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Three former taxa of *Cucurbitaria* and considerations on *Petrakia* in the Melanommataceae

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Abstract

Based on phylogenetic analyses of an ITS-LSU-SSU-*rpb2*-*tef1* sequence data matrix three taxa once classified in *Cucurbitaria* are referred to the Melanommataceae. *Cucurbitaria rhododendri*, also known as *Melanomma rhododendri*, is not congeneric with the generic type of *Melanomma*, *M. pulvis-pyrius* and thus classified in the new genus *Alpinaria*. *Cucurbitaria piceae*, known as *Gemmamyces piceae*, the cause of the *Gemmamyces* bud blight of *Picea* spp., belongs also to the Melanommataceae. The name *Gemmamyces* is conserved. For *Cucurbitaria obducens*, also known as *Teichospora obducens*, the new genus *Praetumpfia* is described, as it cannot be accommodated in any known genus. All species are redescribed and epitypified. Based on sequence data and morphology, *Blastostroma*, *Mycodidymella* and *Xenostigmina* are synonyms of *Petrakia*. The genus *Petrakia* is emended. We also provide sequences of additional markers for *Beverwykella pulmonaria*, *Melanomma pulvis-pyrius*, *Petrakia echinata* and *Pseudotrichia mutabilis*.

Keywords

Ascomycota; *Gibberidea*; *Megaloseptoria*; phylogenetic analysis; Pleosporales; pyrenomycetes

Of the five genera Barr (1990a) included in Melanommataceae, *Strickeria* was shown by Jaklitsch et al. (2016a) to be a member of the Xylariales, *Keissleriella* was treated by Tanaka et al. (2015) in detail in the Lentitheciaceae, and *Ostropella* was found by Mugambi and Huhndorf (2009) to belong to the Platystomaceae. As a consequence, only the two genera *Melanomma* and *Byssosphaeria* remained in the family, while other authors assigned several additional genera to the Melanommataceae, often with a question mark. According to Mugambi & Huhndorf (2009) *Bertiella*, *Herpotrichia*, *Pleomassaria* and *Pseudotrichia* belong to the family. Based on earlier compilations, Tian et al. (2015, p. 269) recently recognised 20 genera in the Melanommataceae, including the two new genera *Muriformistrickeria* and *Pseudostrickeria* having muriform ascospores. Of the 20 genera they included eleven in their phylogenetic tree of the Melanommataceae and three in the

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adjacent Pleomassariaceae. No DNA data have been published for *Anomalemma*/*Exosporiella*, *Asymmetricospora*, *Bicrouania*, *Calyptronectria*, *Mamillisphaeria*, *Navicella* and *Nigrolentilocus*. *Ohleria* does not belong to the Melanommataceae as recently shown by Jaklitsch & Voglmayr (2016), and also *Navicella* is unlikely to be a member of the Melanommataceae. The DNA sources of *Bertiella macrospora* (Mugambi & Huhndorf 2009) are from the Americas and Kenya, while its type was collected in Italy. It remains thus to be shown that these fungi are indeed the same species and congeneric. As in part already mentioned by Tian et al. (2015), it should be noted that some species included in their tree do not or may not bear the correct generic name, because the respective generic type has not been sequenced. This affects *Aposphaeria* (*A. pulviscula*), *Herpotrichia*, *Monotosporella*, *Mycopappus* and *Phragmocephala*. Here we give an account of two additional genera with muriform ascospores and one with phragmospores, and redescribe *Cucurbitaria* (*Teichospora*) *obducens*, *Cucurbitaria* (*Melanomma*) *rhododendri* and *Cucurbitaria* (*Gemmamyces*) *piceae* / *Megaloseptoria mirabilis*. In addition, we provide a brief account on the genera *Blastostroma*, *Mycodidymella* and *Xenostigmina*, which are considered synonyms of *Petrakia* based on sequence data and morphology.

Materials and methods

Isolates and specimens

All newly prepared isolates used in this study originated from ascospores or conidia of fresh specimens. Numbers of strains including NCBI GenBank accession numbers of gene sequences used to compute the phylogenetic trees are listed in Tab. 1. Representative isolates have been deposited at the CBS-KNAW Fungal Biodiversity Centre, Utrecht, The Netherlands (CBS). Details of the specimens used for morphological studies are listed in the Taxonomy section under the respective descriptions. Cultures of following taxa were sequenced but are not further treated here: *Beverwykella pulmonaria*: THE NETHERLANDS, Baarn, January 1951, leg. A.L. van Beverwijk (CBS 283.53; ex-holotype culture). *Melanomma pulvis-pyrius*: AUSTRIA, Kärnten, St. Margareten im Rosental, Gupf, at Brici (“Writze”), on twigs of *Corylus avellana*, 25 July 2009, leg. W. Jaklitsch (WU 31375; culture from ascospores: MPP). *Petrakia echinata*: AUSTRIA, Niederösterreich, Wöllersdorf, Marchgraben, on leaves of *Acer pseudoplatanus*, 20 September 2009, leg. H. Voglmayr (WU 36921; culture from conidia: L55); Oberösterreich, Raab, Wetzlbach, on leaves of *Acer pseudoplatanus*, 5 September 2009, leg. H. Voglmayr (WU 36922; culture from conidia: L54). *Pseudotrichia mutabilis*: AUSTRIA, Vienna, 19th district, at Höhenstraße near Wildgrubgasse, on stromata of *Rosellinia corticium* on twigs of *Acer pseudoplatanus*, 16 November 2013, leg. W. Jaklitsch (WU 36923; culture from ascospores: PM1). Specimens have been deposited in the Herbarium of the University of Vienna (WU).

Culture preparation, growth rate determination and phenotype analysis

Cultures were prepared and maintained as described previously (Jaklitsch 2009). Microscopic observations were made in tap water except where noted. Morphological analyses of microscopic characters were carried out as described earlier (Jaklitsch 2009). Methods of microscopy included stereomicroscopy using Nikon SMZ 1500 and Nomarski differential interference contrast (DIC) using the compound microscope Nikon Eclipse

E600. Images and data were gathered using Nikon Coolpix 4500 and Nikon DS-U2 digital cameras and measured with NIS-Elements D v. 3.0. Measurements are reported as maximum and minimum in parentheses and the range representing the mean plus and minus the standard deviation of a number of measurements given in parentheses.

DNA extraction and sequencing methods

The extraction of genomic DNA was performed as reported previously (Voglmayr & Jaklitsch 2011, Jaklitsch et al. 2012) using the DNeasy Plant Mini Kit (QIAgen GmbH, Hilden, Germany). The following loci were amplified and sequenced: the complete internally transcribed spacer region (ITS1-5.8S-ITS2) and a c. 900 bp fragment of the large subunit nuclear ribosomal DNA (nLSU rDNA), amplified and sequenced as a single fragment with primers V9G (de Hoog & Gerrits van den Ende 1998) and LR5 (Vilgalys & Hester 1990); a c. 1.1 kb fragment of the small subunit nuclear ribosomal DNA (nSSU rDNA) with primers SL1 (Landvik et al. 1997) and NSSU1088 (Kauff & Lutzoni 2002); a c. 1.2 kb fragment of the RNA polymerase II subunit 2 (*rpb2*) with primers fRPB2-5f and fRPB2-7cr (Liu et al. 1999); and a c. 1.3 kb fragment of the translation elongation factor 1-alpha (*tef1*) with primers EF1-728F (Carbone & Kohn 1999) and TEF1LLErev (Jaklitsch et al. 2005). PCR products were purified using an enzymatic PCR cleanup (Werle et al. 1994) as described in Voglmayr & Jaklitsch (2008). DNA was cycle-sequenced using the ABI PRISM Big Dye Terminator Cycle Sequencing Ready Reaction Kit v. 3.1 (Applied Biosystems, Warrington, UK) with the same primers as in PCR; in addition, primers ITS4 (White et al. 1990) and LR3 (Vilgalys & Hester 1990) were used for the ITS-LSU region. Sequencing was performed on an automated DNA sequencer (3730xl Genetic Analyzer, Applied Biosystems).

Analysis of sequence data

For phylogenetic analyses, a combined matrix of ITS-LSU, SSU, *rpb2* and *tef1* sequences was produced. GenBank sequences of Melanommataceae were selected according to Tian et al. (2015), and *Cyclothyriella rubronotata* (Cyclothyriellaceae) was selected as outgroup according to Jaklitsch & Voglmayr (2016). All alignments were produced with the server version of MAFFT (www.ebi.ac.uk/Tools/mafft), checked and refined using BioEdit version v. 7.0.9.0 (Hall 1999). For phylogenetic analyses, all sequence alignments were combined. As for *Seifertia azaleae* ITS and LSU sequences were not available for the same accessions, we decided to combine the ITS sequence from DAOM 239135 with the LSU sequence from DAOM 239136, to obtain an appropriate resolution of the tree. We consider this justified as the sequences originate from a reliable source (Seifert et al. 2007). The final matrix contained 1424 nucleotide characters from the ITS-LSU, 967 from the SSU, 1088 from *rpb2* and 1057 from *tef1*.

Maximum parsimony (MP) analysis of the combined matrix was performed using a parsimony ratchet approach. For this, a nexus file was prepared using PRAP v. 2.0b3 (Müller 2004), implementing 1000 ratchet replicates with 25% of randomly chosen positions upweighted to 2, which was then run with PAUP v. 4.0a150 (Swofford 2002). The resulting best trees were then loaded in PAUP and subjected to heuristic search with TBR branch swapping (MULTREES option in effect, steepest descent option not in effect). Bootstrap analysis with 1000 replicates was performed using 5 rounds of replicates of heuristic search with random addition of sequences and subsequent TBR branch swapping (MULTREES option in effect, steepest descent option not in effect) during each bootstrap replicate, with each replicate limited to 1 million rearrangements. In all MP analyses molecular characters were unordered and given equal weight; analyses were performed with gaps treated as missing data; the COLLAPSE command was set to minbrlen.

Maximum likelihood (ML) bootstrap analyses were performed with RAxML (Stamatakis 2006) as implemented in raxmlGUI 1.3 (Silvestro & Michalak 2012), using the ML + rapid bootstrap setting and the GTRGAMMAI substitution model with 1000 bootstrap replicates. The matrix was partitioned for the individual gene regions, and substitution model parameters were calculated separately for them.

Results and discussion

The newly sequenced accessions of *Alpinaria rhododendri*, *Gemmamyces piceae*, *Melanomma pulvispyrius*, *Petrakia echinata* and *Pseudotrichia mutabilis* match other accessions for which sequence data are already available in GenBank. Of the 4536 nucleotide characters included in the phylogenetic analyses, 923 are parsimony informative (274 of ITS-LSU, 13 of SSU, 409 of *rpb2*, 227 of *tef1*). The parsimony analysis revealed 6 MP trees of 2838 steps, one of which is shown as Fig. 1. Tree topologies of all MP trees are similar except for slightly different positions of *Beverwykella pulmonaria*, *Herpotrichia juniperi* and *Muriformistrickeria rubi* (not shown).

In the phylogenetic analyses, the deeper nodes mostly lack significant support (Fig. 1). Sister group relationship of Pleomassariaceae to Melanommataceae is unsupported. While *Aposphaeria* and *Herpotrichia* are polyphyletic, the genus *Byssosphaeria* is a highly supported monophylum. The strain CBS 543.70 named *Aposphaeria populina* is conspecific with *Melanomma pulvis-pyrius*. *Gemmamyces piceae* and *Praetumpfia obducens* are contained within the same subclade, but without significant support. The sister-group relationship of *Seifertia* to *Petrakia* receives high bootstrap support. We consider *Mycopappus aceris* and *Xenostigmina zilleri*, which are conspecific (Crous et al. 2009), to be congeneric with *Petrakia echinata*, based on the close, highly supported phylogenetic relationship as well as similar morphology of sexual and asexual morphs.

Taxonomy

Alpinaria Jaklitsch & Voglmayr, **gen. nov.** – MycoBank no.: MB 819135

Etymology. – A combination of alpine (referring to its habitat) and *Cucurbitaria* (referring to the original generic name of its type species).

Description. – Ascomata erumpent from bark, solitary or in groups, more or less globose, black; apex with a central ostiolar perforation or with a papilla. Peridium pseudoparenchymatous, brown. Hamathecium of septate paraphyses. Asci cylindrical, bitunicate, fissitunicate, containing 8 ascospores in uniseriate arrangement. Ascospores ellipsoid to fusoid, brown, with transverse eusepta.

Asexual morph not known.

Type species. – ***Alpinaria rhododendri*** (Niessl) Jaklitsch & Voglmayr.

Alpinaria rhododendri (Niessl) Jaklitsch & Voglmayr, **comb. nov.** – Fig. 2.

MycoBank no.: MB 819136

Basionym. – *Cucurbitaria rhododendri* Niessl, Verh. Nat. Ver. Brünn 10: 200. 1872.

≡ *Gibberidea rhododendri* (Niessl) Petr., Ann. Mycol. 32: 330. 1934; nom. illegit.

= *Melanomma rhododendri* Rehm, Ber. Naturhist. Ver. Augsburg 26: 48. 1881.

≡ *Gibberidea rhododendri* (Rehm) Petr., Krypt. Forsch. (München) 2: 160. 1931.

≡ *Gibberidea rhododendri* (Rehm) Kirschst., Hedwigia 81: 206, 1944; nom. illegit.

Holotype. – AUSTRIA, Steiermark, Liezen, Bosruck, on twigs of *Rhododendron hirsutum*, August 1885, leg. G. Niessl (M-0281615!).

Epitype, here designated. – AUSTRIA, Osttirol, Lienz, Prägraten am Großvenediger, Wallhorn, Bodenalm, on twigs of *Rhododendron ferrugineum*, 18 June 2015, leg. H. Voglmayr & W. Jaklitsch (WU 36914; ex-epitype culture CBS 141994 = MP4; MBT373732).

Description. – Ascomata (270)325–505 (630) µm diam. (n=65), erumpent from bark, after peeling of the bark superficial on wood, solitary or in groups of 2–5(20) individuals, more or less globose, often fusing laterally, black; sometimes on a greyish to black crust; apex with a central rounded ostiolar perforation or with a small, apically often flattened papilla 50–160 µm diam. Surface slightly roughened to irregularly tuberculate. – Peridium 20–50 µm thick, sometimes thickened in varying regions, pseudoparenchymatous, of dark brown angular cells, becoming paler and thinner-walled toward the interior, in surface view exhibiting varying regions of *textura prismatica* and *t. angularis* of thick-walled reddish brown cells (4.5)7–12(15) × (3.5)4.5–7(8.5) µm (n=30). – Hamathecium of branched, apically free, 1–3.5(4) µm wide paraphyses. Asci (94)98–114(123) × (8)8.5–10(10.5) µm (n=20), cylindrical, bitunicate, fissitunicate, containing 8 ascospores in uniseriate arrangement; apex thick-walled, containing a narrow, inversely funnel-shaped ocular chamber; stipe short, base knob-like. Ascospores (12.5)14.3–17.0(18.5) × (5.0)5.5–6.6(7.5) µm, l/w (2.0)2.4–2.8(3.1) (n = 108), ellipsoid to fusoid, brown, with 3 eusepta appearing thicker than the wall, constricted at the median primary septum, medium to greyish brown, darkening in 3% KOH, upper part or second cell slightly enlarged, end cells sometimes slightly lighter, obtuse, with one large guttule per cell, smooth. Asexual morph not known.

Habitat. – On twigs or buds of *Rhododendron* spp., in Europe on *R. hirsutum* and *R. ferrugineum* in the Alps.

Distribution. – Europe, North America, Asia (Himalaya, fide Müller 1959).

Other material examined. – AUSTRIA, Kärnten, Feldkirchen, Turrach, Schwarzsee, grid square 9049/3, on twigs of *Rhododendron ferrugineum*, 18 August 2004, leg. W. Jaklitsch W.J. 2604 (WU 36915); Steiermark, Liezen, Kleinsölk, Putzentalalm, grid square 8749/1, on twigs of *Rhododendron hirsutum*, 6 August 2003, leg. W. Jaklitsch W.J. 2308 (WU 36917); Tirol, Imst, Kühtai, betweeen Haggen and Kühtai, near Zirmbachalm, grid square 8732/3, on twigs of *Rhododendron ferrugineum*, 3 September 2003, leg. W. Jaklitsch W.J. 2369 (WU 36918); Osttirol, Lienz, Defereggental, Staller Sattel, grid square 9139/1, on twigs of *Rhododendron ferrugineum*, 4 September 2003, leg. W. Jaklitsch W.J. 2373 (WU 36916); Vorarlberg, Bregenz, Damüls, shortly after the village heading to Laternsertal, grid square 8725/1, on twigs of *Rhododendron ferrugineum*, 1 September 2004, leg. W. Jaklitsch W.J. 2656 (WU 36919).

Notes and discussion. – A detailed description was given by Petrak (1931). A hypostroma as described by him is only rarely present as a crust and may not belong to the fungus or be the remaining basal peridium of old ascomata. He, like other mycologists, treated this taxon in *Gibberidea*, whereas Holm (1968) confined this genus to *G. visci* and referred *G. rhododendri* to *Melanomma*. He wrote “Probably its oldest validly published name is·*Cucurbitaria rhododendri* Niessl, which, however, cannot be transferred to *Melanomma*, because of *Melanomma rhododendri* Rehm, based on another type”. Winter (1887) and Petrak (1934, 1963a) cited the exsiccatum Rehm Ascomyceten No. 186 (fascicle 4, 1872 or 1873) as reference for *Melanomma rhododendri* Rehm. However, when distributed the specimen labels did not contain a diagnosis but only the collection data (including the date 8/1872), and the taxon was only validly published in the schedae of Rehm’s Ascomyceten in 1881 (Rehm 1881). Thus *Cucurbitaria rhododendri* in Niessl (1872) is the earliest name for the fungus, as noted by Petrak (1934) and Holm (1968). In his account of *Melanomma* names, Saccardo (1878, p. 345) first synonymised Niessl’s and Rehm’s taxa and listed it as *Melanomma rhododendri* (Niessl) Rehm, ignoring that they are based on different types. When Rehm (1881) formally described *Melanomma rhododendri* as a new species, he cited Niessl’s *Cucurbitaria* as a synonym but with the remark “sec. Saccardo”. Holm (1968) argued that this “can be interpreted as reservation on Rehm’s part” and is therefore not in conflict with ICN Art. 52.2, rendering *Melanomma rhododendri* Rehm a valid name which is a heterotypic synonym of *Cucurbitaria rhododendri* Niessl. We here follow Holm’s arguments.

Due to its alpine habitat, *Alpinaria rhododendri* is often not well-developed, and most of the available material contains only a small portion of well-developed asci. Ascospores soon collapse laterally, as was already documented in the protologue by Niessl (1872) as constrictions. Characteristic for the fungus seems to be the alternation in thick-walled *t. prismatica* and *t. angularis* of the peridial surface, which is obviously responsible for its tuberculate or irregular appearance. An American collection (Mugambi & Huhndorf 2009, as *Melanomma rhododendri*) is conspecific with our material, which confirms its occurrence in North America. That specimen was collected in the Great Smoky Mountains National Park in Tennessee on *Rhododendron* sp. (A. Miller, pers. comm). We cannot rule out that similar fungi occur on other hosts, e.g. other species of *Rhododendron* outside Europe, therefore we epitypify *C. rhododendri*. Other hosts such as *Kalmia*, *Ledum* or *Vaccinium*, as given by Holm (1968) need to be verified.

Gemmamyces piceae (Borthw.) Casagr., Phytopath. Z. 66: 119. 1969. – Fig. 3.

Basionym. – *Cucurbitaria piceae* Borthw., Notes Roy. Bot. Gdn Edinb. 4: 261. 1909.

= *Megaloseptoria mirabilis* Naumov, Morbi Plant. Script. Sect. Phytopath. Hort. Bot. Prince. USSR 14: 144. 1925.

= *Megalospora gemmicida* Naumov, Mater. Mikol. Fitopat. Ross. 6: 10. 1927.

= *Gemmamyces piceicola* Z.Q. Yuan, in Yuan & Wang, Mycotaxon 53: 374. 1995.

Lectotype of *Cucurbitaria piceae* designated by Shoemaker (1967). – UK, SCOTLAND, Abercairney, on buds of *Picea pungens*, May 1906, leg. A. W. Borthwick (E 00456086!).

Epitype, here designated. – AUSTRIA, Niederösterreich, Zwettl, Ottenschlag, Neuhof, on buds of *Picea pungens*, 22 May 2016, leg. W. Jaklitsch (WU 36906; ex-epitype culture, from ascospores: CBS 141759 = C251; MBT373733).

Description. – Hypostroma either confined to a *t. intricata* of 2–6(–8) μm wide hyphae inside the host or continuing above the host surface as a flat layer or forming stipes of dense dark brown, moderately thick-walled *t. intricata* to *t. epidermoidea* bearing ascomata or pycnidia. – Outer stroma margin delimited by a covering of a dark brown, amorphous, resinous substance incrusting surface hyphae. – Ascomata (225)315–580(875) μm diam. (n = 38), (245)300–525(720) μm high (n = 18), superficial, aggregated or clustered in groups on the hypostroma, often in large numbers, stipitate or not, very variable in shape, globose, turbinate or clavate, sometimes cylindrical or strongly laterally compressed and spathulate, sometimes laterally fused bearing 2–3 ostiolar papillae, black, surface warted or cracked into plates. – Ostiolar papilla when present apically flattened, (80)82–112(138) μm diam. (n = 20), often absent or inconspicuous; ostioles (73)86–118(122) μm long (n = 12), periphysate. – Peridium pseudoparenchymatous, thickened near the apex and (64)71–96(109) μm thick, at the sides (36)42–62(67) μm thick and at the base (43)61–162(205) μm (n = 12); base often vertically extended and coalescing with the hypostroma; peridium consisting of a brown *t. angularis* of (4.5)6–12.5(20) μm (n = 60) wide cells, coarse at the surface and covered by dark brown amorphous resin, becoming gradually paler, smaller and thinner-walled towards the inside, turning olivaceous-black in 3 % KOH; at the apex an additional layer of hyaline to pale brownish, compressed, thin-walled cells (3)4–8(11.5) μm (n = 66) present. – Hamathecium forming a dense matrix of narrow pseudoparaphyses (1.5)2–3.5(4) μm wide. – Asci (184)193–248(285) × (22)27–35.5(36.5) μm (n = 14), oblong to subclavate, bitunicate, fissitunicate, with thick endotunica, a small but distinct ocular chamber and an inconspicuous apical ring (6.5)8–11(11.5) × 2–3.3(4)μm (n = 18) turning faintly reddish in Congo Red after KOH pre-treatment, a short stipe and containing (4)8 initially uni-, upon maturation biseriate ascospores. Hymenium becoming detached from the basal peridium in 3% KOH. – Ascospores (35.5)42–56(67) × (13)15.5–20(24.5) μm, l/w (1.9)2.5–3.1(3.5) (n = 72), fusoid, less commonly broadly ellipsoid, with (3)7–9(12) transverse and 1–2(4) longitudinal septa, slightly constricted at the slightly eccentric primary septum, first hyaline, turning yellowish to yellowbrown or pale brown at maturity, slowly turning olivaceous in 3% KOH when mature, smooth.

Pycnidia (230)275–475(566) µm diam., (230)343–520(602) µm high (n = 20), superficial, aggregated on a hypostroma, often in association with ascomata, often at several levels above each other, globose, subconical to oblong, sometimes laterally fusing, black, surface verruculose to smooth, contents white when fresh. Pycnidial apex usually continuously attenuated to an undifferentiated or slightly projecting ostiolar papilla (70)80–134(159) µm diam. (n = 25), circular in section. Peridium similar to ascomata, ca. 70–160 µm thick, sometimes elongated to ca. 300 µm at the base, cells of dark brown *t. angularis* in face view (4)6–10(12) µm diam. (n = 25). Conidia (155)188–280(320) × (5.2)6.3–8.8(10.5) µm, l/w (21)26–36(39) (n = 31), vermiform, hyaline, with 7–33 septa, one more or less acute and one truncate end, smooth, formed on cylindrical cells situated basal in the pycnidial venter.

Habitat. – On buds of *Picea* spp., most commonly on planted trees of *Picea pungens*.

Distribution. – Widespread in Europe, North America and Asia, following its hosts.

Other material examined (all on buds of *Picea pungens* except where noted). – AUSTRIA, Kärnten, Klagenfurt-Land, St. Margareten im Rosental, village area, 24 July 2015, leg. W. Jaklitsch (WU 36903; culture from conidia: CBS 141555 = C209). Niederösterreich, Baden, Klausen-Leopoldsdorf, Hauptbach, 17 April 2016, leg. W. Jaklitsch (WU 36904= C247); Krems-Land, Mühldorf, 4 June 2016, leg. W. Jaklitsch & H. Voglmayr (WU 36909); Willendorf in der Wachau, roadside, 22 May 2016, leg. W. Jaklitsch (WU 36907; C252); Mödling, Gießhübl, Wassergspreng, 12 July 2015, leg. H. Voglmayr (WU 36910); Sankt Pölten-Land, Michelbach, Maierhöfen, Berg, 27 June 2015, leg. W. Jaklitsch & H. Voglmayr (WU 36900; culture from ascospores: C199); Scheibbs, Purgstall, Stock, opposite the Lebenshilfe Werkstätte Merkenstetten, 4 June 2016, leg. W. Jaklitsch & H. Voglmayr (WU 36911); Zwettl, Gutenbrunn, Ulrichschlag, 11 July 2015, leg. H. Voglmayr & W. Jaklitsch (WU 36901; C202); Weinsberger Wald, on buds of *Picea abies*, 11 Jul 2015, leg. W. Jaklitsch, I. Greilhuber & H. Voglmayr (WU 36902 = C204); Kottes-Purk, 22 May 2016, leg. W. Jaklitsch (WU 36905; C250); Ottenschlag, Neuhof, on buds of *Picea abies*, 4 June 2016, leg. H. Voglmayr & W. Jaklitsch (WU 36908; culture from conidia: C260). SWEDEN, Västerbotten, Umeå, Brännland, garden c. 400 SW of the place of the former Brännland railway station, N 63° 52,6´ E 20° 3,1´, on buds of *Picea pungens* (cult.), 19 September 1976, leg. O.E. Eriksson (WU 36912: part of UME 34777); ibidem, 31 October 1976, leg. O.E. Eriksson (WU 36913: part of UME 27112).

Notes and discussion. – It is important to optimize the collection time for the correct morphology of the sexual morph due to slow development of its asci and ascospores, which strongly depends on the climate on the exposed buds. In many specimens the sexual morph is either immature or old, often overgrown by algae, *Fusarium* or other fungi, and often only the asexual morph is present. Size and septation of ascospores are much dependent on circumstances influencing development and maturation; they are often described as having less septa, usually with 5–8 transverse septa. Asci are first cylindrical and develop ascospores in a uniseriate arrangement. Later they become oblong or clavate with ascospores partly biseriately arranged. Ascospores are first hyaline, develop septa and turn yellowish to brownish. The protologue of *Cucurbitaria piceae* by Borthwick (1909) is based on material partly matured by incubation in a moist chamber for several weeks. Asci are described as 4–

6 spored and ascospores 4–10 septate-muriform, but only 20 × 6 µm in size. Shoemaker (1967) already noted and explained reasons for the wrong ascospore size described by Borthwick (1909). He lectotypified *Cucurbitaria piceae* and prepared a description based on this material. The residual material of the lectotype is depauperate and only a single bud contains ascomata. They contain mostly immature asci but also some more or less mature ascospores, which measure 39–53 × 13.5–20.5 µm. Another depauperate part was separated from the holotype as *Megaloseptoria mirabilis* by R.A. Shoemaker (annotation slip), another as *Camarosporium strobilinum*. Due to the poor condition of the lectotype we epitypify *Cucurbitaria piceae*. Sexual morph well matured in nature is e.g. present in the epitype WU 36906 and in WU 36909. Also size and septation of the conidia depends much on the specimens, as was also shown by Černý et al. (2016).

ITS sequences of European accessions are identical with those obtained from herbarium material in Canada, i.e. European and American material represents the same fungus. Recently, Černý et al. (2016) published a comprehensive study on the *Gemmamyces* bud blight and its development in the Czech Republic, redescribed *Gemmamyces piceae*, summarized information about distribution and host spectrum, outlined the basic epidemiology and discussed the potential importance of the disease. Also their ITS sequences are identical with ours.

Although we cannot rule out that there may be a second similar species in Asia, we think that *G. piceicola*, described by Yuan & Wang (1995) as specific for *Picea schrenkiana*, is the same fungus, inasmuch as the differences in ascospore morphology described by them are not convincing. Molecular data are needed to clarify whether *G. piceicola* is distinct from *G. piceae*.

Both *Megaloseptoria mirabilis* and *Camarosporium strobilinum* were interpreted by Shoemaker (1967) as candidates for the asexual morph of *Gemmamyces piceae*, a name usually not accepted for the sexual morph in favour of *Cucurbitaria piceae* (see e.g. Shoemaker 1967, Eriksson 1982), while Sivanesan (1984) or Černý et al. (2016) only give *M. mirabilis* as asexual morph. Petrak (1963b) had even questioned a relationship between *Megaloseptoria* and *Gemmamyces* (as *Cucurbitaria*). Here we confirm conspecificity of *Gemmamyces piceae* and *Megaloseptoria mirabilis* based on identical DNA data obtained from cultures produced from ascospores and from conidia. Although *Megaloseptoria* has priority, Rossman et al. (2015) recommended the use and protection of *Gemmamyces* as a holomorphic generic name due to the wide use of *Gemmamyces* for the causes of spruce bud blight diseases (according to Hansen & Lewis 1997). In addition, use of *Megaloseptoria* would require the new combination *Megaloseptoria piceae* because *Cucurbitaria piceae* is older than *Megaloseptoria mirabilis*. Therefore, subject to acceptance of conservation, *Gemmamyces piceae* should be used as correct name for the species.

Petrakia Syd. & P. Syd., in Sydow & Sydow, Ann. Mycol. 11(5): 406 (1913), **emend.**

Description. – Ascomata epiphyllous, partly immersed in leaf tissue, solitary or rarely confluent, globose-depressed, brown to black; apex with a central ostiolar perforation, without periphyses. Peridium pseudoparenchymatous. Hamathecium of hyaline septate pseudoparaphyses. Asci cylindrical, bitunicate, fissitunicate, containing 8 ascospores in biseriate arrangement. Ascospores fusoid, straight to curved, tapering towards the ends, hyaline to light brown, with one median to submedian primary euseptum, constricted at the primary septum, at maturity sometimes with additional transverse septa.

Asexual morphs on natural hosts usually of two types (synanamorphs). – (1) mycopappus-like and (2) petrakia-, xenostigmina- or blastostroma-like. Conidiomata sporodochial, epiphyllous. Conidiophores macronematous, simple or branched, septate, subcylindrical, short. Conidiogenous cells terminal, conidiogenesis holoblastic. Conidia solitary, hyaline or brown, multicellular, phragmo-, dictyo- or dictyostaurosporous, variously shaped from irregularly subglobose, fusoid, falcate to sigmoid.

Type species. – ***Petrakia echinata*** (Peglion) Syd. & P. Syd.

Petrakia aceris (Dearn. & Barthol.) Jaklitsch & Voglmayr, **comb. nov.**

MycoBank no.: MB 819137

Basionym. – *Cercosporella aceris* Dearn. & Barthol., Mycologia 9(6): 362. 1917.

≡ *Mycopappus aceris* (Dearn. & Barthol.) Redhead & G.P. White, Canad. J. Bot. 63(8): 1430. 1985.

= *Stigmina zilleri* A. Funk, Canad. J. Bot. 65(3): 482. 1987.

≡ *Xenostigmina zilleri* (A. Funk) Crous, Mycol. Mem. 21: 155. 1998.

= *Mycosphaerella mycopappi* A. Funk & Dorworth, Canad. J. Bot. 66(2): 295. 1988.

≡ *Didymella mycopappi* (A. Funk & Dorworth) Crous, Mycol. Mem. 21: 152. 1998.

Notes and discussion. – Phylogenetic analyses (Fig. 1) reveal a close relationship of *Xenostigmina zilleri* to *Petrakia echinata*. Funk & Dorworth (1988) described *Mycosphaerella mycopappi* as sexual morph of *Xenostigmina zilleri*, which was transferred to *Didymella* by Crous (1998). Crous et al. (2009) proved that *Mycopappus aceris* is the synanamorph of *Xenostigmina zilleri*, but they could not confirm ‘*Mycosphaerella*’ *mycopappi* as their sexual morph, as no ex-ascospore cultures were available for sequencing. However, there are LSU and SSU sequences deposited at GenBank originating from culture ATCC 64711, which apparently represents an ex-type culture of *Mycosphaerella mycopappi* (Seifert et al. 2007), as it has been deposited by A. Funk, one of the authors of the taxon. LSU sequence U43480 from this culture is identical to the LSU sequences from *Xenostigmina zilleri*. The recently described mycodidymella-like sexual morph of *Petrakia echinata* (Butin et al. 2013) is similar in ascoma and ascospore morphology, indicating that the connection of *Mycosphaerella mycopappi* with *Xenostigmina zilleri* is actually correct.

Almost identical ITS and LSU sequences, mycopappus-like synanamorphs, similar sexual morphs and similar conidial ontogeny are strong arguments that *Petrakia echinata* and *Xenostigmina zilleri* should be classified within the same genus. The presence of prominent conidial appendages and the broadly ellipsoid conidial shape in *Petrakia* are the only striking differences to *Xenostigmina*, which in our view is insufficient for separation at the generic level, as shape and appendages are adaptations to dispersal which can rapidly evolve and change easily. It should be noted that *Mycopappus* in its current circumscription is polyphyletic, and *Mycopappus alni*, the generic type, as well as *M. quercus*, have sclerotiniaceous affinities and therefore belong to Leotiomycetes (Johnston et al. 2014, Redhead & White 1985, Suto & Suyama 2005), which is also reflected by marked morphological differences (Suto & Kawai 2000). Because *Petrakia* is the oldest available genus, and due to priority, we here combine *Cercosporella aceris* in *Petrakia*.

Petrakia aesculi (C.Z. Wei, Y. Harada & Katum.) Jaklitsch & Voglmayr, **comb. nov.**

MycoBank no.: MB 819138

Basionym. – *Mycodidymella aesculi* C.Z. Wei,Y. Harada & Katum., Mycologia 90(2): 336. 1998.

= *Mycopappus aesculi* C.Z. Wei, Y. Harada & Katum., Mycologia 90(2): 336. 1998.

= *Blastostroma aesculi* C.Z. Wei, Y. Harada & Katum., Mycologia 90(2): 338. 1998.

Notes and discussion. – Although no sequence data are available, it is evident from its *Mycopappus* and *Blastostroma* synanamorphs and the almost identical sexual morph (Wei et al. 1998) that it is closely related to *Petrakia aceris*. The blastostroma-like asexual morph of *P. aesculi* closely resembles the xenostigmina-like asexual morph of *Petrakia aceris*, only differing by hyaline conidia without longitudinal septa (Wei et al. 1998). We therefore consider it justified to combine it in *Petrakia*. *Mycodidymella aesculi* and *Blastostroma aesculi* are the respective generic types, consequently both genera become synonyms of *Petrakia*.

Praetumpfia Jaklitsch & Voglmayr, **gen. nov.**

MycoBank no.: MB 819139

Etymology. – The generic name is based on the collection area (colloquial name) of the epitype, meaning “leading to the brook Tumpfi”.

Description. – Ascomata scattered or aggregated, erumpent-superficial on wood, sometimes on a black stromatic crust, globose to pyriform, black. Ascomatal apex papillate; ostioles periphysate, sometimes with yellow contents. Peridium pseudoparenchymatous, two-layered. Hamathecium consisting of narrow pseudoparaphyses immersed in a matrix. Asci cylindrical to subclavate, bitunicate, fissitunicate, with a short stipe and a knob-like base, narrow walls with endotunica thickened at the apex and a small ocular chamber; containing 8 ascospores. Ascospores ellipsoid with upper part often slightly wider, straight, muriform, constricted at the median primary septum, brown, smooth or finely punctate.

Asexual morphs coelomycetous. Pycnidia often co-occurring with ascomata, aggregated to scattered, subglobose to collapsing discoid, black, smooth. Peridium dark brown, pseudoparenchymatous. Conidiophores branched into several short simple branches, sometimes once rebranching, bearing lateral pegs or solitary phialides and a single terminal phialide. Phialides lageniform to cylindrical. Conidia oblong to cylindrical, 1-celled, hyaline, straight or curved.

Type species: ***Praetumpfia obducens*** (Schumach. : Fr.) Jaklitsch & Voglmayr

Praetumpfia obducens (Schumach. : Fr.) Jaklitsch & Voglmayr, **comb. nov.** – Fig. 4.

MycoBank MB 819140

Basionym. – *Sphaeria obducens* Schumach., Enum. pl. (Kjbenhavn) 2: 159. 1803.

≡ *Sphaeria obducens* Schumach. : Fr., Syst. mycol. 2: 456. 1823.

≡ *Teichospora obducens* (Schumach. : Fr.) Fuckel, Jahrb. Nassau. Ver. Naturk. 23–24: 161. 1870 [1869–70].

≡ *Strickeria obducens* (Schumach. : Fr.) G. Winter, Rabenh. Krypt.-Fl., 2nd ed. (Leipzig) 1.2: 285. 1885 [1887].

≡ *Cucurbitaria obducens* (Schumach. : Fr.) Petr., Ann. Mycol. 25: 226. 1927.

Lectotype of *Sphaeria obducens*, here designated. – SWEDEN, E. Fries, Scleromyceti Exs. no. 119, Herb. Fries (C!, as *Sphaeria incrustans* f. *minor* Fr.; MBT373734).

Epitype, here designated. – AUSTRIA, Kärnten, Klagenfurt-Land, St. Margareten im Rosental, village area, on branches of *Fraxinus excelsior*, 2 May 2014, leg. W. Jaklitsch (WU 36897; ex-epitype culture CBS 141474 = C54; MBT373735).

Description. – Ascomata scattered or more frequently aggregated in large numbers, erumpent to mostly superficial on decorticated wood or on wood beneath bark, sometimes on a black stromatic crust, becoming visible through fissures, globose, subglobose or pyriform, rarely collapsing, (235)310–435(460) µm high, (225)280–485(700) µm diam. (n = 123), black, surface verrucose, sometimes nearly smooth. Ascomatal apex papillate, (89)105–170(220) µm diam. (n = 31). Ostiolar contents characteristically yellow, consisting of minute amorphous granules and periphyses. Peridium 50–95 µm thick, pseudoparenchymatous, consisting of two clearly distinguishable layers, a 30–60 µm thick hyaline inner layer of more or less isodiametric, thick-walled (6)8–13(14.5) µm (n = 18) wide cells, and a 20–40 µm thick brown outer layer of thick-walled angular, (4.5)5–8(10) µm (n = 28) wide cells. Hamathecium consisting of 1.5–4 µm wide pseudoparaphyses immersed in a matrix. Asci (135)151–213(241) × (18.3)20.5–25.3(27.7) µm (n = 26), cylindrical, less commonly subclavate, bitunicate, fissitunicate, with a short stipe and a knob-like base, narrow walls with endotunica thickened at the apex and a broad but shallow ocular chamber; containing 8 ascospores in (obliquely) uniseriate to partly biseriate arrangement. Ascospores (18.2)21.5–27.3(33.0) × (8.7)10.5–13.3(15.4) µm, l/w (1.7)1.9–2.3(2.7) (n = 76), ellipsoid with upper part often slightly wider, straight, with (3)5(–78) transversal and 1–3 longitudinal septa, most frequently with 5 transversal septa and V-septa in end cells, constricted at the median primary septum, pale to medium brown, not darkening in 3% KOH, smooth to finely punctate.

Asexual morph on the natural host: Pycnidia frequently occurring in association with ascomata or without them, scattered to usually aggregated on wood in bark fissures, sometimes erumpent from bark, (98)135–235(270) µm (n = 35) diam, subglobose to collapsing discoid, shiny black, smooth. Peridium dark brown, pseudoparenchymatous, of thick-walled rounded to angular cells (4)5–8(9) µm (n = 30) diam. Conidiophores shrub-like, basally branched into several short simple branches up to ca. 50 × 1.5–3 µm, sometimes once asymmetrically rebranching, bearing lateral pegs or solitary phialides and a single terminal phialide. Phialides (6)9–13(14) × (1.7)2.0–2.5(2.8) µm, lageniform to cylindrical. Conidia (4.0)4.5–5.2(5.7) × (1.2)1.3–1.6(1.7) µm, l/w (2.6)3.0–3.7(4.0) (n = 57), oblong to cylindrical, 1-celled, hyaline, straight or slightly curved.

Cultures. – Colony radius on CMD (30)40–55 mm at 22–25 °C after 2 months, first hyaline, turning orange, reddish orange to orange-brown; aerial hyphae scant, odour sweetish to sour-musty. Pycnidia only rarely formed in small numbers but not seen after reculturing. Colony on MEA similar but thicker due to abundant aerial hyphae.

Habitat. – On corticated or partly decorticated branches of *Fraxinus excelsior*.

Distribution. – Europe, North America.

Other material examined (all from partly decorticated branches of *Fraxinus excelsior*). – AUSTRIA, Kärnten, Klagenfurt-Land, St. Margareten im Rosental, village area, grid square 9452/4, asexual morph on bark, 6 July 2013, leg. W. Jaklitsch (WU 36895; culture C2); Stariwald (east side), grid square 9452/4, 3 May 2014, leg. W. Jaklitsch (WU 36898; culture C56); Wograda, grid square 9452/3, 29 April 1995; leg. W. Jaklitsch W.J. 592 (WU 36892); ibidem, 1 May 2002, leg. W. Jaklitsch W.J. 1873 (WU 36893); Niederösterreich, Bruck an der Leitha, at the crossing from the road B9 to Petronell-Carnuntum, 20 October 2013, leg. W. Jaklitsch & H. Voglmayr (WU 36896; culture C20); Vienna, 22nd district, Lobau, near Panozzalacke, grid square 7865/1, 8 April 1995, leg. W. Jaklitsch W.J. 560 (WU 36891); ibidem, 21 March 2015, leg. W. Jaklitsch (WU 36899; culture C151). GERMANY, Fuckel, Fungi Rhenani 2024 (WU). SPAIN, Asturias, Coto de Buenamadre, banks of rio Orio, soc. *Hysterographium fraxini*, 2 June 2013, leg. J. Fournier (WU 36894; culture CuO).

Notes and discussion. – No type material of Schumacher is extant, therefore material of the sanctioning author Fries can be selected. As the material from C is part of an exsiccatum, we cannot rule out that additional parts exist in other herbaria, therefore lectotypification is necessary. Fries first called the fungus *Sphaeria incrustans* f. *minor* by mistake as admitted by Fries (1823, p. 456) himself, under *S. obducens*. Epitypification appears to be necessary, as this fungus is reported to occur on many different hosts (Barr 1990b, Dennis 1981), but it seems to be confined to *Fraxinus excelsior*.

The fungus redescribed here has been known as *Teichospora obducens* since Fuckel (1870). Petrak (1927) could not interpret any morphological difference from *Cucurbitaria berberidis* as relevant at the generic level and thus combined *S. obducens* in *Cucurbitaria*. This was ignored by many authors including Mirza (1968) and Munk (1957). As reported by Jaklitsch et al. (2016b), Arx & Müller (1975) even typified *Teichospora* with *T. obducens* by error. However, Barr (1990b) accepted placement in *Cucurbitaria*. As shown above, neither genus applies for this taxon, therefore the new genus *Praetumpfia* is here described for it.

Characteristic of ascomata of *P. obducens* is the large yellow intra-ostiolar plug, which is best seen in fresh immature ascomata. *Praetumpfia obducens* seems to be specific for *Fraxinus*. The occurrence of *P. obducens* in its pycnidial morph on bark and of ascomata on attached branches, most frequently on attachment areas, may point to an endophytic and facultative parasitic life style of the fungus. As Petrak (1927) pointed out, the fungus seems to split the bark. It may therefore damage trees to some extent, but has not been seriously associated with dieback of *Fraxinus*. In contrast, the powerful and devastating parasite *Hymenoscyphus fraxineus* (syns. *H. pseudoalbidus*, *Chalara fraxinea*), which infects shoots of *Fraxinus excelsior*, has since recently caused serious losses of ash trees in Europe (Baral et al. 2014, Kirisits et al. 2012, Kowalski et al. 2016).

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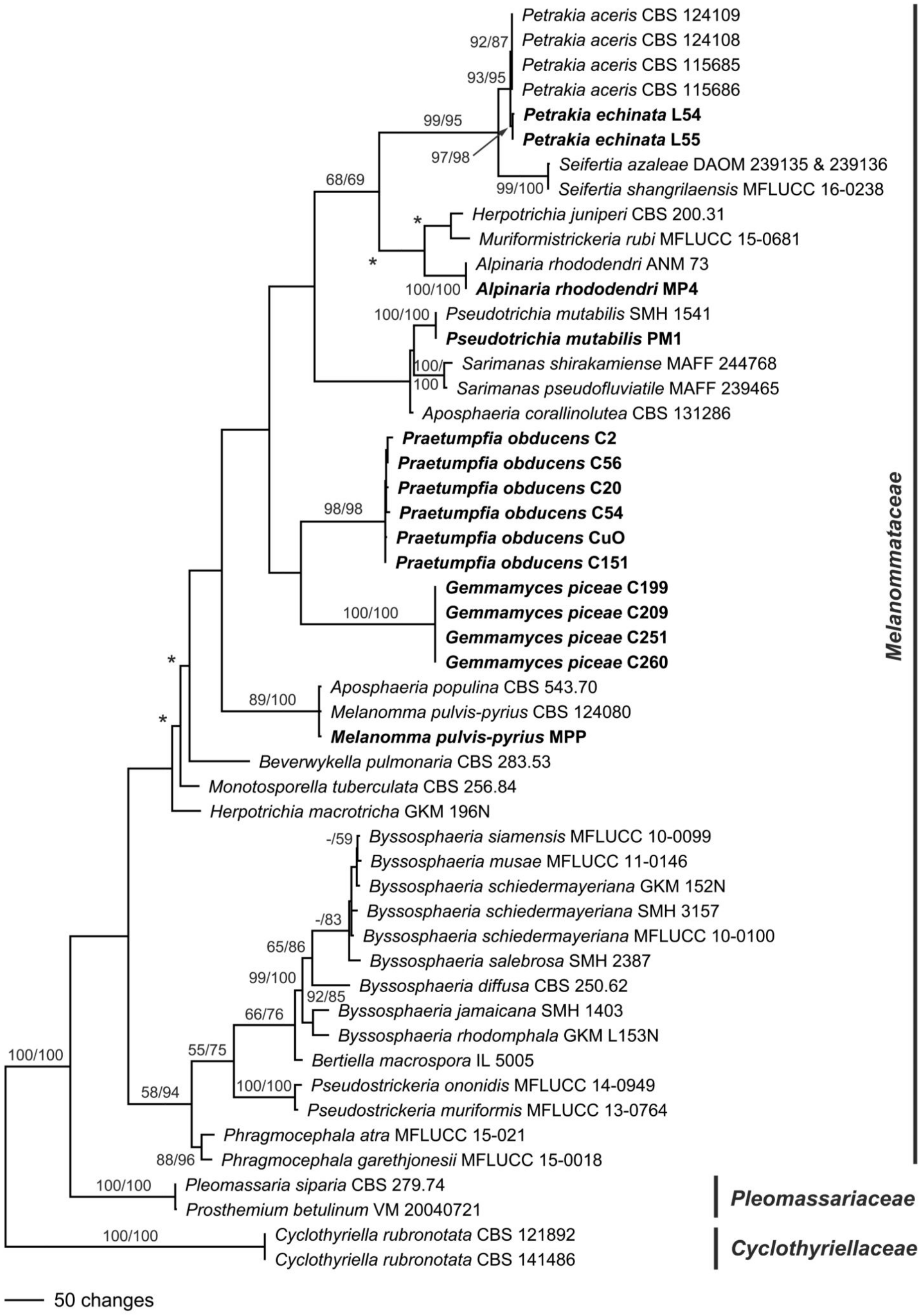

Fig. 1.

Phylogram showing one of 6 MP trees 2838 steps long revealed by PAUP from an analysis of the combined ITS-LSU, SSU, *rpb2* and *tef1* matrix of Melanommataceae and related families. MP and ML bootstrap support above 50% are given above or below the branches. Accessions in bold were sequenced in the present study. The asterisks (*) denote the nodes collapsed in the strict consensus tree of all MP trees.

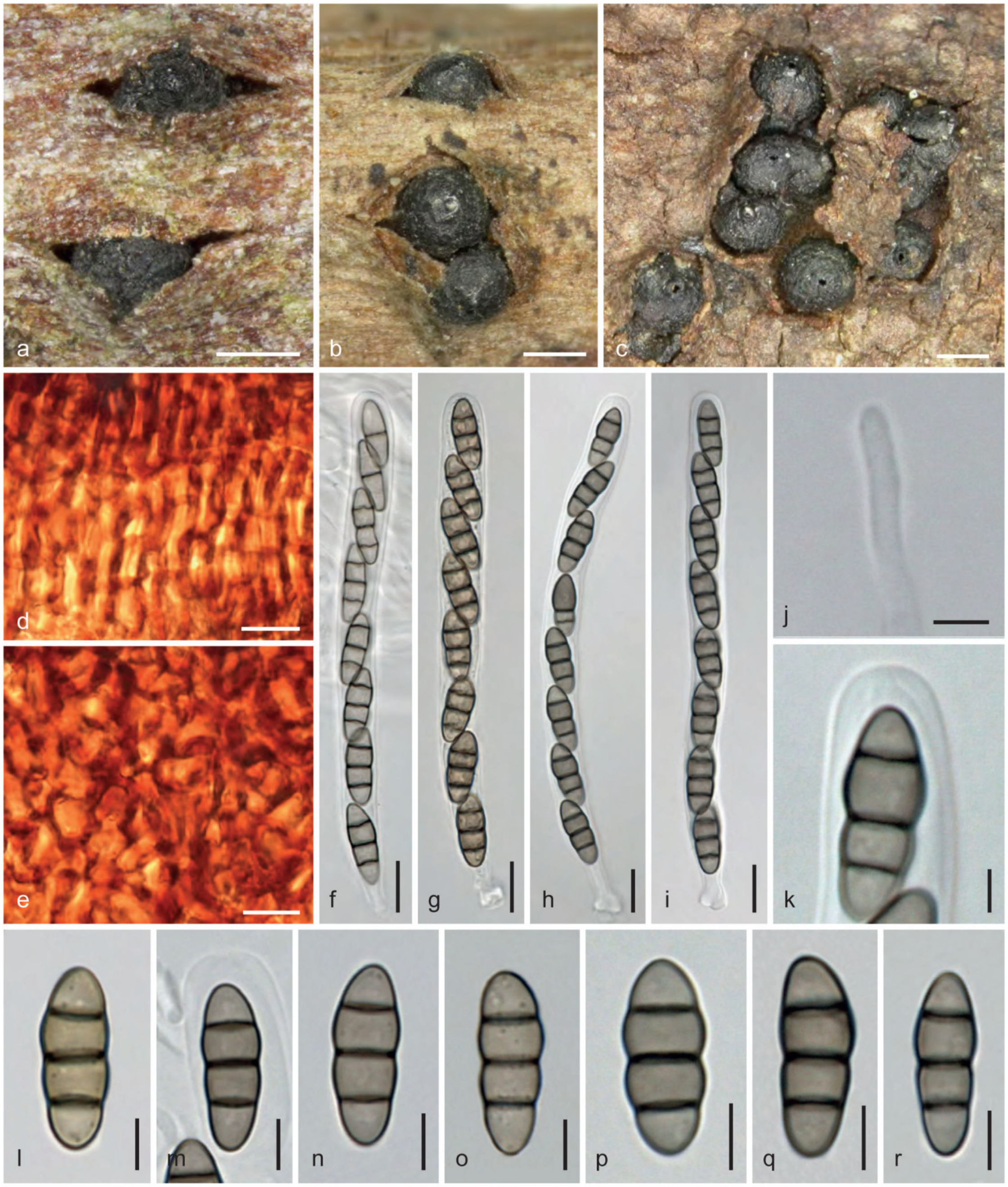

Fig. 2.

Alpinaria rhododendri. **a–c**. Ascomata in face view**. d, e**. Peridium in surface view (d. *t. prismatica*; e. *t. angularis*). **f–i**. Asci. j. Paraphysis tip. **k**. Ascus apex. **l–r**. Ascospores (m. in ascus apex). a, l, o. WU 36914. b, m, n. holotype M. c. WU 36919. d–k, p–r. WU 36918. Scale bars: a–c = 0.3 mm; d–i = 10 µm; j, k = 3 µm; l–r = 5 µm.

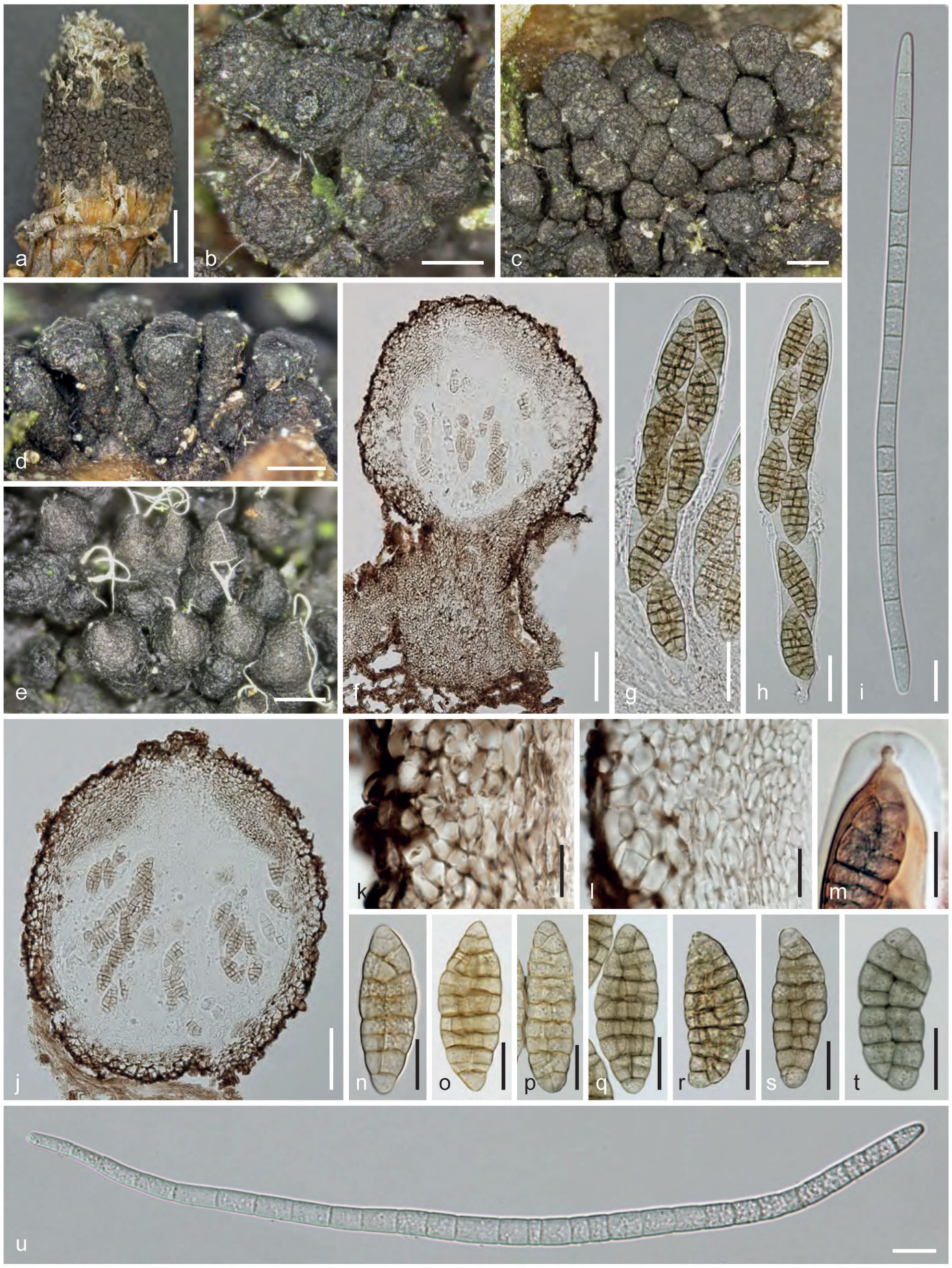

Fig. 3.

Gemmamyces piceae. **a**. Habit. **b, c**. Ascomata in face view. **d**. Stipitate ascomata in side view. **e**. Pycnidia in nature with white conidial tendrils. **f, j**. Ascoma in vertical section (in f stipitate on hypostroma). **g, h**. Asci (opening in h). i, u. Conidia. **k, l**. Peridium in vertical section (l. from apical region). **m**. Ascus tip showing apical ring (in Congo Red). **n–t**. Ascospores (q–t. in 3% KOH). a. UME 34777; b, g, h, n, o, q–s. WU 36906; c, m, p. WU 36903; d–f, i–l, t, u. WU 36909. Scale bars: a = 2.5 mm; b = 200 µm; c–e = 300 µm; f, j = 70 µm; g, h = 30 µm; i, k–u = 15 µm.

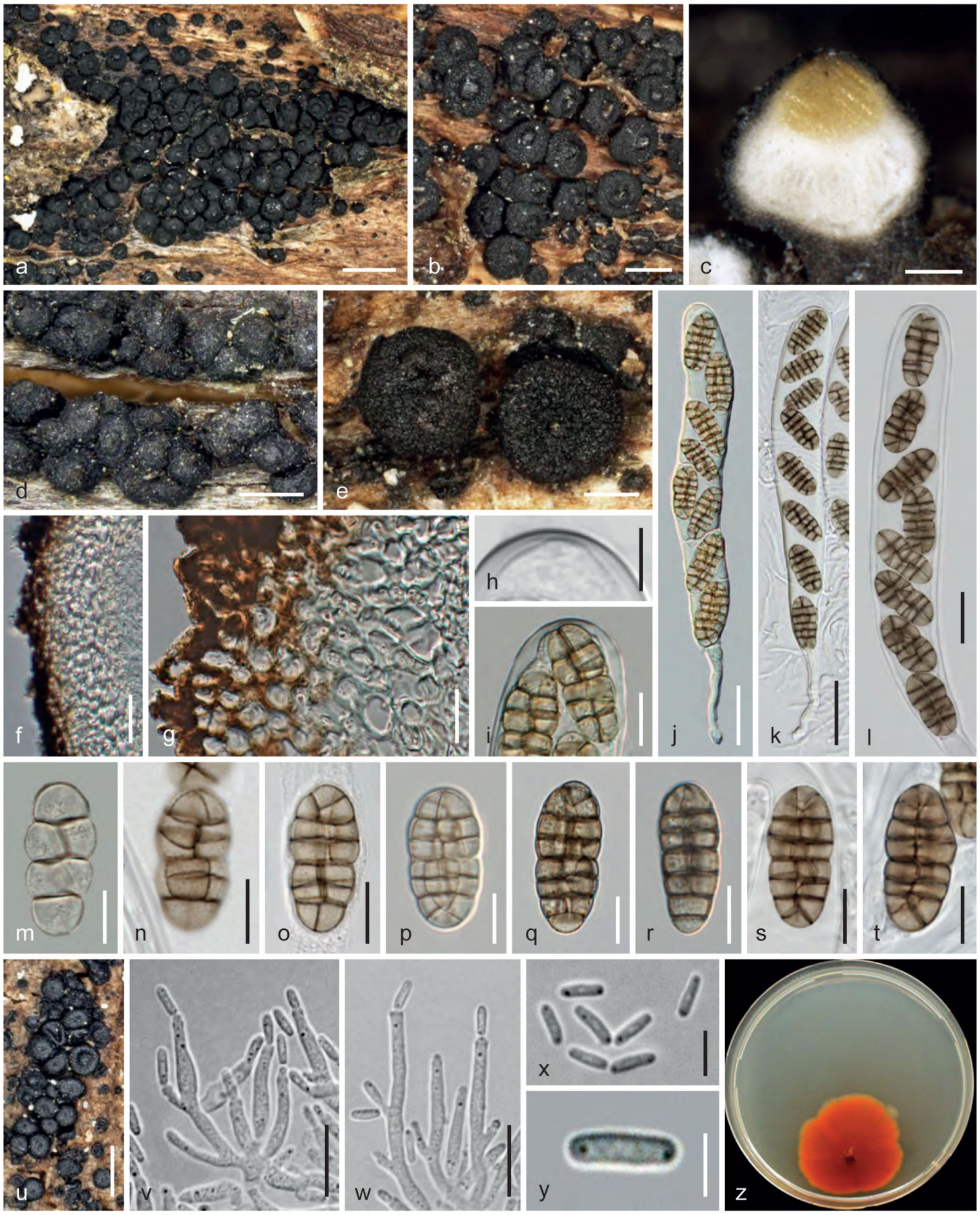

Fig. 4.

Praetumpfia obducens. **a, b, d, e**. Ascomata in face view. **c**. Ascoma in vertical section showing yellow ostiolar region. **f, g**. Peridium in vertical section. **h, i**. Ascus tips showing shallow ocular chamber. **j–l**. Asci. **m–t**. Ascospores (m, p. immature). **u**. Pycnidia in nature. **v, w**. Conidiophores and phialides. **x, y**. Conidia. **z**. Culture on CMD (22°C, 42 d). a, b, e, p–r. WU 36897; c, z. WU 36896; d, t. lectotype; f–j, m WU 36899; k, l, n, o, s. WU 36894; u–

y. WU 36895. Scale bars: a = 1 mm; b, e = 200 µm; c = 100 µm; d, u = 400 µm; f, j, k = 30 µm; g, i, n–t, v, w = 10 µm; h, m, x = 5 µm; l = 15 µm; y = 3 µm.

Tab. 1

Strains and NCBI GenBank accessions used in the phylogenetic analyses of the combined matrix. Sequences in bold were generated during the present study. For *Seifertia azaleae*, the ITS and LSU sequences of DAOM 239135 and DAOM 239136, respectively, were combined in the matrix to increase the phylogenetic resolution.

Taxon	Strain	GenBank accession numbers				
		ITS	LSU	SSU	tef1	rpb2
Alpinaria rhododendri	ANM 73	–	GU385198	–	–	–
Alpinaria rhododendri	MP4	**KY189973**	**KY189973**	**KY190004**	**KY190009**	**KY189989**
Aposphaeria corallinolutea	CBS 131286; PD 83/367	–	JF740329	–	–	–
Aposphaeria populina	CBS 543.70	–	EU754130	EU754031	–	–
Bertiella macrospora	IL 5005	–	GU385150	-	–	–
Beverwykella pulmonaria	CBS 283.53	**KY189974**	**KY189974**	**KY190005**	–	**KY189990**
Byssosphaeria diffusa	CBS 250.62; AFTOL-ID 1588	–	DQ678071	DQ678019	DQ677915	DQ677968
Byssosphaeria jamaicana	SMH 1403	–	GU385152	–	GU327746	–
Byssosphaeria musae	MFLUCC 11-0146	KP744435	KP744477	KP753947	–	–
Byssosphaeria rhodomphala	GKM L153N	–	GU385157	–	GU327747	–
Byssosphaeria salebrosa	SMH 2387	–	GU385162	–	GU327748	–
Byssosphaeria schiedermayeriana	SMH 3157	–	GU385163	–	GU327745	–
Byssosphaeria schiedermayeriana	GKM 152N	–	GU385168	–	GU327749	–
Byssosphaeria schiedermayeriana	MFLUCC 10-0100	–	KT289894	KT289896	-	KT962060
Byssosphaeria siamensis	MFLUCC 10-0099	–	KT289895	KT289897	-	
Cyclothyriella rubronotata	CBS 121892; TR	KX650541	KX650541	–	KX650571	KX650516
Cyclothyriella rubronotata	CBS 141486; TR9	KX650544	KX650544	KX650507	KX650574	KX650519
Gemmamyces piceae	C199	**KY189975**	**KY189975**	–	**KY190010**	**KY189991**
Gemmamyces piceae	C209	**KY189976**	**KY189976**	**KY190006**	**KY190011**	**KY189992**
Gemmamyces piceae	C251	**KY189977**	**KY189977**	–	**KY190012**	**KY189993**
Gemmamyces piceae	C260	**KY189978**	**KY189978**	–	**KY190013**	**KY189994**
Herpotrichia juniperi	CBS 200.31; AFTOL-ID 1608	–	DQ678080	DQ678029	DQ677925	DQ677978
Herpotrichia macrotricha	GKM 196N	–	GU385176	–	GU327755	–
Melanomma pulvis-pyrius	MPP	**KY189979**	**KY189979**	–	**KY190014**	**KY189995**
Melanomma pulvis-pyrius	CBS 124080	-	GU456323	GU456302	GU456265	GU456350
Monotosporella tuberculata	CBS 256.84	-	GU301851	-	GU349006	–
Muriformistrickeria rubi	MFLUCC 15-0681	-	KT934253	KT934257	KT934261	–
Petrakia aceris (*Mycopappus* asexual morph)	CBS 124109	FJ839625	FJ839660	–	–	–
Petrakia aceris (*Xenostigmina* asexual morph)	CBS 115685	FJ839638	GU253857	–	–	–
Petrakia aceris (*Xenostigmina* asexual morph)	CBS 115686	FJ839640	GU253858	–	–	–
Petrakia aceris (*Xenostigmina* asexual morph)	CBS 124108	FJ839639	FJ839675	–	–	–
Petrakia echinata	L54	KY189980	KY189980	**KY190007**	**KY190015**	**KY189996**
Petrakia echinata	L55	KY189981	KY189981	–	**KY190016**	**KY189997**

Taxon	Strain	GenBank accession numbers				
		ITS	LSU	SSU	tef1	rpb2
Phragmocephala atra	MFLUCC 15-0021	KP698721	KP698725	KP698729	–	–
Phragmocephala garethjonesii	MFLUCC 15-0018	KP698722	KP698726	KP698730	–	–
Pleomassaria siparia	CBS 279.74; AFTOL-ID 1600	AB554089	DQ678078	DQ678027	DQ677923	DQ677976
Praetumpfia obducens	C2	**KY189982**	**KY189982**	–	**KY190017**	**KY189998**
Praetumpfia obducens	C20	**KY189983**	**KY189983**	–	**KY190018**	**KY189999**
Praetumpfia obducens	C54	**KY189984**	**KY189984**	**KY190008**	**KY190019**	**KY190000**
Praetumpfia obducens	C56	**KY189985**	**KY189985**	–	**KY190020**	**KY190001**
Praetumpfia obducens	C151	**KY189986**	**KY189986**	–	-	–
Praetumpfia obducens	CuO	**KY189987**	**KY189987**	–	**KY190021**	**KY190002**
Prosthemium betulinum	VM 20040721	AB554085	AB553754	AB553644	–	–
Pseudostrickeria muriformis	MFLUCC 13-0764	–	KT934254	KT934258	KT934262	–
Pseudostrickeria ononidis	MFLUCC 14-0949	–	KT934255	KT934259	KT934263	KT934264
Pseudotrichia mutabilis	SMH 1541	–	GU385209	–	–	–
Pseudotrichia mutabilis	PM1	**KY189988**	**KY189988**	–	**KY190022**	**KY190003**
Sarimanas pseudofluviatile	MAFF 239465; KT760	LC001717	LC001714	LC001711	–	–
Sarimanas shirakamiense	MAFF 244768; KT3000	LC001718	LC001715	LC001712	–	–
Seifertia azaleae	DAOM 239135	EU030273	–	–	–	–
Seifertia azaleae	DAOM 239136	–	EU030276	–	–	–
Seifertia shangrilaensis	MFLUCC 16-0238	–	KU954100	KU954101	KU954102	–