of *Umbilicaria* in order to get monophyletic clades apart from a *Lasallia*-clade. But this is a question to be resolved by specialists in *Umbilicaria* taxonomy.

As *Lasallia* in its common circumscription is an easily recognizable genus, it is widely accepted in lichen floras (e.g., AWASTHI 2007, GALLOWAY 2007, HITCH & PURVIS 2009, JOHN & TÜRK 2017, KROG et al. 1994, MCCUNE & GEISER 2009, SANCHO 2004, WIRTH et al. 2013) and regional revisions of Umbilicariaceae (e.g., FREY 1977, KROG & SWINSCOW 1986, KRZEWICKA 2004, WEI & JIANG 1993). A key including the species in question and taking into consideration also secondary chemistry characters was published by POSNER et al. (1991).

## Acknowledgements

Thanks are due to Walter OBERMAYER for making and arranging the photographs and Christian SCHEUER for critically reading the manuscript.

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## Lichenicolous Biota (Nos 301–320)

Josef HAFELLNER\*

HAFELLNER Josef 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana (Graz) 94: 25–42. - ISSN 1024-0306.

**Abstract:** The 13<sup>th</sup> fascicle (20 numbers) of the exsiccata 'Lichenicolous Biota' is published. The issue contains material of 18 non-lichenized fungal taxa (16 teleomorphs of ascomycetes, 2 basidiomycetes). Collections of the type species of the following genera are distributed: *Lichenochora* (*L. obscuroides*, syn. *L. thallina*) and *Nesolechia* (*N. oxyspora*). The new combination *Sphaerellothecium arnoldii* (A.Massal.) Hafellner is proposed.

\*Institut für Biologie, Bereich Pflanzenwissenschaften, NAWI Graz,  
Karl-Franzens-Universität, Holteigasse 6, 8010 Graz, AUSTRIA  
e-mail: josef.hafellner@uni-graz.at

### Introduction

The exsiccata 'Lichenicolous Biota' is continued with fascicle 13 containing 20 numbers.

The exsiccata covers all lichenicolous biota, i.e., it is open not only to non-lichenized and lichenized fungi, but also to myxomycetes, bacteria, and even animals, whenever they cause a characteristic symptom on their host (e.g., discoloration or galls). Consequently, the exsiccata contains both highly host-specific and plurivorous species, as long as the individuals clearly grow or fructifications develop upon a lichen and the collection is homogeneous, so that identical duplicates can be prepared.

The five complete sets are sent to herbaria of the following regions: Central Europe (Graz [GZU]), Northern Europe (Uppsala [UPS]), Western Europe (Bruxelles [BR]), North America (New York [NY]), Australasia (Canberra [CANB]). Incomplete sets will preferably be distributed to Barcelona [BCN], Edinburgh [E], Saint Petersburg [LE], Munich [M], and Prague [PRM] (herbarium acronyms sec. HOLMGREN et al. 1990, continued and updated as electronic database by THIERS 2019+ and hosted at New York Botanical Garden under <http://sweetgum.nybg.org/science/ih/>). Also in the future, it is planned to publish at least one fascicle per year, consisting of a variable number of decades.

The grid reference preceded by the abbreviation 'GF' refers to the grid used by the project 'Floristische Kartierung Mitteleuropas' (floristic mapping of Middle Europe, e.g. EHRENDORFER & HAMANN 1965).

For the 13<sup>th</sup> fascicle, I gratefully acknowledge the contribution of 2 collections by Rolf SANTESSON (†).

In fieldwork I received support by Angela HAFELLNER and Jolanta MIADLIKOWSKA.

Rolf SANTESSON (†) contributed to the scientific content of the fascicle by the identification of either lichenicolous fungi or hosts.

Christian SCHEUER and Walter OBERMAYER are thanked for critically reading the manuscript.

I would be much obliged to colleagues who send material of lichenicolous biota for distribution in future fascicles. The collections should be divided up into at least 5 (up to 10) duplicates, preferably already prepared. Unprepared collections should be rich enough to obtain at least 5 duplicates.

Nomenclatural novelty:

***Sphaerellothecium arnoldii* (A.Massal.) Hafellner combinatio nova**

Mycobank number: MB 833734

Bas.: *Tichothecium arnoldii* A.Massal., *Miscellanea Lichenologica*: 27 [meaning 57] (sub *Arnoldi*) (1856); non (Hepp) Körb. (1865). – *Endococcus arnoldii* (A.Massal.) Trevis., *Conspectus Verrucarinarum*: 17 (1860).

Syn.: *Phaeospora* (*Sphaeria*?) *arnoldii* Hepp, *Flechten Europas* no. 701 (1860, sub *Arnoldi*) (superfluous name). – *Tichothecium arnoldii* (Hepp) Körb., *Parerga Lichenologica*: 469 (1865) non A.Massal. (1856). – *Discothecium arnoldii* (Hepp) Vouaux, *Bulletin de la Société Mycologique de France* 29: 58 (1913). – *Polycoccum arnoldii* (Hepp) D.Hawksw., *Botaniska Notiser* 132: 289 (1979).

Note 1: *Phaeospora arnoldii* Hepp is usually regarded as newly described species. It is doubtful that this was the intention of the author. When Hepp introduced the name *Phaeospora arnoldii* he listed some synonyms. Among others he cited a legitimate name with priority, *Tichothecium arnoldii* A.Massal. (1856), which he ought to have adopted. Therefore, it could well be that Hepp intended to make a new combination rather than to describe a new species, because in the 19<sup>th</sup> century new combinations were often made without citing the author of the basionym in brackets.

Note 2: MASSALONGO (1856) indicated the type with the phrase “In thallo *Urceolariae scruposae bryophylae (iridatae Massal.?)* in Franconia superiori. Arnold”, whereas HEPP (1860) uses the phrase “Parasitisch auf *Urceol. scruposa* var. *iridata* (Mass.) auf steinigem Boden zwischen Winterhof und Ruppertsbuch, bei Eichstätt; F. Arnold”. So, evidently both collections come from the same area but do not come necessarily from the same locality because ARNOLD (1858: 702) listed 4 localities in Franconia, where he had collected this lichenicolous fungus.

Note 3: The offprint of the publication by MASSALONGO (1856) available to us looks like a booklet, but it has a confusing pagination imprinted. It starts from [35] to “42” and continues with “13” (meaning 43) onwards. Therefore page “27” several pages later – the page on which *Tichothecium arnoldii* A.Massal. is described (compare e.g. KESSLER 1930: 402) – should be read 57. And further back in the text, the page numbers “35” (meaning 65) to “42” (meaning 72) turn up a second time continuing this time with the pages “43” (meaning 83) to “46” (meaning 86). Such a copy is also available from Bayerische Staatsbibliothek Digital ([url: https://reader.digitale-sammlungen.de/de/fs1/object/display/bsb10301610\\_00005.html](https://reader.digitale-sammlungen.de/de/fs1/object/display/bsb10301610_00005.html)). In contrast, a copy with re-arranged chapters and corrected pagination (p. [35]–75) but with part of the text missing is incorporated in the volume edited by LAZZARIN (1991) containing several of the rarer papers of Massalongo’s lichenological oeuvre. The explanation why the pagination of all versions known to us does not start with page number 1 is imprinted at the end: “Estratto dal Volume pubblicato in occasione delle Nozze Bizio-Pazienti” (whole volume not seen by us) in which Massalongo’s work was evidently not the first in a series of papers dealing with various subjects.

Note 4: The shape of the asci of the species indicates a closer relationship to *Sphaerellothecium araneosum* (Rehm ex Arnold) Zopf rather than to *Polycoccum tryptethelioides* (Th.Fr.) R.Sant. Additionally, the small ascomata are connected to a net of brown superficial hyphae, little conspicuous under the dissecting microscope but very distinct in preparations for the light microscope. These pigmented vegetative hyphae had already been noticed by Hepp (l.c., “Mycelium braun, wie bei den Sphaerien!”), the reason why he was uncertain about the generic placement of this species.

Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 301. *Cercidospora epipolytropa* (Mudd) Arnold

in Flora (Regensburg) 57: 154 (1874). – Bas.: *Thelidium epipolytropum* Mudd, Manual of British Lichens: 298 (1861). – Syn.: *Didymella epipolytropa* (Mudd) Berl. & Voglino, Sylloge Fungorum Additamentum I–IV: 89 (1886). – *Didymosphaeria epipolytropa* (Mudd) G. Winter in Rabenhorst Kryptogamen-Flora, 2. Aufl., 1(2): 432 (1885).

Host: *Lecanora polytropa* var. *polytropa* (apothecia)

**Europe, Austria:** Styria, Eastern Alps, Seetaler Alpen, Zirbitzkogel massif W above the village Obdach, Sabathyalm, on the E edge NE below the summit of Oberer Schlaferkogel, NE-side of a small mountain top, 47°04'40"N / 14°34'36"E, 2060 m alt., GF 8953/1, mosaic of patches of Loiseleurietum and bare mineral soil, on pebbles of mica schist.

Note 1: *Lecanora polytropa* is the type host of *Cercidospora epipolytropa*.

Note 2: Accompanying thalli of *Rhizocarpon geographicum* may be infected with *Endococcus macrosporus* (Hepp ex Arnold) Nyl. (e.g., seen on specimen sent to UPS).

11. X. 2018

leg. J. Hafellner (83763), det. J. Hafellner

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 302. *Cercidospora stereocaulorum* (Arnold) Hafellner

in Herzogia 7(3-4): 362 (1987). – Bas.: *Leptosphaeria stereocaulorum* Arnold, Flora (Regensburg) 57: 153, 175 (1874). – Syn.: *Metasphaeria stereocaulorum* (Arnold) Sacc., Sylloge Fungorum 2: 183 (1883). – *Sphaerulina stereocaulorum* (Arnold) Vouaux, Bulletin de la Société Mycologique de France 29: 35 (1913).

Host: *Stereocaulon* spec. (thallus)

**Europe, Austria:** Vorarlberg, Eastern Alps, Verwall-Gruppe, Hochjoch massif E above of the market town Schruns, by the trail from the lookout Sauerbleis to Schwarzsee, 47°04'15"N / 09°59'00"E, c. 2100 m alt., GF 8925/2, outcrops of mica schist in alpine vegetation on steep slope exposed to the N, along fissures of the outcrops.

Note 1: The type host of *Cercidospora stereocaulorum* is *Stereocaulon alpinum*.

Note 2: The infection causes a strong deformation of phyllocladia (formation of galls), in which groups of ascomata of the lichenicolous fungus develop. These are not the cephalodia which are also present and are of greyish colour.

6. VIII. 2008

leg. J. Hafellner (79744), det. J. Hafellner

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS



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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 303. *Endococcus umbilicariae* (Linds.) Hafellner

in Fritschiana 94: 9 (2019). – Bas.: *Microthelia umbilicariae* Linds., Transactions of the Royal Society of Edinburgh 25: 538 (1869). – Syn.: *Polycoccum umbilicariae* (Linds.) D.Hawksw., Bulletin of the British Museum (Natural History), Botany series 14(2): 171 (1985).

Host: *Lasallia pustulata* (thallus)

**Africa, Canary Islands:** Gran Canaria, a short distance N below the summit of Pico de las Nieves, 27°58'00"N / 15°34'20"W, c. 1870 m alt., conspicuous wall-like basaltic outcrop in pine forest, on steep rock faces exposed to the N.

Note 1: *Lasallia pustulata* is the type host of *Endococcus umbilicariae*.

Note 2: *Lasallia* has been reduced to subgeneric rank within *Umbilicaria* (compare Davydov et al., Taxon 66(6): 1282–1303, 2017), but this is not generally accepted.

26. II. 1994

leg. J. Hafellner (48136), det. J. Hafellner

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 304. *Heterocephalacria bachmannii* (Diederich & M.S.Christ.) Millanes & Wedin

in Liu et al., Studies in Mycology 81: 120 (2015). – Bas.: *Syzygospora bachmannii* Diederich & M.S.Christ. in Diederich, Bibliotheca Lichenologica 61: 30 (1996).

Host: *Cladonia macroceras* (podetia)

**Europe, Austria:** Steiermark (Styria), Eastern Alps, Northern Limestone Alps, Müzzsteger Alpen, eastern foothills of Veitsch Alpe, N of the town Kindberg, by the trail a short distance SE below the refuge Grundbauernhütte, 47°38'45"N / 15°28'55"E, c. 1420 m alt., GF 8358/4, talus of ravine, on raw humus between *Vaccinium myrtillus*.

Note 1: The type host of *Heterocephalacria bachmannii* is *Cladonia subrangiformis*.

Note 2: The basidiomata of the macroscopically similar *Tremella cladoniae* Diederich & M.S.Christ. are usually confined to the squamules of the primary thallus of *Cladonia* species. For distinguishing microscopical characters between the two species compare Diederich (Biblioth. Lichenol. 60: 32 Fig. 10 and 67 Fig. 30, 1996).

28. VII. 2012

leg. J. Hafellner (83934), det. J. Hafellner

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 305. *Lichenochora obscuroides* (Linds.) Triebel & Rambold

in Rambold & Triebel, Bibliotheca Lichenologica 48: 168 (1992). – Bas.: *Lecidea obscuroides* Linds., Transactions of the Royal Society of Edinburgh 22: 112, 247 (1859). – Syn.: *Sphaerella thallina* Cooke, Grevillea 8(no. 45): 10 (1879). – *Lichenochora thallina* (Cooke) Hafellner, Nova Hedwigia 48: 363 (1989).

Host: *Phaeophyscia orbicularis* (thallus)

**Europe, Austria:** Kärnten (Carinthia), Eastern Alps, foothills of Saualpe W of the town Wolfsberg, c. 1 km W of the village St. Michael by the road to Lading, 46°50' 05"N / 14°47'10"E, c. 550 m alt., GF 9154/4, fruit trees in a pasture, on twigs of *Juglans regia* fallen to the ground after strong wind.

Note 1: *Phaeophyscia orbicularis* is the type host of *Lichenochora obscuroides*.

Note 2: *Lichenochora obscuroides* is a heterotypic name of the type species of *Lichenochora*, *L. thallina*, and has priority over the latter.

25. XII. 2010

leg. J. Hafellner (77052), det. J. Hafellner

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 306. *Phacopsis cephalodioides* (Nyl.) Triebel & Rambold

in Nova Hedwigia 47(3-4): 296 (1988). – Bas.: *Agyrium cephalodioides* Nyl., Flora (Regensburg) 49: 373 (1866).

Host: *Hypogymnia tubulosa* (thallus)

**Africa, Madeira:** Pico do Arieiro, S below the summit on slope exposed to the S, 32°43'55"N / 16°55'45"W, c. 1700 m alt., tract of land reforested with pines, on bark of *Pinus spec.*

Note 1: The type host of *Phacopsis cephalodioides* is *Hypogymnia physodes*.

Note 2: Triebel & Rambold (l.c.) have reinvestigated authentic material originating from Denmark and have designated a lectotype.

Note 3: A strain of *Nesolechia oxyspora* is additionally present on the specimen kept in GZU and may also be seen on duplicates sent to other herbaria.

18. II. 1990

leg. J. Hafellner (70464) & A. Hafellner, det. J. Hafellner

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS

Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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**307. *Sphaerellothecium arnoldii* (A.Massal.) Hafellner**

in Fritschiana (Graz) 94: 27 (2019). – Bas.: *Tichothecium arnoldii* A.Massal., Miscellanea Lichenologica: 27 (1856, sub *Arnoldi*). – Syn.: *Endococcus arnoldii* (A.Massal.) Trevis., Conspectus Verrucarinarum: 17 (1860).

Host: *Diploschistes muscorum* (thallus, apothecia)

**Europe, Austria:** Kärnten (Carinthia), Eastern Alps, Gailtaler Alpen, on the mountain Reißkofel c. 11 km E of the market town Kötschach-Mauthen, by the trail from the bivouac along the western crest to the summit, 46°41'10"N / 13°08'10"E, c. 2060 m alt., GF 9344/2, low outcrops of Triassic limestone and fragments of *Cariacetum firmæ*, on soil.

Note 1: *Diploschistes muscorum* is the type host of *Sphaerellothecium arnoldii*.

Note 2: *Sphaerellothecium arnoldii* must not be confused with another lichenicolous fungus occurring on *Diploschistes* species, *Lichenothelia rugosa* (G.Thor) Ertz & Diederich, for which ascospores with an irregular sculpture are diagnostic.

21. VII. 2009

leg. J. Hafellner (76065), det. J. Hafellner

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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**308. *Sphaerellothecium parietinarium* (Linds.) Hafellner & V.John**

in Herzogia 19(1): 168 (2006). – Bas.: *Microthelia parietinaria* Linds., Transactions of the Royal Society of Edinburgh 25: 541 (1869). – Syn.: *Didymosphaeria parietinaria* (Linds.) Sacc. & D.Sacc., Sylloge Fungorum 17: 681 (1905). – *Endococcus parietinarius* (Linds.) Clauzade & Cl.Roux, Champignons lichenicoles non lichenisés (Montpellier): 28 (1976).

Host: *Xanthoria aureola* (thallus)

**Africa, Canary Islands:** Lanzarote, volcano Guanapay E above the village Teguisse, NE margin of the crater, 29°03'30"N / 13°32'55"W, c. 450 m alt., on low outcrops of volcanic conglomerate on the outside of the crater, on rock faces exposed to the N.

Note 1: The type host of *Sphaerellothecium parietinarium* is *Xanthoria parietina*.

Note 2: The host has been named following the species concept outlined by Lindblom & Ekman (Mycological Research 109(2): 187–199, 2005).

9. IV. 1999

leg. J. Hafellner (47437) & A. Hafellner, det. J. Hafellner

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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309. ***Stigmatidium congestum*** (Körb.) Triebel

in Triebel et al., Mycotaxon 42: 290 (1991). – Bas.: *Pharcidia congesta* Körb., Parerga Lichenologica: 470 (1865).

Host: *Lecanora chlarotera* (apothecia)

**Europe, Austria:** Steiermark (Styria), Eastern Alps, Niedere Tauern, Schladminger Tauern, Obertal S of the town Schladming, between Hopfriesen and the inn Tauerngold, 47°19'05"N / 13°41'20"E, c. 1060 m alt., GF 8648/3, riparian forest along the creek, on bark of *Alnus incana*.

Note 1: *Lecanora chlarotera* (f. *rugosella*) is the type host of the species.

Note 2: Roux & Triebel (Bull. Soc. Linn. Provence 45: 483, 1994) reinvestigated the holotype (L-Typenherbar) and designated lectotypes for the heterotypic synonyms *Epicymatia vulgaris* Fuckel and *Epicymatia commutata* Niessl, both also with *Lecanora chlarotera* as type hosts.

Note 3: *Vouxiella lichenicola* is present as admixture on the specimen in GZU and may also be detected on other duplicates.

25. VIII. 2001

leg. J. Hafellner (56865), det. J. Hafellner

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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310. ***Stigmatidium epistigmellum*** (Nyl. ex Vouaux)

Kocourk. & K.Knudsen

in Bryologist 112(3): 579 (2009). – Bas.: *Pharcidia epistigmella* Nyl. ex Vouaux, Bulletin de la Société Mycologique de France 28: 235 (1912).

Host: *Caloplaca bolacina* (thallus, apothecia)

**Northern America, U.S.A.:** California, Los Angeles County, San Clemente Island, between Eel Point and Seal Cove on the W shore of the island, 32°55'00"N / 118°32'15"W, c. 50 m alt., talus a few hundred meters back from the shore, on boulders of volcanic rock.

Note 1: The size of the ascospores in the population distributed here is close to the lower end of variability allowed by Kocourková & Knudsen (Bryologist 112: 579, 2009) and is herewith close to that given in the protologue.

Note 2: The type host of *Stigmatidium epistigmellum* was originally identified as *Caloplaca festiva* but was corrected to *C. luteominia* by Kocourková & Knudsen (l. c.) after revision of the holotype.

16. IV. 1966

leg. R. Santesson (18037), det. R. Santesson

distributed to: BCN, BR, CANB, E, GZU, LE, M, NY, PRM, UPS

Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 311. *Abrothallus parmeliarum* (Sommerf.) Nyl.

in Bulletin de la Société Botanique de la Normandie, 2. sér., 3: 12 (1869). – Bas.: *Lecidea parmeliarum* (“*parmeliorum*”) Sommerf., Supplementum Florae Lapponicae: 176 (1826). – Syn.: *Buellia parmeliarum* (Sommerf.) Tuck., Synopsis of the North American Lichens, Part 2: 106 (1888). – *Buelliella parmeliarum* (Sommerf.) Fink, Lichen Flora of the United States: 372 (1935).

Host: *Platismatia glauca* (thallus, on galls induced by *Nesolechia oxyspora*)

**Africa, Madeira:** Pico dos Estanquinhos at NE edge of the plateau Paul da Serra, uppermost N slopes somewhat below the summit, 32°46'20"N / 17°04'35"W, c. 1600 m alt., *Vaccinium padifolium* shrub among scattered volcanic outcrops and boulders, on twigs of *Vaccinium padifolium*.

Note 1: Two species of *Parmelia* s. str. are mentioned in the protologue as host species, *Parmelia omphalodes* and *P. saxatilis*. By lectotypification the host of the type is *Parmelia saxatilis* (compare Suija et al., Taxon 67(6): 1174, 2018).

Note 2: *A. parmeliarum* must not be confused with a second species (*A. cetrariae* I.Kotte) occasionally found on *Platismatia glauca*. The ascomata of that species develop dispersed on the thallus and are regularly accompanied by the coelomycetous anamorphic state.

17. II. 1990 leg. J. Hafellner (84255) & A. Hafellner, det. J. Hafellner  
distributed to: BR, CANB, GZU, NY, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 312. *Endococcus umbilicariae* (Linds.) Hafellner

in Fritschiana 94: 9 (2019). – Bas.: *Microthelia umbilicariae* Linds., Transactions of the Royal Society of Edinburgh 25: 538 (1869). – Syn.: *Polycoccum umbilicariae* (Linds.) D.Hawksw., Bulletin of the British Museum (Natural History), Botany series 14(2): 171 (1985).

Host: *Lasallia pustulata* (thallus)

**Africa, Madeira:** Pico Escalvado c. 1 km S of Pico do Arieiro, 32°43'00"N / 16°55'45"W, c. 1670 m alt., volcanic cliffs, on steep rock faces exposed to the N difficult to access.

Note 1: *Lasallia pustulata* is the type host of *Endococcus umbilicariae*.

Note 2: *Lasallia* has been reduced to subgeneric rank within *Umbilicaria* (compare Davydov et al., Taxon 66(6): 1282–1303, 2017), but this is not generally accepted.

20. II. 1990 leg. J. Hafellner (27351) & A. Hafellner, det. J. Hafellner  
distributed to: BR, CANB, GZU, NY, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 313. *Nectriopsis lecanodes* (Ces.) Diederich & Schroers

in Sérusiaux et al., *Lejeunia*, n. s., 162: 56 (1999). – Bas.: *Sphaeria Nectria lecanodes* Ces. in Rabenhorst, *Botanische Zeitung* 15: 407 (1857); Rabenhorst, *Herbarium Mycologicum*, ed. 2, no. 525 (1863). – Syn.: *Nectria lecanodes* (Ces.) Fuckel, *Jahrbücher des Nassauischen Vereins für Naturkunde* 23–24: 178 (1870).

Host: *Lobaria macaronesica* (thallus)

**Africa, Canary Islands:** Tenerife, Macizo de Anaga, surroundings of Mirador Pico de Ingles NE above the village Las Mercedes, 28°31'55"N / 16°15'50"W, c. 960 m alt., laurel forest, on bark of *Laurus azorica* agg.

Note 1: The type host of *Nectriopsis lecanodes* is *Peltigera canina*.

Note 2: The original spelling of the name is “*Sph. Nectria lecanodes* Ces. mss.” From the previous page (p. 406) it is evident that “*Sph.*” is an abbreviation of the generic name *Sphaeria*. Therefore, the basionym is *Sphaeria lecanodes* and not *Nectria lecanodes* as often cited. The text of the protologue was reprinted together with the exsiccatum label, and there the entire text is signed by “Cesati”, indicating that both name and validating description were contributed by Cesati. Therefore, the correct citation of the author of the taxon is “Ces.” (ICN 46.2).

Note 3: *Tremella lobariacearum* and *Plectocarpon macaronesiae* have been observed as admixture on the specimen in GZU and may also be present on other duplicates.

8. II. 1989

leg. J. Hafellner (84233), det. J. Hafellner

distributed to: BR, CANB, GZU, NY, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 314. *Nesolechia oxyspora* (Tul.) A.Massal.

in *Miscellanea Lichenologica*: 43 (1856). – Bas.: *Abrothallus oxysporus* Tul., *Annales des Sciences Naturelles, Botanique*, sér. 3, 17: 116 (1852). – Syn.: *Lecidea oxyspora* (Tul.) Nyl., *Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg* 3: 185 (1855). – *Epithallia oxyspora* (Tul.) Nyl., *Öfversigt af Kongl. Vetenskaps-Akademiens Forhandlingar* 12: 9 (1855). – *Biatora oxyspora* (Tul.) Tuck., *A Synopsis of the North American Lichens* 2: 29 (1888). – *Phacopsis oxyspora* (Tul.) Triebel & Rambold, *Nova Hedwigia* 47: 300 (1988). – *Punctelia oxyspora* (Tul.) Divakar, Crespo & Lumbsch in Divakar et al., *Fungal Diversity* 84: 114 (2017).

Host: *Platismatia glauca* (thallus)

**Africa, Madeira:** NW of Montaña de las Negrinas, near the turnoff to Alajeró, 28°06'00"N / 17°13'50"W, c. 1380 m alt., pine-reforestation, on bark of *Pinus* spec.

Note 1: Two hosts are listed in the protologue: *Platismatia glauca* (sub *Cetraria* g.) and *Parmelia saxatilis*. The host of the lectotype is *Parmelia saxatilis* (Triebel et al., *Bryologist* 98: 78, 1995).

Note 2: Following the taxon concept outlined by Triebel et al. (*Bryologist* 98: 73, 1995), three infra-specific taxa can be distinguished in *Nesolechia oxyspora*. Of these, *N. oxyspora* var. *oxyspora* is able to infect species of *Everniastrum*, *Melanohalea*, *Parmelia*, *Platismatia*, and *Punctelia*.

14. II. 1991

leg. J. Hafellner (34583) & A. Hafellner, det. J. Hafellner

distributed to: BR, CANB, GZU, NY, UPS

Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 315. *Polycoccum microcarpum* Diederich & Etayo

in Etayo & Diederich, The Lichenologist 30(2): 111 (1998).

Host: *Cladonia digitata* (thallus)

**Europe, Austria:** Steiermark (Styria), Eastern Alps, Nördliche Kalkalpen, Ennstaler Alpen, Gesäuse, in the secondary valley Hartelsgraben ca. 3 km W of the village Hiefrau, just N of the 2<sup>nd</sup> bridge, 47°35'15"N / 14°42'25"E, c. 660 m alt., GF 8454/1, mixed forest with codominant *Picea abies*, *Abies alba* and *Fagus sylvatica*, on decaying stumps.

Note 1: The type host of *Polycoccum microcarpum* is an undetermined *Cladonia* species. On the listed paratypes the following host species are mentioned: *Cladonia bellidiflora*, *Cladonia digitata*, *Cladonia cervicornis*.

Note 2: A coelomycetous anamorphic state supposed to belong to *Polycoccum microcarpum* has been additionally noticed on the specimen held at GZU and it may also be present on the other duplicates.

26. VIII. 2004 leg. J. Hafellner (64100) & J. Miadlikowska, det. J. Hafellner  
distributed to: BR, CANB, GZU, NY, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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### 316. *Sphaerellothecium contextum* Triebel

in Bibliotheca Lichenologica 35: 76 (1989).

Host: *Protoparmelia badia* (thallus, apothecia)

**Europe, Austria:** Steiermark (Styria), Eastern Alps, Gurktaler Alpen, on the mountain Kirbisch ca. 11 km SW of the town Murau, SW above of the village St. Lorenzen, a short distance below the summit on slope exposed to NE, 47°03'05"N / 14°03'05"E, c. 2100 m alt., GF 8950/1, outcrops and boulder fields of Palaeozoic siliceous schist in dwarf shrub belt, on inclined rock faces.

Note 1: The type host of *Sphaerellothecium contextum* is *Sporastatia testudinea*.

Note 2: The species was first noticed and thoroughly investigated but misidentified by Zopf (Nova Acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum 70: 178–185, 1897, sub *Sphaerellothecium araneosum*).

24. VIII. 2003 leg. J. Hafellner (62324), det. J. Hafellner  
distributed to: BR, CANB, GZU, NY, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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**317. *Stigmidium epistigmellum* (Nyl. ex Vouaux) Kocourk. & K.Knudsen**

in Bryologist 112(3): 579 (2009). – Bas.: *Pharcidia epistigmella* Nyl. ex Vouaux, Bulletin de la Société Mycologique de France 28: 235 (1912).

Host: *Caloplaca bolacina* (thallus, apothecia)

**Northern America, U.S.A.:** California, Los Angeles County, Santa Catalina Island, E side of Isthmus Cove, 33°26'35"N / 118°29'25"W, c. 20 m alt., rock outcrops not far from the seashore, on volcanic rocks.

Note 1: The size of the ascospores in the population distributed here is close to the lower end of variability allowed by Kocourková & Knudsen (Bryologist 112: 579, 2009) and is herewith close to the size given in the protologue.

Note 2: The type host of *Stigmidium epistigmellum* was originally identified as *Caloplaca festiva* but was corrected to *C. luteominia* by Kocourková & Knudsen (l. c.) after revision of the holotype.

Note 3: Interestingly, *Caloplaca luteominia*, also present on the duplicates sent to UPS and NY, is not infested.

4. IV. 1966 leg. R. Santesson (17221b), det. R. Santesson  
distributed to: BCN, BR, CANB, GZU, NY, PRM, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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**318. *Stigmidium heterodermiae* Etayo**

in Bibliotheca Lichenologica 84: 124 (2002).

Host: *Heterodermia leucomelos* s.l. (thallus)

**Africa, Canary Islands:** El Hierro, Mirador de Bascos W above the village Sabinosa, 27°45'15"N / 18°07'05"W, c. 660 m alt., at the upper edge of the cliffs exposed to the NW, on low outcrops of volcanic rocks.

Note 1: The type host of *Stigmidium heterodermiae* is *Heterodermia boryi*, in the past often treated as infraspecific taxon of *Heterodermia leucomelos*. For the *Heterodermia leucomelos* group the genus *Leucodermia* has been proposed (see Mongkolsuk et al., Phytotaxa 235(1): 1–66, 2015).

Note 2: The original spelling of the epithet of the host lichen will be protected by conservation (see May, Taxon 66: 487, 2017) and the change to the female gender as occasionally proposed ("*leucomelaena*") is therefore obsolete.

5. II. 1995 leg. J. Hafellner (83976) & A. Hafellner, det. J. Hafellner  
distributed to: BR, CANB, GZU, NY, UPS



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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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319. ***Stigmidium tabacinae*** (Arnold) Triebel

in Bibliotheca Lichenologica 35: 236 (1989). – Bas.: *Pharcidia tabacinae* Arnold, Flora (Regensburg) 64: 176 (1881). – Syn.: *Sphaerulina tabacinae* (Arnold) Vouaux, Bulletin de la Société Mycologique de France 29: 34 (1913).

Host: *Toninia toepfferi* (thallus)

**Africa, Canary Islands:** La Gomera, SE above of the village Chipude, saddle NE of the mountain La Fortaleza, 28°06'08"N / 17°16'25"W, c. 1130 m alt., open vegetation on the ridge, on volcanic soil.

Note 1: The type host of *Stigmidium tabacinae* is *Psora tabacina* auct., a species now usually treated under the name *Toninia tristis*.

Note 2: Triebel (l. c.) designated a lectotype originating from northern Italy and preserved in M.

20. II. 1991 leg. J. Hafellner (83951) & A. Hafellner, det. J. Hafellner  
distributed to: BR, CANB, GZU, NY, UPS

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Hafellner J. 2019: Lichenicolous Biota (Nos 301–320). - Fritschiana 94: 25–42.

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320. ***Tremella cladoniae*** Diederich & M.S.Christ.

in Diederich, Bibliotheca Lichenologica 61: 65 (1996).

Host: *Cladonia coniocraea* (thallus)

**Europe, Austria:** Steiermark (Styria), Eastern Alps, Northern Limestone Alps, Ennstaler Alpen, Tamischbachturm massif SW of the village Großreifling, SE-slopes of Bärenstein, by the trail from Tamischbachgraben to Bärensattel, 47°37'35"N / 14°41'35"E, c. 1000 m alt., GF 8354/3, mixed forest, on mossy bark at the base of trunks of *Fagus sylvatica*.

Note 1: The type host of *Tremella cladoniae* is an unnamed *Cladonia*.

Note 2: The basidiomata of the macroscopically similar *Heterocephalacria bachmannii* (Diederich & M.S.Christ.) Millanes & Wedin are usually found on the upper parts of podetia of various *Cladonia* species. For distinguishing microscopical characters between the two species compare Diederich (Biblioth. Lichenol. 60: 32 Fig. 10 and 67 Fig. 30, 1996).

24. VII. 2005 leg. J. Hafellner (67396), det. J. Hafellner  
distributed to: BR, CANB, GZU, NY, UPS

## Taxon Synopsis:

Taxon	Exs. no.
Ascomycota	
Arthoniomycetes	
Lecanoromycetes (incl. Ostropomycetidae)	
<i>Nesolechia oxyspora</i> .....	314
<i>Phacopsis cephalodioides</i> .....	306
Leotiomycetes	
Sordariomycetes (incl. Hypocreales)	
<i>Lichenochora obscuroides</i> .....	305
<i>Nectriopsis lecanodes</i> .....	313
Eurotiomycetes (incl. Verrucariales and Mycocaliciales)	
<i>Endococcus umbilicariae</i> .....	303, 312
<i>Sphaerellothecium arnoldii</i> .....	307
<i>Sphaerellothecium contextum</i> .....	316
<i>Sphaerellothecium parietinarium</i> .....	308
<i>Stigmidium congestum</i> .....	309
<i>Stigmidium epistigmellum</i> .....	310, 317
<i>Stigmidium heterodermiae</i> .....	318
<i>Stigmidium tabacinae</i> .....	319
Dothideomycetes	
<i>Abrothallus parmeliarum</i> .....	311
<i>Cercidospora epipolytropa</i> .....	301
<i>Cercidospora stereocaulorum</i> .....	302
<i>Polycoccum microcarpum</i> .....	315
Anamorphic Fungi (unclassified)	
Hyphomycetes	
Coelomycetes	
Basidiomycota	
Agaricomycetes	
Pucciniomycetes	
Tremellomycetes	
<i>Heterocephalacria bachmannii</i> .....	304
<i>Tremella cladoniae</i> .....	320

## Host Index:

Host taxon	Lichenicolous taxon	Exs. no.
<i>Caloplaca bolacina</i> .....	<i>Stigmidium epistigmellum</i> .....	310, 317
<i>Cladonia coniocraea</i> .....	<i>Tremella cladoniae</i> .....	320
<i>Cladonia digitata</i> .....	<i>Polycoccum microcarpum</i> .....	315
<i>Cladonia macroceras</i> .....	<i>Heterocephalacria bachmannii</i> .....	304
<i>Diploschistes muscorum</i> .....	<i>Sphaerellothecium arnoldii</i> .....	307
<i>Heterodermia leucomelos</i> .....	<i>Stigmidium heterodermiae</i> .....	318
<i>Hypomyces tubulosa</i> .....	<i>Phacopsis cephalodioides</i> .....	306
<i>Lasallia pustulata</i> .....	<i>Endococcus umbilicariae</i> .....	303, 312
<i>Lecanora chlarotera</i> .....	<i>Stigmidium congestum</i> .....	309
<i>Lecanora polytropa</i> .....	<i>Cercidospora epipolytropa</i> .....	301
<i>Lobaria macaronesica</i> .....	<i>Nectriopsis lecanodes</i> .....	313
<i>Phaeophyscia orbicularis</i> .....	<i>Lichenochora obscuroides</i> .....	305
<i>Platismatia glauca</i> .....	<i>Abrothallus parmiliarum</i> .....	311
<i>Platismatia glauca</i> .....	<i>Nesolechia oxyspora</i> .....	314
<i>Protoparmelia badia</i> .....	<i>Sphaerellothecium contextum</i> .....	316
<i>Stereocaulon spec.</i> .....	<i>Cercidospora stereocaulorum</i> .....	302
<i>Toninia toepfferi</i> .....	<i>Stigmidium tabacinae</i> .....	319
<i>Xanthoria aureola</i> .....	<i>Sphaerellothecium parietinarium</i> .....	308

## Geographic Index:

### BIOGEOGRAPHIC UNITS (see BRUMMITT 2001)

<b>Country</b> (or Archipelago)	<b>Lichenicolous taxon</b>	<b>Exs. no.</b>
1. EUROPE		
Austria.....	<i>Cercidospora epipolytropa</i> .....	301
.....	<i>Cercidospora stereocaulorum</i> .....	302
.....	<i>Heterocephalacria bachmannii</i> .....	304
.....	<i>Lichenochora obscuroides</i> .....	305
.....	<i>Polycoccum microcarpum</i> .....	315
.....	<i>Sphaerellothecium arnoldii</i> .....	307
.....	<i>Sphaerellothecium contextum</i> .....	316
.....	<i>Stigmidium congestum</i> .....	309
.....	<i>Tremella cladoniae</i> .....	320
2. AFRICA		
Canary Islands (belonging to Spain)		
.....	<i>Endococcus umbilicariae</i> .....	303
.....	<i>Nectriopsis lecanodes</i> .....	313
.....	<i>Sphaerellothecium parietinarium</i> .....	308
.....	<i>Stigmidium heterodermiae</i> .....	318
.....	<i>Stigmidium tabacinae</i> .....	319
Madeira (belonging to Portugal)		
.....	<i>Abrothallus parmeliarum</i> .....	311
.....	<i>Endococcus umbilicariae</i> .....	312
.....	<i>Nesolechia oxyspora</i> .....	314
.....	<i>Phacopsis cephalodioides</i> .....	306
3. ASIA TEMPERATE		
4. ASIA TROPICAL		
5. AUSTRALASIA		
6. PACIFIC		
7. NORTHERN AMERICA		
U.S.A. ....	<i>Stigmidium epistigmellum</i> .....	310, 317
8. SOUTHERN AMERICA (including CENTRAL AMERICA)		
9. ANTARCTIC		

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ISSN 1024-0306