Sporocadaceae, a family of coelomycetous fungi with appendage-bearing conidia

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Abstract: Species of Sporocadaceae are endophytic, plant pathogenic or saprobic, and associated with a wide range of host plants. Recent molecular studies have that allowed to address familial and generic boundaries of fungi belonging to Sporocadaceae were based on a limited number of samples and DNA loci. The taxonomy of this group of fungi is therefore still not fully resolved. The aim of the present study is to provide a natural classification for the Sporocadaceae based on multi-locus phylogenetic analyses, using LSU, ITS, tef-1α, tub2 and rpb2 loci, in combination with morphological data. A total of 30 well-supported monophyletic clades in Sporocadaceae are recognised, representing 23 known and seven new genera. Typifications are proposed for the type species of five genera (Diploceras, Discosia, Synnemapestaloides, Sarcostroma, Seimatosporium, Synnemapestaloides and Truncatellaceae). A total of 51 new species, one nomina nova and 15 combinations are introduced.

Key words: Multi-locus phylogeny, New taxa, Seimatosporium, Sporocadus, Taxonomy.

Taxonomic novelties: New genera: Distotonannopendiculata F. Liu, L. Cai & Crous, Diversimediolispora F. Liu, L. Cai & Crous, Heterotruncatella F. Liu, L. Cai & Crous, Nonnapplicata F. Liu, L. Cai & Crous, Parabartalinia F. Liu, L. Cai & Crous, Pseudosarcostroma F. Liu, L. Cai & Crous, Xeroseimatosporium F. Liu, L. Cai & Crous; New species: Sporocadus rosigema F. Liu, L. Cai & Crous; New specific: Bartalinia pini F. Liu, L. Cai & Crous, Discosia rubi F. Liu, L. Cai & Crous, Distotonannopendiculata casuarinae F. Liu, L. Cai & Crous, Distotonannopendiculata verrucata F. Liu, L. Cai & Crous, Diversimediolispora hunicola F. Liu, L. Cai & Crous, Heterotruncatella acaeca F. Liu, L. Cai & Crous, Heterotruncatella aspera F. Liu, L. Cai & Crous, Heterotruncatella avellanea F. Liu, L. Cai & Crous, Heterotruncatella breviiappendiculata F. Liu, L. Cai & Crous, Heterotruncatella consticta F. Liu, L. Cai & Crous, Heterotruncatella diversa F. Liu, L. Cai & Crous, Heterotruncatella grevilleae F. Liu, L. Cai & Crous, Heterotruncatella longissima F. Liu, L. Cai & Crous, Heterotruncatella proteica F. Liu, L. Cai & Crous, Heterotruncatella quercinae F. Liu, L. Cai & Crous, Heterotruncatella singularis F. Liu, L. Cai & Crous, Heterotruncatella synapheae F. Liu, L. Cai & Crous, Heterotruncatella vincocubalina F. Liu, L. Cai & Crous, Hymenopleella austroafricanana F. Liu, L. Cai & Crous, Hymenopleella polyapseta F. Liu, L. Cai & Crous, Hymenopleella subclivindrica F. Liu, L. Cai & Crous, Monochaeta quercus F. Liu, L. Cai & Crous, Morina crinita F. Liu, L. Cai & Crous, Nonnapplicata quercina F. Liu, L. Cai & Crous, Pestalotiopsis hispanica F. Liu, L. Cai & Crous, Pestalotiopsis leucaendredi F. Liu, L. Cai & Crous, Pestalotiopsis spathullappendiculata F. Liu, L. Cai & Crous, Pestalotiopsis terecilla F. Liu, L. Cai & Crous, Pseudopestalotiopsis solitica F. Liu, L. Cai & Crous, Pseudosarcostroma osyridicola F. Liu, L. Cai & Crous, Robillarda australiana F. Liu, L. Cai & Crous, Sarcostroma africanum F. Liu, L. Cai & Crous, Sarcostroma australiense F. Liu, L. Cai & Crous, Sarcostroma diversisepatum F. Liu, L. Cai & Crous, Sarcostroma leucospermi F. Liu, L. Cai & Crous, Sarcostroma longispinulatum F. Liu, L. Cai & Crous, Sarcostroma paragevelliææ F. Liu, L. Cai & Crous, Sarcostroma protea F. Liu, L. Cai & Crous, Seimatosporium germanicum F. Liu, L. Cai & Crous, Seimatosporium soli F. Liu, L. Cai & Crous, Seimatosporium vitis-viniferae F. Liu, L. Cai & Crous, Sporocadus bisepatus F. Liu, L. Cai & Crous, Sporocadus cotri F. Liu, L. Cai & Crous, Sporocadus incanus F. Liu, L. Cai & Crous, Sporocadus mal F. Liu, L. Cai & Crous, Sporocadus microylo F. Liu, L. Cai & Crous, Sporocadus multisepatus F. Liu, L. Cai & Crous, Sporocadus rotundatus F. Liu, L. Cai & Crous, Sporocadus trimorphus F. Liu, L. Cai & Crous, Synnemapestaloides juniperi F. Liu, L. Cai & Crous; New combinations: Discosia tricellularis (Okane et al.) F. Liu, L. Cai & Crous, Discosia yakushimensis (Kaz. Tanaka et al.) F. Liu, L. Cai & Crous, Distotonannopendiculata banksiae (Crous & Summerrill) F. Liu, L. Cai & Crous, Heterotruncatella lutea (H.J. Swart & D.A. Griffiths) F. Liu, L. Cai & Crous, Heterotruncatella restionacearum (S.J. Lee & Crous) F. Liu, L. Cai & Crous, Heterotruncatella spadicea (S.J. Lee & Crous) F. Liu, L. Cai & Crous, Hymenopleella endophytica (Hyang B. Lee et al.) F. Liu, L. Cai & Crous, Hymenopleella lakedulianensis (L. Cai et al.) F. Liu, L. Cai & Crous, Morina acaciae (Crous) F. Liu, L. Cai & Crous, Pseudopestalotiopsis elaeidis (C. Booth & J.S. Robertson) F. Liu, L. Cai & Crous, Pestalotiopsis cinnamomii (Wijayaw. & Camporesi) F. Liu, L. Cai & Crous, Pestalotiopsis rosarum (Henn.) F. Liu, L. Cai & Crous, Pestalotiopsis sorbi (Wijayaw. et al.) F. Liu, L. Cai & Crous, Xeroseimatosporium quercinum (Geonas. et al.) F. Liu, L. Cai & Crous; Typifications (basionyms): Epitypes: Pestalotia hypericina Ces., Pestalotia monochaeta Desmazières, Sphaeria arcurceae Tode, Sporocadus tichenicola Corda, Truncatellaceae spadicea S. Lee & Crous; Neotype: Stilbospora angiustata Pers.

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INTRODUCTION

The name “Coelomycetes” was originally introduced to accommodate the (asexual/mitosporic) genera Phyllosticta, Phomopsis and Phloeospora. However, as these fungi showed considerable variations in their conidiomata (Grove 1919) the group was then extended to include all genera that produce conidia within a cavity or cushion-like fungal matrix (Grove 1935, 1937). Therefore, the name “Coelomycetes” is used for convenience (Kendrick 2000) and identifies an artificial group of fungi instead of a formal taxonomic rank (Taylor 1995), and its members have been revealed to be spread across the Dothideomycetes, Leotiomycetes, Sordariomycetes (Wijayawardene et al. 2016b), and even basidiomycetous coelomycetes, e.g. Basidiopycnis, Chaetospermum, Fibulocoea (Nag Raj 1981).
A large number of coelomycetes are characterised by the production of appendage-bearing conidia, and they are distributed across several classes of Ascomycota as well as a few genera of Basidiomycota. Although Nag Raj (1993) provided the diagnostic morphological characters for 142 genera of appendaged coelomycetes, their phylogenetic affiliation remains largely unresolved.

The Sporocadaceae, also known as pestalotioid fungi, is a typical group of appendaged coelomycetes, including many genera treated by Nag Raj (1993). Pestalotioid fungi are defined as having multi-septate and more or less fusiform conidia with appendages at one or both ends, frequently with some melanised cells, resembling those taxa having affinities with Pestalotia. This genus has undergone many rearrangements since it was first introduced (De Notaris 1841). Klebahn (1914) noted that Pestalotia was heterogeneous and could be subdivided based on cell numbers in the conidium, designating these groups as quadricolulate, quinqueloculatae, and sexiloculatae. Based on this characteristic, Steyaert (1949) separated the genera Pestalotiopsis and Truncatella from Pestalotia. He defined species of Pestalotia as characterised by 6-cell conidia, while Pestalotiopsis and Truncatella were typified by 5- and 4-cell conidia, respectively. Guba (1961) revised Pestalotia and did not accept Pestalotiopsis as separate genera, yet maintained the sections based on the number of conidial cells as proposed by Steyaert (1949). Sutton (1969, 1980), however, accepted Pestalotiopsis, Truncatella and Monochoa transferred many Pestalotia species to other genera, although the taxonomic status of Pestalotia s. str. remained unresolved.

Pestalotia-like asexual morphs were classified in Amphisphaeriaceae (Samuels et al. 1987), accommodating 36 genera (Hawksworth et al. 1995). Its ordinal level of classification, the Amphisphaeriales, was introduced by Eriksson & Hawksworth (1986), but treated as a synonym of Xylariales one year later (Eriksson & Hawksworth 1987). This classification was followed by subsequent authors and later supported by molecular data (Hawksworth et al. 1995). The order was recently resurrected by Senanayake et al. (2015) to include Amphisphaeriaceae, Clypeosphaeriaceae and another four novel families derived from Amphisphaeriaceae (Bartaliinaceae, Discosiaaceae, Pestalotiopsidaceae and Phlogicylindriaceae). However, the sequence dataset used in Senanayake et al. (2015) was largely incomplete and some of the introduced families were not well supported statistically. Subsequently, Jaklitsch et al. (2016) synonymised Bartaliinaceae, Discosiaaceae, Pestalotiopsidaceae and Robiliaceae (Crous et al. 2015), and revived the older family name sporocadaceae to accommodate them. Together with the Amphisphaeriaceae and Phlogicylindriaceae, Sporocadaceae was accommodated in the Xylariales, and Amphisphaeriales was not accepted due to a lack of phylogenetic support in their analysis (Jaklitsch et al. 2016). Presently, agreement on the classification and delimitation of the family itself seems to have been reached after intense debate. Fungi in the Sporocadaceae (e.g. Bartalia, Pestalotia, Pestalotiopsis, Robilardia, Seimatosporum, Seiridium and Truncatella) possess common asexual morphological characters related to their acervular conidiomata, conidiogenesis and conidia.

Another genus within Sporocadaceae that has been revised and rearranged repeatedly since its introduction is Seimatosporum (Corda 1833, Sutton 1963, 1964, 1973, 1975a, b, 1977, Shoemaker 1964, Shoemaker & Müller 1964, Pirouzynsk & Shoemaker 1970, Swart & Griffiths 1974, Brockmann 1976, Swart 1979, Nag Raj 1993). Between 1964 and 1980 the generic concept of Seimatosporum was broadened to include 15 generic synonyms, and as many as 25 synonyms are listed in Index Fungorum (2018). Sutton (1980) noted the heterogeneity of conidial morphologies in Seimatosporum and suggested separating it into smaller genera, either based on conidial septation, pigmentation, sexual links, or a combination of these criteria. Later, Nag Raj (1993) rearranged the Seimatosporum complex into five genera, i.e. Seimatosporum (syn. Basipilus, Cryptostictis, Dochmophola and Seiridina), Sporocadus (syn. Coryneopsis and Leptocorynus), Sarcostroma (syn. Andiseta, Disaeta and Labridium), Diplorhiza (syn. Allelochaeta and Monocera), and Vermisporium. Based on LSU and ITS phylogenetic analyses, Vermisporium was again synonymised under Seimatosporum (Barber et al. 2011, Tanaka et al. 2011). In a subsequent multi-locus phylogenetic study including type species, Crous et al. (2018) resurrected the older name Allelochaeta (syn. Discostromopsis, Vermisporium) to accommodate these taxa.

Discostroma (Clements 1909) was recognised as the sexual morph of Seimatosporum (Nag Raj 1993). Although this sexual and asexual connection was linked via molecular analyses by Tanaka et al. (2011), this study did not include the respective type species. The type species of Seimatosporum, Sei. rosae (Corda 1833), was recently epitypified by Norphanphoun et al. (2015).

To date, most phylogenetic studies addressing genera of Sporocadaceae have been based solely on ITS and LSU sequence data. Sequences of ex-type strains were included (2015, 2016). Consequently, the taxonomic concept of, and generic delimitation within Sporocadaceae remain unclear.

In addition, members of Sporocadaceae are of particular interest with regard to the production of secondary metabolites, e.g. Pestalotiopsis, Bartalinia and Morinia (Collado et al. 2006, Gangadevi & Muthumary 2008, Liu et al. 2009). Pestalotiopsis fici was shown to possess a very high number of gene clusters involved in bioactive compound synthesis (Wang et al. 2016). Because genera in this family of fungi share the same evolutionary history, it is unlikely that the diversity of secondary metabolites detected in Pestalotiopsis is an exception within the family. Therefore, a large number of potential novel metabolites might be hidden and await discovery. The natural classification system proposed for Sporocadaceae in this study could thus present a major step to screen for novel metabolites in future studies.

Numerous strains belonging to Sporocadaceae were examined in the present study, including the established genera Pestalotiopsis, Pseudopestalotiopsis, Neopestalotiopsis, Seiridium, Monochoa, Seimatosporum, Discosia, Bartalinia, Truncatella, Zetiasplona and Broomella. The primary objectives were: 1) to delineate the phylogenetic lineages and generic boundaries through a polyphasic approach; 2) to determine generic synapomorphy in Sporocadaceae; and 3) to designate appropriate epitypes to stabilise the application of names. To address these issues we performed multi-locus phylogenetic analyses based on LSU, ITS, rpb2, tef-1a and tub2 DNA sequence data. Sequences of ex-type strains were included when available.
MATERIALS AND METHODS

Isolates

All isolates of *Amphisphaeriaeae*-related fungi with appendage-bearing conidia were obtained from the culture collection (CBS) of the Westerdijk Fungal Biodiversity Institute (WI), Utrecht, the Netherlands, and the working collection of Pedro Crous (CPC) housed at the WI (Table 1). Sequences from other strains not examined here but published in previous phylogenetic studies were retrieved from GenBank (Table 1). Representative cultures of the new species described in this study were deposited in the CBS culture collection.

DNA extraction, PCR amplification and sequencing

Total genomic DNA was extracted from fresh mycelia grown on malt extract agar (MEA) using the Wizard Genomic DNA Puriﬁcation Kit (Promega Corporation, Fitchburg, Wisconsin, USA) following the manufacturers' protocols. Five partial loci including the 5.8S nuclear ribosomal DNA gene with the two flanking internally transcribed spacer regions (ITS), the large subunit of the rRNA (LSU), DNA-directed RNA polymerase II second largest subunit (rpb2), and the translation elongation factor 1-alpha (tef-1α) and β-tubulin (tub2) genes were ampliﬁed and sequenced using the following primer pairs: ITS4/ITS5 for ITS (White et al. 1990), LR0R/LR5 for LSU (Vilgalys & Hester 1990, Rehner & Samuels 1994), RPB2-5f2/RPB2-7cr for rpb2 (Liu et al. 1999, Sung et al. 2007), EF-1/EF-2 for tef-1α (O'Donnell et al. 1998) and T1/T2b for tub2 (Glass & Donaldson 1995, O'Donnell & Cigelnik 1997). The PCR mixtures for ITS, LSU, tef-1α and tub2 were prepared as in Bonthond et al. (2018). For rpb2, the PCR mixture consisted of 1 μL genomic DNA, 1 × NH₄ reaction buffer (Bioline, Luckenwalde, Germany), 0.2 μM of each primer, 4 % Bovine Serum Albumin (BSA, New England BioLabs, #B9000S), 40 μM dNTP, 1.6 mM MgCl₂, and 0.25 U Taq DNA polymerase (Bioline) in a total volume of 12.5 μL. The general PCR conditions were: an initial denaturation step of 5 min at 94 °C followed by 35 cycles of 30 s at 94 °C, 50 s at 52 °C (ITS, LSU) or 55 °C (rpb2, tub2, tef-1α) and 1 min at 72 °C, and a ﬁnal elongation step of 7 min at 72 °C. The amplicons were sequenced with both forward and reverse primers using an Applied Biosystems 3730xl DNA Analyzer (Thermo Fisher Scientiﬁc). Forward and reverse reads were paired and consensus sequences calculated in MEGA v. 7.0.21 and DNASTAR Lasergene SeqMan Pro v. 8.1.3. All new sequences and sequences which were longer in length or had nucleotide differences with published sequences were submitted to GenBank (Table 1).

Phylogenetic analyses

Sequence alignments of the ﬁve individual loci (LSU, ITS, rpb2, tub2, tef-1α) were made using MAFFT v. 7 (http://mafft.cbrc.jp/alignment/server/index.html), and were then manually edited in MEGA v. 7.0.21. Maximum Likelihood (ML) and Bayesian analysis (BA) were used for phylogenetic inferences of single gene sequence alignments and the concatenated alignments. The individual gene trees were assessed for clade conﬁicts between the individual phylogenies.

ML and BA were implemented on the CIPRES Science Gateway portal (https://www.phylo.org/; Miller et al. 2012) using RAxML-HPC BlackBox v. 8.2.10 (Stamatakis 2014) and MrBayes v. 3.2.6 (Huelsenbeck & Ronquist 2001, Ronquist & Huelsenbeck 2003), respectively. For ML analyses, a GTR+GAMMA substitution model with 1 000 bootstrap iterations was used. Bayesian analyses were computed with four simultaneous Markov Chain Monte Carlo chains, 100 000 000 generations and a sampling frequency of 1 000 generations, ending the run automatically when standard deviation of split frequencies fall below 0.01. The burn-in fraction was set to 0.25, after which the 50 % majority rule consensus trees and posterior probability (PP) values were calculated. For the concatenated dataset, character sets were deﬁned for each locus, and MrModelTest v. 2.2 (Nylander 2004) was used to determine their optimal nucleotide substitution model settings. The resulting trees were plotted using FigTree v. 1.4.2 (http://tree.bio.ed.ac.uk/software/ﬁgtree). Alignments were deposited in TreeBASE (www.treebase.org; S23478).

Morphology

Cultures were cultivated on MEA, commeal agar (CMA), potato dextrose agar (PDA), and synthetic nutrient-poor agar (SNA; see Crous et al. 2009 for recipes) at 21 °C in a 12 h day/night regime. After 14 d, growth rates were measured and colony characters were noted. Colony colours were rated following the colour charts of Rayner (1970). Morphological observations of reproductive structures were determined using a Nikon AZ100 dissecting microscope and a Nikon Eclipse 80i compound microscope with differential interference contrast (DIC) illumination, both equipped with a Nikon DS-R2 high deﬁnition colour digital camera. Slide preparations were made with lactic acid except for strains of Pestalotiopsis and Pseudopestalotiopsis, conidia of which are generally contractile in lactic acid and were thus mounted with water. Measurements and descriptions of microscopic structures were preferentially made from cultures grown on SNA. If sterile on SNA, morphological characters produced on other media were described. At least 30 measurements were taken for each structure, and the mean value, standard deviation and minimum—maximum values were given, with the extreme measurements in parentheses. Length of the conidia was measured from the base of the basal cell to the base of the apical appendage, and conidial width was measured at the widest point of the conidium (Bonthond et al. 2018).

RESULTS

Phylogenetic assessment

Single gene alignments of tub2 and tef-1α of all isolates included in this study contained a high number of gaps, indicating a high degree of nucleotide variation, which may result in unreliable sequence alignments and phylogenies. We therefore excluded tub2 and tef-1α from the multi-locus concatenated dataset that was used to construct the overview phylogeny for generic determination.

Overview phylogeny

The concatenated DNA sequence dataset (ITS, LSU and rpb2) used to infer delimitation at the family and genus levels
Table 1. Strains used in this study with details of their host, location, and GenBank accessions numbers.

| Organism name | Strain number | Status | Country | Substrate | GenBank accession numbers |
|---------------|---------------|--------|---------|----------|--------------------------|
| All. acuta    | CPC 16629     |        | Australia | Eucalyptus dives | MH554297 MH554086 MH554578 MH554519 MH555000 |
| All. biseptata| CBS 131116 = CPC 13584 | ET | Australia | Eucalyptus orestia | MH554286 MH554075 MH554749 MH554510 MH554987 |
| All. elegans  | CBS 187.81    | ET     | Australia | Melaleuca lanceolata | MH554234 MH554014 MH554690 MH554448 MH554927 |
| All. falcata  | CBS 131117 = CPC 13578 | ET | Australia | Eucalyptus alliatrix | MH554217 MH553999 MH554688 MH554426 MH554907 |
| All. fusiporta| CBS 810.73 = ATCC 26928 = IMI 163446 | IT | Italy | Eucalyptus polyanthemos | MH554279 MH554067 MH554743 MH554503 MH554980 |
| All. kriegeriana | CBS 144172 = CPC 17616 |        | Australia | Eucalyptus sp. | MH554304 MH554094 MH554767 MH554528 MH555008 |
| All. kriegeriana | CBS 188.81 = NBRC 32679 |        | Australia | Callistemon sieberi (= C. paludosus) | MH554235 MH554015 MH554691 MH554449 MH554928 |
| All. neoacuta | CBS 115131 = CPC 156 | T | South Africa | Eucalyptus smithii | JN671209 JN671200 MH704627 MH704602 MH554998 |
| All. neoacuta | CBS 110733 = CPC 157 | T | South Africa | Eucalyptussmithii | JN671210 JN671201 MH704628 MH704603 MH554999 |
| All. neodilophospora | CBS 144177 = CPC 17161 | T | Australia | Callistemon pinifolius | MH554300 MH554090 MH554763 MH554524 MH555004 |
| All. neoornbiculatis | CBS 13581 |        | Australia | Eucalyptus regnans | MH554285 MH554074 MH554748 MH554509 MH554966 |
| All. orbiculatis | CBS 144182 = CPC 20191 | T | Australia | Eucalyptus obliqua | MH554315 MH554105 MH554778 MH554539 MH555018 |
| All. parasalegans | CBS 150.71 = NBRC 32674 | T | Australia | Eucalyptus sp. | MH554299 MH554089 MH554762 MH554523 MH555003 |
| All. pseudo walkeri | CBS 144195 = CPC 17043 | T | South Africa | Eucalyptus sp. | MH554293 MH554082 MH5704629 MH704604 MH554994 |
| All. sparsifoliae | CPC 14502 | T | Australia | Eucalyptus sp. | MH554294 MH554083 MH554630 MH704605 MH554995 |
| All. sparsifoliae | CBS 144183 = CPC 14529 | T | Australia | Eucalyptus sp. | MH554306 MH554096 MH554769 MH554530 MH555010 |
| All. walkeri | CBS 131119 = CPC 17644 | ET | Australia | Eucalyptus sp. | MH554294 MH554083 MH554630 MH704605 MH554995 |
| Bartalinia bella | CBS 125525 = CMW 31067 | T | South Africa | Maytenus abbottii | MH554214 GU291796 MH554663 MH554421 MH554904 |
| Bartalinia bella | CBS 464.61 = IMI 083535 = IMUR 1520 | T | Brazil | Air | MH554264 MH554051 MH554727 MH554486 MH554964 |
| Bar. pini | CBS 143891 = CPC 24328 | T | Uganda | Pinus patula | MH554330 MH554125 MH554797 MH554559 MH555033 |
| Bar. robillardoides | CBS 122615 = CMW 805 | T | South Africa | Cupressus lusitanica | MH554207 MH553989 MH554657 MH554415 MH554897 |
| Beltrania pseudorhombica | CBS 138003 = CPC 23656 | | China | Pinus tabulaeformis | KJ710243 LT853104 LT853252 LT853202 LT853152 |

LSU: LSU, ITS: ITS, tub2: tub2, rpb2: rpb2, tef-1a: tef-1a.
| Organism name | Strain number | Status | Country | Substrate | GenBank accession numbers 3 |
|---------------|---------------|--------|---------|-----------|---------------------------|
| Bel. rhombica  | CBS 123.58 = IMI 072432 | T      | Mozambique | Sand near mangrove swamp | MH554209 MH553990 MH704631 MH704606 MH554899 |
| Broomella vitalbae | HPC 1154 | –      | –       | –         | MH554367 MH554173 MH554846 MH554608 MH555069 |
| Ciliochorella castaneae | MFLUCC 13-0798 | ET     | Italy | Clematis vitalba | KP775749 NR_153610 – – – |
| Ciliochorella castaneae | NBRC 104545 | Japan  | Japan | Ceridiphyllum japonicum | AB433277 – – – – |
| Ciliochorella castaneae | NBRC 104546 | Japan  | Kalopanax pictus | – | AB433278 – – – – |
| Ciliochorella castaneae | MFLUCC 12-0310 = NTL067 | T      | Thailand | Dead leaves | KF827445 KF827444 KF827478 KF827477 KF827479 |
| Ciliochorella castaneae | MFLUCC 14-0984 | T      | Thailand | Phanera purpurea, dead leaves | KX789681 KX789680 KX789682 – – |
| Clypeosphaeria mamillana | CBS 140735 | ET     | France | Cornus alba | MH554225 K949897 MH704637 MH704610 MH5489001 |
| Cly. uniseptata | CBS 114967 = HKUCC 6349 | –      | –       | –         | MH554197 MH553979 MH554638 MH504611 MH554878 |
| Diploceras hypericum | CBS 109058 | No. LYN 251 A | New Zealand | Hypericum sp. | MH554178 MH553955 MH554614 MH554373 MH554852 |
| Diploceras hypericum | CBS 197.36 | Switzerland | Hypericum sp. | – | MH554237 MH554017 MH554693 MH554451 MH554930 |
| Diploceras hypericum | CBS 492.97 | Netherlands | Hypericum perforatum | – | MH554267 MH554054 MH554730 MH554489 MH554967 |
| Diploceras hypericum | CBS 143885 | ET      | Netherlands | Hypericum perforatum | MH554316 MH554108 MH554781 MH554542 MH555019 |
| Disaeta arbuti | CBS 143903 | CPC 28304 | Australia | Acacia pycnantha | MH554346 MH554148 MH554821 MH554583 MH555050 |
| Dis. brasiliensis | MFLUCC 12-0429 = NTL094-2 | T      | Thailand | Dead leaf | KF827436 KF827432 KF827469 KF827465 KF827473 |
| Dis. brasiliensis | MFLUCC 12-0431 = NTL095 | Thailand | Dead leaf | – | KF827437 KF827433 KF827470 KF827466 KF827474 |
| Dis. brasiliensis | MFLUCC 12-0435 | Thailand | Dead leaf | – | KF827438 KF827434 KF827471 KF827467 KF827475 |
| Dis. fagi | MFLU 14-0299 | T      | Italy | Fagus sylvatica | KM678048 KM678040 – – – |
| Dis. fagi | MFLU 14-0298 | T      | Italy | Fagus sylvatica | KM678045 KM678042 – – – |
| Dis. neofraxinea | MFLUCC 13-0204 | T      | Italy | Fagus sylvatica | KR072672 KR072673 – – – |
| Dis. pseudoartocreas | CBS 136438 | CPC 21117 | Austria | Tilia sp. | KF777214 KF777161 MH554672 MH554430 MH554913 |
| Dis. rubi | CBS 143893 | CPC 25062 | USA | Rubus phoenicolasius | MH554334 MH554131 MH554804 MH554566 MH555038 |
| Dis. rubi | NBRC 32624 = IMI 251648 | –      | –       | Quercus fusiformis | – 03262401 – – – |
| Discosia sp. | MAFF 410149 | Japan | Pinus densiflora | – | AB593708 AB594776 AB594174 – – |
| Discosia sp. | NBRC 8975 | –      | –       | Poa pratensis | AB593705 AB594773 AB594172 – – |
| Discosia sp. | MFLU 14-0298 | T      | Italy | Fagus sylvatica | KM678045 KM678042 – – – |
| Discosia sp. | MAFF 242784 | T      | Japan | Machilus thunbergii | AB593716 AB594784 AB594182 – – – |
| Discosia sp. | MAFF 242783 | Japan | Castanea crenata | – | AB593715 AB594783 AB594181 – – |
| Discosia sp. | NBRC 31640 | –      | –       | Decayed leaf | – 03164001 – – – |
| Discosia sp. | NBRC 3183 | Japan | Prunus mume | – | 03183001 – – – |
| Discosia sp. | MAFF 242778 | Japan | Unknown leaves | – | AB593709 AB594777 AB594175 – – |
| Discosia sp. | MAFF 242779 | Japan | Unknown leaves | – | AB593713 AB594781 AB594179 – – |
| Discosia sp. | MAFF 242782 | Japan | Unknown leaves | – | AB593714 AB594782 AB594180 – – |

(continued on next page)
| Organism name | Strain number | Status | Country | Substrate | GenBank accession numbers |
|--------------|---------------|--------|---------|-----------|--------------------------|
| Discosia sp. 5 | MAFF 242785 | Japan | Hamamelis japonica | LSU ITS tub2 tef-1α α rpb2 | AB593711 AB594779 AB594177 – – |
| Discosia sp. 6 | CBS 241.66 | South Africa | Acacia karroo | LSU ITS tub2 tef-1α α rpb2 | MH554244 MH554282 MH554698 MH554456 MH554933 |
| Discosia sp. 7 | CBS 684.70 | Netherlands | Aesculus hippocastanum | LSU ITS tub2 tef-1α α rpb2 | MH554277 MH554506 MH554740 MH554500 MH554978 |
| Dis. tricellularis | MAFF 237478 | Japan | Rhododendron indicum | LSU ITS tub2 tef-1α α rpb2 | AB593730 AB594798 AB594189 – – |
| Dis. yakushimensis | MAFF 242774 = NBRC 32705 | T | Japan | Rhododendron indicum | LSU ITS tub2 tef-1α α rpb2 | AB593721 AB594789 AB594187 – – |
| Distononappendiculata banksiae | CBS 131308 = CPC 13637 | T | Australia | Banksia marginata | LSU ITS tub2 tef-1α α rpb2 | JQ044442 JQ044422 MH554670 MH554428 MH554909 |
| Dist. casuarinae | CBS 144032 = CPC 29074 | T | Australia | Banksia repens | LSU ITS tub2 tef-1α α rpb2 | MH554359 MH554163 MH554836 MH554598 MH555062 |
| Dist. verrucata | CBS 302.86 | T | USA | Soil | LSU ITS tub2 tef-1α α rpb2 | MH554247 MH554028 MH554705 MH554463 MH554941 |
| Heterotruncatella acaciigena | CBS 143880 = CPC 15130 | T | Australia | Acacia pedina | LSU ITS tub2 tef-1α α rpb2 | MH554295 MH554084 MH554756 MH554517 MH554996 |
| Het. aspera | CBS 144140 = CPC 28910 | T | Australia | Acacia glaucoptera | LSU ITS tub2 tef-1α α rpb2 | MH554352 MH554156 MH554829 MH554591 MH555055 |
| Het. avellanea | CBS 143906 = CPC 28968 | T | Australia | Acacia glaucoptera | LSU ITS tub2 tef-1α α rpb2 | MH554355 MH554159 MH554832 MH554594 MH555058 |
| Het. breviappendiculata | CBS 143896 = CPC 25377 | T | Australia | Eucalyptus viminalis | LSU ITS tub2 tef-1α α rpb2 | MH554338 MH554136 MH554809 MH554571 MH555042 |
| Het. constricta | CBS 144033 = CPC 29480 | T | Australia | Banksia gardneri | LSU ITS tub2 tef-1α α rpb2 | MH554363 MH554169 MH554842 MH554604 MH555066 |
| Het. diversa | CBS 143909 = CPC 29040 | T | Australia | Acacia sp. | LSU ITS tub2 tef-1α α rpb2 | MH554345 MH554144 MH554817 MH554579 MH555049 |
| Het. grevilleae | CBS 143881 = CPC 16997 | T | Australia | Grevillea sp. | LSU ITS tub2 tef-1α α rpb2 | MH554356 MH554160 MH554833 MH554595 MH555059 |
| Het. longissima | CBS 144137 = CPC 19047 | T | Australia | Synaphea sp. | LSU ITS tub2 tef-1α α rpb2 | MH554361 MH554165 MH554838 MH554600 MH555064 |
| Het. lutea | CBS 349.73 = ATCC 26926 = IMI 168736 | IT | Australia | Acacia pycnantha | LSU ITS tub2 tef-1α α rpb2 | DQ414533 LT853099 LT853246 LT853196 LT853146 |
| Het. proteicola | CBS 144020 = CPC 13700 | South Africa | Protea acaulos | LSU ITS tub2 tef-1α α rpb2 | MH554288 MH554077 MH554751 MH554512 MH554989 |
| Het. quercicola | CBS 143895 = CPC 25385 | T | USA | Quercus walshii | LSU ITS tub2 tef-1α α rpb2 | MH554337 MH554135 MH554508 MH554570 MH555041 |
| Het. restionacearum | CBS 118150 = CMW 17968 | South Africa | Restio filiformis | LSU ITS tub2 tef-1α α rpb2 | MH554203 DQ278914 MH554649 MH554407 MH554889 |
Table 1. (Continued).

| Organism name | Strain number | Status | Country | Substrate | GenBank accession numbers |
|---------------|---------------|--------|---------|-----------|--------------------------|
|               |               |        |         |           | LSU | ITS | tub2 | tef-1α | rp2 |
| **LSU ITS tef-1α rpb2** |               |        |         |           |     |     |     |        |     |
| Het. singularis | CBS 119210 = CMW 18755 | T | South Africa | Ischyrolepis cf. gaudichaudiana | DQ278929 DQ278915 | MH554653 MH554411 MH554892 |
| Heterotruncalella sp. | CBS 144031 = CPC 29042 | T | Australia | Hakea elliptica | MH554357 MH554161 MH554834 MH554596 MH555060 |
| Het. spadicea | CBS 118144 = CMW 18013 | T | South Africa | Ischyrolepis cf. gaudichaudiana | DQ278926 DQ278921 | MH554646 MH554404 MH554886 |
| Heterotruncatella sp. | CBS 118145 = CMW 18099 | ET | South Africa | Cannomois virgata | DQ278927 DQ278912 | MH554647 MH554405 MH554887 |
| Hymenolepiella austroafricana | CBS 138386 = CPC 21940 | T | South Africa | Rhodocoma capensis | DQ278928 DQ278913 | MH554648 MH554406 MH554888 |
| Hyalotiella spartii | CBS 143890 = CPC 29096 | T | Australia | Sorghum halepense | MH554353 MH554157 MH554830 MH554592 MH555056 |
| Hyla. transvalensis | CBS 143897 = CPC 26201 | T | France | Restio egregius | DQ278918 | – | – | – | – |
| Hym. endophytica | EML-AS5-1 | T | Korea | Abies firma | KX216518 KX216520 | – | – | – |
| Hym. hippophaeicola | CBS 113687 = UPSC 1865 | T | Sweden | Hippophae rhamnoides | MH554188 MH553969 MH554628 MH554387 MH554863 |
| Hym. lakefuxianensis | CBS 140410 = HKUCC 7303 | ET | China | Submerged wood | AF452047 | – | – | – | – |
| Hym. polyseptata | CBS 143887 = CPC 21944 | T | South Africa | Combretum sp. | MH554321 MH554116 MH554789 MH554550 MH555024 |
| Hym. subcylindrica | CBS 164.77 = NBRC 32675 | T | India | Cocos nucifera | MH554230 MH554009 MH554685 MH554443 MH554925 |
| Immersidiscosia eucalypti | CBS 647.74 = NBRC 32675 | T | India | Gypsophila seeds | MH554275 MH554062 MH554739 MH554498 MH554976 |

(continued on next page)
| Organism name        | Strain number | Status | Country       | Substrate                          | GenBank accession numbers | LSU | ITS | tub2 | tef-1α | rpb2 |
|---------------------|---------------|--------|---------------|------------------------------------|---------------------------|-----|-----|------|--------|------|
| NBRC 104196         |               | Japan  | Quercus myrsinifolia | AB593723 AB594791             | ––                        |     |     |      |        |      |
| NBRC 104197         |               | Japan  | Adiasia japonica | AB593724 AB594792             | ––                        |     |     |      |        |      |
| MAF 242781          |               | Japan  | Unknown dead leaves | AB593725 AB594793             | ––                        |     |     |      |        |      |
| Leptotypha fuckelii | CBS 140409    | NT     | Belgium       | Tilia cordata                 | KT949902 NR_151423 MH554677 MH554435 MH554918 |     |     |      |        |      |
| Lep. sambuci         | CBS 131707    | T      | UK            | Sambucus nigra                | MH554219 NR_151424 MH704632 MH704612 MH554911 |     |     |      |        |      |
| Microdochium         | CBS 125585    | T      | Austria       | Lycoperdonannum                | KP858952 KP859016 KP859080 –– |     |     |      |        |      |
| Mic. phragmitis      | CBS 285.71    | ET     | Poland        | Puccinia teleotobosa, on Phragmites australis | KP858949 KP859013 MH704636 –– |     |     |      |        |      |
| Mic. semincola       | CBS 139961 = KAS3576 | T | Switzerland    | maize kernels                | KP859794 NR_155375 KP859101 –– |     |     |      |        |      |
| Monochaetia ilexii  | CBS 101009    | Japan  | Air           | Quercus robur                 | MH554176 MH553953 MH554612 MH554371 MH554849 |     |     |      |        |      |
| Mon. monochaeta      | CBS 115004    | Netherlands | Quercus robur | MH554198 AY583243 MH554143 MH554398 MH554879 |     |     |      |        |      |
| CBS 199.82 ET Italy  | CBS 315.54 = IMI 056698 | T | UK            | Quercus sp.                   | MH554249 MH554030 –– |     |     |      |        |      |
| CBS 546.80 ET Italy  | CBS 658.95    | Netherlands | culture contaminant | MH554270 MH554056 MH554732 MH554441 MH554969 |     |     |      |        |      |
| CBS 137994 ET France | CBS 144034 = CPC 29514 | T | Mexico        | Quercus eurati                  | MH554365 MH554171 MH554844 MH554606 MH555068 |     |     |      |        |      |
| Mor. acaciae         | CBS 100230    | New Zealand | Prunus salicina cv. ‘Omega’ | MH554174 MH553950 MH554609 MH554368 MH554847 |     |     |      |        |      |
| CBS 137994 = CPC 23421 |         | T | France        | Acacia melanoxylon             | MH554221 MH554002 MH554673 MH554431 MH554914 |     |     |      |        |      |
| Mor. crini           | CBS 143888 = CPC 21978 | T | South Africa  | Cnium bulbispermum             | MH554323 MH554118 MH554791 MH554552 MH555026 |     |     |      |        |      |
| Mor. longiappendiculata | CBS 117603 = CPC 29652 | T | Spain         | Calluna vulgaris               | MH554202 AY929324 MH554644 AY929316 MH554885 |     |     |      |        |      |
| Mor. pestalozzioides | ATCC No. PTA-3882 = F090354 | ET | Spain         | Sedum sediforme               | –– AY929325 –– AY929314 –– |     |     |      |        |      |
| Neoepistolotipsis cubana | CBS 600.96 = INIFAT C96/44-4 | T | Cuba          | Leaf litter                    | KM116253 KM199347 KM199438 KM199521 MH554973 |     |     |      |        |      |
| Neo. eucalyptica     | CBS 264.37 = BBA 5300 | T | ––            | Eucalyptus globulus            | KM116256 KM199376 KM199431 KM199551 MH554935 |     |     |      |        |      |
| Neo. keteleeria      | MFLUCC 13-0915 | China | Keteleeria pubescens | –– KJ023087 KJ032008 KJ023089 –– |     |     |      |        |      |
| Neo. mesopotamica    | CBS 336.8 T Iraq |         | Pinus brutia               | KM116271 KM199362 KM199441 KM199553 MH554944 |     |     |      |        |      |
| Neo. paeniae         | CBS 318.74    | Nigeria | Anacardium occidentale | –– MH554031 MH554707 –– |     |     |      |        |      |
| Neo. protearum       | CBS 111506 = CPC 1766 | T | Zimbabwe      | Leucospermum cuneiforme        | –– MH553959 MH554618 MH554377 –– |     |     |      |        |      |
| CBS 111478 = CPC 1765 |         | T | Zimbabwe      | Leucospermum cuneiforme        | JN712564 LT853103 KM199463 KM199542 MH554873 |     |     |      |        |      |
| Neo. rosea           | CBS 101057    | T | New Zealand   | Rosa sp.                      | KM116245 KM199359 KM199429 KM199523 MH554850 |     |     |      |        |      |
| Neo. surinamensis    | CBS 450.74 T | Suriname | Soil under Elaeis guineensis | KM116258 KM199351 KM199465 KM199518 MH554962 |     |     |      |        |      |
| Neo. zambwana        | CBS 111945 = CPC 1777 | T | Zimbabwe      | Leucospermum cuneiforme        | JX556249 JX556231 KM199465 KM199545 MH554855 |     |     |      |        |      |
| Nonappendiculata quercina | CBS 116061 | T | Italy         | Quercus suber                  | MH554199 MH553982 MH554641 MH554400 MH554882 |     |     |      |        |      |
| CBS 270.82 ET Italy  | CBS 399.71    | T | South Africa  | Acacia karroo                  | MH554246 MH554025 MH554701 MH554459 MH554937 |     |     |      |        |      |
| Pestalotipsis adusta | ICMP 6088 ET Fiji |         | On refrigerator door PVC gasket | –– JX399006 JX399037 JX399070 –– |     |     |      |        |      |
| Organism name | Strain number¹ | Status² | Country | Substrate | GenBank accession numbers³ |
|---------------|----------------|---------|---------|-----------|---------------------------|
| CBS 263.33 | | Netherlands | Rhododendron ponticum | KM16198 KM199316 KM199414 KM199489 |
| **Pes. aggestorun** | LC6301 = LF1308 | T | China | Camellia sinensis | KX895129 KX955015 KX955348 KX955234 |
| | LC2186 = LF2076 | China | Camellia sinensis | – KY464140 KY464160 KY464150 |
| **Pes. ancardiacaeanum** | IFRDCC 2397 | T | China | Mangifera indica | – KC247154 KC247155 KC247156 |
| **Pes. arceuthobii** | CBS 433.65 = ATCC 16338 = WSP 54146(9) | USA | Arceuthobium campylopus f. abietinum shoot, on Abies amabilis | – MH554046 MH554722 MH554481 |
| CBS 434.65 = ATCC 16339 | | T | USA | Arceuthobium campylopus f. tsugense seed, on Tsuga heterophylla | KM16243 KM199341 KM199427 KM199516 |
| **Pes. arengae** | CBS 331.92 | T | Singapore | Arenga undulatifolia | KM16207 KM199340 KM199426 KM199515 |
| **Pes. australiasiae** | CBS 114126 = CPC 2896 | T | New Zealand | Knightia sp. | KM16218 KM199297 KM199409 KM199499 MH554867 |
| | CBS 114141 = CPC 2949 | | Australia | Protea cv. ‘Pink Ice’ | KM16203 KM199298 KM199410 KM199501 |
| **Pes. australis** | CBS 114193 = CPC 3011 | T | Australia | Grevillea sp. | KM16197 KM199332 KM199383 KM199475 MH554875 |
| CBS 118143 = CMW 16285 | | South Africa | Thamnochortus fraternus | – MH553985 MH554645 MH554403 |
| CBS 119350 = CMW 20013 | | South Africa | Brabejum stellatifolium | KM16209 KM199333 KM199384 KM199476 |
| **Pes. biciliata** | CBS 124463 | T | Slovakia | Pteranthus × hispanicus | KM16224 KM199308 KM199399 KM199505 |
| CBS 200.65 | UK | Taxus baccata | – MH554019 MH554695 MH554453 |
| CBS 236.38 | Italy | Paeonia sp. | KM16214 KM199309 KM199401 KM199506 |
| **Pes. brachiata** | LC2988 = LF196 | T | China | Camellia sp. | – KX894933 KX955265 KX955150 |
| LC8188 = LF2078 | | China | Camellia sp. | – KY464142 KY464162 KY464152 |
| **Pes. brassicae** | CBS 170.26 | IT | New Zealand | Brassica napus | – KM199379 – KM199558 |
| **Pes. camelliae** | CBS 443.62 | Turkey | Camellia sinensis | KM16225 KM199336 KM199424 KM199512 |
| LC3003 = LF211 | China | Camellia sinensis | KX895074 KX894934 KX955266 KX955151 |
| MFLUCC 12-0277 | T | China | Camellia japonica | – JX399010 JX399041 JX399074 |
| **Pes. chamaeropis** | CBS 113607 = CPC 3080 | – | – | – KM16212 KM199325 KM199390 KM199472 |
| CBS 186.71 | T | Italy | Chamaerops humilis | KM16210 KM199326 KM199391 KM199473 |
| CBS 25347 | South Korea | Taxus yeco | – MH554132 MH554805 MH554567 |
| **Pes. clavata** | MFLUCC 12-0268 | T China | Buxus sp. | – JX398990 JX399025 JX399056 |
| **Pes. colombiensis** | CBS 118553 = CPC 10969 | T | Colombia | Eucalyptus eurangrandis | KM16222 KM199307 KM199421 KM199488 |
| **Pes. digitalis** | MFLU 14-0208 | T | New Zealand | Digitalis purpurea | – KP781879 KP781883 – – |
| **Pes. dilucida** | LC3232 = LF444 | T | China | Camellia sinensis | KX895092 KX894961 KX895293 KX895178 |
| LC8184 = LF2074 | China | Camellia sinensis | – KY464138 KY464158 KY464148 |
| **Pes. diplocilisae** | CBS 115585 = HKUCC 8394 | Hong Kong | Diplocilis glaucescens | KM16213 KM199315 KM199417 KM199483 |
| CBS 115587 = HKUCC 10130 | T | Hong Kong | Diplocilis glaucescens | KM16242 KM199320 KM199419 KM199486 |
## Table 1. (Continued)

| Organism name | Strain number | Status | Country | Substrate | GenBank accession numbers | LSU | ITS | tub2 | tef-1α | rpb2 |
|---------------|---------------|--------|---------|-----------|--------------------------|-----|-----|------|--------|------|
| *P. disseminata* | CBS 118552 = CPC 10950 | New Zealand | Eucalyptus botryoides | – | MH553986 MH554652 MH554410 – | \ | \ | \ | \ | \ |
| | CBS 143904 = ICMP 21065 = CPC 28705 | New Zealand | Persea americana | – | MH554152 MH554825 MH554587 – | \ | \ | \ | \ | \ |
| | CPC 29351 | New Zealand | Eucalyptus sp. | – | MH554166 MH554839 MH554601 – | \ | \ | \ | \ | \ |
| *P. diversiseta* | MFLUCC 12-0287 T | China | Rhododendron sp. | – | JX399009 JX399040 JX399073 \ | \ | \ | \ | \ |
| *P. dracomontelum* | MFLU 14-0207 T | Thailand | Dracontomelon dao | – | – – KP781880 – | \ | \ | \ | \ | \ |
| *P. ericacearum* | IFRDCC 2439 T | China | Rhododendron delavayi | – | KC537807 KC537821 KC537814 \ | \ | \ | \ | \ |
| *P. furcata* | CPC 20280 = MFLUCC 12-0054 T | Thailand | Camellia sinensis | KM116283 JQ683724 JQ683708 JQ683740 \ | \ | \ | \ | \ | \ |
| *P. gaultheriae* | IFRD 411-014 T | China | Gaultheria forrestii | – | KC537805 KC537819 KC537812 \ | \ | \ | \ | \ |
| *P. grevilleae* | CBS 114127 = CPC 2919 | Australia | Grevillea sp. | KM116212 KM199300 KM199407 KM199504 | MH554868 \ | \ | \ | \ | \ |
| *P. hawaiiensis* | CBS 114491 = CPC 2215 | T USA | Leucospermum cv. ‘Coral’ | KM116239 KM199339 KM199428 KM199514 | \ | \ | \ | \ | \ |
| *P. hispanica* | CBS 115391 = CPC 5193 | T Spain | Protea cv. ‘Susara’ | – | MH553981 MH554640 MH554399 – | \ | \ | \ | \ | \ |
| *P. hollandica* | CBS 265.33 T | Netherlands | Sciadopitys verticillata | KM116228 KM199328 KM199388 KM199406 | MH554936 \ | \ | \ | \ | \ |
| *P. hongkongica* | CBS 336.97 T | Papua New Guinea | Soil in tropical forest | KM116230 KM199317 KM199420 KM199487 | MH554881 \ | \ | \ | \ | \ |
| *P. inflexa* | MFLUCC 12-0270 T | China | Unidentified tree | – | JX399009 JX399039 JX399072 – | \ | \ | \ | \ | \ |
| *P. intermedia* | MFLUCC 12-0259 T | China | Unidentified tree | – | JX398993 JX399028 JX399059 – | \ | \ | \ | \ | \ |
| *P. italiana* | MFLUCC 14-0214 T | Italy | Cupressus glabra | – | KP781878 KP781882 KP781881 | \ | \ | \ | \ | \ |
| *P. jesteri* | CBS 109350 T | Papua New Guinea | Fragraea bodenii | KM116281 KM199380 KM199468 KM199554 | \ | \ | \ | \ | \ |
| *P. jiangxiensis* | LC4242 = YH89 | China | Eurya sp. | – | KX895035 KX895327 KX895213 – | \ | \ | \ | \ | \ |
| | LC3499 = YH257 | T | China | Camellia sp. | KX895128 KX895341 KX895227 – | \ | \ | \ | \ | \ |
| *P. jinjiangensis* | LC6636 = LF1281 | China | Camellia sinensis | KX895135 KX895028 KX895361 KX895247 – | \ | \ | \ | \ | \ |
| | LC8190 = LF2080 | China | Camellia sinensis | – | KY464144 KY464164 KY464154 – | \ | \ | \ | \ | \ |
| *P. kenyana* | CBS 442.67 T | Kenya | Coffea sp. | KM116234 KM199302 KM199395 KM199502 | MH554958 \ | \ | \ | \ | \ |
| *P. knightiae* | CBS 111963 = CPC 2905 | New Zealand | Knightia sp. | KM116241 KM199311 KM199406 KM199495 – | \ | \ | \ | \ | \ |
| | CBS 114138 = CPC 2906 | New Zealand | Knightia sp. | KM116227 KM199301 KM199408 KM199497 | MH554870 \ | \ | \ | \ | \ |
| *P. leucadieni* | CBS 121417 = CMW 22192 | South Africa | Leucadendron sp. | – | MH553987 MH554654 MH554412 – | \ | \ | \ | \ | \ |
| *P. licuicola* | HGUP 4057 T | China | Licuala grandis | – | KC481683 KC481684 – | \ | \ | \ | \ | \ |
| *P. linearis* | MFLUCC 12-0271 T | China | Trachelospermum sp. | – | JX398992 JX399027 JX399058 – | \ | \ | \ | \ | \ |
| *P. lushanensis* | LC4344 = YH198 | China | Camellia sp. | KX895127 KX895005 KX895337 KX895223 – | \ | \ | \ | \ | \ |
| | LC8182 = LF2072 | China | Camellia sp. | – | KY464136 KY464156 KY464146 – | \ | \ | \ | \ | \ |
| *P. macadamiae* | BRIP 63738b T | Australia | Macadamia integrifolia | – | KX186588 KX186680 KX186621 – | \ | \ | \ | \ | \ |
| | BRIP 63739a | Australia | Macadamia integrifolia | – | KX186589 KX186681 KX186622 | \ | \ | \ | \ | \ |
| Organism name | Strain number¹ | Status² | Country   | Substrate                  | GenBank accession numbers³ |
|---------------|----------------|---------|-----------|----------------------------|---------------------------|
| Pes. malayana  | CBS 102220     | T       | Malaysia  | Macaranga triloba          | KM116238 KM199306 KM199411 KM199482 – |
| Pes. monochaeta| CBS 144.97     | T       | Netherlands | Quercus robur             | KM116229 KM199327 KM199386 KM199479 – |
| Pes. novae-hollandiae | CBS 130973 | T       | Australia | Banksia grandis           | KM116232 KM199337 KM199425 KM199511 – |
| Pes. oryzae    | CBS 111522 =   |        | USA       | Telopea sp.               | – KM199294 KM199394 KM199493 – |
|                | CPC 2083       |         |           |                            |                           |
| Pes. papuana   | CBS 171.26     | T       | Italy     | Oryza sativa              | – KM116206 KM199304 KM199397 KM199494 – |
| Pes. monochaeta| CBS 353.69     | T       | Denmark   | Soil along the coast       | KM116221 KM199299 KM199396 KM199496 MHH554947 – |
| Pes. papuana   | CBS 331.96     | T       | Papua New Guinea | Cocos nucifera | KM116240 KM199321 KM199413 KM199491 – |
| Pes. parva     | CBS 114972 =   |        | Hong Kong | Leaf                       | – MH553980 MH704625 MH554397 – |
|                | HKUCC 6037     |         |           |                            |                           |
| Pes. portugalica| CBS 265.37 =   |        | New Zealand | Camellia japonica          | – MHH54065 MHH54741 MHH54501 – |
| Pes. portugalica| CBS 276.35     | T       | –         | Leucothoe fontanesiana     | KM116205 KM199313 KM199405 KM199509 MHH554939 – |
| Pes. rhododendri| CBS 684.85 =   |        | –         | Picea rootstock           | – KC537804 KC537818 KC537811 – |
| Pes. rhododendri| CBS 393.48     | T       | Portugal  | Rhododendron sinogrande   | – MHH54109 MHH54782 MHH54543 – |
| Pes. rhodomyrtus| MFLUCC 12-0258 | T       | China     | Rhodomyrtus tomentosa     | – KF412648 KF412642 KF412645 – |
| Pes. sequoiae  | MFLUCC 13-0399 | T       | Italy     | Sequoia sempervirens      | – KF572344 KX572339 – – – |
| Pestalotiopsis sp. 1 | CBS 111576 = | T       | USA       | Leucosperrum cunei × conocarpodendron | – MHH53961 MHH54620 MHH54379 – |
| Pestalotiopsis sp. 2 | CBS 114489 = | T       | USA       | Leucospermum cv. 'Pink Ice' | – MHH53978 MHH54637 MHH54396 – |
| Pestalotiopsis sp. 3 | CBS 143902 = | T       | Malaysia  | Eucalyptus deglupta       | – MHH54129 MHH54802 MHH54564 – |
| Pestalotiopsis sp. 4 | CBS 143905 = | T       | Australia | Podocarpus sp.            | – MHH54153 MHH54826 MHH54588 – |
| Pestalotiopsis sp. 5 | CBS 143900 = | T       | Australia | Corymbia calophylla       | – MHH54142 MHH54815 MHH54577 – |
| Pestalotiopsis sp. 6 | CBS 143902 = | T       | Australia | Banksia attenuata         | – MHH54145 MHH54818 MHH54580 – |
| Pestalotiopsis sp. 7 | CBS 110326 = | T       | USA       | Pinus sp.                 | – MHH54176 MHH54840 MHH54602 – |
| Pes. spathulata | CBS 356.86     | T       | Chile     | Pinus radiata             | – MHH53995 MHH54664 MHH54422 – |
| Pes. spathulicappendiculata | CBS 144035 = | T       | Australia | Phoenix canariensis       | MHH54366 MHH54172 MHH54845 MHH54607 – |

(continued on next page)
| Organism name       | Strain number | Status | Country | Substrate | GenBank accession numbers |
|---------------------|---------------|--------|---------|-----------|--------------------------|
| Pes. telopeae       | CBS 114137 =  |        | Australia | Protea cv. 'Pink Ice' | KM116219 KM199301 KM199469 KM199559 – |
|                    | CPC 2952      |        |          |           |                          |
| CBS 114161 =        | T             |        | Australia | Telopea sp. | – KM119296 KM199403 KM199500 – |
| Pes. terricola      | CBS 141.69    | T      | Pacific Islands | Soil | – MH554004 MH554680 MH554438 – |
| Pes. trachicarpica  | CBS 111507 =  |        | Zimbabwe | Leucocerasperrum | – MH553960 MH554619 MH554378 – |
|                    | CPC 1784      |        |          | vestitum |                          |
| IFRDCC 2440 =       | T             |        | China    | Trachycarpus | – JQ845947 JQ845945 JQ845946 – |
| Pes. terricola      | CBS 114161 =  | CPC 1784 |          | Soil | – MH554027 MH554704 MH554462 – |
| Pes. unicolor       | MFLUCC 12-0275 | T   | China    | Unidentified tree | – JX398998 JX399029 JX399063 – |
| Pes. verruculosa?   | CBS 100567    | T      | Indonesia | Juniperus sp. | – MH554012 MH554688 MH554444 – |
| Pes. unicolor       | MFLUCC 12-0276 | T   | China    | Rhododendron sp. | – JX398999 JX399030 – – |
| Pes. verruculosa?   | MFLUCC 12-0274 | T   | China    | Rhododendron sp. | – JX398996 – JX399061 – |
| Pes. verruculosa    | CBS 175.25    | T      | Netherlands | Taxus baccata | KM116195 MH553951 MH554610 MH554369 MH554848 – |
| Pes. unicolor       | MFLUCC 12-0276 | T   | China    | Unidentified tree | – JX398999 JX399030 – – |
| Pes. unicolor       | MFLUCC 12-0274 | T   | China    | Rhododendron sp. | – JX398996 – JX399061 – |
| Pes. unicolor       | CBS 100567    | T      | Indonesia | Juniperus sp. | – MH554012 MH554688 MH554444 – |
| Pes. unicolor       | CBS 265.82    | T      | Netherlands | Cunninghamia lanceolata | – MH554024 MH554700 MH554458 – |
| Pes. unicolor       | CBS 325.76    | T      | France   | Cupressus arizonica | – MH554032 MH554708 MH554466 – |
| Pes. unicolor       | CBS 365.54    | T      | Netherlands | Chamaecyparis lawsoniana | – MH554037 MH554713 MH554472 – |
| Pes. unicolor       | CBS 366.54    | T      | Netherlands | Quercus peduncle | – MH554038 MH554714 MH554473 – |
| Pes. unicolor       | CBS 596.73    | T      | France   | – | – MH554059 MH554736 MH554495 – |
| Pes. unicolor       | CBS 888.68    | T      | Netherlands | Thuja occidentalis | – MH554069 MH554745 MH554505 – |
| Pes. unicolor       | CPC 21877     | T      | UK       | – | – MH554114 MH554787 MH554548 – |
| Pes. unicolor       | LC3412 =      | T      | China    | Camellia sinensis | – KX895108 KX894980 KX895312 KX895197 – |
| Pes. unicolor       | LC4553 =      | T      | China    | Camellia sinensis | – KX895012 KX895345 KX895231 – |
| Pes. unicolor       | LC4553 =      | T      | China    | Camellia sinensis | – KX895012 KX895345 KX895231 – |
| Pes. unicolor       | LC4553 = YH420 | T   | China    | Camellia sinensis | – KX895012 KX895345 KX895231 – |
| Pes. unicolor       | LC4553 = YH420 | T   | China    | Camellia sinensis | – KX895012 KX895345 KX895231 – |
| Pes. unicolor       | CBS 120080 =  | T      | Australia | Eucalyptus globulus | DQ923534 NR_132813 MH704633 MH704607 MH554893 – |
| Pes. unicolor       | CPC 12409     | T      | Australia | Eucalyptus globulus | DQ923534 NR_132813 MH704633 MH704607 MH554893 – |
| Pes. unicolor       | CBS 120221 =  | T      | Australia | Eucalyptus globulus | MH554204 EU040223 MH704635 MH704608 MH554894 – |
| Pes. unicolor       | CPC 12429     | T      | Australia | Eucalyptus globulus | MH554204 EU040223 MH704635 MH704608 MH554894 – |
| Pes. unicolor       | CBS 131312 =  | T      | Australia | Eucalyptus cypellocarp a | JQ044445 JQ044426 MH704634 MH704609 MH554910 – |
| Pes. unicolor       | CPC 19419     | T      | Australia | Eucalyptus cypellocarp a | JQ044445 JQ044426 MH704634 MH704609 MH554910 – |
| Pes. unicolor       | LC6618 = LF1263 | T   | China    | Camellia sinensis | – KX895039 KX895025 KX895358 KX895244 – |
| Pes. unicolor       | LC3009 = LF217 | T      | China    | Camellia sinensis | – KX895050 KX894935 KX895267 KX895152 – |
| Pes. unicolor       | LC3010 = LF218 | T      | China    | Camellia sinensis | – KX895051 KX894936 KX895268 KX895153 – |
| Pes. unicolor       | LC3020 = LF228 | T      | China    | Camellia sinensis | – KX895054 KX894940 KX895272 KX895157 – |
| Pes. unicolor       | LC3021 = LF229 | T      | China    | Camellia sinensis | – KX894941 KX895273 KX895158 – |
| Pes. unicolor       | LC3022 = LF230 | T      | China    | Camellia sinensis | – KX894942 KX895274 KX895159 – |
| Pes. unicolor       | LC3023 = LF231 | T      | China    | Camellia sinensis | – KX894943 KX895275 KX895160 – |
| Pes. unicolor       | LC3487 = LF714 | T      | China    | Camellia sinensis | – KX895061 KX894984 KX895315 KX895201 – |
| Organism name | Strain number | Status | Country | Substrate | GenBank accession numbers |
|---------------|---------------|--------|---------|-----------|--------------------------|
|               |               |        |         |           | LSU | ITS | tub2 | tef-1α | rpb2 |
| Pse. chinensis | CPC 21009     | T      | Turkey  | Actinidia chinensis | – | MHS54107 | MHS54780 | MHS54541 |
|               | CPC 21156     | T      | China   | Camellia sinensis  | – | MHS54110 | MHS54783 | MHS54544 |
|               | LC3011 = LF219 | T    | China   | Camellia sinensis  | KX895052 | KX894937 | KX895269 | KX895202 |
|               | LC3012 = LF220 |      | China   | Camellia sinensis  | KX895053 | KX894938 | KX895270 | KX895155 |
|               | LC6306 = LF1313 |    | China   | Camellia sinensis  | KX895043 | KX895017 | KX895350 | KX895236 |
|               | LC6829 = LF1274 |      | China   | Camellia sinensis  | KX895040 | KX895026 | KX895359 | KX895245 |
|               | LC6711 = LF1391 |      | China   | Camellia sinensis  | KX895046 | KX895032 | KX895365 | KX895250 |
|               | LC3013 = LF221 |      | China   | Camellia sinensis  | – | KX894939 | KX895271 | KX895156 |
| Pse. cocos    | CBS 272.29    | T      | Indonesia | Cocos nucifera | KM116276 | KM199378 | KM199467 | KM199553 | MHS54938 |
| Pse. elaeidis | CBS 413.62 = IMI 061175 = QM 9005 | T | Nigeria | Elaeis guineensis | MHS544297 | MHS544044 | MHS547420 | MHS54479 | MHS54955 |
|               | CBS 144023 = CPC 20822 | | Indonesia | Acacia crassipes | – | MHS54106 | MHS54779 | MHS54540 |
|               | LC4479        |       | China   | Lauraceae         | KX895034 | KX895343 | KX895229 |
|               | NBRC 112264 = MM14-F0060 | | Myanmar | Averrhoa carambola | – | LC114025 | LC114045 | LC114065 |
|               | NBRC 112265 = MM14-F0066 | | Myanmar | Unknown plant  | – | LC114026 | LC114046 | LC114066 |
|               | NBRC 112269 | | Myanmar | Unknown plant  | – | LC114027 | LC114047 | LC114067 |
|               | NBRC 112270 | | Myanmar | Unknown plant  | – | LC114028 | LC114048 | LC114068 |
| Pse. ignota   | NN42909      | T      | China   | Camellia sinensis  | – | KUS0020 | – | – |
| Pse. indica   | CBS 459.78   | T      | India   | Rosa sinensis    | MHS54263 | KM199381 | KM199470 | KM199560 | MHS54963 |
| Pse. simitheae | MFLUCC 12-0121 | | Thailand | Pandanus odoratissimus | – | KJ503812 | KJ503815 | KJ503818 |
|               | MFLUCC 12-0125 | | Thailand | Pandanus odoratissimus | – | KJ503813 | KJ503816 | KJ503819 |
| Pse. solicola | CBS 386.97   | T      | Papua New Guinea | Soil in tropical forest | – | MHS54039 | MHS54715 | MHS54474 |
| Pseudopestalotiopsis sp. 1 | NBRC 112258 | | Vietnam | Unknown plant | – | LC114036 | LC114056 | LC114076 |
|               | NBRC 112259 | | Vietnam | Unknown plant | – | LC114039 | LC114059 | LC114079 |
| Pse. theae   | MFLUCC 12-0055 = ET CPC 20281 | | Thailand | Camellia sinensis | KM116282 | JQ683727 | JQ683711 | JQ683743 |
|               | SC011        |       | Thailand | Camellia sinensis | – | JQ683726 | JQ683710 | JQ683742 |
| Pse. vietnamensis | CBS 130710 | | Ghana | Khaya anthotheca | – | MHS53998 | MHS54667 | MHS54425 |
|               | NBRC 112257 | | Vietnam | Unknown plant | – | LC114037 | LC114057 | LC114077 |
| Pseudosarcostroma osyridicola | CBS 103.76 | T | France | Osyris alba | MHS54177 | MHS53954 | MHS54613 | MHS54372 | MHS54851 |
| Robillarda africana | CBS 122.75 = BCC 38220 | T | South Africa | – | KR873281 | KR873253 | MHS54656 | MHS54414 | MHS54896 |
| Rob. australiana | CBS 143882 = CPC 17187 | T | Australia | – | MHS54301 | MHS54091 | MHS54764 | MHS54525 | MHS55005 |
| Organism name                  | Strain number¹ | Status² | Country | Substrate | GenBank accession numbers³ |
|-------------------------------|----------------|---------|---------|-----------|---------------------------|
| Rob. roystoneae               | CBS 115445 = HKUCC 10134 | T       | Hong Kong | Roystonea regia | KR873282 | KR873254 | KR873317 | KR873310 | MH554880 |
| Rob. sessilis                 | CBS 114312            | ET      | Germany  | Dust      | KR873284 | KR873256 | KR873319 | KR873312 | MH554877 |
| Rob. terrae                   | CBS 587.71            | T       | India    | Soil      | KJ710459 | KJ710484 | MH554734 | MH554493 | MH554971 |
| Sarcostroma africanum         | CBS 143879 = CPC 13920 | T       | South Africa | Pelargonium cucullatum | MH554289 | MH554078 | MH554752 | MH554513 | MH554990 |
| Sar. australiense             | CBS 144160 = CPC 15183 | T       | Australia | Daviesia latifolia | MH554340 | MH554138 | MH554811 | MH554573 | MH555044 |
| Sar. diversisepatum           | CBS 189.81 = NBRC 32681 | T       | Australia | Coreoa reflexa | MH554236 | MH554016 | MH554692 | MH554450 | MH554929 |
| Sar. leucospermi              | CBS 111090 = CPC 1420  | T       | South Africa | Leucopuspermum cv. 'High Gold' | MH554291 | MH554080 | MH554754 | MH554515 | MH554993 |
| Sar. longiappendiculatum      | CBS 111038 = CPC 1421  | T       | South Africa | Leucopuspermum cv. 'High Gold' | MH554292 | MH554081 | MH554755 | MH554516 | MH554992 |
| Sar. paragrevilleae           | CBS 111981 = CPC 2937  | R       | Australia | Grevillea sp. | MH554175 | MH553952 | MH554611 | MH554370 | –         |
| Sar. proteae                  | CBS 112001 = CPC 2961  | T       | Australia | Grevillea sp. | MH554193 | MH553974 | MH554633 | MH554392 | MH554871 |
| Sar. restionis                | CBS 111311 = CPC 1472  | T       | New Zealand | Grevillea robusta var. forsteri | MH554232 | MH554011 | MH554687 | MH554445 | –         |

Table 1. (Continued).
Table 1. (Continued).

| Organism name                  | Strain number | Status | Country       | Substrate                  | GenBank accession numbers |
|-------------------------------|---------------|--------|---------------|----------------------------|--------------------------|
|                              |               |        |               |                            |                          |
|                              | CBS 111935 =  | South Africa | Leucospermum sp. | MHS54181 MH553962 MH554621 MH555430 MH554856 |
| CPC 2834                      |               |        |               |                            |                          |
|                              | CBS 111936 =  | South Africa | Leucospermum sp. | MHS54182 MH553963 MH554622 MH555431 MH554857 |
| CPC 2835                      |               |        |               |                            |                          |
|                              | CBS 114017 =  | South Africa | Leucospermum sp. | MHS54191 MH553972 MH554631 MH555439 MH554866 |
| CPC 2832                      |               |        |               |                            |                          |
|                              | CBS 114130 =  | South Africa | Leucospermum sp. | MHS54192 MH553973 MH554632 MH555439 MH554869 |
| CPC 2833                      |               |        |               |                            |                          |
|                              | CBS 116153 =  | South Africa | Ischyrolepis cf. siberi | DQ278925 DQ278923 MH554650 MH554408 MH554890 |
| CMW 17984 = CPC 16911         |               |        |               |                            |                          |
|                              | CBS 116154 =  | T       | South Africa | Restio filiformis | DQ278924 DQ278922 MH554651 MH554409 MH554891 |
| CMW 17971 = CPC 16904         |               |        |               |                            |                          |
|                              | CBS 121418 =  | South Africa | Leucospermum conocarpodendron | MHS54205 MH553988 MH554655 MH555441 MH554895 |
| CMW 22196                     |               |        |               |                            |                          |
|                              | CBS 122695 =  | South Africa | Protea acaulis | MHS54208 EU552155 MH554658 MH555441 MH554898 |
| CMW 22214                     |               |        |               |                            |                          |
|                              | CBS 282.65 =  | T       | South Africa | Pteridium aquilinum | AB593736 AB594804 MH554702 MH554460 MH554890 |
| NBRC 32678 = IMI 096703       |               |        |               |                            |                          |
|                              | CPC 29466     | Australia | Acacia glaucoptera | MHS54362 MH554168 MH554841 MH555403 MH555065 |
|                              |               |        |               |                            |                          |
| Seimatosporium botan          | NBRC 104200 = | T       | Japan         | Paeonia suffruticosa | AB593731 AB594799 LC047770 – – |
| H4619                         |               |        |               |                            |                          |
| Sei. germanicum               | CBS 437.87    | T       | Germany       | – | MHS54259 MH554047 MH554723 MH555442 MH554897 |
|                              |               |        |               |                            |                          |
| Sei. lutecosporum             | CBS 142599    | T       | USA           | Vitis vinifera | KY706309 KY706284 KY706259 KY706334 |
|                              |               |        |               |                            |                          |
| Sei. physocarpi               | CBS 139968 =  | T       | Russia        | Physocyclus opulifolius | KT198723 KT198722 MH554676 MH554434 MH554917 |
| MFLUCC 14-0625                |               |        |               |                            |                          |
|                              | CBS 789.68 =  | T       | Netherlands   | Physocyclus amurenensis | MHS54278 MH554066 MH554742 MH554502 MH554979 |
| NBRC 32682                    |               |        |               |                            |                          |
| Sei. pistaciae                | CBS 138685 =  | T       | Iran          | Pisticia vera | KP004491 KP004463 MH554674 MH554332 MH554915 |
| CPC 24455                     |               |        |               |                            |                          |
| Sei. rosea                    | CBS 139823 =  | ET      | Russia        | Rosa kalmiuscusa | KT198727 LT853105 LT853253 LT853203 LT853153 |
| MFLUCC 14-0621                |               |        |               |                            |                          |
| Sei. soli                     | CBS 941.69    | T       | Denmark       | Forest soil under | MHS54282 MH554071 – MH554507 MH554963 |
|                              |               |        | Fagus sylvatica |                            |                          |
| Sei. vitisfoemina             | CBS 142600    | T       | USA           | Vitis vinifera | KY706321 KY706296 KY706271 KY706346 |
|                              |               |        |               |                            |                          |
| Sei. vitis-viniferae          | CBS 123004    | T       | Spain         | Vitis vinifera | MHS54211 MH553992 MH554660 MH554418 MH554901 |
|                              |               |        |               |                            |                          |
| Taeniidiium cancinnum         | CBS 226.55 =  | T       | Kenya         | Cupressus macrocarpa | MHS54241 LT853089 LT853236 LT853186 LT853137 |
| IMI 052256                    |               |        |               |                            |                          |
| Seir. cupressi                | CBS 224.55 =  | ET      | Kenya         | Cupressus macrocarpa | MHS54240 LT853083 LT853230 LT853180 LT853131 |
| IMI 052254                    |               |        |               |                            |                          |
| Seir. eucalypti               | CBS 343.97    | ET      | Australia     | Eucalyptus delegatensis | MHS54251 MH554034 MH554710 MH554469 MH554946 |
|                              |               |        |               |                            |                          |
| Seir. karvense                | CBS 142629 =  | T       | Australia     | Eucalyptus cladocalyx | – LT853100 LT853247 LT853197 LT853147 |
| CPC 20183                     |               |        |               |                            |                          |
| Seir. kenyanium               | CBS 226.55 =  | T       | Kenya         | Juniperus procer | MHS54242 LT853098 LT853245 LT853195 LT853145 |
| IMI 052257                    |               |        |               |                            |                          |
| Seir. marginatum              | CBS 140403    | ET      | France        | Rosa canina | MHS54233 KT949914 LT853249 LT853196 LT853149 |
|                              |               |        |               |                            |                          |
| Seir. neocupressi             | CBS 142625    | T       | Italy          | Cupressus sempervirens | MHS54329 LT853079 LT853226 LT853178 LT853127 |
| CPC 23786                     |               |        |               |                            |                          |
| Seir. papillatum              | CBS 340.97 =  | T       | Australia     | Eucalyptus delegatensis | DQ414531 LT853102 LT853250 MH554468 LT853150 |
| VPRI 20827                    |               |        |               |                            |                          |

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| Organism name | Strain number | Status | Country | Substrate | GenBank accession numbers |
|---------------|--------------|--------|---------|-----------|-------------------------|
| *Seir. phylicae* | CBS 133587 = CPC 19964 | T | Tristan da Cunha | *Phyllica arborea* | LT853091 LT853238 LT853188 LT853139 |
| *Seir. pseudocardinalis* | CBS 122613 = CMW 1648 | T | Portugal | Cupressus sp. | MH554206 LT853096 LT853243 LT853193 LT853143 |
| *Seir. unicolor* | CBS 538.82 = NBRC 32684 | T | New Zealand | Cryptomeria japonica | MH554269 LT853088 LT853235 LT853185 LT853136 |
| *Sporocadus bisepatus* | CBS 110324 = MYC 754 | T | – | – | MH554179 MH554396 MH554615 MH554744 MH554853 |
| *Spor. comicum* | CBS 143889 = CPC 23235 | T | Germany | *Comus sanguinea* | – – – KU974967 – – – |
| *Spor. cotini* | CBS 139966 = MFLUCC 14-0448 | T | Italy | Cotinus coggyria | MH554222 MH554003 MH554675 MH554433 MH554916 |
| *Spor. incanus* | CBS 123003 | T | Germany | *Sorbus aria* | MH554210 MH553991 MH554659 MH554417 MH554900 |
| *Spor. lichenicola* | CBS 354.90 = NBRC 32677 | T | New Zealand | Fagus sylvatica | MH554252 MH554035 MH554711 MH554470 MH554948 |
| *Spor. mali* | CBS 446.70 | T | Netherlands | Malus sylvestris | MH554261 MH554049 MH554725 MH554484 MH554960 |
| *Spor. microcyclus* | CBS 424.95 | T | Portugal | Sorbus aria | MH554258 MH554045 MH554721 MH554480 MH554981 |
| *Spor. rosarinum* | CBS 113832 = MFLUCC 15-0563 | T | Portugal | *Erinaceus europaeus* | MH554081 MH554054 MH554085 MH554087 MH554089 |
| *Spor. rosigena* | CBS 116498 | T | Italy | *Vitis vinifera* | MH554420 MH553993 MH554642 MH554401 MH554883 |
| *Spor. rotundatus* | CBS 616.83 | T | Italy | *Rosa canina* | MH554819 MH554397 MH554629 MH554388 MH554864 |
| *Spor. sorbi* | CBS 160.25 | T | Canada | *Arceuthobium pessillum* | – – – – – |
| *Spor. trichomatus* | CBS 506.71 | T | Italy | *Sorbus terminalis* | MH554229 MH554008 MH554684 MH554442 MH554924 |
| *Spor. trimorphus* | CBS 114203 = UPSC 2430 | T | Sweden | *Rosa canina* | MH554196 MH553977 MH554636 MH554395 MH554876 |
| *Strickeria kochii* | CBS 140411 | T | Austria | *Robinia pseudoacacia* | – – – – – |
| *Synnemapestaloides juniperi* | CBS 477.77 = NBRC 32676 | T | France | *Juniperus phoenicea* | MH554266 MH554053 MH554729 MH554488 MH554966 |
| *Sym. rhododendri* | MAFF 239201 | T | Japan | *Rhododendron brachycarpum* | LC047744 LC047753 LC047761 – – – |
| Organism name                  | Strain number | Status | Country | Substrate | GenBank accession numbers |
|-------------------------------|---------------|--------|---------|-----------|--------------------------|
| **Truncatella angustata**     | MAFF 243052   |        | Japan   |           | LC047748 LC047757 LC047765 – – |
| CBS 113.11                   |               |        |         |           | MH554185 MH553966 MH554625 MH554384 MH554860 |
| CBS 135.97 = INFAT C69/100   |               |        | Spain   | Decaying bark | MH554220 MH554001 MH554671 MH554429 MH554912 |
| CBS 165.25 = NBRC 32688       |               |        |         |           | MH554231 MH554010 MH554686 MH554444 – |
| CBS 208.80                   |               |        | Netherlands |           | MH554239 MH554020 MH554696 MH554454 – |
| CBS 231.77 = CBS 296.77      |               |        | Turkey | Gossypium sp. | MH554243 MH554021 MH554697 MH554455 MH554932 |
| CBS 338.32                   |               |        | Netherlands | Lupinus sp. | MH554250 MH554033 MH554709 MH554467 MH554945 |
| CBS 356.33                   |               |        |         |           | MH554253 MH554036 MH554697 MH554468 MH554949 |
| CBS 393.80                   |               |        | Chile   | Gevuina avellana | MH554254 MH554041 MH554717 MH554476 MH554952 |
| CBS 398.71                   |               |        | Turkey | Soil | MH554255 MH554042 MH554718 MH554477 MH554953 |
| CBS 443.54                   |               |        | UK      | Picea abies | MH554260 MH554048 MH554724 MH554483 MH554959 |
| CBS 449.51                   |               |        |         |           | MH554262 MH554050 MH554726 MH554485 MH554961 |
| CBS 564.76                   |               |        | Switzerland | Pyrus malus | MH554271 MH554057 MH554733 MH554492 MH554970 |
| CBS 591.66 = ATCC 18162 = NBRC 8584 |   |        | USA | Tundra soil | MH554272 MH554058 MH554735 MH554494 MH554972 |
| CBS 642.97                   |               |        | Switzerland | Heterodera carotae cyst egg mass, on Daucus carota | MH554274 MH554061 MH554738 MH554497 MH554975 |
| CBS 938.70                   |               |        | Netherlands | Prunus laurocerasus | MH554281 MH554070 MH554746 MH554506 MH554982 |
| CPC 21354                    |               |        | France | Vitis vinifera cv. ‘Punellando’ | MH554317 MH554111 MH554784 MH554545 MH555020 |
| CBS 144025 = CPC 21359       |               |        | France | Vitis vinifera cv. ‘Punellando’ | MH554318 MH554112 MH554785 MH554546 MH555021 |
| CPC 21366                    |               |        | France | Vitis vinifera cv. ‘Punellando’ | MH554319 MH554113 MH554786 MH554547 MH555022 |
| Undetermined species         | CBS 113991 = UPSC 2465 |        | Sweden | Salix caprea | MH554190 MH553971 MH554630 MH554389 MH554865 |
| CBS 387.77                   |               |        | Finland | Skin of man | KM116277 MH554040 MH554716 MH554475 MH554950 |
| Xenoseimatosporium quercinum | CBS 129171 = MSCL 1034 |        | Latvia | Rhododendron sp. | MH554216 MH553997 MH554666 MH554424 MH554906 |
| MFLUCC 14-1198                |               |        | Germany | Quercus robur | NG_059681 NR_155804 – – – |

1 ATCC: American Type Culture Collection, Virginia, USA; BCC: BIOTEC Culture Collection, National Center for Genetic Engineering and Biotechnology (BIOTEC), Khon Kaen, Thailand; BRIP: Queensland Plant Pathology Herbarium, Australia; CBS: Culture collection of the Westerdijk Fungal Biodiversity Institute, Utrecht, The Netherlands; CCMC: China Center for Medical Mycology, Beijing, China; CGMCC: China General Microbiological Culture Collection Center, Institute of Microbiology, Chinese Academy of Sciences, Beijing, China; CMW: Culture Collection of the Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa; CPC: Culture collection of Pedro Crous, housed at the Westerdijk Institute; HKUCC: Hong Kong University Culture Collection; ICMP: International Collection of Micro-organisms from Plants, Landcare Research, Private Bag 92170, Auckland, New Zealand; IFO: Institute for Fermentation, Osaka, Japan; IFRDDC: International Fungal Research and Development Culture Collection; IMI: International Mycological Institute, CAB-I-Bioscience, Egham, Surrey, England; IMUR: the Institute of Mycology at the University of Recife, Brazil; LC: working collection of Lei Cai, housed at the Institute of Microbiology, Chinese Academy of Sciences, Beijing, China; MAFF: Ministry of Agriculture, Forestry and Fisheries, Tsukuba, Ibaraki, Japan; MFLUCC: Mae Fah Luang University Culture Collection; MSCL: Microbial Strain Collection of Latvia; NBRC: National Biological Resources Center; PREM: the Herbarium of the National Collection of Fungi, Pretoria, South Africa; UPSC: Uppsala University Culture Collection of Fungi, Sweden; VPRI: Victorian Plant Disease Herbarium, Australia; WSP: Washington State University Plant Pathological Herbarium.

2 Status: status of the strains. ET: ex-epitype; IT: ex-isotype; NT: ex-neotype; R: reference strain; ST: ex-syntype; T: ex-type.

3 Newly generated sequences are indicated in bold.

4 MFLUCC 15-0563: Type of *Seimatosporium rosigenum*; MFLUCC 14-0466: Type of *Seimatosporium pseudorosarum*. 
comprised 194 isolates of Sporocadaceae and related fungi. The concatenated alignment of ITS (594 characters), LSU (841 characters) and rpb2 (832 characters) had a total length of 2,267 characters including alignment gaps. The ML search resolved a best tree with an InL of -37043.320413. MrModelTest recommended that the Bayesian analysis should use Fixed base frequency for ITS and Dirichlet for LSU and rpb2. The SYM+H+G model was proposed for ITS, and GTR+H+G model for LSU and rpb2. The BA lasted for 1,859,000 generations and the 50 % consensus tree and posterior probabilities were calculated from 2,784 trees from two runs. The alignment contained a total of 1,125 unique site patterns (ITS: 334, LSU: 249, rpb2: 542). The ML tree confirmed the same tree topology and the clades as those presented in the Bayesian phylogeny (Fig. 1).

The ITS/LSU/rpb2 phylogeny revealed three major clades, corresponding to the three previously proposed families “Bartaliniaceae, Discosciaceae and Pestalotiopsidaceae”, however with low bootstrap support values/posterior probabilities and short branches. Because these family names were considered synonyms of Sporocadaceae by Jaklitsch et al. (2016), these groups are referred to as Clade 1 (Discosciaceae), Clade 2 (Pestalotiopsidaceae) and Clade 3 (Bartaliniaceae) for convenience (Fig. 1).

In Clade 3, the type species of Neotruncatella, Dyrithiopsis and Hymenopleella clustered in one clade (Fig. 1). However, the incomplete sequence data of Neo. endophytica (EML-ASS-1, lack of rpb2) and Dyr. lakefuxianensis (HKUCC 7303, lack of rpb2 and ITS) could have artificially influenced the observed topology, resulting in long terminal branches and a short interior branch. We therefore removed both strains from further 5-locus phylogenetic analyses (see the following result of Generic and species phylogenies-Clade 3), and delimited generic boundaries in combination with a comparison of morphological characteristics. Based on these results, Neotruncatella and Dyrithiopsis are synonymised under Hymenopleella.

From the combined phylogeny (Fig. 1), 30 clades were recognised in the Sporocadaceae, of which 23 represented existing genera (i.e. Allelochaeta, Bartalnia, Broomella, Ciliochorella, Diploceras, D isaeta, Discosia, Hyalotiella, Hymenopleella, Immersidiscosia, Monochaeta, Morinia, Neopestalotiopsis, Pestalotiopsis, Pseudopestalotiopsis, Robillardia, Sarkostroma, Seimatosporium, Seiridium, Sporocadus, Strickeria, Synnemapestaloides, Trunca tella). In combination with morphological features, the remaining seven clades are here described as new genera.

The single locus phylogeny of LSU (not shown here) displays relatively low resolution for genera, in which Allelochaeta, Bartalnia, Sarkostroma, and Seiridium are shown as paraphyletic. The ITS and rpb2 single locus phylogenies are congruent with the 3-locus tree (Fig. 1) with regard to all genera except Allelochaeta, which separated into two clades of which one is more closely related to Sarkostroma.

Generic and species phylogenies

To better infer delimitation of genera and species in Sporocadaceae, DNA sequence data of five loci (ITS, LSU, rpb2, tef-1a and tub2) were concatenated in three smaller focused datasets corresponding to Clades 1-3 from the overview tree (Fig. 1), including sequences from all available strains. The same phylogenetic methods were applied as described above.

Clade 1: The dataset consisted of 111 strains with Leptotyapha fuckelii (CBS 140409) as outgroup. The final alignment contained a total of 3,776 characters divided into five partitions containing 583 (ITS), 830 (LSU), 832 (rpb2), 641 (tef-1a) and 877 (tub2) characters respectively, including alignment gaps. The ML search revealed a best tree with an InL of -40746.889283. MrModelTest recommended that the Bayesian analysis should use Dirichlet base frequencies for all data partitions. The HKY+I+G model was proposed for ITS, tef-1a and tub2, and GTR+I+G model for LSU and rpb2. The BA lasted for 3,690,000 generations and the 50 % consensus tree and posterior probabilities were calculated from 5,538 trees from two runs. The alignment contained a total of 1,860 unique site patterns (ITS: 197, LSU: 103, rpb2: 458, tef-1a: 486, tub2: 616).

The topology of the phylogenetic trees generated from the ML and BA methods were congruent (Fig. 2) and were also consistent with the overview tree (Fig. 1). Most strains included in Clade 1 are currently labelled as Seimatosporium in the culture collection and in previous publications. However, the multi-locus phylogenies (Figs 1, 2) indicate the presence of well-separated and statistically supported clades, namely Allelochaeta, Discosia, Sarkostroma, Seimatosporium, Sporocadus and Xenoseimatosporium. The separation of these genera is also supported by consistent morphological characters associated with each clade.

Discosia: The generic type strain of Discosia and its sexual morph, Adiscisico, formed a monophyletic clade in the 5-locus tree (Fig. 2). As only ITS sequences of several Discosia species are available, a single ITS tree was then constructed (Fig. 3). The ITS dataset consisted of 30 isolates with Seimatosporium rosae (CBS 139823) as outgroup, and contained 534 characters including alignment gaps. The ML search revealed a best tree with an InL of -1230.494365. MrModelTest recommended that the ITS Bayesian analysis should use Dirichlet base frequency and HKY+I+G model. The BA lasted for 370,000 generations and the 50 % consensus tree and posterior probabilities were calculated from 558 trees from two runs. The alignment contained a total of 76 unique site patterns. The ITS tree contained 15 clades, of which one was recognised as novel species in this study, Discosia rubi (Fig. 3).

Clade 2: The dataset consisted of 53 isolates with Leptotyapha fuckelii (CBS 140409) as outgroup. The final alignment consisted of 3,687 characters divided into five partitions containing 568 (ITS), 836 (LSU), 832 (rpb2), 634 (tef-1a) and 807 (tub2) characters respectively, including alignment gaps. The ML search revealed a best tree with an InL of -27744.6726. MrModelTest recommended that the Bayesian analysis should use Dirichlet base frequencies for all data partitions. The GTR+I+G model was proposed for ITS, LSU and rpb2, and HKY+I+G model for tef-1a and tub2. The BA lasted for 1,895,000 generations and the 50 % consensus tree and posterior probabilities were calculated from 5,688 trees from two runs. The alignment contained a total of 1,647 unique site patterns (ITS: 209, LSU: 117, rpb2: 384, tef-1a: 402, tub2: 535).

The phylogenetic trees generated from the ML and BA were congruent (Fig. 4), and the generic divisions were consistent with the overview tree (Fig. 1). However, Nonappendiculata was more closely related to Monochaeta and Ciliochorella in the 5-locus tree, whereas to Seiridium in the overview tree. This was probably due to the incomplete sequence dataset of Ciliochorella (only LSU sequences of NBRC 104545 and NBRC 104546 are available).

Since for both Pestalotiopsis and Pseudopestalotiopsis few sequences of rpb2 are present in the NCBI GenBank nucleotide
Fig. 1. Overview phylogenetic tree of Sporocadaceae (50 % majority rule consensus) resulting from a Bayesian analysis of the combined LSU, ITS and rpb2 sequence alignment. Bayesian posterior probabilities (PP ≥ 0.95) are emphasised by thickened branches, maximum likelihood bootstrap support values (≥ 50 %) are shown at the nodes. The scale bar represents the expected number of changes per site. Genera are delimited in coloured boxes, with the genus name indicated to the right. Ex-type strains are represented in bold, and the generic type species are highlighted in red colour. Basionyms are indicated between apostrophes (''). Clades 1–3 are further analysed using combined LSU, ITS, rpb2, tef-1α and tub2 sequence alignment, corresponding to Figs 2, 4 and 7. The tree was rooted to Clypeosphaeria mamillana (CBS 140735).
theae, Pestalotiopsis singletons. For example, methods were in slight disagreement on the location of a few patterns. The phylogenetic trees generated from ML and BA from two runs. The alignment contained a total of 913 unique site frequencies for all data partitions. The GTR+I+G model was respectively, including alignment gaps. The ML search resolved each with long branches (Fig. 5). the BA tree (not shown), but clustered together in the ML tree, Pestalotiopsis partitions with 544 (ITS), 535 (1) characters respectively, including alignment gaps. The ML partitions containing 382 (ITS), 488 (tef-1α), and 778 (tub2) characters respectively, including alignment gaps. The ML search resolved a best tree with an InL of -3431.856295. MrModelTest recommended that the Bayesian analysis should use Dirichlet base frequencies, and the synonymy of Pse. myanmarina and Leptuteypa elaedis under Pse. elaedis. Clade 3: Ex-type strains of the generic types of Morinia (Mor. pestalozzioides F090354), Neotruncatella (Neo. endophytica EML-AS5-1), and Broomella (Bro. robillardoides MFLUCC 13-0798) were removed from the 5-locus phylogenetic analysis as they lacked a number of sequence loci in the dataset. The final alignment consisted of 87 isolates and a total of 3 687 characters included five partitions containing 565 (ITS), 832 (LSU), 832 (rpb2), 672 (tef-1α) and 1026 (tub2) characters respectively, including alignment gaps. Beltrania pseudorhombica (CPC 23656) was used as outgroup. The ML search resolved a best tree with an InL of -37400.094265. MrModelTest recommended that the Bayesian analysis should use Dirichlet base frequencies for all data partitions. The GTR+I+G model was proposed for ITS, and HKY+G model for tef-1α and tub2. The BA lasted for 735 000 generations and the 50 % consensus tree and posterior probabilities were calculated from 1 104 trees from two runs. The alignment contained a total of 205 unique site patterns. The phylogenetic trees generated from the ML and BA methods were congruent (Fig. 6). The analyses supported the distinct identity of one new species Pse. solicolor, and the synonymy of Pse. myanmarina and Leptuteypa elaedis under Pse. elaedis.

The phylogenetic trees generated from ML and BA methods (Fig. 7) were congruent and revealed 12 phylogenetic genera. The single gene phylogenies (not shown) were congruent on the
distinct identity of these genera. Among these genera, five were represented by singleton species and long branches, corresponding to Broomella vitiabae, Hyalotella transvalensis, Diversimediispora humicola sp. nov., Parabartalinia lateralis sp. nov. and Pseudosarcostroma osyridicola sp. nov. All strains that identified as Truncatella in previous publications were separated into two distinct clades, namely Truncatella and Heterotruncatella (Fig. 7).

Taxonomy

Based on the above phylogenetic analyses (Figs 1–7), 30 genera are recognised in Sporocadaceae, of which seven are newly introduced. Through morphological examination, as well as habitat and geographical comparisons, a total of 51 new species, 15 new combinations, one nomina nova, five epi-tyifications and one neotypification are proposed. For the species with complete illustrations generated from type specimens, but without ex-type cultures for further molecular research, we provided information about the host and origin. A schematic overview of the conidia and ascospores features of accepted genera in Sporocadaceae is provided (Fig. 8). Due to the large number of taxa discussed throughout this manuscript, the generic names are abbreviated with the first three or four letters. Allelochaeta was recently treated in a separate study (Crous et al. 2018).

Sporocadaceae Corda [as “Sporocadaceae"], Icon. Fung. (Praha) 5: 34, 1842.

Synonyms: Bartaliniaceae Wijayaw. et al., Fungal Diversity 73: 85, 2015, nom. inval. Bartaliniaceae Wijayaw. et al., Fungal Diversity 86: 5, 2017. Discosiaceae Maharachch. & K.D. Hyde, Fungal Diversity 73: 94, 2015. Pestalotiopsidaceae Maharachch. & K.D. Hyde, Fungal Diversity 73: 106, 2015. Robillardiaceae Crous, IMA Fungus 6: 184, 2015. Sexual. Ascomata perithecial, immersed in bark, globose to pyriform, scattered or confluent; peridium thick, dark brown, pseudoparenchymatous. Paraphyses filiform. Asci cylindrical, containing 8 uniseriate or biseriate ascospores, thin-walled. Ascospores fusoid or ellipsoidal, septate, pale yellow to dark brown. Asexual. Conidioda pycnidial, acervular or stromatic in most genera, synnematus or sporodochial in Synnemapestaloides.
superficial, semi-immersed or immersed, scattered, gregarious or confluent, glabrous, wall of textura angularis, textura globulosa or sometimes of textura prismatica. Conidiophores branched or reduced to conidiogenous cells, mostly hyaline, smooth. Conidiogenous cells ampulliform, lageniform, cylindrical or subcylindrical, hyaline, sometimes pale brown. Conidia septate, smooth, undulate or verruculose, fusoid, subcylindrical or cylindrical, straight or curved; end cells mostly hyaline, or sometimes pale brown; median cells pale brown to dark brown, or sometime almost colourless; appendages on the end cells present, or absent in some genera, if present, tubular, filiform, straight or flexuous, attenuated or not, branched or unbranched.

Type genus: Sporodocus Corda, Icon. Fung. (Prague) 3: 23. 1839.

Bartalina Tassi, Bulletin Labor. Orto Bot. de R. Univ. Siena 3: 4. 1900.

Description: Conidiomata stromatic, varying from pycnidioid to indeterminate, subependeral, intracortical or subependeral in origin, immersed, uni- or plurilocular, locules occasionally convoluted, dark brown to brown, glabrous, wall of textura angularis or textura globulosa, sometimes of textura prismatica, cells thick-walled and dark brown to brown in the outer layers, becoming thin-walled and paler toward the conidial hymenium. Conidiophores arising from the inner layers lining the conidioma, or co- or subcylindrical, dark brown to brown, glabrous, wall of textura angularis or textura globulosa, sometimes of textura prismatica, cells thick-walled and dark brown to brown in the outer layers, becoming thin-walled and paler toward the conidial hymenium. Conidiomata stromatic, varying from pycnidioid to indeterminate, subependeral, intracortical or subependeral in origin, immersed, uni- or plurilocular, locules occasionally convoluted, dark brown to brown, glabrous, wall of textura angularis or textura globulosa, sometimes of textura prismatica, cells thick-walled and dark brown to brown in the outer layers, becoming thin-walled and paler toward the conidial hymenium. Conidiophores arising from the inner layers lining the conidioma, or co- or subcylindrical, dark brown to brown, glabrous, wall of textura angularis or textura globulosa, sometimes of textura prismatica, cells thick-walled and dark brown to brown in the outer layers, becoming thin-walled and paler toward the conidial hymenium.
and not separated from it by a septum, invariably trifid with 2–4, narrow, attenuated, flexuous, divergent branches; basal appendage tubular, single, unbranched, exogenous, filiform, flexuous (emended from Crous et al. 2014a).

Type species: Bartalinia robillaroides Tassi.

Notes: Bartalinia was regarded as synonym of Seimatosporum by von Arx (1981), but this was not accepted by Nag Raj (1993) because of the morphological differences between the two genera, especially in conidial appendages. This was supported by von Arx (1981), but this was not accepted by Nag Raj (1993).

Material examined: Brazil, Recife, air, 1960, isolated by A.C. Batista, (holotype of Truncatella bella CBS H-23544, ex-type culture CBS 464.61 = IMI 093535 = IMU 1520). South Africa, KwaZulu Natal, Port Edward, Umbamvuna Nature Reserve, Mr. T. Abbott's garden (31º 02' 948" S, 30º 10' 351" E), on Maytenus abbotti (Celastraceae), 8 May 2008, S. Marincowitz & M. Gryzenhout (holotype of Bartalinia pondoensis PREM 60359, ex-type culture CBS 125525 = CMW 31067).

Notes: Bartalinia pondoensis (Marincowitz et al. 2010) is phylogenetically and morphologically equal to Truncatella bella (Batista et al. 1960), and both species are located in the Bartalinia clade (Fig. 7). They are therefore combined under Bar. bella following the date priority rule.

Bartalina bella (Bat.) Nag Raj, J. Indian bot. Soc. 43: 218. 1964, emend. F. Liu, L. Cai & Crous. Fig. 9.

Basionym: Truncatella bella Bat., Publicações Inst. Micol. Recife 276: 14. 1960.

Synonym: Bartalinia pondoensis Marinc. et al., Mycotaxon 111: 312. 2010.

Culture characteristics: Colonies on MEA umboment with entire edge, white to pale grey, reaching > 90 mm diam after 14 d at 21 °C, conidiomata black, gregarious, semi-immersed or immersed, stromatic; on CMA flat with entire edge, mouse grey with white margin, reaching 70–71 mm diam after 14 d at 21 °C, conidiomata black, scattered, semi-immersed, acervular, stromatic; on PDA flat with entire edge, vinaeous buff, aerial mycelia white and flocculent, reaching > 90 mm diam after 14 d at 21 °C, conidiomata dark vinaceous, semi-immersed, scattered, acervular; on SNA flat with entire edge, white, reaching 60–61 mm diam after 14 d at 21 °C, conidiomata brown vinaceous to black, scattered, superficial, acervular.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, mostly reduced to conidigenous cells, smooth, colourless, invested in mucus. Conidigenous cells annellidic, discrete, cylindrical, lageniform or ampulliform, 5–13 × 1–3 μm (av. = 8.6 ± 2.24 × 1.9 ± 0.44 μm), colourless, smooth. Conidia cylindrical or subcyindrical, straight or slightly curved, 3-septate, not constricted at septa, smooth, 16.5–25 × 2.5–4 μm (av. = 20.5 ± 2 × 3.3 ± 0.37 μm); basal cell obconic with a truncate base, cylindrical, thin-walled, hyaline, 2.5–6 μm (av. = 3.3 ± 0.74 μm) long; median cells 2, cylindrical, pale brown, thick-walled, ± equal, each 4.5–8 μm (av. = 6.6 ± 0.88 μm) long; apical cell conic with an acute apex, thin-walled, hyaline, 2–4 μm (av. = 2.9 ± 0.49 μm) long; apical appendage with 3 branches, attenuated, tubular, flexuous, (4–) 6.5–13 μm (av. = 9.7 ± 1.42 μm) long; basal appendage single, tubular, not attenuated, unbranched, excincent, 1.5–5.5 μm (av. = 3.6 ± 1.01 μm) long; mean conidium length/width ratio = 6:2.1.

Materials examined: Brazil, Recife, air, 1960, isolated by A.C. Batista. (holotype of Truncatella bella CBS H-23544, ex-type culture CBS 464.61 = IMI 093535 = IMU 1520). South Africa, KwaZulu Natal, Port Edward, Umbamvuna Nature Reserve, Mr. T. Abbott’s garden (31º 02’ 948’’ S, 30º 10’ 351’’ E), on Maytenus abbotti (Celastraceae), 8 May 2008, S. Marincowitz & M. Gryzenhout (holotype of Bartalinia pondoensis PREM 60359, ex-type culture CBS 125525 = CMW 31067).
**Etymology:** Named after the host from which it was first collected, *Pinus*.

**Culture characteristics:** Colonies on MEA flat with entire edge, with ruffle sag on surface, greenish brown, reaching > 90 mm diam after 14 d at 21 °C, conidiomata dark brown to black, semi-immersed or immersed, stromatic; on CMA flat with entire edge, glaucous grey, reaching > 90 mm diam after 14 d at 21 °C, conidio-mata dark brown to black, semi-immersed, acervular; on PDA glaucous grey, reaching > 90 mm diam after 14 d at 21 °C, conidiomata dark brown to black, semi-immersed, acervular; on CMA diam after 14 d at 21 °C, conidiomata dark brown to black, semi-immersed, acervular; on PDA diam after 14 d at 21 °C, conidiomata honey to brown, scattered, super-annellidic, excentric, 2.5 μm (av. = 4.5 ± 0.7 μm) long; apical cell conic with an acute apex, thin-walled, hyaline, 2–3 μm (av. = 2.5 ± 0.32 μm) long; apical appendage with three branches, attenuated, tubular, filiform, flexuous, divergent, 4.5–17 μm (av. = 12.5 ± 3.91 μm) long; basal appendage absent or single, if present, tubular, un-branched, excentric, 2.5–11.5 μm (av. = 7.5 ± 2.05 μm) long; mean conidium length/width ratio = 5.6:1.

**Notes:** Two strains of *Bartaliniapini* formed a distinct clade on the multi-locus tree (Fig. 7). *Bartaliniapini* is morphologically similar to *Bar. lateripes*, a species reported from pods of *Cassia maescriata* in the USA, in having 4-septate conidia with three mean conidium length/width ratio = 5.6:1.

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**Materials examined:** *Uganda*, on *Pinus patula* (Pinaceae) needles, Jan. 2014, M.J. Wingfield (holotype CBS H-23514, ex-type culture CBS 143891 = CPC 24328). *USA*, Hawaii, Oahua, on leaves of *Acacia koa* (Fabaceae), 30 Sep. 2015, J. Roux, HPC 780, AK 21, living culture CBS 144141 = CPC 29502.
Fig. 4. Phylogenetic tree resulting from a maximum likelihood analysis of the combined LSU, ITS, rp2, tef-1α and tuf2 sequence alignment (representing clade 2 of Fig. 1). Bayesian posterior probabilities (PP ≥ 0.95) are emphasised by thickened branches, maximum likelihood bootstrap support values (≥ 50 %) are shown at the nodes. The scale bar represents the expected number of changes per site. Genera are delimited in grey boxes. All taxa names in genera Pestalotiopsis, Neopestalotiopsis, Neopestalotiopsis and Seiridium consist of strain number, species name, host and location (underscore is used to separate species name and host). Species names in other genera are aligned to the right. Ex-type strains are represented in bold, and the generic type species are highlighted in red colour. Basionyms, if present, are indicated between apostrophes (‘). The tree was rooted to Leptotyphulafuckei (CBS 14049).

apical appendage branches and a similar mean conidium length/width ratio. However, it differs from the latter in producing longer conidia (1.5–3.5 μm vs. 3.5–4.5 μm) and shorter apical appendages (4.5–17 μm vs. 15–21 μm) (Nag Raj 1993). The only species of Bartalina reported on Pinus is Bar. robbillardoides (Farr & Rossman 2018), but it produces longer conidia than Bar. pini (20–28 × 3–3.5 μm vs. 13.5–20.5 × 1.5–3.5 μm) and it has a larger mean conidium length/width ratio (7.1:1 vs. 5:6.1) than Bar. pini (Nag Raj 1993).

Diploceras (Sacc.) Died., Mykol. Untersuch. Ber.: 342. 1915, emend. F. Liu, L. Cal & Crous

Basionym: Hyaloceras Durieu & Montagne subgen. Diploceras Sacc., Syll. fung. (Abellini) 10: 484. 1892.

Description: Sexual morph: unknown. Asexual morph: Conidiomata stromatous, acervular or pyxidial, erumpent, glabrous, dark brown to black, scattered to gregarious, oval to subglobose, wall of textura angularis, cells thick-walled, brown to dark brown in the outer layers, thin-walled and colourless to almost colourless in the inner layers; ostiole circular to oval, papillate. Conidiophores arising from the upper cells of the basal stroma or lining the cavity of the conidioma, reduced to conidiogenous cells or unbranched and septate, occasionally sparsely branched, colourless, smooth, invested in mucus. Conidiogenous cells discrete or integrated, ampulliform, lageniform, cylindrical, subcylindrical, conical, or obclavate, mostly colourless, or almost colourless to pale brown in the upper part and colourless below, smooth. Conidia fusoid or subcylindrical, straight or slightly curved, 3-septate, wall thin and with or without slight constrictions at the septa, smooth; median cells almost colourless to mid-brown; end cells colourless, bearing single or more appendages at each end; appendages cellular, not separated from the conidial body by septa, branched or unbranched, filiform or attenuated and flexuous; basal appendage excentric (emended from Nag Raj 1993). Type species: Diploceras hypericum (Ces.) Died.

Notes: Diploceras was first introduced as a subgenus of Hyaloceras by Saccardo (1892) and later raised to generic rank by Diedicke (1915), who treated the single and generic type species, Dip. hypericum. Sutton (1975b) re-examined Dip. hypericum and considered it within the broad generic limits of...
Seimatosporium, and therefore added Diploceras to the list of synonyms of Seimatosporium. However, even Sutton considered Seimatosporium to be quite heterogeneous, suggesting that it should be divided into smaller genera (Sutton 1980). Nag Raj (1993) restricted the generic concept of Seimatosporium to a smaller group of species, and revived Diploceras to include Dip. hypericinum and similar forms, previously considered as synonyms of Seimatosporium. The majority of the other species of Diploceras were however shown to belong to Allelochaeta (Crous et al. 2018).
**Diploceras hypericinum** (Ces.) Died., Krypt.-Fl. Brandenburg (Leipzig) 9(5): 887. 1915. Fig. 11.

Basionym: *Pestalotia hypericina* Ces., in Rabenhorst, Klotzschii Herb. Viv. Mycol., Ed. II, Cent. 1: no. 64. 1855.

Synonyms: *Seimatosporium hypericum* (Ces.) B. Sutton, Trans. Brit. Mycol. Soc. 64: 483. 1975.

*Hyalocterus hypericinum* (Ces.) Sacc., Syll. fung. (Abellini) 10: 485. 1892.

**Culture characteristics:** Colonies on MEA flat with entire edge, with radial circular lines from the centre, white to rosy buff, reaching 52–58 mm diam after 14 d at 21 °C; conidiomata black, scattered, acervular, stomatal, superficial or immersed; on CMA flat with entire edge, off-white, reaching 65–68 mm diam after 14 d at 21 °C, conidiomata black, stromatic, scattered, covered by aerial mycelia, superficial; on PDA flat with undulate edge, pale grey, sterile, reaching 76–77 mm diam after 14 d at 21 °C; on SNA colourless, sterile, reaching 7–17 mm diam after 14 d at 21 °C.

**Description:** Sexual morph: unknown. Asexual morph: *Co-nidiophores* septate, branched, colourless, smooth, thin-walled, invested in mucus. *Conidiogenous cells* anellidic, discrete or integrated, mostly sub-cylindrical, 5–15 × 1–2.5 μm (av. = 9.7 ± 2.61 × 1.5 ± 0.27 μm), colourless, smooth or verru- culose. *Conidia* fusiform, sometimes cylindrical, curved, 3-septate, smooth, slightly constricted at septa, 15–22 × 2.5–4.5 μm (av. = 18.5 ± 1.85 × 3.8 ± 0.47 μm); basal cell short cylindrical, trapezoid, thin-walled, hyaline to pale brown, 2.5–3.5 μm (av. = 3.1 ± 0.27 μm) long; median cells 2, cylindrical, pale brown, relatively thick-walled, second cell from the base 6–8.5 μm (av. = 7.3 ± 0.68 μm) long, the third cell 4–6 μm long.

**Notes:**
- **Specimen information:**
  - CBS 113607 Unknown host and location
  - CBS 365.94 Chamaecyparis lawsoniana
  - CBS 368.54 Quercus Netherlands
  - CBS 144.97 *Pestalotiopsis* Quercus Netherlands
  - CBS 444.82 Ceanothus California
  - CBS 596.73 *Triphysaria* France
  - CBS 296.82 *Triphysaria* France
  - CBS 144035 Phoenix canariensis Australia
  - CBS 114178 Leucopostumus australis
  - CBS 119350 Camellia japonica
  - CBS 113607 Unknown host and location
  - CBS 365.94 Chamaecyparis lawsoniana
  - CBS 368.54 Quercus Netherlands
  - CBS 144.97 *Pestalotiopsis* Quercus Netherlands
  - CBS 444.82 Ceanothus California
  - CBS 596.73 *Triphysaria* France
  - CBS 296.82 *Triphysaria* France
  - CBS 144035 Phoenix canariensis Australia
  - CBS 114178 Leucopostumus australis
  - CBS 119350 Camellia japonica
  - CBS 113607 Unknown host and location

**Fig. 5.** (Continued).
Fig. 6. Phylogenetic tree of *Pseudopestalotiopsis* resulting from a maximum likelihood analysis of the combined ITS, *tuf*-1 and *tub2* sequence alignment. Bayesian posterior probabilities (PP ≥ 0.95) are emphasised by thickened branches, maximum likelihood bootstrap support values (≥ 50 %) are shown at the nodes. The scale bar represents the expected number of changes per site. All taxon names consist of strain number, host and location. Species names are aligned to the right. Ex-type strains are represented in bold. Basionyms, if present, are indicated between apostrophes ('). The tree was rooted to *Neopestalotiopsis* protearum (CBS 114178) and *Neo. rosae* (CBS 101057).

(av. = 5.1 ± 0.56 μm) long; apical cell conic with an obtuse apex, thin-walled, hyaline to pale brown, 2.5–4 μm (av. = 3.1 ± 0.36 μm) long; appendages with independent loci of origin, flexuous, attenuated, unbranched, or dichotomously branched at one appendage; 2 apical appendages, 7.5–20.5 μm (av. = 16 ± 2.09 μm) long; 1–3 basal appendages, excentric, (3.5–)8.5–21.5 μm (av. = 15.4 ± 3.69 μm) long; mean conidium length/width ratio = 4.8:1.

Materials examined. **Italy**, Veronelli, on *Hypericum perforatum* (Clusiaceae), unknown collection date, V. de Cesati, Rabenhorst, Klotzschii Herb. Viv. Mycol. Ed. II, no. 64 (HAL, **lectotype designated here**, MBT384683). **Netherlands**, Wageningen, on *Hypericum perforatum* seedlings with leaf spots, Jan. 1997, J. de Gruyter, living culture CBS 492.97 = PD 97/645; on *Hypericum perforatum*, 3 Aug. 2012, W. Quaedvlieg (CBS H-23506 **epitype designated here**, MBT383927, ex-epitype culture CBS 143885 = CPC 21115). **New Zealand**, Auckland, Western Springs, on the leaf of *Hypericum* sp., Aug. 2000, C.F. Hill, living culture CBS 109058.

Notes: *Pestalotia hypericina*, the basionym of *Diploceras hypericum*, was originally reported from *Hypericum perforatum* (Cesati 1855). The morphology of CBS H-23506 agrees with the isotype of *Dip. hypericum* (Nag Raj 1993), and is therefore designated as epitype in this study. As far as currently known, *Dip. hypericum* only infects *Hypericum* spp.

**Disaeta** Bonar, Mycologia 20: 299. 1928, **emend.** F. Liu, L. Cai & Crous.

Description: Sexual morph: unknown. Asexual morph: **Conidiomata** acervular, intra-epidermal or subcuticular, erumpent, discoid, black. **Conidiophores** septate, branched, colourless, smooth. **Conidiogenous cells** discrete or integrated, cylindrical, subcylindrical, or lageniform, thin-walled. **Conidia** fusoid, straight or curved, 4-septate, collapsed or not collapsed at septa, smooth; basal cell obconic with a truncate base, colourless; median cells cylindrical or doliform, thick-walled, pigmented; apical cell conical, colourless; apical and basal appendage single, attenuated, unbranched, basal appendage excentric (emended from Bonar 1928).

Type species: *Disaeta arbuti* Bonar.

**Disaeta arbuti** Bonar, Mycologia 20: 299. 1928, **emend.** F. Liu, L. Cai & Crous. **Fig. 12.**
Culture characteristics: Colonies on MEA flat with entire edge, with radial circular lines from the centre, brown vinaceous, reaching 60–61 mm diam after 14 d at 21 °C, conidiomata brown vinaceous, confluent, superficial or immersed, stromatic, acervular; on CMA flat with entire edge, black, reaching 60 mm diam after 14 d at 21 °C, conidial masses black, gregarious, acervular; on PDA flat with entire edge, dark brown, reaching 40–43 mm diam after 14 d at 21 °C, conidial masses black, scattered or gregarious, superficial or immersed.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, colourless, smooth, thin-walled, invested in mucus. Conidiogenous cells discrete or integrated, cylindrical, subcylindrical, or lageniform, variable in size, 2–14 × 1.5–3 μm (av. = 7.2 ± 3.23 × 2.3 ± 0.35 μm), colourless, smooth, with up to two annellations. Conidia fusoid, straight or curved, mostly 4-septate, occasionally 3-septate, wall smooth, sometimes collapsed between septa, 14.5–24 × 4.5–7 μm (av. = 17.6 ± 2.08 × 5.6 ± 0.68 μm), bearing appendages; basal cell obconic with a truncate base, periclinal wall thin and colourless in the lower half, becoming thick and progressively darker above, 1.5–3 μm (av. = 2.2 ± 0.43 μm) long; median cells

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Fig. 8. An illustration of the diversity of conidia and ascospores in different genera of Sporocadaceae (the generic order is corresponding to the topology of Fig. 1). A. Allelochaeta (CBS 144171, CBS 144191, CBS 131119, CBS 144181, from Crous et al. 2018). B. Sarcostroma (CBS 143879). C. Xenoseimatosporium (CBS 129171). D. Diploceras (CBS 492.97). E. Disaeta (CBS 143903). F. Sporocadus (NBRC 32625). G. Seimatosporium (CBS 138623). H. Synnemapestaloides (MAFF 239201, from K. Tanaka). I. Diacasia (CBS 124801). J. Pestalotiopsis (CBS 143892). K. Ciliochorella (HHUF 2800, from K. Tanaka). L. Monochaeta (CBS 199.82). M. Asci, ascospores and conidia of Seiridium (CBS 140403, Jaklitsch et al. 2016; CBS 343.97, from Bonhöndl et al. 2018). N. Nonappendiculata (CBS 116061). O. Heterotruncatella (CBS 143883, CBS 143901, CBS 143908, CBS 143897). P. Morinia (CBS 143888; F090354, Collado et al. 2006). Q. Asci, ascospores and conidia of Hymenopleella (from left to right: HKUCC 7303, Jeewon et al. 2003a; CBS 140410, from Jaklitsch et al. 2016; CBS 143886; CBS 647.74). R. Bartalina (CBS 143891). S. Parabartalina (CBS 399.71). T. Truncatella (CBS 144025). U–W. Broomella (MFLUCC 13-0798, U. Asci; V. Ascosporae; W. Conidia; reproduced with permission of A.D.A.C., originally published in Cryptogamie, Mycologie in Li et al. 2015). X. Hyalotiella (MFLUCC 13-0397, reproduced with permission of A.D.A.C. [Association des amis des cryptogames, Paris - France], originally published in Cryptogamie, Mycologie in Li et al. 2015). Y. Diversimediispora (CBS 302.86). Z. Pseudosarcostroma (CBS 103.76). AA. Robillarda (CBS 143882). AB. Asci, ascospores and conidia of Strickia (CBS 140411, Jaklitsch et al. 2016). AC. Distononappendiculata (CBS 144032). AD. Immersidiscosia (MAFF 104197, from K. Tanaka). Scale bars = 10 μm.
Bartalinia bella (ex-type CBS 464.61).

A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–H. Conidiomata on MEA, CMA, PDA and SNA, respectively. I–J. Conidiophores. K–M. Conidia. Scale bars = 10 μm.
2–3, cylindrical, doliform, or trapezoidal, fairly thick-walled, pale to mid brown, or yellowish brown, ± equal, each 2.5–5.5(–8) μm (av. = 3.8 ± 0.66 μm) long; apical cell short-conic with an acute apex, hyaline, 1.5–3 μm (av. = 2.3 ± 0.47 μm) long; apical appendage single, unbranched, attenuated, tubular, 5–16 μm (av. = 11.6 ± 2.72 μm); basal appendage single, unbranched, tubular, excentric, 6.5–17.5 μm (av. = 12.9 ± 3.4 μm) long; mean conidium length/width ratio = 3.1:1.

Material examined: Australia, Victoria, on Acacia pycnantha (Fabaceae), 20 Feb. 1976, unknown collector, CBS H-23528, living culture CBS 143903 = CPC 28304.

Notes: This isolate morphologically resembles the type species of Disaeta (Disaeta arbuti) in producing 4-septate conidia with bristle-like appendages (Bonar 1928). Disaeta arbuti was synonymised as Seimatosporium arbuti by Shoemaker (1964). However, neither Bonar (1928) nor Shoemaker (1964) mentioned the type specimen nor where it was deposited. Seimatosporium is generally characterised by 3-septate conidia, therefore we propose that Sei. arbuti should be excluded from this genus and Disaeta should be resurrected. Culture CBS 143903 was isolated from Acacia pycnantha from Australia in this study, which does not match the original collection information of Disaeta arbuti (from Arbutus menziesii in California). Therefore, CBS 143903 is temporarily considered as a representative strain of Disaeta arbuti here, and typification of this species awaits further collections.

Disaeta arbuti morphologically resembles Sarcostroma acacia, another species reported from Acacia pycnantha from

Fig. 10. Bartalinia pini (CBS 143891/CPC 24328). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–F. Conidiomata on MEA. G–H. Conidiomata on CMA and PDA. I–M. Conidiophores, conidiogenous cells and conidia. N–P. Conidia. Scale bars = 10 μm.
Australia, but it differs from the latter in the length of the appendage (5–17.5 μm vs. 2–4 μm) and the mean conidium length/width ratio (3.1:1 vs. 2.4:1) (Nag Raj 1993).

**Discosia** Lib., Pl. crypt. Arduenna, fasc. (Liège) 4: no. 346. 1837.

**Synonyms:** Cryptostictella Grove, J. Bot., Lond. 50: 52. 1912; fide Petrak & Sydow, Ann. mycol. 23: 209–294. 1925.

**Discosiospora** A.W. Ramaley, Mycotaxon 35: 101. 1989.

**Adisciso** Kaz. Tanaka et al., Persoonia 26: 90. 2011.

**Description:** Conidiomata stromatic, variable from applanate to pycnidial, intraepidermal to subepidermal or subperidermal in origin, immersed to suberumpent, occasionally appearing as conical blisters, unilocular to plurilocular, glabrous, dark brown to dull or glistening black; basal stroma in applanate conidiomata well developed, of *textura angularis*, cells thick-walled and dark.

**Fig. 11.** *Diploceras hypercinum* (A–I. CBS 143885/CPC 21115, J–N. CBS 492.97). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–F. Conidiomata on MEA. G–H. Conidiomata on CMA. I–K. Conidiophores, conidiogenous cells. L–N. Conidia. Scale bars = 10 μm.
pigmented in the basal layers, becoming progressively thin-walled and paler toward the conidial hymenium; covering layer variable in thickness, of textura angularis to textura epi-dermoidea, cells thick-walled and brown, often with occluded lumina; walls, in stromatic indeterminate or pycnidial forms, of textura angularis, cells thick-walled and dark brown to brown. Conidiophores arising at the base only, or at the base and part way up the sides, or all around the cavity of the conidioma, mostly reduced to conidiogenous cells, or long, septate and irregularly branched in a few species, colourless, thin-walled, smooth, invested in mucus. Conidiogenous cells discrete, rarely integrated, ampulliform, clavate, lageniform, narrow conical, subcylindrical, or cylindrical, colourless, thin-walled, smooth. Conidia cylindrical, fusoid, naviculate or subcylindrical, straight or curved, euseptate, cells of varying lengths, colourless, pale olivaceous or brown, smooth, bearing a cellular, unbranched or branched, filiform or attenuated appendage at each end; appendages maintaining protoplasmic continuity with conidium body and characteristically inserted on the basal and apical cells on the concave side of the conidium: in subpolar or polar position at the distal ends, medianly, or close to the septa separating the distal cells from the median cells (emended from Nag Raj 1993).

Type species: Discosia artocreas (Tode) Fr.

Fig. 12. Disaeta arbuti (CBS 143903/CPC 28304). A–D, Colonies on MEA, CMA, PDA and SNA, respectively. E–H, Conidiomata on MEA, CMA, PDA and SNA, respectively. I–L, Conidiophores, conidiogenous cells and conidia. M. Conidia. Scale bars = 10 μm.
Notes: Adisciso was introduced as generic name to accommodate sexual Discosia spp. (Tanaka et al. 2011). Based on the multi-locus phylogenetic analyses, the generic type strain of Adisciso (Adi. yakushimensis) clustered within the genus Discosia (Fig. 2). To comply with “One fungus = one name” initiative (Wingfield et al. 2012), Adisciso is synonymised under Discosia.

*Discosia artocreas* (Tode) Fr., Summa veg. Scand., Sectio Post. (Stockholm): 423. 1849. Fig. 13. Basionym: Sphaeria artocreas Tode, Fung. mecklenb. sel. (Lüneburg) 2: 20. 1791.

Synonyms: See Nag Raj (1993).

Culture characteristics: Colonies on MEA undulate with radial circular lines on surface, glaucous grey to greenish grey, reaching 47–50 mm diam after 14 d at 21 °C, conidiomata black, covered by aerial mycelia, gregarious, stromatic, semi-immersed or immersed; on CMA flat with entire edge, greenish grey, reaching 65–68 mm diam after 14 d at 21 °C, conidiomata scattered or gregarious, pale grey, brown or black, stromatic, semi-immersed; on PDA flat with entire edge, forming concentric circles, olivaceous black, sterile, reaching 69 mm diam after 14 d at 21 °C; on SNA flat with erose or dentate edge, white to pale grey, sterile, reaching 20–22 mm diam after 14 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, reduced to conidiogenous cells, colourless, smooth, thin-walled, arising from the upper cells of the basal stroma, invested in mucus. Conidiogenous cells discrete, mostly cylindrical, subcylindrical, or lageniform, 4–9 × 1.5–3.5 μm (av. = 7.3 ± 1.5 × 2.2 ± 0.47 μm), colourless, smooth; conidia sometimes formed directly from hypha. Conidia allantoid, cylindrical, straight or slightly curved, mostly 3-septate, occasionally 1-, 2- or 5-septate, smooth, 10–19 × 2.5–4 μm (av. = 14 ± 2.18 × 3 ± 0.38 μm), bearing appendages; basal cell
trapezoid or cylindrical, thin-walled, hyaline, 1.5–4.5 μm (av. = 2.9 ± 0.066 μm) long; median cells mostly 2, cylindrical, hyaline, thin-walled, ± equal, each 3.5–7 μm (av. = 4.6 ± 0.81 μm) long; apical cell conic with an acute or obtuse apex, hyaline, thin-walled, 1.5–4 μm (av. = 2.5 ± 0.6 μm) long; apical appendage single, unbranched, attenuated, tubular, 2.5–12.5 μm (av. = 9.2 ± 2.47 μm); basal appendage single, unbranched, tubular, excentric, 5.5–13.5 μm (av. = 11.4 ± 1.82 μm) long; mean conidium length/width ratio = 4.7:1.

Notes: Two strains of Discosia rubi formed a well-supported and distinct clade on the ITS tree (Fig. 3), closely related to Dis. neofraxinea. Discosia rubi shows 96 % ITS sequence similarity with Dis. neofraxinea and 98 % on LSU. Morphologically, Dis. rubi is distinct from Dis. neofraxinea by producing relatively shorter conidiogenous cells (4.5–9.5 μm vs. 6–40 μm). The second cell from the base is generally longer than the third cell in Dis. rubi, which is converse in Dis. neofraxinea. In addition, the appendages of Dis. rubi formed from the side of the apical and basal cells, but formed from the apex of conidia in Dis. neofraxinea. This is the first report of a Discosia species from Rubus phoenicolasius.

Discosia trifolii (Okane et al.) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828336. Basionym: Discostroma trifolii Okane et al., Canad. J. Bot. 74: 1339. 1996. Synonym: Adiscisporubus trifolii (Okane et al.) Kaz. Tanaka et al., Persoonia 26: 93. 2011.

Description: See Okane et al. (1996), Tanaka et al. (2011).

Material examined: Japan, Tsukuba, Ibaraki, on leaves of Rhododendron indicum (Ericaceae), 12 Sep. 1993, unknown collector, (NBRC H-12205 (= IFO H-12205), holotype of Discostroma trifolii, ex-type culture NBRC 32705, not seen).

Discosia yakushimensis (Kaz. Tanaka et al.) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828337. Basionym: Adiscisporubus yakushimense Kaz. Tanaka et al., Persoonia 26: 92. 2011.

Description: See Tanaka et al. (2011).

Material examined: Japan, Kagoshima, Yakushima Island, Okenoguchi, near Nakasegawa, 30°16′39″N, 130°37′06″E, on living leaves of Symplocos prunifolia (Symplocaceae), 21 Oct. 2005, K. Tanaka & T. Hosoya, KT 1907 (HHUF 29671 holotype, TNS-F-12443 isotype, monconidial isolate ex-type culture MAFF 242774 = NBRC 104194, not seen).

Distan Donappendiculata F. Liu, L. Cai & Crous gen. nov. MycoBank MB828323.

Etyymology: Dificers from the genus Nonappendiculata by its distoseptate conidia.

Description: Sexual morph: unknown. Asexual morph: Conidiophores aseptate, branched, reduced to conidiogenous cells, colourless, smooth, thin-walled. Conidiogenous cells discrete, cylindrical, subcylindrical or lageniform, 4.5–9.5 × 1.5–2.5 μm (av. = 7.2 ± 1.07 × 2.1 ± 0.25 μm), colourless, smooth. Conidia cylindrical, straight or slightly curved, almost colourless, 3-septate, smooth, without constrictions at the septa, 13.5–23 × 1.5–3.5 μm (av. = 18.6 ± 1.95 × 2.5 ± 0.32 μm); basal cell cylindrical, thin-walled, hyaline, 2.5–5 μm (av. = 4.1 ± 0.57 μm) long; median cells 2, cylindrical, hyaline, thin-walled, unequal, the second cell from base 4–8 μm (av. = 6.4 ± 0.85 μm) long, the third cell 3.5–6 μm (av. = 5 ± 0.6 μm) long; apical cell sub-cylindrical with rounded or obtuse apex; hyaline, thin-walled, 2.4–4.5 μm (av. = 3.3 ± 0.47 μm) long; appendages tubular, slender, flexuous; apical appendage single, unbranched, excentric, 6–15.5 μm (av. = 12 ± 2.51 μm) long, inserted about 1–1.5 μm from the apical septum; basal appendage single, unbranched, excentric, 5.5–19 μm (av. = 14.7 ± 2.81 μm) long, inserted about 1.5–2 μm from the basal septum; mean conidium length/width ratio = 7.4:1.

Material examined: USA, Maryland, on Rubus phoenicolasius (Rosaceae), 4 Sep. 2014, W.L. Bruckart (holotype CBS H-23517, ex-type culture CBS 143093 = CPC 25062).

Notes: Distan Donappendiculata is distinct from other genera in Sporocadaceae in producing distoseptate conidia, and is so far only known from Australia.

Distan Donappendiculata banksiae (Crous & Summerell) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828338. Basionym: Seiridium banksiae Crous & Summerell, Persoonia 27: 137. 2011.
Culture characteristics: See Crous et al. (2011).

Description: Sexual morph: unknown. Asexual morph: Conidiophores lining the basal cavity, hyaline, 0–2-septate, unbranched, or branched below, smooth, thin-walled, mostly reduced to conidiogenous cells. Conidiogenous cells annellidic, discrete or integrated, cylindrical, subcylindrical, ampulliform or lageniform, 7.5–15 × 2.5–4 μm (av. = 11 ± 2.53 × 3.3 ± 0.48 μm), colourless, smooth. Conidia fusoid, straight or slightly curved, brown to olivaceous, 3(–5)-distoseptate with visible septal pores, obviously verruculose, thick-walled, without constrictions at the septa, 23–38 × 10–15 μm (av. = 31.8 ± 3.68 × 12.3 ± 1.64 μm), lacking appendages; basal cell with a truncate base, 1.5–4 μm diam.; apical cell attenuated towards apex; mean conidium length/width ratio = 3.3:1.

Materials examined: Australia, Kangaroo island, on Banksia marginata (Proteaceae), 1 Dec. 2011, W. Quaedvlieg, living culture CPC 20185; Tasmania, Crescent Bay, S 43°11′29.7″ E 147°51′00.7″, on leaves of Banksia marginata, 1 Oct. 2006, B.A. Summerell & P. Summerell (holotype of Seiridium banksiae CBS H-20756, ex-type culture CBS 131308 = CPC 13637); Victoria, on Banksia marginata, 17 Oct. 2009, P.W. Crous, living culture CPC 17658; Western Australia, on leaf of Banksia formosa, 22 Sep. 2015, P.W. Crous, HPC 618, living culture CBS 143906 = CPC 28968.
Notes: This species was originally introduced as *Seiridium banksiae* (Crous et al. 2011) but appears phylogenetically distinct from *Seiridium* (Figs 1, 4) and differs morphologically by producing distoseptate and non-appendaged conidia. *Seiridium banksiae* is transferred to *Distononappendiculata*, and a new combination is proposed. All known collections of *Distononappendiculata banksiae* to date have been collected from *Banksia*.

*Distononappendiculata casuarinae* F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828324. Fig. 16.

*Etyymology:* Named after its host plant genus, *Casuarina*.

*Culture characteristics:* Colonies on MEA flat with entire edge, pale greenish grey, with white margin, reaching 30–35 mm diam after 14 d at 21 °C, conidiomata gregarious, black, superficial, acervular, covered by aerial mycelia; on CMA concave with raised margin, erose or dentate, white, reaching 30–31 mm diam after 14 d at 21 °C, conidiomata scattered or gregarious, black, superficial, acervular; on PDA flat with fimbriate edge, glaucous grey, with white margin, sterile, reaching 46 mm diam after 14 d at 21 °C; on SNA flat with erose or dentate edge, colourless, sterile, reaching 40–41 mm diam after 14 d at 21 °C.

*Description:* Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, some reduced to conidiogenous cells, colourless, smooth, thin-walled. Conidiogenous cells annelidic, discrete or integrated, cylindrical, subcylindrical, sometimes ampulliform or lageniform, 6.5–18.5 × 2–5 μm (av. = 10 ± 2.34 × 3.1 ± 0.69 μm), colourless, smooth. Conidia cylindrical, fusoid, obovoid, straight or slightly curved, pale brown or brown, 3-distoseptate with visible septal pores, wall smooth, thick-walled.

Fig. 15. *Distononappendiculata banksiae* (CBS 143906/CPC 28968). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–F. Conidiomata on MEA. G. Conidiomata on CMA. H. Conidiomata on PDA. I–K. Conidiophores, conidiogenous cells and conidia. L. Conidia with verruculose wall. M. Conidia with septal pores (arrow). N. Conidia. Scale bars = 10 μm.
without constrictions at the septa, 19.5–28.5 × 7.5–11 μm (av. = 23.7 ± 2.52 × 9.2 ± 0.86 μm), lacking appendages; basal cell with a truncate base, 1.5–4 μm (av. = 2.5 ± 0.49 μm) diam; apical cell attenuated towards apex, rounded or obtuse; mean conidium length/width ratio = 3.2:1.

Material examined: Australia, Queensland, on needles of Casuarina sp. (Casuarinaceae) displaying red bands, 9 Aug. 2009, P.W. Crous (holotype CBS H-23505, ex-type culture CBS 143884 = CPC 17253).

Notes: Distononappendiculata casuarinae is associated with red bands on needles of Casuarina sp. It is phylogenetically different from the closely related species Dist. verrucata (95 % sequence similarity on ITS, 90 % on rpb2, 88 % on tef-1α, 88 % on tub2). Morphologically, it differs from Dist. verrucata in producing smooth-walled conidia with septal pores (vs. verruculose, without visible septal pores in Dist. verrucata).

Distononappendiculata verrucata F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828325. Fig. 17.

Etymology: Name reflects the verruca on the conidium surface.

Culture characteristics: Colonies on MEA flat with ruffle lines on surface, erose or dentate edge, white, sterile, reaching 31–32 mm diam after 14 d at 21 °C; on PDA flat with crenate edge, white, rosy buff to vinaceous buff in the centre, reaching 25–26 mm diam after 14 d at 21 °C; on CMA flat with entire edge, white, sterile, reaching 25–26 mm diam after 14 d at 21 °C; on CMA flat with crenate edge, white, sterile, reaching 25–26 mm diam after 14 d at 21 °C; on PDA flat with crenate edge, white, sterile, reaching 25–26 mm diam after 14 d at 21 °C; on SNA flat with erose or dentate edge, white, sterile, reaching 19–20 mm diam after 14 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores aseptate, reduced to conidiogenous cells, occasionally branched at the base, colourless, smooth, thin-walled. Conidiogenous cells discrete, cylindrical, 4–24 × 1–3.5 μm (av. = 8.6 ± 5.17 × 2 ± 0.53 μm), colourless, smooth. Conidia fusoid, obovoid, straight or slightly curved, brown, 3-distoseptate without visible septal pores, wall verruculose and thicker than septa, without constrictions at the septa, 19–33.5 × 6.5–10 μm (av. = 25.1 ± 3.22 × 8.6 ± 0.96 μm), lacking appendages; basal cell with a truncate base, 1.5–2.5 μm (av. = 2 ± 0.29 μm) diam.; apical cell attenuated towards apex, rounded or obtuse; mean conidium length/width ratio = 2.9:1.

Material examined: Australia, Western Australia, on leaves of Banksia repens (Proteaceae), 21 Sep. 2015, P.W. Crous, HPC 611 (holotype CBS H-23538, ex-type culture CBS 144032 = CPC 29074).
Fig. 17. *Distononappendiculata verrucata* (CBS 144032/CPC 29074). A–D. Colonies on MEA, CMA, PDA and SNA. E. Conidiomata on PDA. F–J. Conidiophores and conidiogenous cells bearing conidia. K–L. Conidia. Scale bars = 10 μm.
**Notes:**  Distononappendiculata verrucata is closely related to Dist. banksiae (Figs 1, 4; 97 % sequence similarity on ITS, 93 % on rpb2, 87 % on tef-1a, 89 % on tub2), but differs from the latter in producing thinner conidia (6.5–10 μm vs. 10–15 μm) and having a smaller mean conidium length/width ratio (2.9:1 vs. 3.3:1). In addition, the conidia of Dist. verrucata are 3-septate without visible septal pores, while the conidia of Dist. banksiae are 3–5-septate and with visible septal pores. Strain CBS 144302 only sporulates on PDA.

**Diversimediispora** F. Liu, L. Cai & Crous, gen. nov. MycoBank MB828326.

**Etymology:** Diversis = different, diverse, in Latin; medis = medium, in Latin; named after the versicoloured median cells.

**Description:** Sexual morph: unknown. Asexual morph: *Conidiomata* stromatic, acervular to pycnidioïd, superficial to semi-immersed, scattered or gregarious, black, erumpent. *Conidiophores* lining the cavity of the conidioma, septate, reduced (av. = 6.6 ± 0.71 μm) long; apical cell conic or semi-circle with a small protuberance at apex giving rise to appendages, thin-walled, hyaline to pale brown, short, 1.5–3(−4) μm (av. = 2.3 ± 0.46 μm) long; 2–4 apical appendages, arising at the same point, attenuated, tubular, filiform, flexuous, unbranched, or occasionally dichotomously branched at the base of the 1–2 appendages, (7.5−) 16–36.5 μm (av. = 27 ± 4.52 μm) long; basal appendage single, tubular, centric, 5–21.5 μm (av. = 11.2 ± 3.49 μm) long; mean conidium length/width ratio = 2.3:1.

**Material examined:** USA, soil, unknown collection date, Meylan, deposited by F. Seigle-Murandi (holotype CBS H-23539, ex-type culture CBS 302.86).

**Notes:**  *Diversimediispora humicola* is characterised by versicoloured median cells and septa, i.e. its first and second median cells from the apex are darker than the other cells and the second septum from the apex is uniquely darker than the other septa. In addition, the basal median cell of *D. humicola* generally becomes verrucose with age, while the rest of the conium body remains smooth.

**Heterotruncatella** F. Liu, L. Cai & Crous, gen. nov. MycoBank MB828340.

**Etymology:** Morphologically similar to but phylogenetically different from *Truncatella*.

**Description:** *Ascomata* solitary or gregarious, scattered, immersed under minute clypeus, uniloculate, globose to sub-globose, coriaceous, papillate orapatapillate, brown. *Ostiole* central, wide, rounded. *Papilla* composed of cells of *textura porrecta* and internally lined with hyaline paraphyses. *Peridium* comprising light yellow or brown, thick-walled cells of *textura prismatica* in the upper part, and thick-walled, hyaline to pale brown cells of *textura angularis* in other parts. *Hamatheciun* comprising numerous hypha-like, septate paraphyses, slightly constricted at the septa, tapering towards the ends. *Asci* 8-spored, unitunicate, cylindrical to cylindrical-clavate, pedicelate, apically rounded, with a J-apical ring. *Ascospores* biseriate or overlapping tri-seriate, hyaline when young, sometimes pale greyish-brown with doliform median cells and yellowish to pale greyish-brown end cells or brown at maturity, fusoid, glabrous, thick-walled, straight or inequilaterally curved, with pointed ends, 1–3-septate with constrictions at the septa and bearing unbranched, terminal appendages or ornamented wall (from Senanayake et al., 2015, as *Truncatella sparti*).

*Conidiomata* stromatic, acervular to pycnidioïd, immersed to semi-immersed, glabrous, brown to black. *Conidiophores* lining the cavity of the conidioma, septate and branched, colourless, smooth, invested in mucus. *Conidigenous cells* discrete or integrated, cylindrical, subcylindrical, ampulliform, lageniform, annelidic, colourless, smooth. *Conidia* fusoid, euaspetate, straight or curved, constricted or not constricted at

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septa; basal cell trapezoid or obconic with a truncate base, thin-walled, most colourless, sometimes pale brown; median cells doliform to subcylindrical, wall thick, often verruculose, yellowish brown to brown and concolourous; apical cell conic, thin-walled, colourless; apical appendages cellular, unbranched, occasionally branched, attenuated or not attenuated, tubular, filiform, flexuous; basal appendage usually absent, when present, single, occasionally two, tubular, filiform, unbranched, centric.

Type species: _Heterotruncatella lutea_ (H.J. Swart & D.A. Griffiths) F. Liu, L. Cai & Crous.

Notes: Although species in this clade are currently accepted in _Truncatella_, the phylogenetic analyses (Figs 1, 7) show that _Heterotruncatella_ is more related to _Bartalinia, Hymenopleela_ and _Morinia_ than the clade including the generic type of _Truncatella_. Indeed, morphologically fungi from _Truncatella_ and _Heterotruncatella_ are similar in having 3-septate conidia, yellowish brown to brown median cells and branched or unbranched apical appendages.

**Heterotruncatella acacigena** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828342. Fig. 19.

**Etymology:** Named after its host plant genus, _Acacia_.

**Culture characteristics:** Colonies on MEA raised with concave edge, pale brown, reaching 80 mm diam after 14 d at 21 °C, conidiomata black, superficial, acervular; on CMA flat with entire edge, white to pale grey, reaching > 90 mm diam after 14 d at...
21 °C, conidiomata dark brown to black, semi-immersed, scattered or gregarious, covered by mycelia; on PDA flat with entire edge, off-white, reaching > 90 mm diam after 14 d at 21 °C, conidiomata black, scattered or gregarious, superficial, often covered by aerial mycelia, stromatic; on SNA flat with fimbriate edge, colourless, reaching 33–35 mm diam after 14 d at 21 °C, conidiomata black, scattered or gregarious, superficial, stromatic.

**Description:** Sexual morph: unknown. Asexual morph: **Conidiophores** septate, usually branched at the base, mostly reduced to short conidiogenous cells, colourless, smooth, invested in mucus. **Conidiogenous cells** discrete or integrated, cylindrical, subcylindrical, lageniform or ampulliform, 4–15 × 1.5–3 μm (av. = 9 ± 2.97 × 2 ± 0.51 μm), colourless, smooth. **Conidia** fusoid, straight, 3-septate, sometimes distal septa thicker than the median septum, smooth, 13.5–22 × 4.5–7 μm (av. = 16.8 ± 2.22 × 5.9 ± 0.67 μm); basal cell obconic with a narrow truncate base, hyaline, 2–4.5 μm (av. = 3 ± 0.49 μm) long; median cells 2, doliiform, fairly thick-walled, yellowish brown, ± equal, each 4.5–6 μm (av. = 5.4 ± 0.45 μm) long; apical

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**Fig. 19.** *Heterotrichia acacigena* (CBS 143880/CPC 15130). **A–D.** Colonies on MEA, CMA, PDA and SNA, respectively. **E–H.** Conidiomata on MEA, CMA, PDA and SNA, respectively. **I–J.** Conidiophores. **K–L.** Conidiogenous cells and conidia. **M.** Conidia (arrows point to the untypical basal appendages). Scale bars = 10 μm.
Heterotruncatella aspera F. Liu, L. Cai & Crous, 2010. MycoBank MB828345. Fig. 20.

Notes: Heterotruncatella acacigena is closely related to Het. grevilleae (99 % sequence similarity on ITS, 98 % on rpb2, 92 % on tef-1α, 92 % on rpb2 and Het. vinaceobubalina (99 % sequence similarity on ITS, 98 % on rpb2, 94 % on tef-1α, and 95 % on tub2) (Fig. 7). The basal appendages of these three species are not typical of other appendaged coelomycetous genera, which are more or less like promusions continuing with the conidium body. Heterotruncatella acacigena is morphologically different from the related species in conidial length (13.5–22 μm in Het. acacigena vs. 19.5–27 μm in Het. grevilleae, 17–31.5 μm in Het. vinaceobubalina) and median cell length (each 4.5–6 μm in Het. acacigena vs. 6.5–9.5 μm in Het. grevilleae, 5–11.5 μm in Het. vinaceobubalina), as well as the mean conidium length/width ratio (2.8:1 vs. 3.5:1, 3.7:1). In addition, the apical appendages of Het. acacigena and Het. grevilleae are attenuated, while those of Het. vinaceobubalina are consistently with spathulate tips.

Heterotruncatella aspera F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828347. Fig. 21.

Etymology: Name reflects the rough surface of the apical appendage.

Culture characteristics: Colonies on MEA flat with entire edge, white, reaching 57 mm diam after 14 d at 21 °C; conidiomata pale brown to brown, stromatic, gregarious, semi-immersed; on CMA flat with undulate edge, white, reaching 56–58 mm diam after 14 d at 21 °C, conidiomata black, scattered, acervular; on PDA flat with undulate edge, rosy buff, reaching 50–54 mm diam after 14 d at 21 °C, conidiomata brown or black, semi-immersed or immersed, acervular or stromatic; on SNA flat with fimbriate edge, white, sterile, reaching 15–16 mm diam after 14 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, mostly reduced to conidiogenous cells, smooth, colourless, invested in mucus. Conidiogenous cells annelidic, discrete or integrated, cylindrical, subcylindrical, lageniform or ampulliform, 5.5–12.5 × 1.5–3 μm (av. =8.9 ± 2.3 × 2.4 ± 0.35 μm), colourless, smooth. Conidia fusoid or subsfusoid, straight or curved, wall smooth or verruculose, 3-septate, distal septa thicker than median septum, barely constricted at the septa, 16.5–24.5 × 4.5–6.5 μm (av. = 20.5 ± 1.84 × 5.6 ± 0.46 μm); basal cell cylindrical or obconic with a truncate base, trapezoid, thin-walled, hyaline, 3–8 μm (av. = 4.5 ± 1.02 μm) long; median cells 2, doliiform or trapezoid, yellowish brown or mid-brown, thick-walled, ± equal, each 4.5–8 μm (av. = 6.2 ± 0.72 μm) long; apical cell conic with a truncate or acute apex, thin-walled, hyaline, 2.5–5.5 μm (av. = 3.5 ± 0.59 μm) long; 2–3 apical appendages, occasionally 1, arising at different points, attenuated, tubular, flexuous, rough, unbranched, sometimes 1–2 appendages dichotomously branched, 4.5–23 μm (av. = 12.3 ± 3.85 μm) long; basal appendage single or absent, if present, tubular, attenuated, 4–12 μm (av. = 8.1 ± 1.67 μm) long; mean conidium length/width ratio = 3.7:1.

Materials examined: Australia, Western Australia, on Acacia glaucoptera (Fabaceae), 22 Sep. 2015, P.W. Crous (holotype CBS H-23532, ex-type culture CBS 143807 = CPC 26892); on Acacia glaucoptera, 22 Sep. 2015, P.W. Crous, living culture CBS 144140 = CPC 26910.

Notes: Heterotruncatella aspera is closely related to Het. constricta (Fig. 7) with entire edge, reaching > 90 mm diam after 14 d at 21 °C, conidiomata covered by mycelia, black, acervular, stromatic, scattered, superficial or semi-immersed; on CMA flat with entire edge, white, reaching > 90 mm diam after 14 d at 21 °C, conidiomata covered by mycelia, brown, stromatic, erumpent, scattered, semi-immersed; on PDA flat with entire edge, off-white, reaching > 90 mm diam after 14 d at 21 °C, conidiomata black, acervular, superficial, scattered; on SNA flat with entire edge, colourless, reaching 56–59 mm diam after 14 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, smooth, colourless, invested in mucus. Conidiogenous cells annelidic, discrete or integrated, mostly cylindrical or subcylindrical, 7–30.5 × 1–2.5 μm, (av. =20.3 ± 6.06 × 1.8 ± 0.41 μm), colourless, smooth. Conidia fusoid, straight or curved, wall smooth or verruculose, 3-septate, distal septa thicker than median septum, barely constricted at the septa, 16.5–24.5 × 4.5–6.5 μm (av. = 20.5 ± 1.84 × 5.6 ± 0.46 μm); basal cell cylindrical or obconic with a truncate base, trapezoid, thin-walled, hyaline, 3.5–8 μm (av. = 4.6 ± 0.94 μm) long; median cells 2, doliiform or trapezoid, vinaceous buff to hazel, thick-walled, ± equal, each 6–10 μm (av. = 7.7 ± 0.96 μm) long; apical cell conic with a truncate apex, with three small but distinct protuberances at the apex, thin-walled, hyaline, 4–6.5 μm (av. = 5 ± 0.69 μm) long; 3–4 apical appendages, arising at different points, attenuated, filiform, flexuous, unbranched, sometimes dichotomously branched at each appendage, variable in size, 19–80 μm (av. = 47 ± 17.87 μm) long; basal appendage absent, if present, single, 8–20 μm (av. = 11.7 ± 3.68 μm) long; mean conidium length/width ratio = 3.4:1.

Materials examined: Australia, on Eucalyptus viminalis (Myrtaceae), 7 Nov. 2014, P.W. Crous, HPC 69 (holotype CBS H-23532, ex-type culture CBS 143866 = CPC 25377); Western Australia, on Banksia glandens (Proteaceae), 20 Sep. 2015, P.W. Crous, HPC 750, living culture CBS 144033 = CPC 29480.

Notes: Heterotruncatella aveneliana is closely related to Heterotruncatella diversa (Fig. 7) with entire edge, reaching > 90 mm diam after 14 d at 21 °C, conidiomata covered by mycelia, black, acervular, stromatic, scattered, superficial or semi-immersed; on CMA flat with entire edge, white, reaching > 90 mm diam after 14 d at 21 °C, conidiomata covered by mycelia, brown, stromatic, erumpent, scattered, semi-immersed; on PDA flat with entire edge, off-white, reaching > 90 mm diam after 14 d at 21 °C, conidiomata black, acervular, superficial, scattered; on SNA flat with entire edge, colourless, reaching 56–59 mm diam after 14 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, smooth, colourless, invested in mucus. Conidiogenous cells annelidic, discrete or integrated, mostly cylindrical or subcylindrical, 7–30.5 × 1–2.5 μm, (av. =20.3 ± 6.06 × 1.8 ± 0.41 μm), colourless, smooth. Conidia fusoid, straight or curved, wall smooth or verruculose, 3-septate, distal septa thicker than median septum, barely constricted at the septa, 16.5–24.5 × 4.5–6.5 μm (av. = 20.5 ± 1.84 × 5.6 ± 0.46 μm); basal cell cylindrical or obconic with a truncate base, trapezoid, thin-walled, hyaline, 3.5–8 μm (av. = 4.6 ± 0.94 μm) long; median cells 2, doliiform or trapezoid, vinaceous buff to hazel, thick-walled, ± equal, each 6–10 μm (av. = 7.7 ± 0.96 μm) long; apical cell conic with a truncate apex, with three small but distinct protuberances at the apex, thin-walled, hyaline, 4–6.5 μm (av. = 5 ± 0.69 μm) long; 3–4 apical appendages, arising at different points, attenuated, filiform, flexuous, unbranched, sometimes dichotomously branched at each appendage, variable in size, 19–80 μm (av. = 47 ± 17.87 μm) long; basal appendage absent, if present, single, 8–20 μm (av. = 11.7 ± 3.68 μm) long; mean conidium length/width ratio = 3.4:1.
This is the first report of a *Heterotruncatella* or morphologically similar species associated with *Eucalyptus viminalis* and *Banksia gardneri*.

**Heterotruncatella breviappendiculata** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828349. Fig. 22.

Etymology: Name reflects its short apical appendages.

**Culture characteristics:** Colonies on MEA flat with undulate edge, white to straw, reaching 58–62 mm diam after 14 d at 21 °C, conidiomata scattered, black, acervular, superficial; on CMA flat with entire edge, buff, reaching > 90 mm diam after 14 d at 21 °C, conidiomata scattered, dark brown to isabelline, acervular, superficial; on PDA flat with fimbriate edge, white, reaching 54–60 mm diam after 14 d at 21 °C, conidiomata scattered, black, acervular, stromatic, superficial; on SNA flat with undulate edge, colourless, sterile, reaching 42 mm diam after 14 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, mostly reduced to conidiogenous cells, smooth, colourless, invested in mucus. Conidiogenous cells
discrete, or sometimes integrated, cylindrical or subcylindrical, 6–20 × 1.5–3 μm (av. = 11.6 ± 3.16 × 2.3 ± 0.33 μm), colourless, smooth. Conidia fusoid, straight, smooth, 3-septate, distal septa usually thicker than median septum, slightly constricted at the septa, 15–24.5 × 6–10 μm (av. = 19.8 ± 1.79 × 8 ± 1.13 μm); basal cell trapezoid, subcylindrical, thin-walled or fairly thick-walled, hyaline, 1.5–5 μm (av. = 3 ± 0.8 μm) long; median cells 2, doliiform, mid-brown, thick-walled, ± equal, each 5.5–8 μm (av. = 6.6 ± 0.81 μm) long; apical cell conic with a truncate apex, thin-walled, hyaline, 1.5–4 μm (av. = 2.7 ± 0.66 μm) long; 2–4 apical appendages, arising at different points, not attenuated, tubular, rough, unbranched, occasionally dichotomously branched at one appendage, 1.5–9 μm (av. = 4.8 ± 1.9 μm) long; basal appendage absent; mean conidium length/width ratio = 2.5:1.

**Material examined:** Australia, Queensland, on Melaleuca quinquenervia (Myrtaceae), 10 Aug. 2009, P.W. Crous (holotype CBS H-23504, ex-type culture CBS 143883 = CPC 17239).

**Notes:** Heterotruncatella breviappendiculata is most closely related to Het. longissima (Fig. 7), but with relative low sequence similarity (98 % on ITS, 97 % on rpb2, 83 % on tef-1α, and 89 % on tub2). The short apical appendages of Het. breviappendiculata distinguish it from Heterotruncatella.

**Heterotruncatella constricta** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828350. Fig. 23.

**Etymology:** Named after its constricted mature conidia.

**Culture characteristics:** Colonies on MEA flat with undulate edge, white, reaching 58–62 mm diam after 14 d at 21 °C, conidiomata black, covered by mycelia, scattered, acervular, superficial; on CMA flat with entire edge, off-white to buff, reaching 63–65 mm diam after 14 d at 21 °C, conidiomata black, superficial, scattered or gregarious, acervular, stromatic; on PDA flat with undulate edge, white, cinnamon in the center, reaching 42–58 mm diam after 14 d at 21 °C, conidiomata saffron to cinnamon, acervular, superficial, scattered or gregarious; on SNA flat with fimбриate edge, white, reaching 21–25 mm diam after 14 d at 21 °C, conidiomata cinnamon to black, stromatic, immersed.

**Description:** Sexual morph: unknown. Asexual morph: Conidiophores septe, branched, mostly reduced to short conidiogenous cells, colourless, smooth, invested in mucus. Conidiogenous cells 3-amellidic, discrete or integrated, cylindrical, subcylindrical, lageniform or ampulliform, occasionally directly generated from mycelia, variable in size, 3–14 × 1.5–4 μm (av. = 7.7 ± 2.59 × 3 ± 0.52 μm), colourless, smooth. Conidia fusoid, straight, 3(–4)-septate, smooth or verruculose, always constricted at the septa, 17.5–31 × 5.5–9.5 μm (av. = 22.8 ± 2.81 ± 7.6 ± 0.97 μm); basal cell obconic with a truncate base, trapezoid, thin-walled, hyaline, 2–7 μm (av. = 4.7 ± 1.33 μm) long; median cells mostly 2, doliiform or trapezoid, pale to mid-
brown, thick-walled, ± equal, each 5–8.5 μm (av. = 7 ± 0.87 μm) long; apical cell conic with an acute apex, thin-walled, hyaline, 2.5–5.5 μm (av. = 3.5 ± 0.66 μm) long; 2–3 apical appendages, arising at different points, tubular, unbranched, 3–16 μm (av. = 9.8 ± 3.93 μm) long; 0–1 basal appendage, if present, 2–10 μm long; mean conidium length/width ratio = 3:1.

Materials examined: Australia, Western Australia, Perth, Cawarra Park, on leaves of Acacia sp. (Fabaceae), 16 Jun. 2015; P.A. Barber, HPC 499 (holotype CBS H-23526, ex-type culture CBS 143901 = CPC 27578 = PAB_F013); ibid., living culture CBS 144138 = CPC 27580.

Note: See notes under Het. aspera.

Heterotruncatella diversa F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828353. Fig. 24.

Etymology: From the Latin word “diversus”, named after the diverse number of apical appendages.
Culture characteristics: Colonies on MEA flat with entire edge, white to pale brown, reaching 67–68 mm diam after 14 d at 21 °C, conidiomata black, acervular, stromatic, scattered, superficial; on CMA flat with entire edge, white to off-white, reaching > 90 mm diam after 14 d at 21 °C, conidiomata brown, stromatic, scattered, superficial or semi-immersed, covered by aerial mycelia; on PDA flat with entire edge, white, reaching 58 mm diam after 14 d at 21 °C, conidiomata black, acervular, superficial; on SNA flat with entire edge, colourless, reaching 61–62 mm diam after 14 d at 21 °C, only sporulating near the inoculation, conidiomata black, acervular, superficial.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, colourless, smooth, invested in mucus. Conidiogenous cells annelidic, discrete or integrated, mostly cylindrical or subcylindrical, 8.5–19.5 × 1.5–2 μm, colourless, smooth. Conidia fusoid, straight or barely curved, 3-septate, verruculose, slightly constricted at the septa, 19.5–29.5 × 7–9 μm (av. = 23.7 ± 2.32 × 8 ± 0.54 μm), distal septa thicker than median septa; basal cell obconic with a narrow truncate base, trapezoid, thin-walled, hyaline, 2.5–6.5 μm (av. = 4.2 ± 0.81 μm) long; median cells 2, cylindrical or doliiform, mid-brown, thick-walled, ± equal, each 5.5–10 μm (av. = 7.4 ± 1.16 μm) long; apical cell conic with a truncate apex, thin-walled, hyaline, 3.5–5.5 μm (av. = 4.7 ± 0.51 μm) long; 4–6 apical appendages, arising at different points, attenuated, filiform or flexuous, unbranched, occasionally dichotomously branched at one appendage, variable in size, 27–52 μm (av. = 38 ± 4.7 μm) long; 0–1 basal appendage, if present, tubular, unbranched, attenuated, 2.5–9.5 μm (av. = 5.3 ± 2.36 μm) long; mean conidium length/width ratio = 2.9:1.

Material examined: Australia, Western Australia, Albany, on Acacia sp. (Fabaceae), 20 Sep. 2015, P.W. Crous, HPC 720 (holotype CBS H-23533, ex-type culture CBS 143908 = CPC 29040).

Note: See notes under Heterotruncatella avellanea.

Fig. 23. Heterotruncatella constricta (CBS 143901/CPC 27578). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–H. Conidiomata on MEA, CMA, PDA and SNA, respectively. I–J. Conidiophores. K–N. Conidiogenous cells and conidia (arrow points to the annellations). O. Conidia. Scale bars = 10 μm.
Heterotruncatella grevilleae F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828354. Fig. 25.

Etymology: Name reflects the host genus it was isolated from, Grevillea.

Culture characteristics: Colonies on MEA flat with entire edge, white to grey, reaching 82 mm diam after 14 d at 21 °C, conidiomata black, acervular, stromatic, scattered, superficial; on CMA convex with raised, yellow-green pigmented, reaching > 90 mm diam after 14 d at 21 °C, conidiomata black, scattered or confluent, superficial to semi-immersed, acervular, stromatic; on PDA flat with entire edge, off-white to yellow-green, reaching 80–82 mm diam after 14 d at 21 °C, conidiomata black, scattered or gregarious, stromatic; on SNA flat with rhizoids edge,
colourless, reaching 13–22 mm diam after 14 d at 21 °C, conidial masses ochreous.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, smooth, colourless, invested in mucus. Conidiogenous cells annellidic, discrete or integrated, mostly cylindrical or subcylindrical, sometimes lageniform, 7–24.5 × 1.5–2.5 μm (av. = 14.3 ± 4.52 × 1.9 ± 0.33 μm), colourless, smooth. Conidia fusoid, subfusoid, straight, occasionally slightly curved, verruculose, 3-septate, distal septa always thicker than median septum, slightly constricted at the septa, 19.5–27 × 4.5–9 μm (av. = 23.7 ± 1.86 × 6.8 ± 0.96 μm); basal cell obconic with a truncate base, trapezoid, thin-walled, hyaline, 2.5–6 μm (av. = 4.7 ± 0.82 μm) long; median cells 2, doliiform, pale brown, yellowish brown or brown, thick-walled, ± equal, each 6.5–9.5 μm (av. = 7.6 ± 0.83 μm) long; apical cell conic with an acute or obtuse apex, thin-walled, hyaline, 2.5–5.5 μm (av. = 3.3 ± 0.55 μm) long; 2–4 apical appendages, arising at different points, attenuated, tubular, flexuous, unbranched, sometimes dichotomously branched at one appendage, variable in size, 4–16.5 μm (av. = 10.5 ± 3.18 μm) long; 0–1 basal appendage, if present, subulate and very short; mean conidium length/width ratio = 3.5:1.

Material examined: Australia, Queensland, on Grevillea sp. (Proteaceae), 13 Jul. 2009, P.W. Crous (holotype CBS H-23502, ex-type culture CBS 143881 = CPC 16997).

Notes: This is the first report of a truncatella-like species on Grevillea. Also see the notes under Heterotruncatella acacigena.
Heterotruncatella longissima F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828355. Fig. 26.

Etymology: Named after its very long apical and basal appendages.

Culture characteristics: Colonies on MEA flat with ruffle sag on the surface, off-white, reaching 57–65 mm diam after 14 d at 21 °C, conidiomata black, acervular, stromatic, scattered, superficial; on CMA flat with entire edge, white to buff, sterile, reaching > 90 mm diam after 14 d at 21 °C; on PDA flat with entire edge, white, buff or pale brown, sterile, reaching 57–58 mm diam after 14 d at 21 °C; on SNA flat with fimbriate edge, colourless, reaching 37–43 mm diam after 14 d at 21 °C, conidiomata black, acervular, stromatic, scattered or gregarious, superficial.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, smooth, colourless, invested in mucus. Conidiogenous cells annellidic, discrete or integrated, cylindrical, subcylindrical or lageniform, 6.5–16.5 × 1.5–3 μm, (av. =11.1 ± 2.46 × 2.3 ± 0.46 μm), colourless, smooth. Conidia fusoid to oval, straight, wall smooth or verruculose, mostly 3-septate, slightly constricted at the septa, 19.5–24.5 × 7–12.5 μm (av. = 22 ± 1.41 × 10.4 ± 1.06 μm); basal cell obconic with a narrow truncate base, trapezoid, thick- or thin-walled, hyaline, 2–4 μm (av. = 2.9 ± 0.54 μm) long; median cells 2, doliiform, yellowish brown or mid-brown, thick-walled, ± equal, each 5.5–9 μm (av. = 7.7 ± 0.97 μm) long; apical cell conic with a truncate apex, thin-walled, hyaline, 2–4 μm (av. = 2.7 ± 0.47 μm) long; 3–5 apical appendages, arising at different points, filiform, flexuous, attenuated, unbranched, sometimes dichotomously branched at one appendage, variable in size, (18–)41–90 μm (av. = 66 ± 14.08 μm) long; 0–1 basal appendage, if present, 5–32.5 μm (av. = 15.7 ± 6.88 μm) long; mean conidium length/width ratio = 2.1:1.

Materials examined: Australia, Western Australia, on Synaphea sp. (Proteaceae), 18 Sep. 2015, P.W. Crous, HPC 709 (holotype CBS H-23535, ex-type

Fig. 26. Heterotruncatella longissima (CBS 143910/CPC 29114). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–F. Conidiomata on MEA and SNA. G–H. Conidiogenous cells and conidia. I–L. Conidia. Scale bars = 10 μm.
**Notes:** The two strains of *Heterotruncatella longissima* formed a distinct clade on the multi-locus tree (Fig. 7). Morphologically, it differs from all other species in *Heterotruncatella* in producing quite long apical and basal appendages and having a small mean conidium length/width ratio. This is the first report of a *Sporocadaceae* species from *Aspalathus linearis* and *Synaphea*.

**Heterotruncatella lutea** (H.J. Swart & D.A. Griffiths) F. Liu, L. Cai & Crous, **comb. nov.** MycoBank MB828356. **Fig. 27.**

**Basionym:** *Monochaetia lutea* H.J. Swart & D.A. Griffiths, Trans. Brit. Mycol. Soc. 62: 152. 1974.

**Culture characteristics:** Colonies on MEA raised with crenate edge, straw to pure yellow, aerial mycelia flocculent, reaching 50–52 mm diam after 14 d at 21 °C, conidiomata brown to black, scattered or gregarious; on CMA flat with entire edge, pale luteous, reaching 70 mm diam after 14 d at 21 °C, conidiomata brown to black, superficial, scattered or confluent; on PDA flat with undulate edge, pale luteous, buff or honey, reaching 56–68 mm diam after 14 d at 21 °C, conidiomata yellow brown, dark brown or isabelline, scattered or gregarious, superficial.
acervular; on SNA flat with fimbriate edge, straw, reaching 40–42 mm diam after 14 d at 21 °C, conidiomata pale luteous, brown, scattered, superficial, acervular.

Description (On SNA): Sexual morph: unknown. Asexual morph: Conidiophores septate, branched at the base, mostly reduced to conidigenous cells, colourless, smooth, smooth, invested in mucus. Conidiogenous cells discrete or integrated, mostly lageniform or ampulliform, sometimes cylindrical or subcylindrical, 1.5–15.5 × 1.5–4.5 μm (av. = 7.6 ± 3.08 × 2.8 ± 0.72 μm), colourless, smooth. Conidia fusoid or ovoid, straight, 3-septate, smooth, distal septa thicker than the median septum, 13–20.5 × 5–7 μm (av. = 14.8 ± 1.6 × 6.2 ± 0.44 μm); basal cell obconic with a truncate or obtuse base, thin-walled, hyaline, 1.5–4.5 μm (av. = 2.4 ± 0.77 μm) long; median cells 2, doliform, pale to mid-brown, thick-walled, ± equal, each 3.5–6 μm (av. = 4.7 ± 0.57 μm) long; apical cell conic with an acute apex, thin-walled, hyaline, 1–5 μm (av. = 2.4 ± 0.9 μm) long; apical appendage single, attenuated, tubular, unbranched, 1–9 μm (av. = 5.5 ± 2.21 μm) long; 0–1 basal appendage, when present, attenuated, tubular, unbranched, 0.5–5.5 μm (av. = 2.6 ± 1.46 μm) long; mean conidium length/width ratio = 2.4:1.

Material examined: Australia, Victoria, Field Naturalists Reserve Ocean Grove, on Acacia pycnantha (Fabaceae) phylode, unknown collection date. J. Withers, isolated by H.J. Swart in Aug. 1972 (isotype of Monochaeta lutea CBS H-7353, ex-isotype culture CBS 349.73 = ATCC 26926 = IMI 168736).

Notes: Based on the multi-locus phylogenetic analyses, the ex-isotype of Monochaeta lutea clustered in the clade representing the genus Heterotruncatella (Fig. 7). Monochaeta lutea is therefore transferred to Heterotruncatella, and a new combination is proposed. It was originally described with very short apical and basal appendages, less than 1 μm (Swart & Griffiths 1974), while, in the present study, it usually produced longer appendages (1–9 μm) on SNA (Fig. 27). In addition, conidia are variable in shape on MEA (fusoid, falcate to lunate, or irregular), but often without appendage or with very short appendages.

The 3-septate main conidial body of Het. lutea is typical of Heterotruncatella; however, its single apical and basal appendage is more comparable to the related genus Hymeno-pleilla. This may explain its basal position in Heterotruncatella (Fig. 7), and its intermediate state of differentiation and speciation.

Heterotruncatella proteicola F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828357. Fig. 28.

Etymology: Name refers to the host plant it was isolated from, Protea.

Culture characteristics: Colonies on MEA flat with entire edge, white, sterile, reaching 67–69 mm diam after 14 d at 21 °C; on CMA flat with entire edge, straw to ochreous from outside region to the centre, sterile, reaching 72–74 mm diam after 14 d at 21 °C; on PDA flat with entire edge, pure yellow, sterile, reaching 78–79 mm diam after 14 d at 21 °C; on SNA flat with entire edge, colourless, reaching 61–62 mm diam after 14 d at 21 °C.

Description: Sexual morph: see Senanayake et al. (2015). Asexual morph: Conidiomata produced on barley leaves and filter paper in SNA plates, brown to black, stromatic, superficial, scattered or gregarious. Conidiophores septate and branched at the base, colourless, smooth, invested in mucus. Conidiogenous cells anellidic, discrete, mostly cylindrical, subcylindrical, or lageniform, 4.5–11.5 × 1.5–4.5 μm (av. = 8 ± 1.83 × 2.5 ± 0.61 μm), colourless, smooth. Conidia fusoid, straight or slightly curved, mostly 3-septate, occasionally 4-septate, verrucose, slightly constricted at the septa, 22.5–30 × 5–9 μm (av. = 26.2 ± 1.77 × 7.4 ± 0.88 μm); basal cell obconic with a narrow truncate base, thin-walled, hyaline, 2.5–6 μm (av. = 4.6 ± 0.78 μm) long; median cells 2, cylindrical or doliform, pale to mid-brown, thick-walled, ± equal, each 6–10.5 μm (av. = 8.3 ± 0.94 μm) long; apical cell conical, thin-walled, hyaline, 3–6.5 μm (av. = 4.8 ± 0.8 μm) long; 3–5 apical appendages, arising at different points, tubular, filiform, flexuous, attenuated, unbranched, occasionally dichotomously branched at one appendage, 28–44 μm (av. = 36.9 ± 4.52 μm) long; basal appendage single, occasionally two, unbranched, tubular or flexuous, attenuated, centrif or excentric, 2.5–17.5 μm (av. = 8.9 ± 3.64 μm) long; mean conidium length/width ratio = 3.5:1.

Material examined: USA, Utah, on Quercus welschi (Fagaceae), 1 Oct. 2014, M.J. Wingfield, HPC 54 (holotype CBS H-23519, ex-type culture CBS 143895 = CPC 25365).

Notes: According to the phylogenetic analysis (Fig. 7), Het. quercicola is distinct from Tru. angustata, the only Heterotruncatella


species that is thus far reported from Quercus (Farr & Rossman 2018). Morphologically, it differs from other Heterotruncatella species in its ability to produce two basal appendages.

Heterotruncatella restionacearum (S.J. Lee & Crous) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828359.

Basionym: Truncatella restionacearum S.J. Lee & Crous, Stud. Mycol. 55: 184. 2006.

Illustration and description: See Lee et al. (2006).

Materials examined: South Africa, Western Cape Province, Jonkershoek Nature Reserve, culm litter of Ischyrolepis cf. gaudichaudiana (Restionaceae), 31 Jul. 2001, S. Lee (holotype PREM 58871, ex-type living culture CBS 119210 = CMW 18755); on dead culm of Restio filiformis (Restionaceae), 15 Jun. 2001, S. Lee, living culture of Tru. restionacearum CBS 118150 = SL0777 = CMW 17968.

Notes: This species was reported as Tru. restionacearum (Lee et al. 2006). Phylogenetic analysis (Fig. 7) located the ex-type strain of Tru. restionacearum in the genus Heterotruncatella, and a new combination was therefore proposed here.

Heterotruncatella singularis F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828360. Fig. 30.

Etymology: Named after its single apical appendage.

Culture characteristics: Colonies on MEA flat with entire edge, white, aerial mycelia flocculent, sterile, reaching > 90 mm diam after 14 d at 21 °C; on CMA umbonate with entire edge, white to buff, sterile, reaching > 90 mm diam after 14 d at 21 °C; on PDA low convex with entire edge, pale luteous, sterile, reaching > 90 mm diam after 14 d at 21 °C; on SNA flato erose or dentate edge, hyaline, sterile, reaching 60–64 mm diam after 14 d at 21 °C.

Description (in planta): Sexual morph: unknown. Asexual morph: Conidiomata on plant leaves black, semi-immersed or
immersed, erumpent, acervular. Conidiophores aseptate, unbranched or branched at the base, mostly reduced to conidiogenous cells, smooth, colourless, invested in mucus. Conidiogenous cells not annellidic, discrete, cylindrical, 5.5–26.5 × 1.5–2.5 μm, (av. = 13.4 ± 5.83 × 1.7 ± 0.23 μm), colourless, smooth. Conidia fusoid, straight, smooth, 3-septate, not constricted at the septa, 16.5–21 × 7–8.5 μm (av. = 18.9 ± 1.14 × 7.8 ± 0.29 μm); basal cell short obconic or cylindrical with a truncate base, thin-walled, hyaline, or pale to mid-brown, 1–2.5 μm (av. = 1.7 ± 0.27 μm) long; median cells 2, dolliform, pale brown to dark brown, thick-walled, ± equal, together 12.5–16 μm (av. = 14.6 ± 0.86 μm), each 6.5–8.5 μm (av. = 7.4 ± 0.48 μm) long; apical cell short conic, thin-walled, hyaline, 0.5–2.5 μm (av. = 1.5 ± 0.4 μm) long; apical appendage single, not attenuated, filiform, flexuous, unbranched or branched, smooth or rough, variable in size, 13–30.5 μm (av. = 20.4 ± 4.57 μm) long; basal appendage absent; mean conidium length/width ratio = 2.4:1.

Fig. 29. Heterotruncatella quercicola (CBS 143895/CPC 25365). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E. Conidiomata on barley leaves. F. Colonies on filter paper. G–J. Conidiophores, conidiogenous cells and conidia. K–N. Conidia (arrow points to branched apical appendage). Scale bars = 10 μm.
Fig. 30. Heterotruncatella singularis (HPC 721). A–B. Disease symptoms on the front and back of the leaves. C. Conidiomata. D–G. Conidiophores and conidiogenous cells bearing conidia. H–O. Conidia. Scale bars = 10 μm.
Conidiomata (Description 55: 184. 2006. – tubular, branched, variable in size, 6 conical, thin-walled, hyaline, 1.5 idiogenous cells conidiomata, septate, branched, colourless, smooth. Con-) nidiophores 55: 185. 2006. doliiform, cylindrical, pale brown or yellowish brown, thick- pale brown, 2 with a truncate base, trapezoid, thin-walled, hyaline or sometimes straight or slightly curved, mostly 3-septate, occasionally 5 – comb. nov. (S. Lee & Crous) F. Liu, L. Cai & Heterotruncatella spadicea the compared to those of the other species. This is to our knowledge capensis the apical and basal cell of conidia of the. Although represented by a single strain, Het. singularis is distinct from all other species on the multi-focus tree (Fig. 7). Morphologically, it differs from other Heterotruncatella species in producing a single and branched apical appendage. In addition, the apical and basal cell of conidia of Het. singularis are short compared to those of the other species. This is to our knowledge the first report of a Sporocadaceae species on Hakea elliptica.

Heterotruncatella spadicea (S. Lee & Crous) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828361, Fig. 31. Basionym: Truncatella spadicea S. Lee & Crous, Stud. Mycol. 55: 185. 2006. Synonym: Truncatella megaspora S. Lee & Crous, Stud. Mycol. 55: 194. 2006.

Description (On CMA): Sexual morph: unknown. Asexual morph: Conidiomata black, stromatic, scattered, semi-impressed. Co- nodiophores arising from the entire periphery of the inside of the conidioma, septate, branched, colourless, smooth. Con- idiogenous cells discrete or integrated, cylindrical, subcylindrical, lageniform, 4–15.5 × 1.5–3.5 μm, (av. = 8.9 ± 2.33 × 2.2 ± 0.39 μm), colourless, smooth. Conidia fusoid, subcylindrical, straight or slightly curved, mostly 3-septate, occasionally 5–6-septate, smooth, not constricted at the septa, 15–24 × 4.5–6 μm (av. = 18.3 ± 2.36 × 5.2 ± 0.42 μm); basal cell obconic with a truncate base, trapezoid, thin-walled, hyaline or sometimes pale brown, 2–5.5 μm (av. = 3.2 ± 0.84 μm) long; median cells 2, doliform, cylindrical, pale brown or yellowish brown, thick-walled, ± equal, each 4–8 μm (av. = 5.6 ± 0.82 μm) long; apical cell conical, thin-walled, hyaline, 1.5–4.5 μm (av. = 2.9 ± 0.76 μm) long; 1–4 apical appendages, arising at the same point, not attenuated, tubular, branched, variable in size, 6–41 μm long; basal appendage absent; mean conidium length/width ratio = 3.5:1.

Materials examined: Australia, Western Australia, on Sorghum halepense (Poaceae) weed, 19 Sept. 2015, P.W. Crous, living culture CPC 28956. South Africa. Western Cape Province, Jonkershoek, on culm litter of Ischyrolepis capensis, 5 Apr. 2001, S. Lee (holotype of Truncatella spadicea PREM 58873); on dead culm of Cannomois virgata (Restionaceae) 15 Jun. 2001, S. Lee (epitype of Truncatella spadicea designated here CBS H-23556, MBT383972, living culture CBS 118145 = SLO762 = CMW 17958); on dead culm of Ischyro- lepis (Restionaceae), 31 Jul. 2001, S. Lee, living culture CBS 118144 = SLO867 = CMW 18013; Kirstenbosch, on dead culm of Rhodochoma capensis (Restionaceae), 3 Dec. 2001, S. Lee, living culture CBS 118148 = SL 1071 = CMW 18093; Kogelberg Nature Reserve, culm litter of Restio egregius, 3 Nov. 2000, S. Lee (holotype of Truncatella megaspora PREM 58870); Western Cape, on dead culms of Elegia filacea (Restionaceae), Dec. 2001, S. Lee, living culture CPC 17911 = CMW 22206.

Notes: Truncatella megaspora and Tru. spadicea were originally described from Restio egregius (Restionaceae) and Ischyrolepis capensis (Restionaceae), respectively (Lee et al. 2006). Unfortunately, no living culture was obtained for either species, and only ITS sequences are available (Lee et al. 2006). Two type specimens (T. megaspora, PREM 58870 & T. spadicea, PREM 58873) formed one well-supported clade with five other strains (Fig. 7), indicating that they represented the same species. Although a living culture CBS 118144 from same host plant and same location as Tru. spadicea was obtained in this study, it was sterile. We therefore designated CBS H-23556, dried culture of living culture CBS 118145 from the same host family (Restio- naceae) as an epitype. Truncatella spadicea is lectotypified and combined as Het. spadicea in this study.

Conidia of Het. spadicea are variable in size. According to Lee et al. (2006), Tru. megaspora was characterised by producing larger conidia (25–36 × 9–13 μm) than any other related spe- cies, and the conidia of Tru. spadicea (PREM 58873) are 20–23 × 7–8.5 μm. The conidial length of the epitope (15–24 μm) is comparable to Tru. spadicea (PREM 58873), but differs in the width of conidia (4.5–6 μm vs. 7–8.5 μm). The number and length of apical appendages are consistent in these strains and specimens.

Heterotruncatella spartii (Senan. et al.) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828362. Fig. 32. Basionym: Truncatella spartii Senan. et al., Fungal Diversity 73: 91. 2015.

Culture characteristics: Colonies on MEA flat with undulate edge, with radial lines on the surface, pale luteous, reaching 59–60 mm diam after 14 d at 21 °C, conidiomata black, scat- tered, superficial, often covered by aerial mycelia, acervular, stromatic; on CMA flat with entire edge, white, reaching 70 mm diam after 14 d at 21 °C, conidiomata black, scattered, super- ficial or semi-immerged, acervular; on PDA flat with entire edge, off-white, reaching 71 mm diam after 14 d at 21 °C, conidiomata dark brown to black, scattered, superficial, acervular; on SNA flat with entire edge, colourless, reaching 24–25 mm diam after 14 d at 21 °C, conidiomata black, scattered, superficial, acervular or stromatic.

Description: Sexual morph: see Senanayake et al. (2015). Asexual morph: Conidiophores septate, branched at the base, colourless, smooth, invested in mucus. Conidiogenous cells anellidic, discrete, mostly cylindrical, subcylindrical, or lageni- form, 8.5–23 × 1.5–4.5 μm, (av. = 13.2 ± 4 × 2.1 ± 0.55 μm), colourless, smooth. Conidia fusoid, straight or curved, mostly 3- septate, smooth or verruculose, barely constricted at the septa, 20.5–37 × 6–9 μm (av. = 26.7 ± 0.83 × 7.6 ± 0.78 μm); basal cell obconic with a truncate base, thin-walled, hyaline, 2.5–6.5 μm (av. = 4.7 ± 0.83 μm) long; median cells 2, cylindrical or sub- cylindrical, mid-brown to brown, thick-walled, ± equal, each 5–12 μm (av. = 9.1 ± 1.57 μm) long; apical cell conic with an acute or truncate apex, thin-walled, hyaline, 4–6.5 μm (av. = 5.1 ± 0.87 μm) long; 3–4 apical appendages, arising at different points, tubular, rough, unbranched or dichotomously branched at one appendage, variable in size, (4–) 11.5–52(–63) μm long; single basal appendage or absent, if present, tubular, unbranched, centric, occasionally dichoto- mously branched, 4.5–25(–44) μm long; mean conidium length/ width ratio = 3.5:1.

Materials examined: China, on Pinus sp. (Pinaceae), unknown collection date, P.W. Crous, living culture CPC 23515. Ethiopia, on Pinus radiata, Jun. 2013, P.W. Crous, living culture CBS 144028 = CPC 23170. Ireland, on bone sample of deer, unknown collection date, Dr. Wagner, living culture CBS 144030 = CPC 24980. Italy. Province of Forlí-Cesena [FC], Galeata, Passo delle Forche, on branch of Spartium junceum (Fabaceae), 9 Nov. 2013, E. Camporesi (holotype of Truncatella spartii MFLUCC 15-0721, ex-type culture MFLUCC 15-0371, not seen). Mexico, Texcoco, on Pinus sp., 8 Dec. 2009, M. de Jesus Yanez Morales, living culture CPC 17945. USA, Utah, on Pinus edulis, Oct. 2014, M.J. Wingfield, HPC 53, CBS H-23518, living culture CBS 143894 = CPC 25363.

Notes: According to the phylogenetic analyses (Fig. 7), the ex- type of Tru. spartii (MFLUCC 15-0537) (Senanayake et al. 2015) is located in the new genus Heterotruncatella, and it is therefore combined as Het. spartii. The conidia of Tru. spartii were described as 8–12 × 4–5.5 μm in Senanayake et al.
However, these are much longer and wider in the photoplate of that publication (fig. 8 in Senanayake et al. 2015). We therefore redescribed the asexual morph using the phylogenetically similar strain CBS 143894 (Fig. 7).

Heterotruncatella synapheae F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828363. Fig. 33.

Etymology: Name reflects the host genus it was isolated from, Synaphea.
Culture characteristics: Colonies on MEA raised with convex edge, white to buff, reaching 51–55 mm diam after 14 d at 21 °C, conidial masses black, superficial; on CMA flat with entire edge, pale brown to dark vinaceous, sterile, reaching 76–80 mm diam after 14 d at 21 °C; on PDA flat with entire edge, buff to honey, sterile, reaching 58–60 mm diam after 14 d at 21 °C; on SNA flat with entire edge, colourless, sterile, reaching 50–51 mm diam after 14 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, reduced to conidiogenous cells, smooth, colourless. Conidiogenous cells annelidic, discrete, cylindrical or subcylindrical, 2.5–9.5 × 1.5–2 μm, (av. = 5 ± 1.82 ± 1.8 ± 0.27 μm), colourless, smooth. Conidia fusoid, subfusoid to oval, straight or curved, wall rough or verruculose, mostly 3-septate, occasionally 4–5-septate, distal septa thicker than median septum, constricted at the septa, 20.5–29 × 8–10.5 μm (av. = 25.6 ± 2.06 × 9.5 ± 0.81 μm); basal cell obconic with a truncate base, sub-cylindrical, thin-walled, hyaline to pale brown, 2–6 μm (av. = 4.3 ± 0.8 μm) long; median cells 2, occasionally 3–4, doliiform, brown, thick-walled, ± equal, each 6–10.5 μm (av. = 8.3 ± 0.93 μm) long; apical cell conic with a truncate apex, or irregular, thin-walled, hyaline to pale brown, 1.5–3.5 μm (av. = 3 ± 0.62 μm) long; 3–5 apical appendages, arising at different points, attenuated, flexuous, unbranched, 21–46 μm (av. = 32 ± 7.04 μm) long; basal appendage absent; mean conidium length/width ratio = 2.7:1.

Fig. 32. Heterotruncatella spartii (CBS 143894/CPC 25363). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–H. Conidiomata on MEA, CMA, PDA and SNA respectively. I–K. Conidiophores, conidiogenous cells and conidia. L–M. Conidia with 3–5 appendages. Scale bars = 10 μm.
Material examined: Australia. Western Australia, Fitzgerald River National Park, Twertap road, on Synaphea polymorpha (Proteaceae), 22 Sep. 2015, P.W. Crous, HPC 667 (holotype CBS H-23534, ex-type culture CBS 143909 = CPC 29096).

Notes: Typical conidiomata were not formed in Het. synapheae, and only black conidial masses were observed on MEA. Heterotruncatella synapheae is closely related to Het. singularis, but with low sequence similarity (94 % on ITS, 95 % on rpb2, 85 % on tef-1α, and 89 % on tub2). Morphologically, Het. synapheae produces longer and wider conidia (20.5–29 × 8–10.5 μm vs. 16.5–21 × 7–8.5 μm) than Het. singularis. In addition, the 3–5 apical appendages of Het. synapheae are unbranched and long (21–46 μm), while Het. singularis produces only a single, branched or unbranched and relatively shorter appendage (13–30.5 μm). This is to our knowledge the first report of a Sporocadaceae species on Synaphea polymorpha.

Heterotruncatella vinaceobubalina F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828364. Fig. 34.

Etymology: Name reflects the colour of its median cells, vinaceous buff.

Culture characteristics: Colonies on MEA flat with entire edge, off-white to grey, reaching 50–54 mm diam after 14 d at 21 °C, conidiomata black, stromatic, scattered, semi-immersed; on CMA flat with entire edge, glaucous sky blue to greenish glaucous, reaching 70–74 mm diam after 14 d at 21 °C, conidiomata black, acervular, scattered, semi-immersed; on PDA flat with undulate edge, smoke grey, rosy buff around centre, reaching 54–58 mm diam after 14 d at 21 °C, conidiomata black, scattered, acervular, semi-immersed; on SNA flat with fimbriate edge, colourless, sterile, reaching 27–29 mm diam after 14 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores branched at the base, smooth, colourless, invested in mucus. Conidiogenous cells annellidic, discrete or integrated, cylindrical, subcylindrical, sometimes lageniform or ampulliform, 5.5–19.5 × 1.5–3 μm (av. = 10.8 ± 3.37 × 2.2 ± 0.34 μm), colourless, smooth. Conidia fusoid, straight, having verrucous particles on the surface, mostly 3-septate, occasionally 5-septate, distal septa thicker than median septum, slightly constricted at the septa, 17–31.5 × 5–8.5 μm (av. = 23.2 ± 2.9 × 7 ± 0.82 μm); basal cell obconic with a truncate base, or cylindrical, thin-walled, hyaline, 2–6.5 μm (av. = 4.1 ± 1.14 μm) long; median cells 2, doliform, vinaceous buff, thick-walled, ± equal, each 5–11.5 μm (av. = 7.6 ± 1.17 μm) long; apical cell conic with a truncate apex, thin-walled, hyaline, 2–6 μm (av. = 3.3 ± 0.88 μm) long; 2–3 apical appendages, arising at different points, tubular, flexuous, not attenuated, usually with spathulate apexes, unbranched, barely dichotomously branched at one appendage, 9–32 (–42) μm (av. = 20.1 ± 7.21 μm) long; basal appendage 0–1, if present, tubular, attenuated, 3.5–9.5 (–12.5) μm (av. = 5.5 ± 1.9 μm); mean conidium length/width ratio = 3.7:1.

Materials examined: France. La Réunion, on Acacia heterophylla (Fabaceae), 7 Mar. 2015, P.W. Crous, HPC 255, CBS H-23523, living culture CBS 143898 = CPC 26343.

Note: See notes under Het. acacigena.
**Hyalotiella** Papendorf, Trans. Brit. Mycol. Soc. 50: 69. 1967.

**Description:** Conidiomata stromatic, pycnidial, immersed, vase-shaped with a well-defined venter and a long neck, venter unilocular or irregularly divided, glabrous, brown to dark brown, ostiolate; wall of *textura* angularis, cells thick-walled, dark brown to brown in the outer layers becoming progressively thin-walled and paler toward the interior. Conidiophores arising all around the cavity of the venter, reduced to conidiogenous cells, or septate and branched only at the base, invested in mucus. Conidiogenous cells discrete, cylindrical, lageniform to...
ampulliform, colourless, smooth. Conidia cylindrical, euseptate; apical cell subcylindrical, colourless; median cells almost colourless to pale brown, longer than end cells, smooth; appendage cellular, arising from the apical cell and maintaining protoplasmic continuity with it, branched close to the point of origin; branches 2–4, attenuated, flexuous (emended from Nag Raj 1993).

Type species: Hyalotiella transvalensis Papendorf.

Hyalotiella transvalensis Papendorf, Trans. Brit. Mycol. Soc. 50: 69. 1967, emend. F. Liu, L. Cai & Crous. Fig. 35.

Culture characteristics: Colonies on MEA convex with papillate surface, undulate, white, producing yellow droplet, sterile, reaching 27 mm diam after 14 d at 21 °C; on CMA flat with undulate edge, colourless, sterile, reaching 32–33 mm diam after 14 d at 21 °C; on PDA flat with erose or denate edge, white, producing yellow droplet, sterile, reaching 46–47 mm diam after 14 d at 21 °C; on SNA flat with undulate edge, colourless, conidiomata stromatic, black, immersed, scattered.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, mostly reduced to conidiogenous cells, smooth, colourless, invested in mucus. Conidiogenous cells annellidic, discrete or integrated, mostly lageniform or ampulliform, sometimes cylindrical, 4.5–12 × 1.5–3.5 μm, (av. = 7.8 ± 2.25 × 2.4 ± 0.44 μm), colourless, smooth. Conidia cylindrical with obtuse ends, straight or slightly curved, 3-septate, smooth, 25–31.5 × 2.5–4 μm (av. = 28.5 ± 1.74 × 3.1 ± 0.33 μm); basal cell obconic with an obtuse or round base, thin-walled, colourless to pale grey, 2–3.5 μm (av. = 2.9 ± 0.46 μm) long; median cells 2, cylindrical, pale grey, thick-walled, ± equal, each 8.5–13 μm (av. = 11 ± 1.19 μm) long; apical cell conic with an acute apex, thin-walled, hyaline, 3.5–5 μm (av. = 4.1 ± 0.51 μm) long; 2–4 apical appendage branches, attenuated, tubular, flexuous, 5–25 μm (av. = 14.8 ± 5.23 μm) long; basal appendage absent; mean conidium length/width ratio = 9.2:1.

Further descriptions: See Papendorf (1967).

Material examined: South Africa, North West Province, Potchefstroom, from leaf-litter and top soil of Acacia karroo (Fabaceae) community, 1964, M.C. Papendorf (holotype PRE 43026, ex-type culture CBS 303.65 = ATCC 18127 = IMI 137470).

Notes: The ITS sequence of the ex-type of Hya. transvalensis (CBS 303.65) shows 99 % similarity to the ex-type of Hya. spartii (MFLUCC 13-0397), differing by only 3 nucleotide bases. The tef-1α sequence of Hya. spartii (GenBank KP757764) was generated with a primer pair different from this study (EF1-983F/EF1-2218R) and therefore not included in the multi-locus phylogenetic analyses. Other sequences of Hya. spartii are

Fig. 35. Hyalotiella transvalensis (CBS 303.65). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E. Vertical section of conidioma. F–H. Conidiophores and conidiogenous cells. I–L. Conidia. Scale bars: E = 20 μm, F–L = 10 μm.

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unavailable for comparison. Morphologically, *Hya. transvalensis* differs from *Hya. spartii* in the dimension and shape of conidiomata (Nag Raj 1993, Li et al. 2015) and branch numbers of conidial appendages (2–4 vs. 5–6) (Li et al. 2015).

**Hymenopleella** Munk, Dansk bot. Ark. 15(no. 2): 89. 1953, emend. F. Liu, L. Cai & Crous.

Synonyms: *Dyrithiopsis* L. Cai et al., Mycologia 95: 912. 2003. *Neotruncatella* Hyang B. Lee & T.T.T. Nguyen, Fungal Diversity 80: 198. 2016.

**Type species**: *Hymenopleella hippophaeicola* Jaklitsch & Voglmayr, Persoonia 37: 96. 2016.

**Description**: Sexual morph: Ascomata perithecial, immersed or semi-immersed, subglobose, blackened, coriaceous, papillate, ostiole, periphysate. Peridium pseudoparenchymatous, 2-layered, dark brown. Paraphyses hypha-like, sparse, septate, tapering towards the ends. Asci unitunicate, cylindrical, with eight uni- to partially biseriate ascospores, apically rounded, discoid, subapical ring. Ascospores oblong, ellipsoid or fusoid, symmetric, transversely septate or muriform, euseptate, light yellow- to reddish brown, smooth, partly turning dull green in Lugol, lacking a sheath (emended from Jeewon et al. 2003a, Jaklitsch et al. 2016).

Asexual morph: Conidiomata globose to subglobose, black. Conidiogenous cells hyaline, ampulliform, subcylindrical, cylindrical, formed from the inner cells of the peridial wall. Conidia fusoid, subcylindrical, straight or curved, 3–7-septate, bearing appendages; basal cell obconic, colourless and thin-walled, smooth; median cells doliiform or cylindrical, thick-walled, yellow to yellowish-brown at maturity, wall smooth or verruculose; apical cell conical, almost colourless, thin-walled, smooth; appendages tubular, attenuated; apical appendage single, unbranched; basal appendage absent or single, centric or excentric (emended from Hyde et al. 2016).

**Notes**: Generic type strains of *Neotruncatella* (asexual morph), *Dyrithiopsis* and *Hymenopleella* (sexual morph) formed one clade in the multi-locus phylogenetic tree (Fig. 1), and their sexual-asexual relationship is therefore confirmed in this study (Fig. 1). Although *Neotruncatella* was recently synonymised with *Monochaetinula* because of the phenotypic similarities of the asexual morph and same lifestyle (Perera et al. 2018), it awaits confirmation using molecular data. Therefore, *Monochaetinula* is not synonymised here.

**Hymenopleella austroafricana** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828365. Fig. 36.
**Etymology:** Named after the continent where this fungus was isolated, Africa (South Africa and Zambia).

**Culture characteristics:** Colonies on MEA flat with undulate edge, greyish green, reaching 50–52 mm diam after 14 d at 21 °C, conidiomata scattered or gregarious, black, usually covered with aerial mycelia, stromatic; on CMA flat with entire edge, buff at the margin, brown near the centre, reaching 70 mm diam after 14 d at 21 °C, conidiomata black, scattered, acervular, forming on the aerial mycelia; on PDA flat with undulate edge, off-white, reaching 56–68 mm diam after 14 d at 21 °C, conidiomata brown or black, scattered, superficial or immersed, acervular; on SNA flat with rhizoid edge, white, reaching 40–42 mm diam after 14 d at 21 °C, conidiomata black, scattered, superficial, stromatic.

**Description:** Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, mostly reduced to conidiogenous cells, colourless, smooth, invested in mucus. Conidiogenous cells discrete or integrated, mostly sub-cylindrical or lageniform, 4–11.5 × 1.5–3 μm (av. = 6.8 ± 1.91 × 2 ± 0.33 μm), hyaline or pale brown, smooth. Conidia fusoid, subcylindrical or reniform, straight or curved, 3–5-septate, mostly 4-septate, smooth, without constrictions at the septa, 12.5–21.5 × 4–5.5 μm (av. = 16.5 ± 2.03 × 4.8 ± 0.4 μm); basal cell obconic with a truncate base, thin-walled, hyaline, 2–4.5 μm (av. = 3.5 ± 0.71 μm) long; median cells mostly 3, cylindrical, trapezoid, mid-brown or yellowish brown, thick-walled, ± equal at the second and third cells from apex, each 2–4.5 μm (av. = 3.2 ± 0.62 μm) long, the fourth cell 3–7 μm (av. = 4.5 ± 0.91 μm) long; apical cell conic with an acute apex, thin-walled, hyaline, 1.5–4.5 μm (av. = 2.9 ± 0.67 μm) long; 0–1 apical appendage, when present, tubular, attenuated, unbranched, 3.5–7.5 μm (av. = 4.8 ± 1.83 μm) long; 0–1 basal appendage, when present, tubular, attenuated, unbranched, 1.5–5.5 μm (av. = 3 ± 1.36 μm) long; mean conidium length/width ratio = 3.4:1.

**Materials examined:** South Africa, Limpopo Province, Klein Kariba Holiday Resort, Gleditsia triacanthos (Fabaceae), 22 Jan. 2013, P.W. Crous (holotype CBS H-23509, ex-type culture CBS 143886 = CPC 21940); on Bridelia mollis (Phyllanthaceae), 22 Jan. 2013, unknown collector, living culture CBS 144026 = CPC 21946. Zambia, on Combretum hereroense (Combretaceae), 28 Mar. 2013, P.W. Crous, living culture CBS 144027 = CBS 22553 = OM4158.

**Notes:** Hymenopleella austroafricana is morphologically similar to Hym. polyscytata in producing fusoid, straight or curved, yellowish brown and single appendaged (if present) conidia, but they can be distinguished from each other by the number of septa (3–5 vs. 4–7) and conidial dimensions (12.5–21.5 × 4–5.5 μm vs. 24.5–33 × 6.5–8 μm), as well as the mean conidium length/width ratio (3.4:1 vs. 4:1). In addition, Hym. austroafricana is phylogenetically distinct and shares low sequence similarity with Hym. polyscytata (88 % on rbp2, 81 % on tef-1α, 84 % on tub2). This is the first report of a member of Sporocadaceae associated with Bridelia mollis and Combretum hereroense.

**Hymenopleella polyscytata** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB823636. Fig. 37.

**Etymology:** Refers to its diverse number of septa.

**Culture characteristics:** Colonies on MEA flat with entire edge, glaucous, reaching 80–82 mm diam after 14 d at 21 °C; on CMA flat with entire edge, off-white, olivaceous in the centre, reaching 72–74 mm diam after 14 d at 21 °C; on PDA flat with entire edge, buff, reaching > 90 mm diam after 14 d at 21 °C; on SNA flat with entire edge, pale buff, reaching 45–47 mm diam after 14 d at 21 °C.

**Description:** Sexual morph: unknown. Asexual morph: Sterile on MEA, PDA and SNA. On CMA, conidiomata black, semi-immersed, scarce and scattered. Conidiophores septate, branched, colourless, smooth, invested in mucus. Conidiogenous cells annelidic, discrete or integrated, cylindrical, subcylindrical, or lageniform, 8.5–22 × 1–3.5 μm (av. = 13.4 ± 3.48 × 2 ± 0.43 μm), colourless, smooth. Conidia fusoid, straight or slightly curved, 4–7-septate, smooth, barely constricted at the septa, 24.5–33 × 6.5–8 μm (av. = 29.4 ± 1.97 × 7.3 ± 0.46 μm); basal cell obconic with a truncate or obtuse base, thin-walled, hyaline, 2.5–7 μm (av. = 4 ± 0.79 μm) long; median cells 3–6, cylindrical or doliform, pale to mid-brown, thick-walled; in 4-septate conidia, median cells ± equal, each 3.5–8 μm (av. = 6.5 ± 0.66 μm) long; in 5-septate conidia, median cells not equal, the two short cells 2.5–5 μm (av. = 3.7 ± 0.48 μm) long, the other two long cells 5.5–9 μm (av. = 5.3 ± 0.71 μm) long; in 6-septate conidia, the distal four median cells usually ± equal, each 2.5–4.5 μm (av. = 3.7 ± 0.42 μm) long, the median cell 4–7.5 μm (av. = 6.3 ± 0.8 μm) long; in 7-septate conidia, median cells ± equal, 2.5–6 μm (av. = 3.6 ± 0.58 μm) long; apical cell conic with an acute or obtuse apex, thin-walled, hyaline, 2.5–5 μm (av. = 3.4 ± 0.56 μm) long; apical appendage single, attenuated, tubular, unbranched, 4–9 μm (av. = 7 ± 1.27 μm) long; 0–1 basal appendage, when present, attenuated, tubular, unbranched, 2.5–6.5 μm (av. = 5 ± 1.09 μm) long; mean conidium length/width ratio = 4:1.

**Material examined:** South Africa, Limpopo Province, Klein Kariba Holiday Resort, on Combretum sp. (Combretaceae), 22 Jan. 2013, P.W. Crous (holotype CBS H-23510, ex-type culture CBS 143887 = CPC 21944).

**Notes:** This species is morphologically distinct from other species by producing 4–7-septate conidia. See also the notes under Hym. lakefuxianensis and Hym. austroafricana.

**Hymenopleella endophytica** (Hyang B. Lee et al.) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB823637.

**Basionym:** Neotrichia endophytica Hyang B. Lee et al., Fungal Diversity 80: 198. 2016.

**Description:** See Hyde et al. (2016).

**Material examined:** Republic of Korea, Jeonnam Province, garden of the Chonnam National University located in Gwangju (35°10'N, 126°55'E), on Alisifa firma leaf, 3 Aug. 2015 (holotype of Neotrichia endophytica EML-ASS-1, ex-type culture CNCU-EMLASS-1 = JMRCC/SF:012333, not seen).

**Notes:** The single species of the monotypic genus Neo-trichia, Neo. endophytica, was introduced by Hyde et al. (2016), and subsequently synonymised under Monochaetinula terminaliae (Perera et al. 2018) because of the phenotypic similarity of their asexual morphs and the similar lifestyle. However, Monochaetinula terminaliae lacks sequences derived from type material and further research using molecular data is thus required to confirm them as synonymous. Neotrichia endophytica is located in the genus Hymenopleella based on LSU and ITS analyses (not shown), and a new combination is therefore proposed here as *Hymenopleella endophytica*.

**Hymenopleella lakefuxianensis** (L. Cai et al.) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB823639.
Basionym: Dyrithiopsis lakefuxianensis L. Cai et al., Mycologia 95: 913. 2003.
Synonym: Monochaetiopsis lakefuxianensis L. Cai et al., Mycologia 95: 914. 2003.

Description: See Jeewon et al. (2003a).

Material examined: China, Yunnan Province, Cheng Jiang, Fuxian Lake, on submerged twig, 28 Aug. 2000, L. Cai, R. Jeewon & K.D. Hyde (holotype of Dyrithiopsis lakefuxianensis HKU(M) 8280, living culture HKUCC 7303, not seen).

Notes: Only a LSU sequence of the basionym Dyrithiopsis lakefuxianensis (ex-type HKUCC 7303) was available for comparison (from Jeewon et al. 2003a), and this species is closely related with Hym. polyseptata (Fig. 1, 99 % sequence similarity). Morphologically, Hym. lakefuxianensis produces 4-septate (occasionally 5-septate) conidia, while conidia of Hym. polyseptata are 4–7-septate. In addition, Hym. lakefuxianensis was reported from a submerged twig in a lake in China, while Hym. polyseptata was isolated from leaves of a Combretum sp. in South Africa.

Hymenopleella subcylindrica F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828370. Fig. 38.

Etymology: Named after the subcylindrical shape of its conidia.

Culture characteristics: Colonies on MEA flat with entire edge, white, reaching 55–56 mm diam after 14 d at 21 °C, conidiomata gregarious, black, semi-immersed, usually covered with aerial mycelia; on CMA flat with entire edge, isabelline to olivaceous, reaching 38–40 mm diam after 14 d at 21 °C, conidiomata black, scattered, acervular, semi-immersed; on PDA flat with entire edge, off-white, sterile, reaching 56–58 mm diam after 14 d at 21 °C; on SNA flat with feathery margin, white, reaching 15–22 mm diam after 14 d at 21 °C, conidiomata luteous to olivaceous, scattered or gregarious, superficial, acervular.

Description: Sexual morph: unknown. Asexual morph: Conidiophores seporate and branched at the base, mostly reduced to conidiogenous cells, colourless, smooth. Conidiogenous cells discrete, sub-cylindrical or lageniform, 3.5–12 × 1–3 μm (av. = 6.2 ± 1.95 × 2.1 ± 0.41 μm), hyaline, smooth. Conidia...
Fig. 38. *Hymenopleella subcylindrica* (CBS 647.74). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–G. Conidiomata on MEA, CMA and SNA, respectively. H–J. Conidiophores and conidiogenous cells bearing conidia. K. Conidia on SNA. L. Conidia on MEA. Scale bars = 10 μm.
epithets in Index Fungorum and MycoBank (2018), and most have been transferred to other genera, e.g. Diplomasca, Monochaetinula, Sarcostruma, Seimatosporium and Seiridium (Nag Raj 1993).

Monochaeta monochaeta (Desm.) Allesch., Rabenh. Krypt.-Fl. 1(7): 667. 1902, emend. F. Liu, L. Cai & Crous. Fig. 39.

Basionym: Pestalotia monochaeta Desm., Ann. Sci. Nat., Bot., sér. 3, 10: 355. 1848.

Culture characteristics: Colonies on MEA low convex with entire edge, straw to pure yellow, reaching 58–60 mm diam after 14 d at 21 °C, conidiomata dark brown, acervular, semi-immersed, scattered or gregarious, with extruding apricot or olivaceous conidial masses; on CMA, low convex with entire edge, white, aerial mycelia flocculent, reaching 51 mm diam after 14 d at 21 °C, conidiomata umbrous, scattered, superficial or semi-immersed, acervular; on PDA flat with entire edge, white, reaching 58–59 mm diam after 14 d at 21 °C, conidiomata olivaceous to black, scattered, acervular, semi-immersed; on SNA flat with undulate edge, buff, reaching 26–30 mm diam after 14 d at 21 °C, conidiomata black, scattered or gregarious, superficial or semi-immersed, acervular, stromatic.

Description (On SNA): Sexual morph: unknown. Asexual morph: Conidiophores septate and branched, hyaline or pale brown, thin-walled. Conidiogenous cells anellidic, discrete or integrated, cylindrical, subcylindrical, variable in size, 2.5–21.5 × 1.5–3 μm (av. = 10.3 ± 4.54 × 2.4 ± 0.29 μm), hyaline or pale brown, smooth or verruculose. Conidia fusoid, straight, mostly 4-septate, occasionally 5-septate, wall smooth or undulate, not constricted at the septa, but commonly collapsed at septa, 17–23 × 4.5–7 μm (av. = 20.15 ± 5.59 × 0.83 μm); basal cell obconic with a truncate base, thin-walled, hyaline, 2–4 μm (av. = 3 ± 0.47 μm) long; median cells 3, trapezoid or subcylindrical, pale to mid-brown, thick-walled, the first median cell from base 4–7.5 μm (av. = 5.5 ± 0.73 μm) long, the second cell 2.5–5 μm (av. = 4.3 ± 0.45 μm) long, the third cell 3.5–5 μm (av. = 4.3 ± 0.45 μm) long, together 13–16 μm (av. = 14.2 ± 0.94 μm) long; apical cell conic with an acute apex, thin-walled, hyaline, or occasionally pale brown, 2.5–4 μm (av. = 3.2 ± 0.5 μm) long; appendages tubular, attenuated, unbranched, variously bent; single apical appendage, 7–14.5 μm (av. = 10.1 ± 1.64 μm) long; basal appendage absent, or when present, single, unbranched, centric, 1.5–7.5 μm (av. = 4.2 ± 1.51 μm); mean conidium length/width ratio = 3.4:1.

Materials examined: France, on wilting and dry leaf of Quercus ilex (Fagaceae), 1848, unknown collector (FH00822884, issued in Desmazières, Pl. Cryst. N. France, Ed. I, fasc. 35, no. 1734, lectotype designated here, MBT384685). Italy, Lizzano in Belvedere, Toscane, on leaf of Quercus pubescens, 27 Sep. 1981, H.A. van der Aa (CBS H-14562 epitype designated here, MBT338993, ex-type culture CBS 199.82). Netherlands, Utrecht, Baarn, contaminant in other fungus, Aug. 1980, D. Heymeyer, CBS H-14563, living culture CBS 546.80; Baarn, on Quercus robur leaf, 9 Aug. 1995, H.A. van der Aa and G. Verkley, living culture CBS 658.86; Soest, De Stompert, on leaf of Quercus robur (endophytic isolate), isolated by G. Verkley, Jun. 2002, living culture CBS 115004. UK, England, Lincolnshire, Bardney Forest, on Quercus sp., unknown collection date and collector, isolated and deposited by T.R. Peake, living culture CBS 315.54 = IMI 056698.

Notes: Monochaeta monochaeta was originally reported on wilting and dry leaves of Quercus sp. in France. Other reported host plants include Castanea crenata, Rhododendron linearefolium var. macrosepalum, and R. maximum (Nag Raj 1993). Five strains isolated from Quercus spp. from Europe (Italy, www.studiesinmycology.org 353
Fig. 39. Monochaeta monochaeta (CBS 199.82). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–H. Conidiomata on MEA, CMA, PDA and SNA, respectively. I–J. Conidiophores. K–M. Conidiogenous cells bearing conidia. N–V. Conidia. Scale bars = 10 μm.
**Monochaetia quercus** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828371. Fig. 41.

**Etymology**: Name reflects the host genus it was isolated from, *Quercus*.

**Culture characteristics**: Colonies on MEA flat with entire edge, white, reaching > 90 mm diam after 10 d at 21 °C, conidiomata black, acervular, semi-immersed, scattered; on CMA, flat with entire edge, white to pale luteous, aerial mycelia flocculent, sterile, reaching > 90 mm diam after 10 d at 21 °C; on PDA flat with lobate edge, white with ochreous edge, sterile, reaching 81 mm diam after 10 d at 21 °C; on SNA flat with entire edge, colourless, sterile, reaching 81–82 mm diam after 10 d at 21 °C.

**Description**: Sexual morph: unknown. Asexual morph: Conidiophores septate and branched, mostly reduced to conidigenous cells, colourless, smooth, thin-walled. Conidiogenous cells discrete, mostly cylindrical, occasionally subcylindrical, 6.5–21.5 × 1.5–3.5 μm (av. = 12.4 ± 1.6 × 2.4 ± 0.3 μm), hyaline, smooth. Conidia fusoid, straight, mostly 4-septate, occasionally 3-septate, smooth, usually not constricted at the septa, 22.5–29 × 4.5–7 μm (av. = 25.6 ± 1.55 × 6.4 ± 0.43 μm), bearing appendages; basal cell obconic with a narrow truncate base, trapezoid, periclinal wall thin, hyaline, 3.5–5 μm (av. = 4.1 ± 0.43 μm) long; median cells 2–3, doliform, cylindrical, trapezoid, thick-walled, pale to mid-brown, together 15–20 μm (av. = 17.3 ± 1.22 μm) long; if 3-septate, the first median cell from apex 8–10 μm (av. = 9 ± 0.49 μm) long, second cell 5.5–8 μm (av. = 7 ± 0.77 μm) long; if 4-septate, the first two median cells ± equal, 3.5–6.5 μm (av. = 5.3 ± 0.69 μm) long, the third cell 5.5–8.5 μm (av. = 6.8 ± 0.63 μm) long; apical cell conic, hyaline, 3.5–5.5 μm (av. = 4 ± 0.45 μm); appendage tubular, attenuated, single, unbranched; apical appendages single, straight or oblique, 7–17.5 μm (av. = 12.9 ± 2.63 μm) long; basal appendage single, centric, 4.5–15 μm (av. = 10.4 ± 2.22 μm); mean conidium length/width ratio = 4.1.

**Material examined**: Mexico. Aguascalientes, Quercus eduardi, on Quercus eduardi (Fagaceae), 14 Aug 2015, O. Moreno-Rico, HPC 789 (holotype CBS H-23536, ex-type culture CBS 144034 = CPC 29514).

**Notes**: Six Monochaeta species have been reported from *Quercus* spp., i.e. *Mon. bicornis*, *Mon. hysteriformis*, *Mon. ilicina*, *Mon. kansensis*, *Mon. monochaeta*, and *Mon. saccardoi* (Nag Raj 1993). *Monochaeta quercus* is morphologically most similar to *Mon. bicornis* but differs in the number of conidial septa (3–4 vs. 4), wall ornamentation of median cells (smooth vs. verruculose), conidial length (22.5–29 μm vs. 14–19 (22) μm) and the mean conidium length/width ratio (3.4:1 vs. 4.1) (Nag Raj 1993). *Monochaeta quercus* is sporulated on MEA in this study.

Based on a blastn search of NCBI’s GenBank nucleotide database, the closest hit using the ITS sequence of *Mon. quercus* is GenBank LC146750 (identity = 474/480 (99%), no gaps), a sequence from the type strain of *Mon. dimorphospora* (NBRC 9980). However, other sequences of NBRC 9980 are unavailable for comparison. Morphologically, *Mon. quercus* differs from *Mon. dimorphospora* in the lack of arthroconidia and producing longer conidia (22.5–29 × 4.5–7 μm vs. 18–20 × 4–4.5 μm) (Yokoyama 1975). In addition, the three median cells of *Mon. quercus* are generally variable in length, in contrast to the equal length of the median cells in *Mon. dimorphospora* (Yokoyama 1975).

**Morinia** Berl. & Bres., Annuario Soc. Alpinisti Trident., 14: 82. [1887–88]. 1889, emend. F. Liu, L. Cai & Crous.
Type species: *Moriania pestalozzioides* Bert. & Bres., Ann. Soc. Alpinisti Tridentini 14: 82. [1887–88]. 1889.

Description: Sexual morph: unknown. Asexual morph: Conidiomata acervular, stromatic, pycnidoid, superficial or semi-immersed, erumpent, scattered, globose or subglobose, glabrous brown, dark; wall of textura angularis. Conidiophores arising from all around the cavity of the conidioma from the innermost wall layer, septate and branched, or reduced to conidiogenous cells, colourless, smooth, invested in mucus. Conidiogenous cells ampulliform, cylindrical, subcylindrical, lageniform, colourless, smooth. Conidia fusoid, ellipsoidal, sub-cylindrical, transversely euseptate, muriformly septate or not, straight to slightly curved, smooth or verruculose, with or without constriction at the septa, median cells pale brown to brown, end cells colourless or pale brown, bearing appendages; appendages attenuated or not attenuated, unbranched, tubular, flexuous or not; appendages on apical cell several, inserted at different loci; basal appendage single, rarely two, centric or eccentric.

Notes: *Morinia* is characterised by muriform and appendage-bearing conidia in acervular conidiomata (Collado et al. 2006) and previously included two asexual species, *Mor. pestalozzioides* and *Mor. longiappendiculata*. In this study, two species characterised by only transverse conidia are incorporated in this genus, i.e. *Mor. acacia* (Basionym: *Zetiasplozna acacia*) and *Mor. crini*.

*Moriania acaciae* (Crous) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828372.

Basionym: *Zetiasplozna acacia* Crous, Persoonia 32: 249. 2014.

Description: See Crous et al. (2014b).

Material examined: France, Nice, Nice Botanical Garden, N43°41'08.2" E007°12'34.4", on leaves of *Acacia melanoxylon* (Fabaceae), 20 Jul. 2013, P.W. Crous (holotype of *Zetiasplozna acacia* CBS H-21708, ex-type CBS 137994 = CPC 23421). New Zealand, Hastings, Hawkes Bay, on *Prunus salicina* cv. *Omega* (Rosaceae), unknown collection date, C. Martin, living culture CBS 100230.

Notes: The genus *Zetiasplozna* was established to accommodate species that are bartalinia-like in general morphology (Nag...
However, its phylogenetic location is still undetermined due to the lack of sequences of the generic type *Zet. unicola*. In the present study, *Zet. acacia* is phylogenetically located in the *Moria* clade (Fig. 1) and also shows morphological resemblance, which is therefore used as basis to introduce a new combination, *Mor. acaciae*.

*Morinia crini* F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828373. Fig. 42.

**Etymology:** Name reflects the host plant genus it was isolated from, *Crinus*.

**Culture characteristics:** Colonies on MEA flat with entire edge, milk white at the margin, then successively grey and straw to the centre, reaching 62–64 mm diam after 14 d at 21 °C, conidiomata black, gregarious, acervular, stromatic, superficial; on CMA flat with entire edge, greyish blue-green, reaching 53–54 mm diam after 14 d at 21 °C, conidiomata black,
scattered, superficial, acervular, stromatic; on PDA flat with entire edge, off-white to pink, reaching 53–55 mm diam after 14 d at 21 °C; conidiomata black, acervular, stromatic, scattered, superficial; on SNA flat with undulate edge, white, reaching 34–35 mm diam after 14 d at 21 °C; conidiomata black, acervular, scattered, superficial.

Description (On SNA): Sexual morph: unknown. Asexual morph: Conidiophores septe, branched, colourless, smooth, invested in mucus. Conidigenous cells 3-anellidic, integrated, mostly cylindrical, subcylindrical, sometimes lageniform, variable in size, 5.5–20.5 × 1.5–3 μm (av. = 11 ± 3.59 × 2.4 ± 0.44 μm), colourless or pale brown, smooth. Conidia cylindrical, subcylindrical, sometimes lunate, straight or slightly curved, 2–5-septate, mostly 4-septate, not constricted at the septa, 17.5–22 × 3.5–5 μm (av. = 19.8 ± 1.14 × 4.2 ± 0.35 μm); basal cell obconic with a truncate base, subcylindrical, thin-walled, colourless to pale brown, smooth, 2.5–5 μm (av. = 3.9 ± 0.54 μm) long; median cells mostly 3, cylindrical or subcylindrical, pale brown, thick-walled, verruculose, together 9.5–14.5 μm (av. = 12.5 ± 0.96 μm) long; ± equal in the first two median cells from apex, each 3.5–5 μm (av. = 4.1 ± 0.42 μm) long; the third cell 4–6 μm (av. = 5 ± 0.52 μm) long; apical cell conic with an acute or truncate apex, thin-walled, colourless to pale brown, smooth, 1.5–3.5 μm (av. = 2.9 ± 0.46 μm) long; two apical appendages, on the apical cell axial and lateral, attenuated, tubular, unbranched, or occasionally dichotomously branched at one appendage, 7.5–11.5 μm (av. = 9.7 ± 1.03 μm) long; single basal appendage, occasionally two, centric or excentric, 4–9 μm (av. = 6.1 ± 1.13 μm) long; mean conidium length/width ratio = 4.7:1.

Material examined: South Africa, Free State Province, Bloemfontein, Bloemfontein Botanical Garden, on Crinum bulbispermum (Amaryllidaceae), 19 Jan. 2013, P.W. Crous (holotype CBS H-23511, ex-type culture CBS 143888 = CPC 21978).

Notes: Although Morinia crini is closely related to Mor. long-appendiculata and Mor. pestalozzioides (Fig. 1), it resembles Mor. acaciae in morphology, producing subcylindrical, transversely-septate conidia with one excentric apical and one lateral appendage (Crous et al. 2014b). However, Morinia crini differs from Mor. acaciae in the length of conidia (17.5–22 μm vs. 31–41 μm), apical and basal appendages (apical: 7.5–11.5 μm vs. 12–17 μm, basal: 7–9 μm vs. 2–8 μm). In addition, their mean conidium length/width ratio is quite distinct (4.7:1 in Mor. crini vs. ca. 8:1 in Mor. acaciae). Morinia crini also resembles Zet. thuemenii (Nag Raj 1993), except that it has shorter conidia (17.5–22 μm vs. 20–32 μm) and smaller mean conidium length/width ratio (4.7:1 vs. 5:7:1). This is the first report of Morinia species from Crinum bulbispermum.

Nonappendiculata F. Liu, L. Cai & Crous, gen. nov. MycoBank MB828374.

Etymology: Reflecting its non-appendaged conidia.

Description: Sexual morph: unknown. Asexual morph: Conidioi mata black, scattered, acervular, stromatic, globose, semi-immersed. Conidiophores septe, unbranched or branched at the base, colourless, smooth, often reduced to conidiogenous cells. Conidigenous cells cylindrical, subcylindrical or lageniform, colourless, smooth. Conidia fusoid, straight or slightly curved, 3-septate (septal pores present or not), smooth, not constricted at the septa; basal cell obconic with a truncate or obtuse base, colourless to pale grey; median cells doliform, pale brown, thick-walled; apical cell conical, colourless to pale grey; appendages absent.

Type species: Nonappendiculata quercina F. Liu, L. Cai & Crous

Notes: Nonappendiculata is closely related to Seiridium on the 3-locus (LSU+ITS+rpb2) phylogenetic tree (Fig. 1) but presents a distinct clade on the 5-locus tree (Fig. 4). It produces 3-septate, non-appendaged and fusoid conidia, a character that distinguishes it from Seiridium (generally with 5-septate and appendaged conidia) (Bonhond et al. 2018).

Nonappendiculata quercina F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828375. Fig. 43.

Etymology: Named after its host plant genus, Quercus.

Culture characteristics: Colonies on MEA flat with entire edge, grey to pale glaucous sky blue, sterile, reaching 43–45 mm diam after 14 d at 21 °C; on CMA, flat with entire edge, glaucous grey, sterile, reaching 37–39 mm diam after 14 d at 21 °C; on PDA flat with entire edge, pale grey, sterile, reaching 42–43 mm diam after 14 d at 21 °C; on SNA flat with entire edge, pale grey, reaching 27–30 mm diam after 14 d at 21 °C.

Description (On SNA): Sexual morph: unknown. Asexual morph: Conidiomata black, scattered, covered by aerial mycelia, acervular, stromatic. Conidiophores septe, unbranched or branched at the base, colourless, smooth, often reduced to conidiogenous cells. Conidigenous cells discrete, cylindrical, subcylindrical, variable in size, 3–19 × 1–3 μm (av. = 12.5 ± 3.35 × 1.7 ± 0.37 μm), colourless, smooth. Conidia fusoid, straight, 3-septate, smooth, not constricted at the septa, 13–18 × 5–7 μm (av. = 15.7 ± 1.16 × 6.2 ± 0.42 μm); basal cell obconic with a truncate base, thin- or fairly thick-walled, pale grey, 3–4.5 μm (av. = 3.8 ± 0.54 μm) long; median cells 2, doliform, pale brown, thick-walled, ± equal length, each 3–4.5 μm (av. = 3.8 ± 0.42 μm) long; apical cell conic with an acute or rounded apex, hyaline to pale grey, 2.5–5 μm (av. = 4 ± 0.68 μm); lacking appendages; mean conidium length/width ratio = 2.5:1.

Materials examined: Italy, on Quercus suber (Fagaceae) bud, unknown collection date and collector, deposited by F. Marras (holotype CBS H-33558, ex-type culture CBS 143888 = CPC 21978).

Notes: The two strains of Non. quercina formed a distinct clade in both single gene (not shown here) and multi-locus trees (Figs 1, 4). It differs from closely related genera by producing 3-euseptate conidia without appendages. On OA, conidia are longer but thinner than on SNA (16–22.5 × 4–5.5 μm, av. = 18.6 ± 1.6 × 4.9 ± 0.5 μm vs. 13–18 × 5–7 μm, av. = 15.7 ± 1.16 × 6.2 ± 0.42 μm).

Based on a blastn search of NCBI's GenBank nucleotide database, the closest hits using the LSU sequence are Seiridium species (99 %), and the closest hits using the ITS sequence are Discosia sp. from an olive tree in Portugal (GenBank KU325138, identity = 100 %; unpublished) and Discosia sp. from Hama melis japonica in Japan (GenBank AB594779, identity = 95 %; Tanaka et al. 2011).

Parabartalinia F. Liu, L. Cai & Crous, gen. nov. MycoBank MB828376.

Etymology: The name refers to the morphological similarity with genus Bartalinia, but is phylogenetically distinct.
Sexual morph: unknown. Asexual morph: Conidiomata acervular, stromatic, superficial or semi-immersed, erumpent, dark brown to black, wall of textura angularis or textura globulosa, cells thick-walled and dark brown to brown in the outer layers, becoming thin-walled and paler toward the conidial hymenium. Conidiophores arising from the inner layers of the wall all around the cavity of the conidioma, sparsely septate and branched at the base, often reduced to conidiogenous cells, colourless, invested in mucus. Conidiogenous cells ampulliform, cylindrical, colourless, thin-walled, smooth. Conidia cylindrical to fusoid with a rounded or obtuse apex and a truncate base, straight or slightly curved, 4-septate, smooth, apical and basal cell colourless, median cells pale brown, without or with slight constriction at the septa, suprabasal cell longer than the rest, bearing appendages; apical appendage arising laterally from the apical cell, 3–5 divergent branches, attenuated, filiform, flexuous; basal appendage single, filiform, unbranched, exogenous.

Type species: Parabartalinia lateralis F. Liu, L. Cai & Crous

Notes: Parabartalinia is proposed to accommodate the single species Par. lateralis, which is closely related to Bartalinia in the multi-locus gene trees (Figs 1, 7) but distinct from the latter in each of the single gene trees (data not shown). Morphologically, the conidial apex of Par. lateralis is rounded and with laterally branched appendages, while it is conical with an acute or blunt apex in Bartalinia and its apical appendages arise from the conidial apex. We therefore propose a new monotypic genus to accommodate this species.

Parabartalinia lateralis F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828378. Fig. 44.

Etymology: Name reflects lateral formation of apical appendage on the apical cell.

Culture characteristics: Colonies on MEA flat, radially striate with entire edge, white to greenish glaucous, reaching 73–75 mm diam after 14 d at 21 °C, conidiomata dark brown to black, gregarious, semi-immersed; on CMA flat with entire edge, smoke grey, reaching 48–49 mm diam after 14 d at 21 °C, conidiomata dark brown to black, scattered or gregarious, acervular, semi-immersed; on PDA flat with entire edge, white to pale grey, reaching 70–71 mm diam after 14 d at 21 °C, conidiomata olivaceous, scattered or gregarious, superficial or semi-immersed; on SNA flat with entire edge, white, reaching 46–46 mm diam after 14 d at 21 °C, conidiomata olivaceous, scattered or gregarious, superficial.
Fig. 44. Parabartalinia lateralis (CBS 399.71). (I–K, Q–T. on OA, L–P. on SNA). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–F. Conidiomata on MEA and CMA. G–H. Conidiomata on SNA. I–M. Conidiophores and conidiogenous cells bearing conidia. N–T. Conidia. Scale bars = 10 μm.
Description: Sexual morph: unknown. Asexual morph: Conidiophores septe, branched, mostly reduced to conidiogenous cells, smooth, colourless, invested in mucus. Conidiogenous cells discrete, mostly cylindrical, ampulliform, 4–26 × 1–2.5 μm, (av. =11.2 ± 6.58 × 1.4 ± 0.33 μm), colourless, smooth, thin-walled. Conidia cylindrical or fusoid, straight, 4-septate, wall smooth or undulate, not constricted or slightly constricted at the septa, septa darker than the rest of conidia, 14–20 × 3–6 μm (av. = 17.2 ± 1.3 × 4.1 ± 0.6 μm); basal cell short obconic with a truncate base, thin-walled, hyaline, 0.5–2.5 μm (av. = 1.6 ± 0.31 μm) long; median cells 3, subcylindrical, pale brown, fairly thick-walled, together 10.5–16 μm (av. = 13.5 ± 1.1 μm) long, ± equal of the first two median cells from apical cell, each 3–4.5 μm (av. = 3.8 ± 0.37 μm) long, the third cell 4–6.5 μm (av. = 5.8 ± 0.5 μm) long; apical cell with rounded apex, not conical, thin-walled, hyaline, 1.5–2.5 μm (av. = 2 ± 0.29 μm) long; 3–5 apical appendages branches, laterally formed on the apical cell, attenuated, flexuose, unbranched or branched, 15–30 μm (av. = 22.9 ± 3.44 μm) long; basal appendage single, unbranched, filiform, excentric, 2.5–9 μm (av. = 5.9 ± 1.71 μm) long; mean conidium length/width ratio = 4.2:1.

Material examined: South Africa, Karoo Desert, on Acacia karroo (Fabaceae) leaf litter, 12 Mar. 1971, M.C. Papendorf (holotype CBS H-23542, ex-type culture CBS 39971).

Notes: Based on the multi-locus analyses, Par. lateralis is more closely related to Bartalina, and the sequence similarities between Par. lateralis and Bar. pini, for example, are 99 % (819/828) in LSU, 98 % (504/516) in ITS, 92 % (763/830) in rpb2, 83 % (298/360) in tef-1a, and 82 % (561/684) in tub2. For morphological differences, see notes under the genus Parabartalina.

Pestalotiopsis Steyaert, Bull. Jard. bot. État Brux. 19: 300. 1949.

Description: Conidiomata acervular or pycnidial, immersed to erumpent, unilocular to irregularly plurilocular with the locules occasionally incompletely divided, glabrous, brown to black; stroma or walls of textura angularis, globulosa, prismatica or intricata. Conidiophores branched and septate, or reduced to conidiogenous cells, colourless, smooth, invested in mucus. Conidiogenous cells discrete or integrated, cylindrical, ampulliform or lageniform, colourless, smooth. Conidia fusiform, straight or slightly curved, euseptate, bearing appendages; basal cell obconic with a truncate base, almost colourless to colourless, thin-walled; median cells pigmented, concolourous or versicoloured, with thicker walls than the end cells, smooth or verruculose; apical cell conical to hemispherical, colourless to almost colourless, thin-walled; appendages arising as tubular extensions and maintaining protoplasmic continuity with the conidium body, filiform or attenuated; apical appendages one to many, branched or unbranched, with or without spathulate tips, arising irregularly or in an apical crest or in tiers; basal appendage 0–3, branched or unbranched, centric.

Type species: Pestalotiopsis guepinii (Desm.) Steyaert.

Notes: In general, the three loci (ITS, tef-1a, tub2) used in Pestalotiopsis analysis showed low specific resolution, especially in the top part of the phylogenetic tree (Fig. 5), with short branches and low terminal bootstrap values/posterior probabilities. Many strains analysed in this study were shown as singletons and coincidently located in the top part (Fig. 5), and had limited morphological and phylogenetic differences from relatives, we therefore named them as informal species (Pestalotiopsis spp. 1–6). To facilitate further research, their morphological characters are described below.

In addition, the Pestalotiopsis phylogenetic analysis with additional isolates compared to previous studies (Maharachchikumbura et al. 2014, Liu et al. 2017) indicated that a few known species might be synonyms (e.g. Pes. kenyana and Pes. trachiparica; Pes. adusta and Pes. papuana; Pes. brassicae, Pes. hollandica, Pes.italiana, Pes. monochaeta, Pes. sequoiae and Pes. verruculosa; Pes. lushanensis and Pes. rhodendron). More informative gene loci are required to help solve these issues.

Pestalotiopsis disseminata (Thüm.) Steyaert, Bull. Jard. bot. État Brux. 19: 319. 1949. Fig. 45.

Basionym: Pestalotia disseminata Thüm., Inst. Coimbra: no. 578. 1879.

Culture characteristics: Colonies on MEA flat with undulate edge, white, reaching 43–53 mm diam after 10 d at 21 °C, conidiomata black, acervular, superficial; on CMA flat with undulate edge, white, sterile, reaching 73–75 mm diam after 10 d at 21 °C; on PDA flat with undulate edge, white, sterile, reaching 84–86 mm diam after 10 d at 21 °C; on SNA flat with undulate edge, white, sterile, reaching 59–62 mm diam after 10 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septe, branched at the base. Conidiogenous cells discrete or integrated, cymbiform, cylindrical, clavate or obclavate, hyaline, smooth-walled, 7–24.5 × 2–5 μm (av. = 15.9 ± 4.76 × 3.1 ± 0.85 μm). Conidia fusoid, straight, 4-septate, occasionally 3-septate, slightly constricted at the septa, 15–26.5 × 4.5–8 μm (av. = 21.9 ± 2.58 × 6.3 ± 0.9 μm); basal cell sub-cylindrical, obconic with an obtuse base, hyaline, thin-walled, 2–5.5 μm (av. = 4.2 ± 0.93 μm) long; three median cells doliiform or trapezoid, 9.5–17 μm (av. = 14.7 ± 2.15 μm) long, smooth-walled, concolourous, brown, septa darker than the rest of the cells, ± equal, each 3–6.5 μm (av. = 4.8 ± 0.81 μm) long; apical cell 2–4 μm (av. = 3.2 ± 0.49 μm) long, hyaline, conic with a truncate base, thin-walled; with 1–3 tubular apical appendages (mostly 3), unbranched, flexuous, rough, attenuated, 5–12.5 μm (av. = 8.2 ± 1.96 μm) long; basal appendages single, occasionally 2, tubular, unbranched, 2–5 μm (av. = 3.3 ± 0.62 μm) long; mean conidium length/width ratio = 3.5:1.

Materials examined: New Zealand, Auckland, on Persea americana (Lauraceae), 1 May 2015, Meje. CBS H-23529, living culture CBS 143904 = ICMP 21065 = CPC 28705; on Eucalyptus sp. (Myrtaceae), unknown collection date and collector, living culture CPC 29351; North Island, Kerikeri, on Persea americana (Lauraceae), a species originally reported from Eucalyptus botryoides from Portugal (Thuemen 1879). Since our strains were isolated from a different location, New Zealand, CBS 118552 is only considered as a representative strain of Pes. disseminata in this study. Although there have been a few Pestalotiopsis species reported from Persea americana (Farr & Rossman 2018), this is the first report from New Zealand.
**Pestalotiopsis hispanica**  F. Liu, L. Cai & Crous, sp. nov.  
MycoBank MB828379. Fig. 46.

**Etymology**: Latin name for Spain, where this fungus was collected.

**Culture characteristics**: Colonies on MEA flat with lobate edge, white, sterile, reaching 63–67 mm diam after 10 d at 21 °C; on CMA flat with entire edge, white to rosé vinaceous, sterile, reaching 65–66 mm diam after 10 d at 21 °C; on PDA flat with undulate edge, white, reaching 74–76 mm diam after 10 d at 21 °C, conidiomata black, scattered, semi-immersed or immersed, acervular; on SNA flat with erose or dentate edge, colourless, reaching 52–54 mm diam after 10 d at 21 °C, conidiomata black, scattered or gregarious, superficial to semi-immersed.

**Description**: Sexual morph: unknown. Asexual morph: Conidiophores hyaline, septate, branched. Conidiogenous cells discrete or integrated, cylindrical or sub-cylindrical, hyaline, smooth-walled, 3–24 x 1–3 μm (av. = 12.5 ± 5.06 x 2 ± 0.51 μm). Conidia fusoid to oval, straight, 4-septate, 16.5–29 x 6–9.5 μm (av. = 23.3 ± 2.99 x 8.3 ± 0.61 μm); basal cell cylindrical, obconic with a truncate base, hyaline, thin-walled, 3–5 μm (av. = 4 ± 0.56 μm) long; three median cells doliiform or trapezoid, 14–18.5 μm (av. = 17 ± 0.94 μm) long, smooth-walled, concolourous or the top two median cells darker than the third cell, pale brown to brown, the two median septa usually darker than distal septa, ± equal, each 4.5–6.5 μm (av. = 5.6 ± 0.39 μm) long; apical cell 2–4.5 μm (av. = 3.1 ± 0.61 μm) long, hyaline, sub-cylindrical or conical with a truncate or acute base, thin-walled; with 2–4 tubular apical appendages, arising from apex or laterally from apical cell, unbranched, or branched at one appendage, 2–14 μm (av. = 9.2 ± 2.53 μm) long; 0–1 basal appendages, when present, tubular, unbranched, centric, 1.5–4.5 μm (av. = 3.4 ± 0.67 μm) long; mean conidium length/width ratio = 2.8:1.

**Material examined**: Spain, Madeira, Gardens, on Protea ‘Susara’ (Proteaceae), 1 Apr. 2002, S. Denman (holotype CBS H-23554, ex-type culture CBS 115391 = CPC 5193 = JT1086).

**Notes**: Pestalotiopsis hispanica is closely related to Pes. brachiata (Fig. 5), but can be clearly differentiated by the length of its apical (2–14 μm vs. 16–28.5 μm) and basal (1.5–4.5 μm vs. 5.5–9.5 μm) appendages, as well as the number of basal appendages (0–1 vs. 1–4) (Liu et al. 2017). Compared to the apically produced appendages of Pes. brachiata, the apical appendages of Pes. hispanica arise from the apical crest or laterally from the apical cell.

**Pestalotiopsis leucadendri**  F. Liu, L. Cai & Crous, sp. nov.  
MycoBank MB828380. Fig. 47.

**Etymology**: Name reflects the host genus from which it was collected, Leucadendron.

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**Fig. 45. Pestalotiopsis disseminata (CBS 143904/CPC 28705). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E. Conidiomata on MEA. F–I. Conidiophores, conidiogenous cells and conidia. J–M. Conidia. Scale bars = 10 μm.**
Culture characteristics: Colonies on MEA flat with undulate edge, white, sterile, reaching 50–52 mm diam after 10 d at 21 °C; on CMA flat with undulate edge, white, sterile, reaching 52–53 mm diam after 10 d at 21 °C; on PDA flat with entire edge, white, reaching 60 mm diam after 10 d at 21 °C, conidiomata brown, semi-immersed, gregarious, stromatic; on SNA flat with undulate edge, colourless, sterile, reaching 44–46 mm diam after 10 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores often reduced to conidiogenous cells, septate and branched at the base. Conidiogenous cells discrete or integrated, cylindrical, subglobose, ampulliform or lageniform, hyaline, smooth-walled, 3–14 × 1.5–5.5 μm (av. = 7.6 ± 3.07 × 3 ± 0.93 μm). Conidia fusoid, mostly straight, 4-septate, 21–28.5 × 5–9 μm (av. = 24.9 ± 1.86 × 7.3 ± 1.19 μm); basal cell obconic with a truncate base, hyaline, thin-walled, 2.5–5.5 μm (av. = 4 ± 0.78 μm) long; three median cells doliiform or trapezoid, 14.5–20 μm (av. = 17.5 ± 1.31 μm) long, smooth-walled, minutely verruculose, concolourous or median cell darker than other cells, pale brown to dark brown, septa darker than the rest of cell, ± equal, each 4.5–7 μm (av. = 5.8 ± 0.65 μm) long; apical cell 2.5–5 μm (av. = 3.7 ± 0.65 μm) long, hyaline, trapezoid or conic with a truncate base, thin-walled; with 2–3 tubular apical appendages (mostly 3), unbranched, filiform, flexuous, (5–) 10–24.5 μm (av. = 15.9 ± 3.08 μm) long; 0–1 basal appendages, if present, tubular, unbranched, centric, 1–8.5 μm (av. = 4.5 ± 1.97 μm) long; mean conidium length/width ratio = 3.4:1.

Material examined: South Africa, Western Cape Province, Kleinmond, on Leucadendron sp. (Proteaceae) leaf litter, 11 Jul. 2000, S. Marincowitz (holotype CBS H-23557, ex-type culture CBS 121417 = SL528 = CMW 22192).

Notes: Pestalotiopsis leucadendri is closely related to Pes. australis (Fig. 5, 100 % identical on ITS and tef-1a, 94 % on tub2); however, morphologically it is different in having shorter conidia (21–28.5 × 5–9 μm vs. 26–36 × 7–8.5 μm) and basal
cells (2.5–5.5 μm vs. 6–10 μm), as well as a smaller mean conidium length/width ratio (3.4:1 vs. 4:1) (Maharachchikumbura et al. 2014).

**Pestalotiopsis sp. 1.** Fig. 48.

Culture characteristics: Colonies on MEA flat with lobate edge, white, reaching 78–80 mm diam after 10 d at 21 °C, conidiomata buff at immature stage, exuding black conidial masses when mature, scattered or gregarious, acervular, stromatic, semi-immersed, erumpent; on CMA flat with entire edge, colourless, reaching 76 mm diam after 10 d at 21 °C, conidiomata black, scattered or gregarious, superficial, semi-immersed or immersed, stromatic; on PDA convex with papillate surface, brown to olivaceous, reaching > 90 mm diam after 10 d at 21 °C, conidiomata dark brown to olivaceous, scattered, semi-immersed, stromatic, erumpent; on SNA flat with lobate edge, colourless, reaching 65–71 mm diam after 10 d at 21 °C, conidiomata black, scattered, superficial or immersed.

Description: Sexual morph: unknown. Asexual morph: Conidiophores hyaline, reduced to conidiogenous cells. Conidiogenous cells discrete, ampulliform, ovoid or clavate, hyaline, smooth-walled, 4–10.5 × 1.5–4 μm (av. = 6 ± 1.73 × 2.7 ± 0.66 μm). Conidia fusoid, mostly straight, 4-septate, 20–25.5 × 7–9 μm (av. = 22.4 ± 1.48 × 8.2 ± 0.65 μm); basal cell obconic with a truncate base, hyaline or pale grey, thin-walled, 2–5.5 μm (av. = 3.1 ± 0.73 μm) long; three median cells doliform or trapezoid, 15.5–18 μm (av. = 16.5 ± 0.58 μm) long, smooth-walled, concolourous or median cell darker than other median cells, mid-brown to brown, septa darker than the rest of cell, ± equal, each 4.5–6.5 μm (av. = 5.4 ± 0.58 μm) long; apical cell 2–3.5 μm (av. = 3.1 ± 0.4 μm) long, hyaline, sub-cylindrical or conic with a truncate base, thin-walled; with 3–4 tubular apical appendages (mostly 3), arising from different points, unbranched, or dichotomously branched at one appendage, attenuate, flexuous, 6.5–18 μm (av. = 12.8 ± 2.38 μm) long; 0–1 basal appendages, when present, tubular, unbranched, centric, 1.5–6 μm (av. = 3.6 ± 1.12 μm) long; mean conidium length/width ratio = 2.7:1.

Material examined: USA, Hawaii, on Leucospermum cuneiforme × concarpodendron (Proteaceae), 16 Dec. 1998, P.W. Crous, CBS H-23548, living culture CBS 111576 = CPC 2146 = JT 617 = STE-U 2146.

Notes: Pestalotiopsis sp. 1 is closely related to Pestalotiopsis sp. 2 based on the ML analysis (Fig. 5; 99 % sequence similarity on ITS, 96 % on tef-1α, 100 % on tub2), but it differs from the latter in the width of conidia (7–9 μm vs. 4.5–7.5 μm), length of median cells (15.5–18 μm vs. 11.5–16.5 μm), and the mean conidium length/width ratio (2.7:1 vs. 3.7:1). The median cell of Pestalotiopsis sp. 1 is darker than other median cells. In contrast, median cells of Pestalotiopsis sp. 2 tend to be concolourous. However, the phylogenetic position of Pestalotiopsis sp. 1 is
unstable under different arithmetic analyses (not shown here). This is probably a novel species, and awaits further study.

According to Farr & Rossman (2018), three Pestalotiopsis species have been reported from Leucospermum from Hawaii, namely Pes. aquatica, Pes. hawaiiensis, and Pes. vismiae. Pestalotiopsis hawaiiensis is located in the basal part of the Pestalotiopsis tree (Fig. 5) and is obviously distinct from Pestalotiopsis sp. 1. Although another two species Pes. aquatic and Pes. vismiae are not represented by type-derived sequences, they can be morphologically distinguished from Pestalotiopsis sp. 1 by the thinner conidia (6–7 μm in Pes. aquatic, 5–6.5 μm in Pes. vismiae vs. 7–9 μm in Pestalotiopsis sp. 1) (Petrak 1950, Ellis & Everhart 1889).

Pestalotiopsis sp. 2. Fig. 49.

Culture characteristics: Colonies on MEA flat with lobate edge, white to honey, sterile, reaching > 90 mm diam after 10 d at 21 °C; on CMA flat with entire edge, isabelline, reaching 75 mm

Fig. 48. Pestalotiopsis sp. 1 (CBS 111576). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–H. Conidiomata on MEA, CMA, PDA and SNA, respectively. I–K. Conidiophores, conidiogenous cells and conidia. L–O. Conidia. Scale bars = 10 μm.
diam after 10 d at 21 °C, conidiomata yellow green to pistachio green, glaucous blue-green, scattered or gregarious, superficial, stromatic; on PDA flat with entire surface, dark olivaceous, sterile, reaching > 90 mm diam after 10 d at 21 °C; on SNA flat with entire edge, colourless, sterile, reaching 80–82 mm diam after 10 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Conidiophores hyaline, often reduced to conidiogenous cells, occasionally septate and branched at the base. Conidiogenous cells mostly discrete, sphaeriform, ampulliform, ellipsoidal, hyaline, smooth-walled, 2.5–8.5 × 2–7 μm (av. = 5.4 ± 1.33 × 4 ± 1.2 μm). Conidia fusoid, straight or curved, constricted at septa, 4-septate, occasionally 2- or 5-septate, 20–26.5 × 4.5–7.5 μm (av. = 23.7 ± 1.6 × 6.4 ± 0.74 μm); basal cell obconic with a truncate base, hyaline to pale grey, thin-walled, 4–6.5 μm (av. = 4.9 ± 0.83 μm) long; three median cells doliiform.
11.5–16.5 μm (av. = 15 ± 1.25 μm) long, smooth-walled, minutely verruculose, concolourous, pale brown, septa darker than the rest of the cell, ± equal, each 3.5–6 μm (av. = 4.6 ± 0.52 μm) long; apical cell 2.5–6 μm (av. = 4.5 ± 0.67 μm) long, hyaline, conic with a truncate base, thin-walled; with 1–4 tubular apical appendages, arising from different points, unbranched, tubular, 3.5–9 μm (av. = 6.8 ± 1.36 μm) long if more than one appendage, 7.5–16 μm (av. = 11 ± 2.1 μm) long if only one appendage; one basal appendage, tubular, unbranched, centric, 2.5–7.5 μm (av. = 3.8 ± 1.3 μm) long; mean conidium length/width ratio = 3.7:1.

**Material examined:** USA, Hawaii, Harry Lui, on Leucospermum cv. Pink Ice (Proteaceae), 16 Dec. 1998, P.W. Crous, CBS H-23552, living culture CBS 114489 = CPC 2135 = JT 630.

**Notes:** See notes under Pestalotiopsis sp. 1.

**Pestalotiopsis sp. 3. Fig. 50.**

**Culture characteristics:** Colonies on MEA flat with lobate edge, white, reaching 79–82 mm diam after 10 d at 21 °C, conidiomata black, superficial or semi-immersed, acervular; on CMA flat with undulate edge, white, reaching 60–63 mm diam after 10 d at 21 °C, conidiomata black, scattered or gregarious, superficial, acervular; on PDA flat with undulate edge, white, reaching 78–82 mm diam after 10 d at 21 °C, conidiomata black, superficial, gregarious, stromatic; on SNA flat with erose or dentate edge, colourless, reaching 57–62 mm diam after 10 d at 21 °C, conidiomata black, superficial, scattered, acervular.

**Description:** Sexual morph: unknown. Asexual morph: Conidiophores often reduced to conidiogenous cells, occasionally septate and branched at the base. Conidiogenous cells discrete, mostly ampulliform or lageniform, hyaline, smooth-walled, 6–13 × 1–5 μm (av. = 8.5 ± 1.66 × 2.8 ± 0.94 μm). Conidia fusoid, straight, 4-septate, 18.5–24 × 5.5–8 μm (av. = 20.5 ± 1.32 × 6.5 ± 0.51 μm); basal cell obconic with a truncate base, hyaline, thin-walled, 2.5–4.5 μm (av. = 3.3 ± 0.58 μm) long; three median cells doliform or trapezoid, 12.5–17 μm (av. = 14.7 ± 1.15 μm) long, smooth-walled, concolourous or the median cell darker than others, pale to mid-brown, septa darker than the rest of cells, ± equal; apical cell 2–4 μm (av. = 2.6 ± 0.4 μm) long, hyaline, conic with a truncate or acute base, thin-walled; with 2–3 tubular apical appendages (mostly 3), arising from different points, unbranched, flexuous, attenuated, 7.5–16.5 μm (av. = 11.4 ± 1.89 μm) long; basal appendages single, tubular, unbranched, centric, 0.5–5 μm (av. = 2.7 ± 0.82 μm) long; mean conidium length/width ratio = 3.2:1.

**Material examined:** Australia, Western Australia, on Podocarpus sp. (Podocarpaceae), 27 Sep. 2015, P.W. Crous HPC 632, living culture CBS 143905 = CPC 28896.

**Notes:** According to Farr & Rossman (2018), there are 33 Pestalotiopsis species recorded from Podocarpus. Most of these species were recorded from China and were identified based on ITS phylogeny but without any comparison to types (e.g. Wei et al. 2005, 2007, Liu et al. 2006, 2010). These species were thus not included in the Pestalotiopsis phylogenetic analysis (Fig. 5) due to the lack of tef-1a and tub2 sequences and few nucleotide informative sites in ITS. Therefore, although Pestalotiopsis sp. 4 resided in a distinct lineage, we are unsure if CBS 143905 represents a new species or is one of the known species. Besides, we presently only have a single strain, and this species therefore awaits further study.

**Pestalotiopsis sp. 5. Fig. 52.**

**Culture characteristics:** Colonies on MEA flat with undulate edge, white, sterile, reaching 86–88 mm diam after 10 d at 21 °C; on CMA flat with undulate edge, white, reaching 80–84 mm diam after 10 d at 21 °C, conidiomata black, scattered, acervular, superficial; on PDA umbomate with entire edge, white, reaching >90 mm diam after 10 d at 21 °C, conidiomata black, gregarious, stromatic, superficial; on SNA flat with undulate edge, colourless, sterile, reaching 70–75 mm diam after 10 d at 21 °C.

**Description:** Sexual morph: unknown. Asexual morph: Conidiophores often reduced to conidiogenous cells, occasionally branched at the base. Conidiogenous cells mostly discrete, cylindrical, ampulliform, hyaline, smooth-walled, 4–24 × 1.5–3.5 μm (av. = 14.2 ± 5.49 × 2.1 ± 0.47 μm). Conidia fusoid, straight or occasionally curved, 4-septate, 22–29.5 × 5–7.5 μm (av. = 25 ± 1.86 × 6.4 ± 0.56 μm); basal cell sub-cylindrical, obconic with a narrow truncate or acute base, hyaline, thin-walled, 4–6.5 μm (av. = 4.7 ± 0.66 μm) long; three median cells doliform, trapezoid or cylindrical, 13.5–18.5 μm (av. = 15.7 ± 1.27 μm) long, smooth-walled, concolourous, mid-brown to brown, septa darker than the rest of cells, ± equal, each 4–6.5 μm (av. = 5 ± 0.61 μm) long; apical cell 2.5–5.5 μm (av. = 3.9 ± 0.61 μm) long, hyaline, conic with a truncate base, thin-walled; with 2–3 tubular apical appendages
(mostly 3), arising from different points, unbranched, 5–21 \( \mu m \) (av. = 13 ± 2.8 \( \mu m \)) long; basal appendages single, tubular, unbranched, centric, 2.5–7 \( \mu m \) (av. = 4.2 ± 1.13 \( \mu m \)) long; mean conidium length/width ratio = 3.9:1.

**Material examined:** Australia, Western Australia, Perth, Chichester Park, on Corymbia calophylla (Myrtaceae) foliage and fruits, 16 Jun. 2015, P.A. Barber, HPC 491, CBS H-23525, living culture CBS 143900 = CPC 27562 = PAB_F008.

**Notes:** *Pestalotiopsis* sp. 5 is closely related with *Pestalotiopsis* sp. 4 (97 % sequence similarity on tef-1α, 99 % on tub2), and they are minutely different from each other in the length of conidia (22–29.5 \( \times \) 5–7.5 \( \mu m \) vs. 18.5–24 \( \times \) 5.5–8 \( \mu m \)). *Pestalotiopsis* sp. 5 awaits further study once more isolates and evidence become available.

**Pestalotiopsis sp. 6.** Fig. 53.

*Culture characteristics:* Colonies on MEA flat with undulate edge, white, reaching 80 mm diam after 10 d at 21 °C, conidiomata brown or black, superficial or semi-immersed, scattered or
gregarious, acervular, stromatic, erumpent; on CMA flat with entire edge, white to off-white, reaching 68–71 mm diam after 10 d at 21 °C, conidiomata brown or black, superficial, semi-immersed or immersed, scattered, acervular, stromatic, erumpent; on PDA flat with entire edge, white, reaching > 90 mm diam after 10 d at 21 °C, conidiomata black, superficial, scattered or gregarious, acervular; on SNA flat with undulate edge, colourless, reaching 64–66 mm diam after 10 d at 21 °C, conidiomata black, superficial, semi-immersed, scattered, acervular.

Description: Sexual morph: unknown. Asexual morph: Conidiophores often reduced to conidiogenous cells. Conidiogenous cells integrated, mostly cylindrical, or obclavate, hyaline, smooth-walled, variable in size, 4–23 × 1.5–4 μm (av. = 10.6 ± 4.88 × 2.4 ± 0.62 μm). Conidia fusoid, oval, straight, 4-septate, 20–26.5 × 9–11 μm (av. = 22.4 ± 1.67 × 10.2 ± 0.52 μm); basal cell obconic with a truncate or obtuse base, hyaline or pale brown, thin-walled, 1.5–4.5 μm (av. = 3 ± 0.75 μm) long; three median cells doliiform, 15–19.5 μm (av. = 16.8 ± 0.96 μm) long, smooth-walled, median cell sometimes darker than other cells, pale to brown, septa darker than the rest of cell, ± equal, each 4–6.5 μm (av. = 5.1 ± 0.75 μm) long; apical cell 1.5–4 μm (av. = 2.7 ± 0.63 μm) long, hyaline, conic with an acute or obtuse base, thin-walled; with three tubular apical appendages, unbranched, or occasionally branched at one
appendage, flexuous, (4.5–)8.5–25 μm (av. = 17.5 ± 4.01 μm) long; 0–1 basal appendages, tubular, unbranched, centric, 1.5–6.5 μm (av. = 4.2 ± 1.28 μm) long; mean conidium length/width ratio = 2.2:1.

Materials examined: Australia, Western Australia, Perth, Nanika Park, on Iso-pogon (Proteaceae) leaves, 26 Jun. 2015, P.A. Barber, HPC 505, CBS H-23527, living culture CBS 143902 = CPC 27649; Perth, on Eucalyptus platypus (Myr-taceae), 15 Jun. 2015, P.A. Barber, HPC 502, living culture CPC 27696; Perth, Fernwood Park, on Banksia attenuata (Proteaceae), 15 Jun. 2015, P.A. Barber, HPC 493, CPC 27641 = PAB F 001; Western Australia, on Banksia sp., 23 Sep. 2015, P.W. Crous, living culture CPC 29456.

Notes: Pestalotiopsis sp. 6 is closely related with Pes. knightiae and Pes. grevilleae (Fig. 5), and showed 98 % tef-1α sequence similarity to these two species. These three species are all reported from Proteaceae but from different geographical areas. Since their morphological characters are indistinguishable, Pestalotiopsis sp. 6 is not treated further in this study.

**Pestalotiopsis spathuliappendiculata** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828381. Fig. 54.

Etymology: Referring to the spathulate apex of the apical appendages.

**Culture characteristics:** Colonies on MEA flat with entire edge, white to off-white, sterile, reaching 71 mm diam after 7 d at 21 °C; on CMA raised with concave edge, with undulate margin, white, reaching 65–68 mm diam after 7 d at 21 °C, conidial masses black, forming on the surface of aerial mycelia; on PDA flat with entire edge, white, sterile, reaching 76–80 mm diam after 7 d at 21 °C; on SNA flat with entire edge, colourless, reaching 65–68 mm diam after 7 d at 21 °C, conidiomata forming on pine needle, pale luteous or buff, stromatic, scattered, semi-immersed.

**Description:** Sexual morph: unknown. Asexual morph: Conidiophores, conidiogenous cells and conidia. J–L. Conidia. Scale bars = 10 μm.
unbranched, centric, 1.5–10.5 μm (av. = 4.9 ± 2.16 μm) long; mean conidium length/width ratio = 3.5:1.

Material examined: Australia, Victoria, Bundoora, LaTrobe University Campus, on Phoenix canariensis (Arecaceae), 27 Mar. 2015, T. Aldous (holotype CBS H-23537, ex-type culture CBS 144035 = CPC 29602 = VPRI 42602).

Notes: The conidiomata of Pes. spathuliappendiculata differ in colour from typical Pestalotiopsis (olivaceous or black), being pale luteous or buff. Furthermore, the arrangement of apical appendages of Pes. spathuliappendiculata (arising from the top, middle or base of the apical cell) and shape (coarse and spathulate at the tip) are distinct from all other known Pestalotiopsis species.

**Pestalotiopsis terricola** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828382. Fig. 55.

Etymology: Named after the habitat of this fungus, terrestrial.

Culture characteristics: Colonies on MEA flat with erose or dentate edge, white, reaching 60–61 mm diam after 7 d at 21 °C, conidiomata gregarious, semi-immersed, buff, exuding black conidial masses; on CMA and PDA flat with erose or dentate edge, white, reaching 71–80 mm diam after 7 d at 21 °C, conidiomata scattered or gregarious, semi-immersed, erumpent, acervular, buff, exuding black conidial masses; on SNA flat with erose or dentate edge, colourless, reaching 52–55 mm diam.
after 7 d at 21 °C, conidiomata black, scattered, superficial, acervular.

Description: Sexual morph: unknown. Asexual morph: Conidiophores often reduced to conidiogenous cell, septate and occasionally branched at the base. Conidiogenous cells mostly discrete, cylindrical, obclavate, or clavate, hyaline, smooth-walled, 3.5–14.5 × 1.5–3.5 μm (av. = 8.8 ± 2.47 × 2.1 ± 0.53 μm). Conidia fusoid, straight, 4-septate, 16.5–21.5 × 5–7 μm (av. = 19.5 ± 1.42 × 6.2 ± 0.44 μm); basal cell subcylindrical, obconic with a narrow truncate base, hyaline, thin-walled, 3–5 μm (av. = 3.9 ± 0.55 μm) long; three median cells doliiform, 10.5–14 μm (av. = 12.9 ± 0.9 μm) long, smooth-walled, concolourous, brown, septa darker than the rest of cell, ± equal, each 3.5–4.5 μm (av. = 4.1 ± 0.38 μm) long; apical cell 2–3.5 μm (av. = 2.6 ± 0.35 μm) long, hyaline, conic with a truncate base, thin-walled; with 2–4 tubular apical appendages (mostly 2–3), arising from the apical crest, unbranched, filiform, tubular, 5–10 μm (av. = 7.9 ± 1.13 μm) long; single basal appendage, tubular, unbranched, centric, 1–3.5 μm (av. = 2.6 ± 0.65 μm) long; mean conidium length/width ratio = 3.1:1.

Material examined: Pacific Islands, Tahiti, soil, unknown collection date, A.M. Fontana (holotype CBS H-15717, ex-type culture CBS 141.69).

Notes: Although represented by single strain, Pes. terricola is well separated from other species (Fig. 5). The short apical and basal appendages of Pes. terricola resemble Pes. licualica.
Pes. papuana and Pes. parva (Liu et al. 2017). Phylogenetically however, these three species are distant relatives to one another (Fig. 5).

**Pseudopestalotiopsis** Maharachch. et al., Stud. Mycol. 79: 180. 2014, **emend.** F. Liu, L. Cai & Crous

*Description: Conidiomata* acervular or pycnidial, subglobose, globose, clavate, solitary or aggregated, brown to black, immersed, semi-immersed to erumpent, unilocular; exuding brown to black conidia in a slimy, globose mass. *Conidiophores* often reduced to conidiogenous cells. *Conidiogenous cells* discrete, cylindrical, ampulliform to lageniform, hyaline, smooth- and thin-walled; conidiogenesis initially holoblastic, percurrent proliferations to produce additional conidia at slightly higher levels. *Conidia* fusoid, ellipsoid, subcylindrical, straight to slightly curved, 4-septate, slightly constricted at septa; basal cell conical to cylindrical with a truncate base; three median cells doliform, concolourous, brown to dark brown or olivaceous, wall smooth or verruculose, septa darker than the rest of the cell; apical cell conical to subcylindrical, thin- and smooth-walled; with tubular apical appendages, one to many, filiform or attenuated, flexuous, branched or unbranched, with or without spatulate tips; basal appendage single, tubular, unbranched, centric (emended from Maharachchikumbura et al. 2014).

*Type species: Pseudopestalotiopsis theae* (Sawada) Maharachch. *et al.*
**Pseudopestalotiopsis chinensis** F. Liu & L. Cai, Scientific Reports 7 (no. 866): 13. 2017.

Synonym: *Pestalotiopsis longiappendiculata* F. Liu & L. Cai, Scientific Reports 7 (no. 866): 9. 2017.

**Description and illustrations:** See Liu et al. (2017).

**Notes:** A sequencing error occurred in the ITS sequence (KX894939.1) of *P. longiappendiculata* (CGMCC 3.18153) in Liu et al. (2017), which was not detected in the subsequent control and processing steps. *Pestalotiopsis longiappendiculata* therefore became a mistakenly introduced name, and is reduced to a synonymy under *Pse. chinensis* due to its phylogenetic similarity to *Pse. chinensis* (Fig. 6). Furthermore, the ITS sequence of CGMCC 3.18153 has been corrected in GenBank under KX894939.1.

**Pseudopestalotiopsis elaeidis** (C. Booth & J.S. Robertson) F. Liu, L. Cai & Crous, *comb. nov.* MycoBank MB828383.

**Basionym:** *Leptosphaeria elaeidis* C. Booth & J.S. Robertson, Trans. Brit. Mycol. Soc. 44: 26. 1961.

**Synonyms:** *Pestalosphaeria elaeidis* (C. Booth & J.S. Robertson) Aa, Proc. K. Ned. Akad. Wet., Ser C, Biol. Med. Sci.: 87. 1976. *Leptuypa elaeidis* (C. Booth & J.S. Robertson) Arx, Gener. Fungi Sporul. Cult., Edn 3 (Vaduz): 176. 1981. *Pseudopestalotiopsis myanmarina* Nozawa & Kyoko Watan., Mycoscience 58: 331. 2017.

**Description:** See Nozawa et al. (2017).

**Material examined:** China, Jiangxi Province, Yangling National Forest Park, on Lauraceae, 5 Sep. 2013, Y.H. Gao, living culture LC4479. *Indonesia,* on Acacia cassipula, 22 Jun. 2012, M. Wingfield, living culture CBS 144023 = CPC 20822. *Myanmar,* between Dawei and Myeik, on Averrhoa carambola, 13 Nov. 2014, K. Watanabe (*holotype* of *Pseudopestalotiopsis myanmarina* NBRC 112264 = MM14-F0060, not seen); between Dawei and Myeik, unknown host, collection date and collector, living culture NBRC 112265 = MM14-F0066, not seen; Pathain, unknown host plant, collection date and collector, living culture NBRC 112270 = MM14-F0112, not seen; *Nigeria,* on seedling of *Elaeis guineensis* (Arecaceae), Sep. 1995, unknown collector (*isotype* of *Leptosphaeria elaeidis* CBS H-281; *ex-type* culture CBS 413.62 = IMI 61175 = QM 6005).

**Notes:** There is only one base pair difference between the ITS and *tef-1α* sequences of the ex-type cultures of *Leptosphaeria elaeidis* (CBS 413.62) and *Pseudopestalotiopsis myanmarina* (NBRC 112264). These species are morphologically comparable. Since *Lep. elaeidis* was published earlier than *Pse. myanmarina,* it was combined in the genus *Pseudopestalotiopsis* and the latter species synonymised under *Pse. elaeidis*.

**Pseudopestalotiopsis solicola** F. Liu, L. Cai & Crous, *sp. nov.* MycoBank MB828384. Fig. 56.

**Eymology:** Named after the substrate of this fungus, soil.

**Cultural characteristics:** Colonies on MEA convex with papillate surface, crenate edge, amber, reaching 54–75 mm diam after 7 d at 21 °C, conidiomata black, scattered, superficial, acervular; on CMA flat with entire edge, colourless, reaching 68 mm diam after 7 d at 21 °C, conidiomata amber to honey, superficial or semi-immersed, gregarious, stromatic, erumpent; on PDA flat with entire edge, buff, reaching > 90 mm diam after 7 d at 21 °C, conidiomata amber to honey, superficial or semi-immersed, gregarious; on SNA flat with undulate edge, colourless, reaching 62–68 mm diam after 7 d at 21 °C, conidiomata black, scattered, semi-immersed or immersed.

**Description:** Sexual morph: unknown. Asexual morph: *Conidiophores* reduced to conidiogenous cells, occasionally septate. *Conidiogenous cells* mostly discrete, sphaeriform, ampulliform, ellipsoid, hyaline, smooth-walled, 4.5–9 × 3.5–6 μm (av. = 6.1 ± 1.15 × 4.8 ± 0.62 μm). *Conidia* fusoid, straight, 4–septate, 18–25.5 × 7–9.5 μm (av. = 21.3 ± 1.66 × 8 ± 0.6 μm); basal cell subcylindrical, obconic with a truncate base, hyaline, thin-walled, 2.5–4 μm (av. = 3.1 ± 0.47 μm) long; three median cells doliform, 11.5–16.5 μm (av. = 14.7 ± 1.09 μm) long, smooth-walled, concolourous, brown, septa darker than the rest of the cell, ± equal, each 4–5.5 μm (av. = 4.7 ± 0.38 μm) long; apical cell 2–5.5 μm (av. = 3.5 ± 1.01 μm) long, hyaline, cylindrical or conic with a truncate base, thin-walled; with 2–4 tubular apical appendages (mostly 3), unbranched, filiform, tubular, slightly swollen at the apex, 13–23.5 μm (av. = 18 ± 2.69 μm) long; 0–1 basal appendages, when present tubular, unbranched, centric, 1.5–6 μm (av. = 3.4 ± 1.27 μm) long; mean conidium length/width ratio = 2.7:1.

**Material examined:** Papua New Guinea, Madang Prov. Brahman, soil in tropical forest, Nov. 1995, A. Aptroot (*holotype* CBS H-23541, ex-type culture CBS 386.97).

**Notes:** *Pseudopestalotiopsis solicola* is closely related to *Pse. theeae* (99 % similarity on *tef-1* and 95 % on *tef-1α*) and an unnamed clade (*Pseudopestalotiopsis* sp. 1) that was published in Nozawa et al. (2017) (Fig. 6, 99 % sequence similarity on *tef-2* and 95 % on *tef-1α*). Morphologically, it is different from *Pse. theeae* in producing shorter apical appendages (13–23.5 μm vs. 22.5–31 μm) and a smaller mean conidium length/width ratio (2.7:1 vs. 3.4:1).

**Pseudosarcostroma** F. Liu, L. Cai & Crous, *gen. nov.* MycoBank MB828385.

**Eymology:** Based on its morphological similarity to Sarcostroma.

**Description:** Sexual morph: unknown. Asexual morph: *Conidiomata* acervular, superficial or immersed, pale brown, wall of *textura rectangularis*, cells thick-walled and colourless to pale brown. *Conidiophores* arising from the inner layers of the conidioma, sparsely septate and branched at the base, often reduced to conidiogenous cells, colourless, invested in mucus. *Conidiogenous cells* mostly discrete, sphaeriform or ampulliform, discrete or integrated, colourless, thin-walled, smooth. *Conidia* fusoid with an acute apex and a truncate or obtuse base, straight or slightly curved, 4–5-septate, wall undulate or verruculose, apical and basal cell colourless, median cells pale brown, without or with slight constriction at the septa, bearing appendages; apical appendage single, attenuated, flexuous, not branched; basal appendage single, tubular, excentric, unbranched.

**Type species:** *Pseudosarcostroma osyradicola* F. Liu, L. Cai & Crous.

**Notes:** In the multi-locus (Figs 1, 7) and single gene trees (not shown here), *Pseudosarcostroma* is closely related to *Broomella, Bartalina, Truncatella, Parabartalina,* and *Diversimediispora.* Morphologically, it differs from *Bartalina, Truncatella, Para- bartalina* and *Diversimediispora* in the type of apical appendage (unbranched vs. branched), and differs from *Broomella* in the number of conidal septa (4–5-septate vs. 2–3-septate). In addition, the distal sepal of *Pseudosarcostroma* are thicker than median sepal, which are concolourous in the above listed genera. Although *Pseudosarcostroma* is morphologically similar
to Sarcostroma in having a single appendage at each end and with an undulate or verruculose conidial wall, they are phylogenetically distinct (Fig. 1).

**Pseudosarcostroma osyridicola** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828386. Fig. 57.

*Etymology:* Named after its host genus, *Osyris*.

**Culture characteristics:** Colonies on MEA flat with entire or undulate edge, rosy buff, sterile, reaching 57–58 mm diam after 14 d at 21 °C; on CMA umbonate with entire edge, white to grey, sterile, reaching 63–64 mm diam after 14 d at 21 °C; on PDA flat with entire edge, rosy buff, sterile, reaching 66–69 mm diam after 14 d at 21 °C; on SNA flat with fimbriate edge, white to grey, reaching 23–27 mm diam after 14 d at 21 °C, conidial masses pale brown, scattered, gregarious or confluent, superficial or immersed, acervular.

**Description:** Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, mostly reduced to conidiogenous cells, smooth, colourless. Conidiogenous cells discrete, mostly lageniform or ampulliform, 4.5–14.5 × 1.5–3.5 μm, (av. = 8 ± 2.25 × 2.4 ± 0.51 μm), colourless, smooth. Conidia fusoid, straight or slightly curved, wall undulate, mostly 4-septate, occasionally 5-septate, distal septa thicker than the rest cell, 18.5–29.5(–33) × 4.5–7.5 μm (av. = 24 ± 2.73 × 5.7 ± 0.7 μm);
basal cell obconic with a truncate base, trapezoid, hyaline, thin-walled, 3–5 μm (av. = 4 ± 0.57 μm) long; median cells 2, cylindrical, doliiform, pale brown, thick-walled, ± equal, each 3–8 μm (av. = 5.6 ± 1.07 μm) long; apical cell conic with an acute apex, thin-walled, hyaline, 2–5 μm (av. = 3.3 ± 0.72 μm) long; single apical appendage, centric, attenuated, tubular, unbranched, 9.5–20.5 μm (av. = 14.5 ± 2.44 μm) long; single basal appendage, excentric, attenuated, tubular, unbranched, 5.5–19.5 μm (av. = 10 ± 2.99 μm) long; mean conidium length/width ratio = 4.2:1.

Material examined: France. St Rémy de Provence, on Osyris alba (Santalaceae) twigs, 22 Oct. 1974, W. Gams (holotype CBS H-14564, ex-type culture CBS 103.76).

Notes: In addition to Pseudosarcostroma osyridicola, two other pestalotioid species have been reported from Osyris alba (Farr & Rossman 2018), which are Discostroma osyridis from Portugal (Sivanesan 1983) and Monochaetia osyrella (syn. Mon. osyridella, Pestalotia osyrella) from Italy, Yugoslavia and Austria (Guba 1961, Nag Raj 1988, 1993). Although type-derived sequences are unavailable for both species, they are morphologically different from Pseudosarcostroma osyridicola. The basal appendage of Pseudosarcostroma osyridicola is excentric and the distal septa are thicker than the rest of the cell; however, in Mon. osyrella, the basal appendage is centric, and the distal septa are as thick and dark as the peripheral wall, but the two median septa are thinner (Nag Raj 1993). Discostroma osyridis differs from Pseudosarcostroma osyridicola by producing non-appendaged conidia (Sivanesan 1983).

Robillarda Sacc., Michelia 2 (6): 8. 1880, nom. cons.

Description: Conidiomata stromatic, pycnidal or pycnidoid, semi-immersed or immersed, erumpent, unilocular to variability loculate with the locule often convoluted, glabrous, dehiscing by an ostiole or by an irregular split in the apical wall and overlying host tissue; wall thick of textura angularis to textura prismatica. Conidiophores reduced to conidiogenous cells or with 1–2 supporting cells lining the cavity of the locule,
invested in mucus. Conidiogenous cells discrete, ampulliform to lageniform, hyaline, smooth; proliferating sympodially or percurrently near apex. Conidia composed of a conidium body and a separate apical cell modified into a branched appendage; conidium body ellipsoid, fusiform or subcylindrical, 1-euseptate, wall smooth, with or without constriction at the septum, hyaline to pale brown, often guttulate; apical cell short-cylindrical at base, then dividing into 2–5 branches, branches thin-walled, tubular, filiform, ends pointed or swollen, flexuous, divergent, smooth, hyaline, devoid of contents (emended from Crous et al. 2015).

Type species: *Robillarda sessilis* (Sacc.) Sacc. 1880.

*Robillarda australiana* F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828387. Fig. 58.

**Etymology**: Named after the country where it was collected, Australia.

**Culture characteristics**: Colonies on MEA flat with entire edge, white, reaching 76–77 mm diam after 14 d at 21 °C, conidiomata brown, scattered, erumpent, stromatic, covered by mycelia; on CMA flat with entire edge, aerial mycelia sparse, flocculent,

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Fig. 58. *Robillarda australiana* (CBS 143882/CPC 17187). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–H. Conidiomata on MEA, CMA, PDA and SNA, respectively. I–K. Conidiophores and conidiogenous cells (arrows point to protuberances). L–N. Conidia. Scale bars = 10 μm.
reaching 58–60 mm diam after 14 d at 21 °C, conidiomata pale brown to brown, superficial or semi-immersed, erumpent, stromatic; on PDA flat with entire edge, white, aerial mycelia villiform, reaching 73–75 mm diam after 14 d at 21 °C, conidiomata dark brown to black, semi-immersed, often covered by aerial mycelia, stromatic; on SNA flat with entire edge, colourless, reaching 57–58 mm diam after 14 d at 21 °C, conidiomata black, scattered, immersed, acervular.

Description: Sexual morph: unknown. Asexual morph: Conidiophores reduced to very short conidiogenous cells, smooth, colourless. Conidiogenous cells discrete, thin-walled, guttulate, lageniform, ampulliform or irregular, 4.5–10.5 × 2–4.5 μm (av. = 7.3 ± 1.53 × 3.1 ± 0.57 μm), colourless, smooth. Each conidiogenous cell producing 2–3 small but distinct pro-tuberances at the apex. Conidia composed of a 1-septate conidium body and a septate apical cell modified into a branched appendage. Conidium body cylindrical, straight, 1-septate, smooth, hyaline to pale brown, guttulate, not constricted at the median septum, 8.5–13.5 × 1.5–2 μm (av. = 11.1 ± 0.82 × 1.9 ± 0.1 μm), lower cell and upper cell in ± equal length; apical cell cylindrical for 2–3.5 μm (av. = 2.7 ± 0.31 μm) long, then dividing into three divergent branches; apical appendages unbranched, attenuated, 6–16.5 μm (av. = 10.5 ± 3.47 μm) long; basal appendages absent; mean conidium length/width ratio = 5.8:1.

Material examined: Australia, Queensland, Noosa Bay, unknown host plant, 27 Jul. 2009, P.W. Crous [holotype CBS H-23503, ex-type culture CBS 143882 = CPC 17187].

Notes: Robillarda austaliana is closely related to Rob. africanana (99 % sequence similarity on ITS, 97 % on rpb2, 93 % on tef1-α and 98 % on tub2), but it differs from the latter in producing a longer apical cell (2–3.5 μm vs. 1–2.5 μm). The conidia of Rob. austaliana are not constricted at the median septum, while they are slightly constricted in Rob. africana. Sarcostroma Cooke, Journal of the Quekett microsc. Club 2: 267. 1871, emend. F. Liu, L. Cai & Crous.

Description: Sexual morph: unknown. Asexual morph: Conidiomata stromatic, variable from acervular to acervuloid, pyxidiod or cupulate, innate-erumpent or erumpent, unilocular with the locale often irregularly convoluted, glabrous, dark brown to black; basidiomata of textura angularis to textura prismatic, cells moderately thick-walled and almost colourless. Conidiophores arising from the upper cells of the basidiomata or at the base and part way up the side walls or lining the cavity of the conidioma, sometimes reduced to conidiogenous cells, septate, unbranched or branched, colourless, thin-walled. Conidiogenous cells discrete or integrated, ampulliform, lageniform to sub-cylindrical or cylindrical, colourless, thin-walled, smooth. Conidiophores arising from the upper cells of the basidiomata or at the base and part way up the side walls or lining the cavity of the conidioma, sometimes reduced to conidiogenous cells, septate, unbranched or branched, colourless, thin-walled. Conidiogenous cells discrete or integrated, ampulliform, lageniform to sub-cylindrical or cylindrical, colourless, thin-walled, smooth. Conidiophores arising from the upper cells of the basidiomata or at the base and part way up the side walls or lining the cavity of the conidioma, sometimes reduced to conidiogenous cells, septate, unbranched or branched, colourless, thin-walled. Conidiogenous cells discrete or integrated, ampulliform, lageniform to sub-cylindrical or cylindrical, colourless, thin-walled, smooth.

Notes: Sarcostroma was resurrected to accommodate some taxa removed from Seimatosporium, characterised by fusoid conidia with four or more cells, pigmented median cells, paler and thin-walled end cells, an attenuated tubular apical appendage and a similar excentric basal appendage (Nag Raj 1993). The holotype of the generic type species (Bas. Podisoma follicola), collected from Juniperus communis in England, the UK, in 1828, was unfortunately presumed lost (comm. June 1989 from keeper of the herbarium, Nag Raj 1993). In this study, we searched without success for type duplicates of Sar. follicola in the herbaria BM, CGE, E, L, LINN, MICH, OXF and PC, where Berkeley could have deposited specimens. Although the sequence of Sar. follicola was unavailable for comparison, morphological characters of Sarcostroma species described in this study fit well with the generic characterisation in Nag Raj (1993). We have not been able to obtain suitable material to serve as epitype. The epitypification is therefore awaiting fresh collections and DNA data.

Sarcostroma africanum F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828388. Fig. 59.

Eymology: Refers to the country where it was collected, South Africa.

Culture characteristics: Colonies on MEA flat with radially folded on surface, greenish grey, sterile, reaching 54–55 mm diam after 14 d at 21 °C; on CMA flat with entire edge, glaucous grey, sterile, reaching 67–74 mm diam after 14 d at 21 °C; on PDA low convex with entire edge, smoke grey, aerial mycelia white and flocculent, sterile, reaching 75 mm diam after 14 d at 21 °C; on SNA flat with entire edge, colourless, reaching 54–55 mm diam after 14 d at 21 °C, conidiomata black, scattered, acervular.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, colourless, smooth, thin-walled. Conidiogenous cells discrete or integrated, cylindrical, sub-cylindrical, 9–16.5 × 1.5–2.5 μm (av. = 12.8 ± 0.8 × 2 ± 0.2 μm), colourless, smooth. Conidia fusoid, straight, 4-septate, wall undulate, not constricted at the septa, 15.5–19.5 × 5–6 μm (av. = 17.8 ± 0.89 × 5.6 ± 0.33 μm), bearing appendages; basal cell obconic with a truncate base, colourless, 2–3 μm (av. = 2.4 ± 0.28 μm) long; median cells 3, cylindrical or doliiform, thick-walled, mid-brown, ± equal, each 3–5.5 μm (av. = 4.1 ± 0.46 μm) long; apical cell conical, colourless, 2–3.5 μm (av. = 2.7 ± 0.3 μm) long; apical appendage single, filiform, unbranched, attenuated, 7–15 μm (av. = 11.2 ± 2.01 μm) long; basal appendage single, unbranched, filiform, excentric, 7.5–14 μm (av. = 10.7 ± 1.71 μm) long; mean conidium length/width ratio = 3.2:1.

Materials examined: South Africa, Western Cape Province, on Pelargonium cucullatum (Geraniaceae), 1 Apr. 2007, P.W. Crous [holotype CBS H-23499, ex-type culture CBS 143879 = CPC 13920]; Western Cape Province, on Euclrea sp. (Ebenaceae), 16 Apr. 2008, F. Roets, CBS H-23501, living culture CBS 144021 = CPC 15183.

Notes: Two strains representing Sar. africanaum formed a well-supported clade closely related to Sar. proteae (Fig. 2). They are morphologically similar but only share 98 % sequence similarity on rpb2, 96 % on tef1-α and 98 % on tub2. This is the first report of Sarcostroma on Pelargonium cucullatum and Euclrea sp. In contrast, Sar. proteae is thus far only known from Protea magnifica in Australia (see below).
**Sarcostroma australiense** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828389. Fig. 60.

**Etymology**: Referring to the country where it was collected, Australia.

**Culture characteristics**: Colonies on MEA flat with entire edge, sulphur yellow to pure yellow, reaching 60–63 mm diam after 14 d at 21 °C, conidiomata black, gregarious, semi-immersed, stromatic; on CMA flat with entire edge, white, reaching 65 mm diam after 14 d at 21 °C, conidiomata black, scattered or gregarious, acervular, stromatic, semi-immersed; on PDA flat with entire edge, rosy buff, reaching 72–73 mm diam after 14 d at 21 °C, conidiomata black, gregarious, semi-immersed, acervular; on SNA flat with entire edge, white, reaching 47–48 mm diam after 14 d at 21 °C, conidiomata scattered or gregarious, olivaceous, superficial, acervular.

**Description**: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, colourless, smooth, thin-walled. Conidiogenous cells discrete, mostly cylindrical, subcylindrical, 7–16.5 × 1.5–3 μm (av. = 10.9 ± 2.32 × 1.9 ± 0.34 μm), colourless, smooth, with up to three annellations. Conidia fusoid, straight, mostly 3–4-septate, occasionally 7-septate, distal septa thicker than the median septum, wall smooth or undulate, not constricted at the septa, 18–22 × 5–6 μm (av. = 20.2 ± 1.07 × 5.5 ± 0.39 μm) long in 4-septate conidia, 15.5–19.5 × 2–4 μm (av. = 18.4 ± 0.95 × 3 ± 0.41 μm) in 3-septate conidia; basal cell subcylindrical, cylindrical, colourless, 2.5–3.5 μm (av. = 3 ± 0.28 μm) long; median cells 2–3, doliiform or subcylindrical, thick-walled, mid-brown, together 12–15.5 μm (av. = 14 ± 0.78 μm) long in 4-septate conidia, 10.5–13.5 μm (av. = 12.4 ± 0.78 μm) in 3-septate conidia; if 4-septate, the second cell from the basal cell 5–6.5 μm (av. = 5.5 ± 0.5 μm) long, the third and fourth cells equal, each 3–5 μm (av. = 4.3 ± 0.41 μm) long; if 3-septate, the second cell from the basal 4.5–6 μm (av. = 5.4 ± 0.38 μm) long, the third cell 6–8 μm (av. = 7.2 ± 0.54 μm) long; apical cell conical, colourless to pale brown, 2–4 μm (av. = 3 ± 0.41 μm) long; apical appendage single, unbranched, attenuated, filiform, 17.5–29.5 μm (av. = 24.8 ± 3.17 μm) long; basal appendage single, unbranched, filiform, excentric, 18.5–31.5 μm (av. = 25.7 ± 2.85 μm) long; mean conidium length/width ratio = 3.7:1 in 4-septate conidia, 6.1:1 in 3-septate conidia.

**Material examined**: Australia, Victoria, The Gurdies, Gurdies Winery, on *Daviesia latifolia* (Fabaceae), 7 Nov. 2014, P.W. Crous, HPC 107 (holotype CBS H-23521, ex-type culture CBS 144160 = CPC 25389).

**Notes**: The dimensions of 4-septate and 3-septate conidia of *Sar. australiense* differ. The second cell from the base in 4-septate conidia is distinctly longer than the other median cells (5–6.5 μm vs. 3–5 μm), but shorter than another median cell in 3-septate conidia (4.5–6 μm vs. 6–8 μm). This character could distinguish *Sar. australiense* from other known *Sarcostroma* species.

*Another Sarcostroma species, Sar. daviesiae*, was also reported from *Daviesia latifolia* in Australia (*Nag Raj* 1993), but it only produced 4-septate conidia which are longer and wider than *Sar. australiense* (22–29 × 7–8 μm vs. 18–22 × 5–6 μm).

**Sarcostroma diversisepatum** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828390. Fig. 61.

**Etymology**: Refers to the different number of septa compared to other *Sarcostroma* species.

**Culture characteristics**: Colonies on MEA flat with entire edge, white, sterile, reaching 75 mm diam after 12 d at 21 °C; on CMA flat with entire edge, white, with black sector, reaching 67 mm diam after 14 d at 21 °C, conidiomata black, scattered or gregarious, acervular, erumpent, rounded in outline; on PDA flat with entire edge, dark mouse grey, with straw aerial mycelia, sterile, reaching 81 mm diam after 12 d at 21 °C; on SNA flat with entire edge, colourless, sterile, reaching 62–63 mm diam after 14 d at 21 °C.
Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, irregularly branched, colourless, or pale brown, smooth, thin- or thick-walled, often reduced to conidiogenous cells. Conidiogenous cells discrete or integrated, mostly cylindrical or ampulliform, variable in size, 2.5–22 × 2–2.5 μm, colourless, smooth, with up to 3 annellations. Conidia mostly falcate, sometimes fusoid, 5(–6)-septate, pale to mid-brown, wall smooth or verruculose, sometimes constricted at the septa, 18.5–24 × 4.5–6.5 μm (av. = 21 ± 1.33 × 5.7 ± 0.45 μm), bearing appendages; basal cell obconic with a truncate base, or cylindrical and cuneiform, colourless, 1.5–4.5 μm (av. = 2.8 ± 0.53 μm) long; median cells 4–5, fairly thick-walled, pale to mid-brown, doliform or cylindrical, ± equal, each 2–4.5 μm (av. = 3.5 ± 0.51 μm) long; apical cell conical, colourless, 1.5–4 μm (av. = 2.7 ± 0.45 μm) long; basal and apical appendage single, unbranched, attenuated, filiform, flexuous; apical appendage 13.5–35 μm (av. = 20 ± 5.45 μm) long; basal appendage excentric, 10–27.5 μm (av. = 18 ± 4.07 μm) long; mean conidium length/width ratio = 3.7:1.

Materials examined: Australia, Victoria, Brisbane Ranges National Park, native habitat, on Correa reflexa (Rutaceae), 28 Jun. 1972, H.J. Swart, living culture.

Fig. 60. Sarcostroma australiense (CBS 144160/CPC 25389). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–H. Conidiomata on MEA, CMA, PDA and SNA, respectively. I–K. Conidiophores and conidiogenous cells bearing conidia. L–M. 2–3-septate conidia. N. Rarely 7-septate conidium. Scale bars = 10 μm.
Notes: Two strains of Sar. diversiseptatum formed a well-supported and distinct clade (Fig. 2), and are morphologically different from other Sarcostroma spp. by producing 5–6-septate conidia. This is the first report of Sarcostroma on Correa reflexa.

Sarcostroma grevilleae (Loos) M. Morelet, Ann. Soc. Sci. Nat. Toulon et du Var 37(4): 233. 1985. Basionym: Amphichaeta grevilleae Loos, Trans. Brit. Mycol. Soc. 33: 41. 1950.

Culture characteristics: Colonies on MEA convex or dome-shaped, with lobate edge, glaucous blue-green, primrose or rosy buff at different regions, reaching 37–39 mm diam after 14 d at 21 °C, conidiomata black, acervular, stromatic, gregarious, semi-immersed; on CMA flat with entire edge, olivaceous buff pigmented, reaching 51 mm diam after 14 d at 21 °C, conidiomata brown to black, acervular or stromatic, super semi-immersed; on PDA flat, radially striate with lobate edge, white, rosy vinaceous, or black at different regions, reaching 34–41 mm diam after 14 d at 21 °C, conidiomata black, acervular or semi-immersed, acervular, stromatic, scattered; on SNA flat with entire edge, colourless, reaching 28–34 mm diam after 14 d at 21 °C, conidiomata black, scattered or gregarious, acervular, superficial or immersed.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, often reduced to conidiogenous cells, colourless, smooth, invested in mucus. Conidiogenous cells discrete or integrated, mostly cylindrical, subcylindrical, sometimes lageniform or ampulliform, 6.5–17 × 1–2.5 μm (av. = 11.5 ± 2.52 × 1.75 ± 0.3 μm), colourless, smooth. Conidia fusoid, straight or slightly curved, pale to mid-brown, mostly 4-septate, occasionally 5-septate, verruculose, not constricted, 17–22 × 4.5–7 μm (av. = 19.4 ± 1.27 × 5.6 ± 0.59 μm), bearing appendages; basal cell obconic with a broad truncate base, sometimes short cylindrical, hyaline, 1.5–4.5 μm (av. = 2.46 ± 0.53 μm) long; median cells 3, doliform or cylindrical, fairly thick-walled and pale to mid-brown, ± equal, each 3–7 μm (av. = 4.75 ± 0.79 μm) long; apical cell short-conic with an acute apex, hyaline, 1.5–3.5 μm (av. = 2.79 ± 0.46 μm) long; apical appendage single, unbranched, attenuated, tubular, filiform, 22–42 μm (av. = 30.5 ± 4.23 μm) long; basal appendage single, unbranched, tubular, filiform, flexuous, excentric. (–) 14–37 μm (av. = 30 ± 4.93 μm) long; mean conidium length/width ratio = 3.5:1.

Materials examined: Australia. New South Wales, Merimbula, on leaves of Grevillea sp. (Proteaceae), 28 Nov. 2016, P.W. Crous, CBS H-23289, living culture CBS 143416 = CPC 32307; Victoria, Parkville, on Grevillea rosmarinifolia, 2 Jul. 1970, H.J. Swart, reference living culture CBS 101.71 = ATCC 24744; Western Australia, on Hakea laurina (Proteaceae), 24 Sep. 2015, P.W. Crous, living culture CPC 28904; on Hakea laurina, 13 Jul. 2011, W. Gams, living culture CPC 19838.

Notes: The colonies of single-spore isolates of Sar. grevilleae contained two colour sections, one being olivaceous to black and the other white (Fig. 62A, C), which is congruent with the original description of the basionym Amphichaeta grevilleae (Loos 1950). In addition, numerous acervuli were formed on the surface of the colourful section, while the white area had abundant mycelia but remained sterile. Since none of our isolates was from the original location of isolation (Sri Lanka), strain CBS 101.71 from Grevillea rosmarinifolia from Australia is considered here as reference culture of Sar. grevilleae.

Sarcostroma leucospermi F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828391. Fig. 63. Etymology: Refers to the host plant, Leucospermum.
Culture characteristics: Colonies on MEA flat with entire edge, yellow-green with white edge, sterile, reaching 85–87 mm diam after 14 d at 21 °C; on CMA flat with entire edge, glaucous to smoke grey, sterile, reaching 67–69 mm diam after 14 d at 21 °C; on PDA low convex with entire edge, glaucous, aerial mycelia flocculent, sterile, reaching 85–86 mm diam after 14 d at 21 °C; on SNA flat with entire edge, colourless, sterile, reaching 66–67 mm diam after 14 d at 21 °C.

Description (on OA): Sexual morph: unknown. Asexual morph: Conidiomata black, scattered, stromatic, covered by aerial mycelia. Conidiophores septate, branched, colourless, smooth, thin-walled. Conidiogenous cells mostly cylindrical, sometimes lageniform, discrete, 4.5–20.5 × 1.5–2.5 μm, colourless, smooth, with up to 3 annellations. Conidia fusoid, straight or sometimes slightly curved, 4(–5)-septate, wall smooth or undulate, 14–21.5 × 5–7.5 μm (av. = 18.3 ± 2.21 × 6.4 ± 0.67 μm), bearing...
appendages; basal cell obconic with a truncate base, cuneiform, occasionally short cylindrical, periclinal wall thin and colourless, 1.5–3.5 μm (av. = 2.6 ± 0.45 μm) long; median cells 3–4, fairly thick-walled, pale to mid-brown, doliiform or cylindrical, the second cell from base 4–6.5 μm (av. = 5.3 ± 0.62 μm) long, the other median cells ± equal, each 3–5 μm (av. = 4.2 ± 0.5 μm) long; apical cell conical, colourless, 1.5–3 μm (av. = 2.5 ± 0.39 μm) long; basal and apical appendage single, unbranched, attenuated, tubular, filiform, flexuous; apical appendage 18–36 μm (av. = 27.3 ± 4.1 μm) long; basal appendage excentric, 22–35 μm (av. = 16.9 ± 3.34 μm) long; mean conidium length/width ratio = 2.9:1.

Materials examined: South Africa, Western Cape Province, Porterville, on Leucospermum 'High Gold' (Proteaceae), 29 Aug. 1996, S. Denman (holotype CBS H-23547, ex-type culture CBS 111290 = CPC 1422); ibid., living culture CBS 111309 = CPC 1420.

Notes: Two strains representing Sar. leucospermi clustered in a well-supported clade closely related to Sar. longiappendiculatum (100 % sequence similarity in ITS, 99 % on rpb2, 99 % on tef-1α and 98 % on tub2) (Fig. 2), but they are morphologically different in conidial characters. The second cell from the base is relatively longer than other median cells in Sar. leucospermi, while the length of median cells in Sar. longiappendiculatum are ± equal. In addition, the mean conidium length/width ratio in Sar. leucospermi is much smaller than in Sar. longiappendiculatum (2.9:1 vs. 4.2:1).

Sarcostroma longiappendiculatum F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828392. Fig. 64.

Etymology: Refers to the long appendages observed in this species.

Culture characteristics: Colonies on MEA flat with entire edge, greenish glaucous to yellow-green, with white margin, reaching 75–76 mm diam after 14 d at 21 °C, conidiomata black, gregarious, semi-immersed, acervular; on CMA flat with entire edge, greenish glaucous, reaching 65 mm diam after 14 d at
Fig. 64. Sarcostroma longiappendiculatum (CBS 143890/CPC 23411). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–H. Conidiomata on MEA, CMA, PDA and SNA, respectively. I–J. Conidiophores. K. Conidia. Scale bars = 10 μm.
21 °C, conidiomata black, scattered or gregarious, acervular, superficial or gregarious; on PDA flat with entire edge, with flocculent aerial mycelia, greyish yellow-green, reaching 78–79 mm diam after 14 d at 21 °C, conidiomata black, scattered, acervular; on SNA flat with undulate edge, white, reaching 42–49 mm diam after 14 d at 21 °C, conidiomata black, gregarious, acervular.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, colourless, smooth, thin-walled, sometimes reduced to conidiogenous cells. Conidiogenous cells discrete or integrated, mostly cylindrical, subcylindrical, 7–13.5 × 1–2.5 μm (av. = 11 ± 1.64 × 1.7 ± 0.23 μm), colourless, smooth. Conidia lunate or fusoid, curved or occasionally straight, 4-septate, wall smooth or undulate, not constricted at the septa, 19–23.5 × 3–6.5 μm (av. = 21 ± 1.06 × 5 ± 0.7 μm), bearing appendages; basal cell obconic with a truncate base, colourless to pale brown, 2.5–4 μm (av. = 3.4 ± 0.32 μm) long; median cells 3, cylindrical or subcylindrical, thick-walled, mid-brown or yellowish brown, together 12.5–15.5 μm (av. = 13.8 ± 0.84 μm) long (each 3.5–5.5 μm (av. = 4.5 ± 0.41 μm)); apical cell conical, colourless or occasionally pale brown, 3–5 μm (av. = 3.8 ± 0.42 μm) long; apical appendage single, filiform, unbranched, attenuated, 25–35 μm (av. = 30 ± 2.15 μm) long; basal appendage single, unbranched, filiform, excentric, 21–37 μm (av. = 28.7 ± 3.45 μm) long; mean conidium length/width ratio = 4.2:1.

Materials examined: France, Nice Botanical Garden, on Babiana dregei (Iridaceae), 24 Jul. 2013, P.W. Crous (holotype CBS H-23513, ex-type culture CBS 143890 = CPC 23411). South Africa, Western Cape Province, Porterville, on Leucospermum ‘High Gold’ (Proteaceae), 29 Aug. 1996, S. Denman, living culture CBS 111308 = CPC 1421 = STE-U 1421.

Notes: This is the first report of Sarcostroma on Babiana dregei. See notes under Sar. leucospermi.

Sarcostroma paragrevilleae F. Liu, L. Cai & Crous, sp. nov.

MycoBank MB828393. Fig. 65.

Etymology: Named after its close phylogenetic relationship to Sarcostroma grevilleae.
Culture characteristics: Colonies on MEA radially striate with lobate edge, white to olivaceous buff, reaching 32 mm diam after 14 d at 21 °C; on CMA flat with entire edge, white, reaching 38 mm diam after 14 d at 21 °C; on PDA flat with irregular edge, white, with olivaceous buff pigmentation, reaching 26–45 mm diam after 14 d at 21 °C; on SNA flat with entire edge, colourless, reaching 37–39 mm diam after 14 d at 21 °C.

Description: Sexual morph: unknown. Asexual morph: Sterile on MEA, PDA and SNA. On CMA, conidiomata only observed around the inoculation point, black, discrete, acervular, erumpent. Conidiophores septate, irregularly branched, colourless, smooth, thin-walled. Conidiogenous cells discrete or integrated, mostly cylindrical, variable in size, 10–40 × 1.5–2.5 μm (av. = 25.5 ± 7.9 × 1.8 ± 0.24 μm), colourless, smooth. Conidia fusoid, oval, mostly slightly curved, 4-septate, wall smooth or verruculose, 14.5–21 × 7–8.5 μm (av. = 18.1 ± 1.48 × 7.9 ± 0.44 μm), bearing appendages; basal cell obconic with a narrow or broad truncate base, colourless, 1.5–2.5 μm (av. = 1.9 ± 0.32 μm) long; median cells 3, fairly thick-walled, yellowish brown or mid-brown, doliform, ± equal, each 3.5–6 μm (av. = 4.7 ± 0.79 μm) long; apical cell short-conic with an acute apex, colourless, 1.5–3 μm (av. = 2.3 ± 0.28 μm) long; basal and apical appendages single, unbranched, attenuated, tubular, filiform, flexuous; apical appendage variable in size, 8–31 μm (av. = 17.6 ± 5.54 μm) long; basal appendage excentric, (5.5–)9–27 μm (av. = 17.6 ± 4.3 μm) long; mean conidium length/width ratio = 2.3:1.

Materials examined: Australia, New South Wales, Mangrove Mountain, on Grevillea sp. (Proteaceae), 12 Oct. 1999, P.W. Crous, living culture CBS 111981 = CPC 2937; on Grevillea sp., 12 Oct. 1999, P.W. Crous, living culture CBS 114143 = CPC 2938; Mount Tomah, on Grevillea sp., 12 Oct. 1999, P.W. Crous (holotype CBS H-23550, ex-type culture CBS 114142 = CPC 2948 = JT 878 = STE-U 2948); Victoria, unknown host, 13 Dec. 1988, unknown collector, living culture CPC 28310; Victoria, Mount Waverley, on Grevillea rosmarinifolia, 29 Jun. 1976, unknown collector, living culture CPC 28309; Victoria, Melbourne, Royal Botanical Gardens Melbourne, on leaves of Grevillea steiglitziana, 2 Dec. 2016, P.W. Crous, living culture CBS 143416 = CPC 32360; on Grevillea aquifolia, 18 Oct. 2009, P.W. Crous, living culture CPC 17628; Western Australia, on Grevillea sp., 29 Sep. 2015, P.W. Crous, HPC 756, living culture CPC 29006; on Banksia (Proteaceae), 23 Sep. 2015, P.W. Crous, living culture CPC 29056; New Zealand, Waitakere, on Grevillea robusta var. forsteri leaf, Feb. 1974, H.J. Boesewinkel, living culture CBS 165.77 = IMI 211586.

Notes: Several strains of Sar. paragrevilleae formed a sister clade to Sar. grevilleae (Fig. 2), another species from Grevillea (99 % sequence similarity in ITS, 94 % on tef-1α and 98 % on tub2). However, they can be morphologically distinguished from each other by the difference in mean conidium length/width ratio (2.3:1 vs. 3.5:1).

Sarcostroma proteae F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828394. Fig. 66.
**Etyymology:** Refers to the host plant, *Protea magnifica*.

**Culture characteristics:** Colonies on MEA flat with entire edge, white to grey, with flocculent aerial mycelia, reaching 40 mm diam after 14 d at 21 °C; on CMA flat with entire edge, white, aerial mycelia sparse, with flocculent mycelia around the inoculation point, reaching 61–63 mm diam after 14 d at 21 °C; on PDA low convex with entire edge, with flocculent aerial mycelia, rosy buff, reaching 67–68 mm diam after 14 d at 21 °C; on SNA hyaline, flat with undulate edge, reaching 48–49 mm diam after 14 d at 21 °C.

**Description:** Sexual morph: unknown. Asexual morph: Sterile on MEA, CMA and PDA. On SNA, *coniidiomata* brown to black, scattered or gregarious, acervular, erumpent, globose or irregular. *Conidiophores* septate, irregularly branched at the base, colourless, smooth, thin-walled, often reduced into conidiogenous cells. *Conidiogenous cells* discrete, mostly cylindrical, sometimes ampulliform or lageniform, 5.5–15 x 1.5–2.5 μm (av. = 10.7 ± 2.88 x 2 ± 0.24 μm), colourless, smooth, with up to two annellations. *Conidia* fusoid, straight or slightly curved, 4-septate, wall smooth or verruculose, not constricted or slightly constricted at the septa, 13–20.5 x 4–6.5 μm (av. = 16.2 ± 1.48 x 5.5 ± 0.68 μm), bearing appendages; basal cell obconic with a narrow truncate base, pericllar wall relatively thinner than median cells, colourless, 1.5–3.5 μm (av. = 2.5 ± 0.4 μm) long; median cells 3, fairly thick-walled, yellowish-brown, doliform or cylindrical, ± equal, each 3–5.5 μm (av. = 4 ± 0.52 μm) long; apical cell short-conic with an acute apex, colourless, 2.5–4 μm (av. = 3.1 ± 0.33 μm) long; basal and apical appendage single, unbranched, attenuated, tubular, flexuous; apical appendage 8–24 μm (av. = 17.5 ± 3.62 μm) long; basal appendage excentric, 10–24 μm (av. = 18.4 ± 3.38 μm) long; median conidium length/width ratio = 2.9:1.

**Materials examined:** Australia, New South Wales, Mount Tomah, on *Protea magnifica* (Proteaceae), Aug. 1999, P.W. Crous, living culture CBS 114189 = CPC 29683; on *Protea magnifica*, Aug. 1999, P.W. Crous, living culture CBS 112001 = CPC 2981; New South Wales, Mount Tomah, on *Protea magnifica*, 12 Oct. 1999, P.W. Crous (*holotype* CBS H-23549, ex-type culture CBS 113610 = CPC 3035); New South Wales, Mount Tomah, on *Protea ionantha*, 12 Oct. 1999, P.W. Crous, living culture CBS 113605 = CPC 3032 = JT 942.

**Notes:** Four strains representing *Sar. protea* formed a well-supported clade closely related to *Sar. africanum* (Fig. 2). They are morphologically similar but only share 98 % sequence similarity on *rpb2*, 96 % on *tef-1α* and 98 % on *tub2*. Sarcotrama protea is so far only known from *Protea* in Australia.

**Sarcostroma protea** S.J. Lee & Crous, Stud. Mycol. 55: 182. 2006.

**Description:** See Lee et al. (2006).

**Materials examined:** Australia, Western Australia, on *Acacia glaucoptera* (Fabaceae), 18 Sep. 2015, P.W. Crous, HPC 727, living culture CPC 29466. New Zealand, on unknown host, 12 Aug. 1996, M.E. Palm, living culture CBS 111311 = CPC 1472 = STE-U 1472. South Africa, Western Cape Province, Stellenbosch, Jonkershoek Nature Reserve, on *Ischyrolepis* cf. sieberi (Restioaceae) dead culm, 15 Jun. 2001, S. Lee, living culture CBS 118153 = CMW 17984 = CPC 16911; on leaf litter of *Protea acaulis* (Proteaceae), 14 Aug. 2000, unknown collector, living culture CBS 122695 = CMW 22214; Kogelberg Nature Reserve, leaf litter of *Leucospermum conocarpodendron* subsp. *viridum* (Proteaceae), 11 Jul. 2000, S. Marinowicz, living culture CBS 121418 = CMW 22195; on *Restio fliformis* (Restionaceae), 15 Jan. 2001, S. Lee (*holotype* PREM 58685, ex-type living culture CBS 118154 = CMW 17971 = CPC 16904); Riverstrand, Kanelberg Flora, on Leucospermum, 27 Aug. 1999, collected by USA quarantine staff, living culture CBS 111936 = CPC 2835 = STE-U 2835; ibid., living culture CBS 111935 = CPC 2834 = STE-U 2834; ibid., living culture CBS 114017 = CPC 2832 = STE-U 2832. UK, England, Cumbria, Roudsea Wood Nature Reserve, on *Plenodium aquilinum* (Dennstaedtiaceae) dead petiole, unknown collection date, isolated by J.C. Frankland, reference strain of Cryptostictis hakeae CBS 282.65 = NRBC 32678 = IMI 069703.

**Notes:** Cryptostictis hakeae (current name: *Sar. hakeae*, Nag Raj 1993) was originally reported from *Hakea* in Australia, and its reference strain clustered together with *Sar. restionis*. As no isolate from *Hakea* was obtained for epitypification and taxonomic determination of *Sar. hakeae* in this study, we retain the name *Sar. restionis* for this species.

**Seimatosporium** Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.). 3(13): 79. 1833. emend. F. Liu, L. Cai & Crous.

**Synonym:** Diplcoceras (Sacc.) Died., Mykol. Untersch. Ber.: 342. 1915.

**Description:** Sexual morph: unknown. Asexual morph: *Conidiomata* acervular, pycnidial, stromatic, semi-immersed to erumpent, glabrous, brown to black, dehiscing by a break in the overlaying host tissues; basal stroma of *textura angularis*. *Conidiophores* arising from the upper layer of cells of the basal stroma or lining the base and sides of the conidioma, septate and branched, colourless, smooth. *Conidiogenous cells* discrete or integrated, subcylindrical, cylindrical, ampulliform or lageniform, annellidic, colourless or almost colourless to pale brown, thin-walled, smooth. *Conidia* fusoid, ellipsoid, ovoid, clavate, eusepalous, wall smooth, sometimes constricted at the septa; basal cell obconic with a truncate base, smooth, colourless; median cells pale brown to brown, concolourous; apical cell without apical appendage pale brown and concolourous with the median cells, but apical cell with an appendage paler or almost colourless; conidia with basal appendage only, or with no appendages, or with appendages at both ends, filiform, flexuous, attenuated; apical appendage (when present) single, unbranched; basal appendage single, branched or unbranched, excentric (emended from Nag Raj 1993).

**Type species:** *Seimatosporium rosae Corda.*

**Seimatosporium germanicum** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828395. Fig. 67.

**Etyymology:** Referring to the country where it was collected, Germany.

**Culture characteristics:** Colonies on MEA flat with entire edge, luteous, reaching 54–55 mm diam after 14 d at 21 °C, conidiomata black, acervular, confluent, superficial; on CMA flat with entire edge, uneven saffron to luteous pigment, reaching 48–51 mm diam after 14 d at 21 °C, conidiomata brown or black, acervular, scattered or confluent, radially arranged, superficial or immersed; on PDA flat with entire edge, saffron, reaching 54–55 mm diam after 14 d at 21 °C, conidiomata brown or black, acervular, scattered or gregarious, superficial; on SNA hyaline, reaching 60–63 mm diam after 14 d at 21 °C, conidiomata brown, smoke brown, acervular, scattered or gregarious, superficial or immersed, radially arranged.

**Description:** Sexual morph: unknown. Asexual morph: *Conidiophores* septate, irregularly branched, colourless to pale brown, smooth. *Conidiogenous cells* discrete or integrated, mostly cylindrical, sometimes ampulliform, 8.5–16 x 1–2.5 μm (av. = 1.2 ± 2.2 x 1.6 ± 0.31 μm), colourless or pale brown, smooth, with up to two annellations. *Conidia* falcate, or straight
with curve at apical cell, 3-septate, wall smooth, 15.5–21.5 × 3–4.5 μm (av. = 18.6 ± 1.42 × 3.6 ± 0.4 μm), bearing appendages; basal cell obconic with a truncate base, or subcylindrical, hyaline, 2.5–4 μm (av. = 3.2 ± 0.42 μm) long; median cells 2, fairly thick-walled and pale brown, cylindrical, ± equal, each 4–8 μm (av. = 5.6 ± 0.71 μm) long; apical cell conic with an acute apex, hyaline, 1.5–5.5 μm (av. = 3.6 ± 0.88 μm) long; apical appendage lacking or, when present, tubular, filiform, single, unbranched, attenuated, 2–16 μm (av. = 9.6 ± 3.62 μm) long; basal appendage lacking or, when present, single, tubular, filiform, unbranched, attenuated, excentric, 1.5–14 μm (av. = 8.7 ± 4.05 μm) long; mean conidium length/width ratio = 5.2:1.

Material examined: Germany, Frankfurt, unknown host, collection date and collector, deposited by J. Wink in CBS culture collection (holotype CBS H-17989, ex-type culture CBS 437.87).

Notes: Seimatosporium germanicum is closely related to Sei. pistaciae and Sei. rosae (Fig. 2, 99 % sequence similarity on ITS and rpb2, 93 % on tef-1α, and 99 % on tub2), but differs from both species in mean conidium length/width ratio (5.2:1 vs. 4.4:1 and 3:1).

Seimatosporium pistaciae Crous & Mirab., Persoonia 33: 249. 2014. Fig. 68.

Description: Sexual morph: unknown. Asexual morph: Conidiomata pycnidialoid, separate to gregarious, becoming erumpent, oval to elongate, up to 150 μm diam. Conidiophores arising from a central stroma, hyaline, 3–4-septate, branched, subcylindrical, 20–45 × 3–4 μm. Conidiogenous cells terminal and intercalary, hyaline, smooth, subcylindrical, straight to somewhat curved, 10–15 × 2–2.5 μm, proliferating inconspicuously percurrently at apex. Conidia ellipsoid to fusoid, cylindrical, straight or slightly curved, mostly 3-septate, occasionally 5–6-septate, smooth, not
constricted at septa, median cells medium brown, basal and apical cell colourless to pale brown, granular, 14–23 × 3.5–5 μm (av. = 18.6 ± 1.1 × 4.2 ± 0.3 μm), apical cell obtusely rounded or conical with an acute apex; apical appendage, when present, single, unbranched, tubular, filiform, flexuous, 5–14 μm; basal appendage single, unbranched, tubular, filiform, flexuous, excentric, 5–20 μm; mean conidium length/width ratio = 4.4:1 (emended from Crous et al. 2014b).

Materials examined: Iran, Saveh, on buds of Pistacia vera (Anacardiaceae), 29 Apr. 2014, M. Mirabolfathy (holotype CBS H-21997, ex-type culture CBS 138865 = CPC 24455); ibid., living culture CPC 24457.

Note: See notes under Sei. rosae.

Seimatosporium rosae Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 3(13): 79. 1833. Fig. 68.

Description: Sexual morph: unknown. Asexual morph: Conidiomata acervular, semi-immersed or immersed, glabrous, brown to black; wall cells of textura angularis. Conidiophores arising from the upper cells of the basal and lateral tissue, septate and branched, colourless, thin-walled, smooth. Conidiogenous cells cylindrical or subcylindrical, colourless, thin-walled, smooth, formed from the inner most layer of pycnidium wall. Conidia 10–16 × 3–4.5 μm (av. = 13.8 ± 0.8 × 4 ± 0.3 μm), fusoid, reniform, straight or slightly curved, 3-septate; basal cell obconic, thin-walled, colourless, 2–3 μm long (av. = 2.4 ± 0.33 μm); median cells doliiform to cylindrical, not constricted at septa, brown, concolourous, septa darker than the rest of the cell, ± equal, each 3–5.5 μm (av. = 4.5 ± 0.46 μm) long; apical cell colourless or almost colourless, conical, 2–3.5 μm long (av. = 2.6 ± 0.44 μm); appendages tubular, filiform, variable in size; apical appendage single, arising from the apex of the apical cell, 1.5–15 μm long (av. = 6.9 ± 4.89μm); basal appendage single, 1–14.5 μm long (av. = 4.8 ± 4.54 μm); mean conidium length/width ratio = 3.45.

Materials examined: Russia, Rostov region, Krasnosulinsky district, Donskoy forestry, on dying and dead branches of Rosa kalmiuica (Rosaceae), 21 May 2014, T. Bulgakov T.056 (epitype MFLU 14-0771, ex-epitype culture CBS 139823 = MFLUCC 14–0621).
Notes: The generic type species *Seimatosporium rosae* (Corda 1833) was recently epitypified by Norphanphoun *et al.* (2015). It shows surprisingly high sequence similarities with *Sei. pistaciae* (Fig. 2, 100 % on ITS and rpb2, 99 % on tef-1α and tub2), but differs from the latter in the morphology of its conidiomata and conidia. The conidiomata of *Sei. rosae* on artificial media (MEA, CMA, PDA) are acervular, scattered, semi-immersed or immersed, while *Sei. pistaciae* usually produces conidial masses rather than acervulous conidiomata, confluent, mostly immersed (Fig. 68). *Seimatosporium rosae* further produces smaller conidia than *Sei. pistaciae* (10–16 × 3–4.5 μm vs. 14–23 × 3.5–5 μm) and different numbers of septa (3-septate vs. 3–6-septate).

*Seimatosporium soli* F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828396. Fig. 69.

**Etymology**: Named after the substrate of this fungus, soil.

**Culture characteristics**: Colonies on MEA flat with entire edge, pale grey, with few radial circular lines from the centre, sterile, reaching 75–76 mm diam after 14 d at 21 °C; on CMA flat with entire edge, colourless, sterile, reaching > 90 mm diam after 14 d at 21 °C; on PDA flat with entire edge, buff, sterile, reaching 78 mm diam after 14 d at 21 °C; on SNA flat with entire edge, colourless, sterile, reaching 35–36 mm diam after 14 d at 21 °C.

**Description**: Sexual morph: unknown. Asexual morph: Conidiophores branched, reduced to conidiogenous cells, colourless, smooth. Conidiogenous cells discrete, mostly cylindrical or subcylindrical, 4.5–12 × 1.5–2.5 μm (av. = 8.5 ± 1.9 × 2.2 ± 0.31 μm), colourless, smooth. Conidia fusoid, curved, 3-septate, wall smooth, 13.5–18 × 2.5–4 μm (av. = 16.4 ±
1.23 × 3.3 ± 0.33 μm), bearing appendages; basal cell trapezoid, subcylindrical, thin-walled, hyaline to pale brown, 2–3.5 μm (av. = 3 ± 0.39 μm) long; median cells 2, cylindrical, thick-walled, pale to mid-brown, ± equal, each 3.5–6 μm (av. = 4.7 ± 0.67 μm) long; apical cell conic with an acute apex, thin-walled, hyaline to pale brown, 2.5–4.5 μm (av. = 3.7 ± 0.43 μm) long; apical appendage single, attenuated, tubular, unbranched, hyaline, occasionally pale brown, 2–11(–15) μm (av. = 5.9 ± 2.85 μm) long; basal appendage lacking or, when present, attenuated, tubular, single, unbranched, excentric, (1–)3–11.5 μm (av. = 6 ± 2.4 μm) long; mean conidium length/width ratio = 5:1.

Material examined: Denmark, Jutland, from forest soil under Fagus sylvatica (Fagaceae), unknown collection date, L. Holm (holotype CBS H-23545, ex-type culture CBS 941.69).

Notes: The ex-type culture of Sei. soli (CBS 941.69) is sterile on MEA, CMA, PDA, OA and SNA, and only a few conidiogenous cells and conidia were observed from the agar that was directly taken from −80 °C. Seimatosporium soli is closely related to Sei. vitis-viniferae (89 % sequence similarity on ITS, 90 % on rpb2, 81 % on tef-1α) and Sei. physocarpi (89 % sequence similarity on ITS, 90 % on rpb2, 77 % on tef-1α) (Fig. 2), but morphologically differs from both species in the shape of conidia (curved vs. straight to slightly curved) and the mean conidium length/width ratio (5:1 vs. 3.2:1). In addition, the basal appendages of Sei. soli are generally shorter than those of Sei. physocarpi (3–11.5 μm vs. 12–14 μm).

Seimatosporium vitis-viniferae F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828397. Fig. 70.

Etymology: Name reflects the host plant it was isolated from, Vitis vinifera.

Culture characteristics: Colonies on MEA flat with entire edge, olivaceous to purplish grey, reaching 55–56 mm diam after 14 d at 21 °C, conidiomata brown, confluently immersed; on CMA flat with entire edge, white to pale yellow, reaching 45–46 mm diam after 14 d at 21 °C, conidiomata black, acervular, scattered, superficial or immersed; on PDA flat with entire edge, yellowish brown to mid-brown, reaching 57–60 mm diam after 14 d at 21 °C, conidiomata glaucous grey, mid-brown or black, acervular, scattered or gregarious, superficial; on SNA pale grey, reaching 34 mm diam after 14 d at 21 °C, conidial masses yellowish brown, acervular, scattered or gregarious, superficial or immersed.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, irregularly branched, sometimes reduced to conidiogenous cells, colourless, smooth. Conidiogenous cells discrete or integrated, mostly cylindrical, variable in size,
4.5–25 × 2–3 μm, colourless, smooth, with up to two annellations. *Conidia* cymbiform, fusoid, straight, 3(–6)–septate, wall smooth, 13.5–26 × 4.5–6 μm (av. = 16.5 ± 2.63 × 5.2 ± 0.37 μm), bearing appendages; basal cell obconic with a truncate base, subcyllindrical, colourless or similar to that of median cells, 2.5–4 μm (av. = 3 ± 0.45 μm) long; median cells 2(–4), fairly thick-walled and pale brown to yellowish brown, ± equal, each 3.5–5.5 μm (av. = 4.5 ± 0.51 μm) long; apical cell obconic or conical, colourless, sometimes similar to that of median cells, 1.5–4.5 μm (av. = 3.2 ± 0.69 μm) long; apical appendage lacking or, when present, single, unbranched, attenuated, 4–11 μm (av. = 7 ± 1.64 μm) long; basal appendage single, unbranched, excentric, 4–10 μm (av. = 7.9 ± 1.58 μm) long; mean conidium length/width ratio = 3.2:1.

Materials examined: *Iran*, on *Vitis vinifera* (Vitaceae, endophyte), unknown collection date, T. Grafenhahn, living culture CBS 116499 = V3055. *Spain*, Madrid, Casa de Campo, Escuela de la Vid, on dead stem of *Vitis vinifera*, o n *Vitis vinifera*, collection date, T. Grafenhahn, living culture CBS 116499 = V3055. *Spain*, Madrid, Casa de Campo, Escuela de la Vid, on dead stem of *Vitis vinifera*, o n *Vitis vinifera*, collection date, T. Grafenhahn, living culture CBS 116499 = V3055.

Notes: In addition to *Sei. vitis-viniferae*, six other *Seimatosporium* species have been reported from *Vitis vinifera*, which are *Sei. botan*, *Sei. hysterioides*, *Sei. lichenicola* (current name: *Spor. lichenicola*), *Sei. lichenicola* (current name: *Spor. lichenicola*), *Sei. lichenicola* (current name: *Spor. lichenicola*), *Sei. vitis-viniferae* (Farr & Rossman 2018). Based on the phylogeny (Fig. 2), *Sei. vitis-viniferae* is well separated from *Sei. botan* and *Sei. lichenicola*. Although the only existing LSU and ITS sequences of *Vitis* are identical to *Sei. vitis-viniferae*, their conidial dimensions are clearly distinct (34–40 × 14–17 μm in *Sei. vitis* vs. 13.5–26 × 4.5–6 μm in *Sei. vitis-viniferae*). In addition, the description and illustration of conidia from Senanayake et al. (2015) indicated that *Sei. vitis* only produces basal appendages, while *Sei. vitis-viniferae* produces appendages basally, or at both conidial ends.

Although the other *Vitis vinifera* related species lack type-derived sequences for comparison, they are morphologically distinct from *Sei. vitis-viniferae*. *Seimatosporium vitis-viniferae* differs from *Sei. hysterioides* in producing smooth conidia that do not have collapsed walls, and more septa (3–6 vs. 3) and a larger mean conidium length/width ratio (3.2:1 vs. 2.5:1) (Nag Raj 1993); and differs from *Sei. parasiticum* (Nag Raj 1993). Compared to *Sei. lichenicola* (Nag Raj 1993), *Sei. vitis-viniferae* produces relatively larger conidia (13.5–26 × 4.5–6 μm, av. = 16.5 ± 5.2 μm vs. 9–16 × 3.5–5 μm, av. = 13 ± 4.4 μm) and with more septa (3–6 vs. 2–3).

*Sporocadus* Corda, licon. fung. (Prague) 3: 23. 1839.

Type species: *Sporocadus lichenicola* Corda.

Description: *Conidiodoma* stromatic, acervular, erumpent, dark brown to black. *Conidiodomes* arising from the upper cells of the basal stroma or lining the cavity of the conidioma, septate and branched, sometimes reduced to conidiodogenous cells, colourless, thin-walled. *Conidiodogenous cells* discrete or integrated, lageniform, clavate, obclavate, subcyllindrical or cylindrical, colourless, thin-walled, smooth. *Conidia* obvoid, ellipsoid, subcyllindrical, pyriform or clavate, straight or curved, smooth, 1–7-septate, mostly 3-septate; basal cell obconic with a truncate base, colourless or concolourous with median cells, thin- or thick-walled; median cells cylindrical or doliform, thick-walled, pale-brown to brown; apical cell conic with round apex, concolourous with median cells; appendage absent in most species, when present, single, unbranched, filiform, tubular, flexuous; basal appendage excentric.

Notes: *Sporocadus* was proposed to accommodate four species (*Spor. herbarum*, *Spor. georginiae*, *Spor. lichenicola*, and *Spor. maculans*) but without designation of a generic type (Corda 1839). Later, Hughes (1958) lectotypified *Sporocadus* based on *Spor. lichenicola*.

*Sporocadus* was subsequently synonymised with *Seimatosporium* under the broad generic concept employed by Sutton (1975a). In contrast, Brockman (1976) and Nag Raj (1993) accepted *Sporocadus* as distinct from *Seimatosporium*, and it was characterised by one type of conidium lacking appendages as in *Spor. lichenicola* (Nag Raj 1993). Based on the multi-locus phylogenetic analyses in the present study, *Sporocadus* and *Seimatosporium* formed two sister clades (Figs 1, 2), and all strains that lack appendages clustered in the *Sporocadus* clade. We therefore resurrect *Sporocadus* and epitypify *Spor. lichenicola* to stabilise the application of the generic name.

This genus is generally characterised by 3-septate, fusoid, cylindrical and obovoid conidia lacking appendages. However, the two basal species of *Sporocadus* (*Spor. trimorphus* and *Spor. rosarum*; Fig. 2) produce non-appendaged as well as appendaged conidia.

*Sporocadus bisepatus* F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828398. Fig. 71.

Etymology: Name reflects the fact that it has 2-septate conidia.

Culture characteristics: Colonies on MEA flat with undulate edge, fuscous black, reaching 58–61 mm diam after 14 d at 21 °C, conidiomata black, acervular, superficial, confluent; on CMA flat with entire edge, black, reaching 45–46 mm diam after 14 d at 21 °C, conidiomata scattered or gregarious, acervular, superficial or immersed; on PDA flat with entire edge, brown, reaching 74–75 mm diam after 14 d at 21 °C, conidiomata dark brown to black, acervular, scattered or gregarious, superficial or immersed; on SNA flat with undulate edge, pale brown, reaching 28–30 mm diam after 14 d at 21 °C, conidiomata pale brown, acervular, superficial or immersed, scattered, gregarious, or confluent.

Description: Sexual morph: unknown. Asexual morph: *Conidiodome* sepalate, irregularly branched, colourless, smooth. *Conidiodogenous cells* discrete or integrated, clavate, cylindrical, obclavate, ampulliform or sometimes subglobose, 3–11.5 × 1.5–2.5 μm (av. = 6.6 ± 2.79 × 1.8 ± 0.29 μm), colourless, smooth. *Conidia* pyriform, obvoid, hyaline to pale brown, 2-septate, wall smooth, some constricted at the septa, 12.5–19.5 × 4.5–9 μm (av. = 15.8 ± 1.77 × 6.9 ± 1.17 μm), lacking appendages; basal cell obconic with a round or acute base, occasionally with narrow truncate base, hyaline, or concolourous with median cells, 3–5.5 μm (av. = 4.1 ± 0.51 μm) long; median cell doliform, fairly thick-walled and pale brown, 3.5–7.5 μm (av. = 5.1 ± 0.76 μm) long; apical cell conic with round apex, pigmentation similar to that of the median cells, 4.5–8 μm (av. = 5.8 ± 1.06 μm) long; mean conidium length/width ratio = 2.3:1.

Material examined: Unknown collection information (holotype CBS H-23627, ex-type culture CBS 123004 = F-274).
Notes: *Sporocadus biseptatus* is the only species in the genus *Sporocadus* that produces 2-septate, non-appendaged conidia. Also see notes under *Spo. microcyclus*.

*Sporocadus cornicola* (Wijayaw. & Camporesi) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828399. Fig. 72.

Basionym: *Seimatosporium cornicola* Wijayaw. & Camporesi, Mycosphere 7: 209. 2016.

**Culture characteristics**: Colonies on MEA radially striate with lobate edge, salmon, reaching 75–81 mm diam after 14 d at 21 °C, conidiomata scattered or gregarious, black, acervular; on CMA, flat with entire edge, flesh, reaching 63 mm diam after 14 d at 21 °C, conidial masses scattered, scarce, black; on PDA flat with entire edge, buff, reaching 90 mm diam after 14 d at 21 °C, conidiomata scattered or gregarious, olivaceous to black; on SNA, colourless, flat with entire edge, reaching 73 mm diam after 14 d at 21 °C, conidial masses olivaceous, black, superficial, scattered or gregarious, often covered by aerial mycelia.

**Description** (On SNA): Sexual morph: unknown. Asexual morph: *Conidiophores* septate, irregularly branched, colourless, smooth. *Conidiogenous cells* cylindrical, variable in size, 8–34 × 1.5–3 μm (av. = 14.7 ± 6.1 × 2.5 ± 0.42 μm), colourless, sometimes pale brown, smooth, discrete or integrated. *Conidia* obovoid, clavate, straight, occasionally curved, mostly 3-septate, occasionally 5–6-septate, wall smooth, barely constricted at the septa, 17.5–23(–32) × 5.5–7.5 μm (av. = 20.9 ± 1.18 × 6.7 ± 0.45 μm), lacking appendages; basal cell obconic with truncate base, colourless or pale brown, 3–5(–9) μm (av. = 4.2 ± 0.38 μm) long; median cells mostly 2, occasionally 4–5, fairly thick-walled, pale to mid-brown, cylindrical, ± equal, each 4–6 μm (av. = 5.3 ± 0.5 μm) long, together 9.5–14.5 μm.
(av. = 11.2 ± 1.26 μm) long; apical cell short-conic with round apex, concolourous with median cells, 3–7 μm (av. = 5.6 ± 0.9 μm) long; mean conidium length/width ratio = 3.4:1. On MEA: Microcyclic conidiogenesis present. Conidia sometimes protruding at apical, basal or median cells, 0–1-septate, variable in size, 1.5–11 × 1–3.5 μm (av. = 5.3 ± 2.54 × 2.4 ± 0.56 μm).

Materials examined: Germany, on Cornus sanguinea (Cornaceae) twig, 8 May 2013, R.K. Schumacher, CBS H-23512, living culture CBS 143889 = CPC 23235.

Italy, Forlì-Cesena [FC] Province, Camposonaldo - Santa Sofia, on dead branch of Cornus sanguinea L. (Cornaceae), 17 Mar. 2012, E. Camporesi, IT 171 (holotype MFLU 16–0701, ex-type MFLUCC 14–0448, not seen).

Notes: The ex-type isolate (MFLUCC 14–0448) of Sei. cornicola shows 100 % sequence similarity in ITS with strain CBS 143889, and both are located in the genus Sporocadus in the ITS tree (not shown). However, due to the unavailability of other sequence data relating to MFLUCC 14–0448, it was removed from the multi-locus phylogenetic analyses. Morphologically, the lack of conidial appendages in Sei. cornicola (Wijayawardene...
et al. 2016a) fits well with the generic characterisation of Sporocadus. Seimatosporium cornicola is therefore recombined as Spo. cornicola.

The morphological description of Sei. cornicola in Wijayawardene et al. (2016a) includes surprisingly large measurements (conidia 34−51 × 13−18 μm; av. = 41.86 × 16.1 μm, n = 20). However, the conidial dimensions, either length or width, of all currently known species in Sporocadus and Seimatosporium are smaller than 34−51 × 13−18 μm. We therefore redescribe Spo. cornicola in this study using strain CBS 143889.

Sporocadus cotini F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828400. Fig. 73.

Etymology: Name reflects the host from which it was isolated, Cotinus coggygria.

Culture characteristics: Colonies on MEA umbonate with erose or denate edge, olivaceous, reaching 35−37 mm diam after 14 d at 21 °C, conidiomata confluent, immersed, covered by sparse white aerial mycelia; on CMA, brown-coloured due to the accumulation of conidiomata, reaching 46−48 mm diam after 14 d at 21 °C, conidiomata black, superficial or immersed, scattered or gregarious.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, colourless, smooth. Conidiogenous cells discrete or integrated, mostly cylindrical or subcylindrical, sometimes clavate or lageniform, 9.5−20.5 × 1−2.5 μm (av. = 12.4 ± 2.52 × 1.6 ± 0.31 μm), colourless, smooth, with up to two annellations. Conidia fusoid, ellipsoidal, subcylindrical, straight, 3−6-septate, wall smooth, 11.5−15.5(−23.5) × 4−6.5 μm (av. = 13.7 ± 0.88 × 5 ± 0.42 μm), lacking appendages; basal cell obconic with a truncate or obtuse base, hyaline to yellowish brown, slightly paler than or concolourous with median cells, 2−4 μm (av. = 2.81 ± 0.49 μm) long; median cells 2−5, doliiform, yellowish brown, ± equal, each 2.5−4.5 μm (av. = 3.6 ± 0.43 μm) long; apical cell conic and usually with a narrow truncate apex, concolourous with or slightly paler than median cells, usually becoming dark brown at the apex point, 2.5−4.5 μm (av. = 3.5 ± 0.4 μm) long; mean conidium length/width ratio = 2.7:1.

Material examined. Russia, Rostov Region, Oktyabrsky district, Persianovsky Arboretum, on Cotinus coggygria (Anacardiaceae), unknown collection date, T. Bulgakov (holotype MFLU 14−0773, ex-type culture CBS 139966 = T-095 = MFLUCC 14-0623).

Fig. 73. Sporocadus cotini (CBS 139966). A−D. Colonies on MEA, CMA, PDA and SNA, respectively. E−H. Conidiomata on MEA, CMA, PDA and SNA, respectively. I−K. Conidiophores, conidiogenous cells and conidia. L. Conidia. Scale bars = 10 μm.
Notes: Specimen MFLU 14–0773 was designated as a reference of *Sei. lichenicola* by Norphanphoun et al. (2015). However, the present study shows that this specimen is phylogenetically and morphologically distinct from *Sei. lichenicola* (current name: *Spo. lichenicola*). Also see notes under *Spo. lichenicola*.

*Sporocadus incanus* F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828401. Fig. 74.

**Etymology**: Name reflects its conidial colour, greyish white.

**Culture characteristics**: Colonies on MEA flat with entire edge, pale hazel, aerial mycelia pale grey and cottony, forming concentric circles on the reverse of the plate, reaching 53–54 mm diam after 14 d at 21 °C; conidiomata stromatic, confluent, semi-immersed; on CMA flat with entire edge, olivaceous grey, forming concentric circles due to the number of black conidiomata, reaching 50–52 mm diam after 14 d at 21 °C; conidiomata scattered or gregarious, stromatic, superficial or immersed; on PDA flat with entire edge, vinaceous buff, aerial mycelia sparse and short, forming concentric circles, reaching 58–60 mm diam after 14 d at 21 °C; conidial masses glaucous grey, superficial, confluent; on SNA flat with rhizoid edge, colourless, very slow growing, reaching 10–12 mm diam after 14 d at 21 °C; conidiomata dark brick to sepia, gregarious, acervular, superficial. **Description**: Sexual morph: unknown. Asexual morph: Conidiophores septate, reduced to very short conidiogenous cells, colourless, smooth. Conidiogenous cells usually discrete, mostly cylindrical, sub-cylindrical, sometimes lageniform, 4.5–14.5 × 1.5–3 μm (av. = 9.9 ± 2.73 × 2.2 ± 0.44 μm), colourless, smooth, with up to four annellations. Conidia obvoid, or cylindrical with round apical and basal ends, straight, mostly 3-septate, occasionally 2-septate, wall smooth, barely constricted at the septa, 11.5–20 × 4.5–6.5 μm (av. = 14.8 ± 1.8 × 5.8 ± 0.49 μm), lacking appendages; basal cell obconic with a truncate base, colourless or sometimes concolourous with median cells, 2–5 μm (av. = 3.1 ± 0.7 μm) long; median cells 2, doliform or cylindrical, thin-walled, colourless or greyish white, ± equal, each 3–5.5 μm (av. = 4.2 ± 0.63 μm) long; apical cell obtuse or conic with round apex, colourless or concolourous with median cells, 2.8–5 μm (av. = 3.9 ± 0.51 μm) long; mean conidium length/width ratio = 2.6:1. **Material examined**: Spain, Madrid, Fuente el Saz, on *Prunus dulcis* (Rosaceae) dead twigs, 3 Mar. 2008, deposited by G. Bills (holotype CBS H-20138, ex-type culture CBS 123003 = F-273).

Notes: Although represented by a single strain, *Spo. incanus* is clearly distinct from other *Sporocadus* spp. based on the multilocus analysis (Fig. 2). Another *Sporocadus* species reported from *Prunus dulcis* from California was *Spo. lichenicola* (French

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**Fig. 74.** *Sporocadus incanus* (CBS 123003). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–H. Conidiomata on MEA, CMA, PDA and SNA, respectively. I–J. Conidiogenous cells and conidia. K. Conidia. Scale bars = 10 μm.
However, the identification of which needs further confirmation with molecular data.

**Sporocadus lichenicola** Corda, Icon. fung. (Prague) 3: 24. 1839. Fig. 75.

*Synonyms:* Seimatosporium lichenicola (Corda) Shoemaker & E. Müll., Canad. J. Bot. 42: 405. 1964. Sphaeria corticola Fuckel, Jb. nassau. Ver. Naturk. 23–24: 114. 1870. Griphosphaeria corticola (Fuckel) Höhn., Annls mycol. 16: 87. 1918. Clethridium corticola (Fuckel) Shoemaker & E. Müll. [as ‘Clethridium’], Canad. J. Bot. 42: 404. 1964. Discostroma corticola (Fuckel) Brockmann, Sydowia 28: 313. 1976.

*Other synonyms:* See Sutton (1980).

**Culture characteristics:** Colonies on MEA flat with erose or dentate edge, white-coloured, sterile, reaching 40 mm diam after 14 d at 21 °C; on CMA, flat with entire edge, mid-brown to dark brown, sterile, reaching 51 mm diam after 14 d at 21 °C; on PDA flat with entire edge, white to milky-coloured, sterile, reaching 46–48 mm diam after 14 d at 21 °C; on SNA, milky-coloured, flat with entire edge, reaching 21 mm diam after 14 d at 21 °C, conidiomata scattered or gregarious, brown to black, acervular.

**Description:** Sexual morph: see Shoemaker & Müller (1964).

Asexual morph: Conidiophores septate, branched, colourless, smooth, invested in mucus. Conidiogenous cells discrete or integrated, lageniform or ampulliform, sometimes cylindrical and subcylindrical, 6–20 × 1.5–4.5 μm (av. = 12.2 ± 4.26 × 3.2 ± 0.95 μm), colourless, smooth, with up to three annellations. Conidia mostly obovoid or subcylindrical with round ends, straight, pale brown, mostly 3–4-septate, occasionally 5-septate, septa ± equally thick in 3-septate conidia, 18–25 × 5.5–8 μm (av. = 21.6 ± 1.52 × 7.2 ± 0.52 μm), lacking appendages; basal cell obconic with a narrow round base, or sometimes with narrow truncate base, hyaline to pale brown, or concolourous with median cells, periclinal wall thin and pale brown, 3–7 μm (av. = 4.71 ± 0.86 μm) long in 3-septate conidia, 1.5–4.5 μm (av. = 2.77 ± 0.67 μm) long if more than 3 septa;
median cells 2–4, doliiform, pale to mid-brown, ± equal in 3–septate conidia, each 4–6.5 μm (av. = 5.48 ± 0.54 μm) long; the second cell from base shorter than other median cells in 4–5-septate conidia, 1.5–3.5 μm (av. = 2.6 ± 0.63 μm) long; apical cell short-conic with a wide round apex, concolourous with the median cells, 4.5–6.5 μm (av. = 5.5 ± 0.52 μm) long; mean conidium length/width ratio = 3:1.

Materials examined. Czech Republic, Prague, on Rosa canina (Rosaceae), 1838, Corda (holotype 40995 ex PR. Herb. Corda 155664, not seen). Germany, on Juniperus communis (Cupressaceae), 5 Apr. 2014, R. Schumacher, living culture CPC 24526; former West-Germany, on Fagus sylvatica (Fagaceae) seed, unknown collection date, U. Delfs-Siemer, CBS H-23540, living culture CBS 354.90 = NBRC 32677, UK, on Rosa canina, unknown collection date and collector (CBS H-23626 epitype designated here, MBT380403, ex-epitype culture NBRC 32625 = IMI 079706).

Notes: The asexual and sexual connection between Sporocadus lichenicola and Clathridium corticola was confirmed (Hughes 1958, Shoemaker & Müller 1964), and both names were subsequently synonymised under Sei. lichenicola (Shoemaker & Müller 1964). Nag Raj (1993) transferred Sei. lichenicola to Sporocadus, as he split Seimatosporium into five genera and accepted Sporocadus as a distinct genus. In Tanaka et al. (2011), this species was again synonymised under Seimatosporium.

Sporocadus lichenicola has been described repeatedly under different names (Corda 1839, Shoemaker & Müller 1964, Sutton 1980). The original description and illustration of Spo. lichenicola in Corda (1839) was simple and did not include measurements of morphological structures. According to Shoemaker & Müller (1964), the asexual morph of Clathridium corticola (DAOM 90913, on Rosa stem, Airolo-Nante, Tessin, Switzerland, 1961, E. Müller & R.A. Shoemaker) was characterised by mostly 3-septate, non-setose and clavate conidia (18–20 × 5–7 μm), matching the type specimen of Spo. lichenicola. Sutton (1980) accepted the species name as Sei. lichenicola, and reported it as having 3-septate, fusoid and non-appendaged conidia (13–15 × 5.5–6.5 μm), which however conflicted with those given by Shoemaker & Müller (1964) and were not based on the type specimens of Spo. lichenicola nor Cla. corticola. Recently, a reference specimen (MFLU 14-0773) of Sei. lichenicola, from dead branches of Cotinus coggyria from Russia, was designated by Norphanphoun et al. (2015). However, measurements of the conidia of MFLU 14-0773 were (10–)12–14 × 4–5(–6) μm, thus also contradicting the description of Shoemaker & Müller (1964).

Since strains without conidial appendages clustered in a distinct clade from Seimatosporium (Figs 1, 2), we agree with Nag Raj (1993) on the taxonomic treatment of Sporocadus and Spo. lichenicola. Our collection from the UK, CBS H-23626, was from the same host plant as the type from the Czech Republic (Rosa canina), and morphologically matched the description provided by Shoemaker & Müller (1964). It is therefore designated as epitype of Spo. lichenicola.

According to the molecular analysis, the reference specimen (MFLU 14-0773, living culture CBS 139966) designated by Norphanphoun et al. (2015) is phylogenetically distinct from Spo. lichenicola and represents another species, spo. cotini.

Sporocadus mali F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828402. Fig. 76.

Etymology: Name reflects the host from which it was collected, Malus sylvestris.

Culture characteristics: Colonies on MEA flat with entire edge, greenish grey with white margin, aerial mycelia greenish grey, reaching 58–59 mm diam after 14 d at 21 °C, sterile; on CMA concave with raised margin, pale pistachio green with white margin, reaching 53–54 mm diam after 14 d at 21 °C, conidiomata pale brown; on PDA flat with entire edge, glaucous grey, reaching 67–68 mm diam after 14 d at 21 °C, sterile; on SNA flat with entire edge, hyaline to glaucous grey, reaching 55–56 mm diam after 14 d at 21 °C, conidial masses black, superficial, scattered.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, usually branched, colourless, smooth. Conidiogenous cells discrete or integrated, mostly subcylindrical, (6.5–)10.5–24 × 1.5–2.5 μm (av. = 16.9 ± 3 × 2.1 ± 0.32 μm), colourless, smooth, with up to five annelloids. Conidia obvoid or cylindrical, straight, occasionally slightly curved, 3–4-septate, wall smooth, 15–20 × 4.5–8 μm (av. = 17.3 ± 1.24 × 6.4 ± 0.66 μm), lacking appendages; basal cell obconic with a narrow truncate base, hyaline to pale brown, usually concolourous with median cells, 2.5–4.5 μm (av. = 3.4 ± 0.48 μm) long; median cells 2–3, doliiform or short cylindrical, pale brown, ± equal, each 3.5–6 μm (av. = 4.6 ± 0.58 μm) long; apical cell with an obtuse end, concolourous with median cells, usually becoming dark brown at the apex point, 3.5–6.5 μm (av. = 5 ± 0.53 μm) long; mean conidium length/width ratio = 2.7:1.

Materials examined. Netherlands, Valkenswaard, on Malus sylvestris (Rosaceae) dead twig, Feb. 1970, H.A. van der Aa (holotype CBS H-18808, ex-type culture CBS 446.70).

Notes: Although represented by a single strain, Spo. mali is well separated from other Sporocadus species (Fig. 2). Morphologically, it resembles Spo. cotini, but can be distinguished from the latter by the number of septa (3–4 vs. 3–6), conidial dimensions (15–20 × 4.5–8 μm vs. 11.5–15.5 × 4–6.5 μm), as well as the shape of the apical cell (obtuse but not conical vs. conical). This is the first report of Sporocadus on Malus sylvestris (Farr & Rossman 2018).

Sporocadus microcylus F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828403. Fig. 77.

Etymology: Named after the commonly observed microcylindrical conidiosgenesis.

Culture characteristics: Colonies on MEA raised with ruffles in crenate edge, black, ochreous, reaching 32–39 mm diam after 14 d at 21 °C, conidiomata black, buff or honey, stromatic, confluent, immersed; on CMA dark brown, reaching 27–30 mm diam after 14 d at 21 °C, conidiomata gregarious or confluent, superficial, semi-immersed, immersed; on PDA flat with entire edge, dark brown, dark vinaceous, with rhizoid appearance due to the accumulation of conidiomata, reaching 76–80 mm diam after 14 d at 21 °C, conidiomata dark brown to black, superficial or semi-immersed, scattered, gregarious or confluent; on SNA, with brown rhizoid appearance due to the accumulation of conidiomata, reaching 17–19 mm diam after 14 d at 21 °C, conidiomata superficial or immersed.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, sometimes reduced to conidiogenous cells, colourless, smooth. Conidiogenous cells discrete or integrated, mostly lageniform, ampulliform, or obl clave,
sometimes subcylindrical, variable in size, 4.5–15 × 1.5–3.5 μm (av. = 9.2 ± 3.02 × 2 ± 0.57 μm), colourless, smooth, with up to four annellations. Conidia obovoid, ellipsoid, straight or slightly curved, pale brown, mostly 3-septate, occasionally 2-septate, wall smooth, 10.5–15.5 × 3–5.5 μm (av. = 13 ± 0.97 × 4.6 ± 0.57 μm), lacking appendages; basal cell obconic with blunt or sometimes round base, hyaline to pale brown, 2–3.5 μm (av. = 2.7 ± 0.4 μm) long; median cells 2, doliiform, fairly thick-walled and pale brown, ± equal, each 2.5–4.5 μm (av. = 3.4 ± 0.55 μm) long; apical cell short-conic with a round apex, concolourous with the median cells, 2.5–3.5 μm (av. = 3.1 ± 0.24 μm) long; mean conidium length/width ratio = 2.8:1. Microcyclic conidiogenesis occurring with conidia, forming secondary conidiophores or conidiogenous cells. These conidia are cylindrical with round ends, straight, pale brown, 3-septate, wall smoothly constricted at septa, 13–25.5 × 5.5–7.5 μm (av. = 19.6 ± 2.35 × 6.5 ± 0.61 μm); basal cell hyaline to pale brown, apical cell and median cells pale brown, ± equal, each 3.5–7 μm (av. = 4.7 ± 0.75 μm). Secondary conidiophores or conidiogenous cells centric or excentric on basal or median cell, hyaline, septate, irregularly branched; conidiogenous cells ampulliform, lageniform, varying in size, 2.5–13 × 1–3 μm (av. = 7.2 ± 3.15 × 1.9 ± 0.49 μm), with up to four annellations.

Materials examined: Germany, Bonn, on Sorbus aria (Rosaceae, endophyte in twig), Feb. 1995, K. Weise (holotype CBS H-23543, ex-type culture CBS 424.95). Netherlands, Baarn, Maarschalkbos, on Ribes (Grossulariaceae) leaf spot, 3 Dec. 1968, H.A. van der Aa, living culture CBS 887.88 = NBRC 32680.

Notes: Sporocadus microcyclus is closely related to Spo. biseptatus (Fig. 2, 99 % sequence similarity on ITS, 95 % on rpb2, 88 % on tef-1α, 88 % on tub2), but it differs from the latter in the number of septa (mostly 3-septate vs. 2-septate) and mean conidial length/width ratio (2.8:1 vs. 2.3:1). In addition, microcyclic conidiogenesis was not observed in Spo. biseptatus, but is commonly observed in Spo. microcyclus.

In addition to Spo. microcyclus, Spo. dacicum was also reported from the host genus Sorbus (S. dacica) from Romania; however, the conidia of Spo. dacicum were mostly bent and curved, a feature different from other known Sporocadus species (Sutton 1975a).

Sporocadus multiseptatus F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828404. Fig. 78.

Etymology: Name reflects the multiseptate nature of its conidia, being 3–7-septate.

Culture characteristics: Colonies on MEA, CMA, PDA and SNA, respectively. A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–F. Conidiomata on SNA. G–J. Conidiophores, conidiogenous cells and conidia (arrows points to annellations). K. Conidia. Scale bars = 10 μm.

Materials examined: Germany, Bonn, on Sorbus aria (Rosaceae, endophyte in twig), Feb. 1995, K. Weise (holotype CBS H-23543, ex-type culture CBS 424.95). Netherlands, Baarn, Maarschalkbos, on Ribes (Grossulariaceae) leaf spot, 3 Dec. 1968, H.A. van der Aa, living culture CBS 887.88 = NBRC 32680.
Fig. 77. Sporocadus microcyclus (CBS 424.95). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–F. Conidiomata on MEA. G–I. Conidiomata on CMA, PDA and SNA, respectively. J–M. Conidiophores, conidiogenous cells and conidia. N–S. Microcyclic conidiogeneses. T. Conidia with constrictions. U. Conidia. Scale bars = 10 μm.
21 °C; on PDA flat with undulate edge, glaucous blue-green, sterile, reaching 40 mm diam after 14 d at 21 °C; on SNA flat with undulate edge, white, reaching 13–14 mm diam after 14 d at 21 °C, conidiomata black, scattered, superficial, acervular.

Description: Sexual morph: unknown. Asexual morph: Co-nidiophores septate, reduced to very short conidiogenous cells, colourless, smooth. Conidiogenous cells discrete, mostly cylindrical, sometimes ampulliform, 5–20 × 1.5–4 μm (av. = 11.6 ± 3.72 × 2.8 ± 0.58 μm), colourless, smooth. Conidia obovoid, subcylindrical, or clavate, straight, 3–7-septate, wall smooth, occasionally slightly constricted at the septa, 21–31 × 7–9.5 μm (av. = 26.5 ± 1.98 × 8.1 ± 0.56 μm), lacking appendages; basal cell obconic with a truncate base, periclinal wall thin, colourless or pale brown, 2.5–6.5 μm (av. = 4.8 ± 0.92 μm) long; median cells 2–5, fairly thick-walled, pale to mid-brown, doliform or cylindrical, variable in size, together 11–22.5 μm (av. = 17.2 ± 2.6 μm) long, each 2.5–8 μm (av. = 4.2 ± 1.24 μm) long; apical cell obtuse, not conic, or conic with obtuse apex, concolourous with median cells, 3–7 μm (av. = 4.6 ± 1.05 μm) long; mean conidium length/width ratio = 3.3:1.

Material examined: Serbia, on Viburnum sp. (Caprifoliaceae), 14 Apr. 2015, R.K. Schumacher, HPC 346 (holotype CBS H-23524, ex-type culture CBS 143899 = CPC 26606).

Notes: Sporocadus multiseptatus is well separated from other Sporocadus spp. based on the multi-locus analysis (Fig. 2) and morphologically distinct in producing longer and relatively wider conidia. In addition, the conidia of Spo. multiseptatus are generally 3–7-septate, while they are usually 3-septate in other Sporocadus species.

Sporocadus rosarum (Henn.) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828405.

Basionym: Coryneum rosarum Henn., Mag. Naturvididensk. 42: 32. 1904.

Synonyms: Seimatosporium rosarum (Henn.) B. Sutton, Mycol. Pap. 138: 168. 1975. Seimatosporium pseudorosarum Wijayaw. et al., Fungal Diversity 75: 156. 2015. Seimatosporium rosigenum Goonas. et al., Fungal Diversity 89: 193. 2018.

Culture characteristics: See Ariyawansa et al. (2015) and Wanasinghe et al. (2018).
**Description:** Sexual morph: unknown. Asexual morph: *Conidiomata* 200–250 μm diam, 100–150 μm high, acervular, unicellular, subglobose, superficial to subepidermal, solitary, black, ostiolate, apapillate. Conidiomata wall multi-layered, outer wall thick, composed of dark brown cells of *textura angularis*, inner wall thin, hyaline. Paraphyses 10–22 μm, filiform, cylindrical, asceptate, hyaline, smooth-walled. *Conidiophores* 6–25 × 2–4 μm, long, cylindrical, branched, hyaline, smooth-walled. *Conidigenous cells* holoblastic, anellidic, simple, integrated, determinate, hyaline. *Conidia* 9–14 × 4–6 μm (av. = 11.31 ± 6.06 μm, n = 20), ellipsoid to obovoid, apex and base, straight, 2–3-septate, with brown to dark brown septa, constricted at the septa, eguttulate, pale brown to medium brown, with hyaline to sub-hyaline basal cell, smooth-walled, apical appendage absent, with or without basal appendage, if present, 9–30 μm long, unbranched (emended from Ariyawansa et al. 2015).

**Materials examined:** *Italy.* Province of Pesaro-Urbino [PU], Monte Nerone, on dead aerial spines of *Rosa canina* (Rosaceae), 11 Jun. 2012, E. Camporesi [holotype of *Seimatosporium pseudorosarum* MFLU 15-0745, living culture MFLUCC 15-0563 = KUMCC 16-0112, not seen (fig. 131, in Wanasinghe et al. 2018, Fungal Diversity 19: 1–236); Province of Rimini [RN], near Pennabilli-Rimini, on dead branch of *Rosa canina* (Rosaceae), 22 Mar. 2014, E. Camporesi [holotype of *Seimatosporium pseudorosarum* MFLU 15-0745, living cultures MFLUCC 14–0466, not seen (fig. 83, in Ariyawansa et al. 2015, Fungal Diversity 75: 27–274)]. *Norway.* Christiania, on leaves of *Rosa canina*, Aug. 1903 [iconotype of *Coryneum rosarum*, slide ex B and IMI 179738 (fig. 77, in Sutton 1975a, Mycol. Pap. 138: 1–224)]. *Sweden.* Uppland, Dalby par., Jerusalem, on *Rosa canina*, 7 Apr. 1987. K. & L. Holm, living culture CBS 113832 = UPSC 2172.

**Notes:** The LSU and ITS sequences of CBS 113832 are identical to the holotype of *Sei. pseudorosarum* (MFLU 15-0745) (Ariyawansa et al. 2015), and only has 2 bp differences with *Sei. rosigenum* (MFLUCC 15-0563) (Wanasinghe et al. 2018). Further, these three strains were associated with the same host plant *Rosa canina*. There is thus no strong evidence to treat them as separate species. Unfortunately, other gene sequences of MFLU 15-0745 and MFLUCC 15-0563 are unavailable and both strains were for this reason excluded from the multi-locus phylogenetic analyses in this study.

Morphologically, *Sei. rosigenum* produced 3-septate conidia with one apical appendage and mostly without basal appendages (Wanasinghe et al. 2018). However, this appears to be the exact opposite compared to their illustration (fig. 131 in Wanasinghe et al. 2018). *Seimatosporium pseudorosarum* was characterised by 2-septate conidia with or without a basal appendage (Ariyawansa et al. 2015). On the other hand, the phylogenetically similar strain CBS 113832 produces 3-septate and non-appendaged conidia, which therefore broadens the species description.

In addition, this species is morphologically identical to *Sei. rosarum* (basionym *Coryneum rosarum*) (Sutton 1975a), and the collection information of strain CBS 113832 (from *Rosa canina* from Sweden) is identical to that of the type of *Coryneum rosarum* (from *Rosa canina* from Norway, IMI 179738); we therefore consider *Sei. pseudorosarum* and *Sei. rosigenum* as synonyms of the older name, *Sei. rosarum*. Phylogenetic analyses placed it in the genus Sporocadus.

*Sporocadus lichenicola* another *Rosa canina* associated species in Europe, can be distinguished from *Spor. rosarum* in the number of conidial septa (4–5-septate vs. 2–3-septate) and absence of appendages.

*Sporocadus rosigena* F. Liu, L. Cai & Crous, nom. nov. MycoBank MB828418. Fig. 79.

**Basionym:** *Seimatosporium rosicola* Wanagas et al., Fungal Diversity: 89: 193. 2018, non *Sporocadus rosicola* Raben. 1848.

**Culture characteristics:** Colonies on MEA flat with irregular outline, rosy buff to vinaceous buff, reaching 50–53 mm diam after 14 d at 21 °C, conidiomata black, acervular, confluent, erumpent; on CMA, flat with entire edge, white-coloured, with sparse aerial mycelia, reaching 68 mm diam after 14 d at 21 °C, conidiomata gregarious or confluent, black; on PDA flat with entire edge, white to milky-coloured, and buff where conidiomata are produced, reaching 76 mm diam after 14 d at 21 °C, conidiomata black, acervular, stromatic, scattered or gregarious, forming circles around the inoculation point; on SNA flat with lobate edge, colourless, reaching 49–51 mm diam after 14 d at 21 °C, conidiomata black, scattered or gregarious, erumpent, semi-immersed or immersed.

**Description:** *Conidiophores* septate, branched, often reduced to conidiogenous cells, colourless, smooth, invested in mucus. *Conidiogenous cells* discrete or integrated, cylindrical or ampulliform, 6–16 × 1.5–3 μm, colourless, or pale brown, smooth, with up to four annellations. *Conidia* obovoid, ellipsoid, or subcylindrical, 3-septate, occasionally 2-septate, wall smooth, 10–15 × 3.5–6.5 μm (av. = 12.6 ± 0.98 ± 5.2 ± 0.62 μm), lacking appendages; basal cell obconic with acute or blunt base, occasionally with a narrow truncate base, hyaline to pale brown, or concolourous with median cells, thin-walled, 1–3.5 μm (av. = 2.5 ± 0.47 μm) long; median cells 2, short-cylindrical to doliform, hyaline or pale brown, and becoming mid-brown when mature, ± equal length, each 2.5–4.5 μm (av. = 3.6 ± 0.45 μm) long; apical cell conic with round apex, concolourous with the median cells, 3.5–5 μm (av. = 4.2 ± 0.45 μm) long; mean conidium length/width ratio = 2.41. Sexual morphology: see Wanasinghe et al. (2018).

**Materials examined:** *Iran.* On *Vitis vinifera* (Vitaceae) twig (endophyte), unknown collection date, T. Gräfenhan, living culture CBS 116498 = V0365. *Italy.* Province of Forlì-Cesena [FC], near Cesenole, Castrocorto Termo e Terra del Sole, on dead aerial spines of *Rosa canina* (Rosaceae), 30 Nov. 2014, E. Camporesi IT 2263 (holotype of *Seimatosporium rosicola* MFLU 16-0239, not seen). *Latvia.* Riga, on *Rhododendron* sp. (Ericaceae), unknown collection date. I. Apine, living culture CBS 129166 = MSLC 860. *Netherlands.* Trekkerdriehuizen near Armoerfoort, inner tissue of zocecidium, caused by Lasioptera rubi, on *Rubus* sp., 26 Mar. 1996, H.A. van der Aa, CBS H-18005, living culture CBS 466.86; on *Rubus fruticosus* (Rosaceae) stem, unknown collection date. isolated by A. Jaarsveld, living culture CBS 250.49; on *Pyrus communis* (Rosaceae) fruit, unknown collection date, isolated by J.A.A.M.H. Goossens, living culture CBS 182.50.

**Notes:** The LSU and ITS sequences of the holotype of *Seimatosporium rosicola* (MFLU 16-0239) only show three and two bases differences, respectively, from other strains of this species. In addition, the morphology of these strains is consistent with *Sei. rosicola* that was described in Wanasinghe et al. (2018). However, due to the unavailability of other gene sequences, the holotype was excluded from the multi-locus phylogenetic analyses in this study. Further multi-locus phylogenetic analyses (Figs 1, 2) showed that this species was located in the *Sporocadus* clade. However, as the epithet "rosicola" is occupied in *Sporocadus*, and a new name *Spo. rosigena* is thus proposed for this species.

*Sporocadus rosigena* has been identified from the host plants *Rubus*, *Pyrus*, *Rhododendron* and *Vitis*. When compared with other species in *Sporocadus*, we noticed that *Spo. rhododendri* was also reported from *Rhododendron* and *Pyrus communis* (Pirozynski & Shoemaker 1970, Sutton 1980). However, the conidia of *Spo. rosigena* are much smaller and thinner than *Spo.*
rhododendri (10–15 × 3.5–6.5 μm vs. 15.5–20 × 6.5–8.5 μm). In addition, median cells of Spo. rosigena are concolourous and each is ± equal in dimension and wall thickness, while the subapical cell of Spo. rhododendri is darker and considerably larger than the rest of the cells (Pirozynski & Shoemaker 1970).

**Sporocadus rotundatus** F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828419. Fig. 80.

Etymology: Name refers to its rounded ends of the apical conidial cells.
Culture characteristics: Colonies on MEA flat with entire edge, dark vinaceous, reaching 64 mm diam after 14 d at 21 °C, conidiomata acervuli, confluent, superficial, semi-immersed, or immersed; on CMA, flat with entire edge, olivaceous, reaching 56–57 mm diam after 14 d at 21 °C, conidiomata confluent, superficial, semi-immersed, or immersed; on PDA flat with fimbriate edge, smoke grey to citrine, reaching 65–66 mm diam after 14 d at 21 °C, conidiomata brown, superficial or immersed; on SNA flat with rhizoids edge, smoke grey, reaching 33–46 mm diam after 14 d at 21 °C, conidiomata superficial or immersed.

Description: Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, often reduced to conidiogenous cells, hyaline, smooth. Conidiogenous cells discrete or integrated, mostly lageniform, ampulliform, short cylindrical, 3.5–9.5 × 1.5–4 μm (av. = 6.1 ± 1.38 × 2.2 ± 0.66 μm), colourless, smooth, with up to three annellations. Conidia varying in shape, clavate, obovoid, ellipsoidal, cylindrical with rounded ends, straight, pale brown, 1–4-septate, wall smooth and sometimes constricted at the septa, 9–16.5 × 4.5–7 μm (av. = 12.5 ± 1.61 × 5.7 ± 0.57 μm), lacking appendages; basal cell obtuse, or sometimes obconic with a truncate base, hyaline to pale brown, 1.5–4 μm (av. = 2.6 ± 0.56 μm) long; median cells 1–3, doliform, pale brown to yellowish brown, ± equal, each 3–4.5 μm (av. = 3.6 ± 0.43 μm) long; apical cell obtuse, not conic, hyaline or concolourous with the median cells, 3.5–7 μm (av. = 5.1 ± 0.75 μm) long in 2-septate conidia, 1.5–3.5 μm (av. = 2.5 ± 0.46 μm) long if more than 2 septa; mean conidium length/width ratio = 2.2:1.

Material examined: Canada, Manitoba, The Pas, on Arceuthobium pussilum (Viscaceae), 25 Jul. 1981, J. Reid (holotype CBS H-18002, ex-type culture CBS 616.83).

Notes: Sporocadus rotundatus is closely related to Spo. cotini (Fig. 2, 99 % sequence similarity on ITS, 93 % on rpb2, 92 % on tef-1α, 90 % on tub2). However, morphologically it differs from Spo. cotini by the number of conidial septa (1–4 vs. 3–6), the shape of apical and basal cells (obtuse vs. conic or obconic), and the mean conidium length/width ratio (2.2:1 vs. 2.7:1). This is the first report of Sporocadus on Arceuthobium pussilum.

Sporocadus sorbi (Wijayaw. et al.) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828421.
Basionym: *Seimatosporium sorbi* Wijayaw. et al., Fungal Diversity 75: 154. 2015.

**Description:** See Ariyawansa et al. (2015).

**Material examined:** Italy, Province of Forlì-Cesena [FC], Fiumicello-Premilcuore, on dead leaf of *Sorbus torminalis* (Rosaceae), 8 May 2013, E. Camporesi, IT 1233 (holotype of *Seimatosporium sorbi* MFLU 15-0744, living cultures MFLUCC 14-0469, not seen). Unknown location, host and collection date, S.M. Zeller, living culture CBS 160.25.

**Notes:** In comparison to the ex-type of *Seimatosporium sorbi* (MFLUCC 14-0469), CBS 160.25 shows 99 % sequence similarity on ITS and is identical on LSU. As sequences for other loci were not available for MFLUCC 14-0469, we excluded it from the multi-locus phylogenetic analyses.

*Sporocadus* sp. 1 Fig. 81.

**Culture characteristics:** Colonies on MEA raised with concave edge, black around the inoculation point due to the accumulation of conidiomata, reaching 68–69 mm diam after 14 d at 21 °C; on CMA, flat with undulate edge, black around the inoculation point due to the accumulation of conidiomata, honey-coloured at the edge, with sparse aerial mycelia, reaching 75 mm diam after 14 d at 21 °C, conidiomata distinct or confluent, semi-immersed or immersed; on PDA flat with entire edge, pale luteous, with honey-coloured fimbriate region around the inoculation point, sterile, reaching 80–81 mm diam after 14 d at 21 °C; on SNA fimbriate with rhizoids, colourless to pale brown, reaching 40–43 mm diam after 14 d at 21 °C, conidial masses brown, gregarious or confluent, superficial or immersed.

**Description:** Sexual morph: unknown. Asexual morph: Conidiophores septate, branched, colourless, smooth, invested in mucus. Conidiogenous cells discrete or integrated, mostly cylindrical or subcylindrical, sometimes ampulliform, 4.5–15.5 × 1–2.5 μm (av. = 10.8 ± 2.6 × 1.9 ± 0.36 μm), colourless, smooth, with up to three annellations. Conidia obovoid, straight, mid-brown to brown, mostly 3-septate, occasionally 1–2-septate, wall smooth, sometimes collapsed at septa, 11–15 × 4.5–6.5 μm (av. = 12.9 ± 1 × 5.5 ± 0.49 μm), lacking appendages; basal cell obconic with truncate base, pale brown to brown, concolourous with median cells, 1.5–3.5 μm (av. = 2.8 ± 0.45 μm) long; median cells 1–2, cylindrical, doliiform, pale brown to brown, ± equal length, each 2–4 μm (av. = 3 ± 0.48 μm) long; apical cell obtuse or short-conic with a round apex, concolourous with the median cells, 1.5–4 μm (av. = 3.2 ± 0.59 μm) long in 3-septate conidia, 4–7 μm (av. = 5.7 ± 0.68 μm) long if less than 3-septate; mean conidium length/width ratio = 2.4:1.

**Material examined:** Italy, Sardegna, Cedrino, on *Euphorbia* (Euphorbiaceae) dead stems, unknown collection date and collector, isolated by H.A. van der Aa, CBS H-18415, living culture CBS 506.71.

**Notes:** *Sporocadus* sp. 1 is morphologically similar to the related species *Spo. rosigena*, but only share 97 % sequence similarity.
on tef-1α and 95 % on tub2. Sporocadus sp. 1 is probably a new species, but awaits more collections and further study.

**Sporocadus trimorphus** F. Liu, L. Cai & Crous, *sp. nov.* MycoBank MB828422. Fig. 82.

**Etymology**: Name refl ects the three types of conidia, with 0–2 appendages.

**Culture characteristics**: Colonies on MEA flat with entire edge, glaucous grey to pale greenish grey, reaching 67–68 mm diam after 14 d at 21 °C; on CMA flat with entire edge, pale olivaceous grey, reaching 54–55 mm diam after 14 d at 21 °C; on PDA flat with entire edge, grey to glaucous grey, reaching 67–68 mm diam after 14 d at 21 °C; on SNA pale grey, reaching 56–58 mm diam after 14 d at 21 °C.

**Description**: Sexual morph: unknown. Asexual morph: Sterile on MEA, CMA, PDA and SNA. On OA, conidiomata scattered, gregarious, dark brown or black, superficial or immersed. Conidiophores septate, irregularly branched, colourless, smooth. Conidiogenous cells integrated, mostly sub-cylindrical, lageniform, ampulliform, 4.5–14 × 1–2.5 μm (av. = 9.1 ± 1.79 × 1.8 ± 0.37 μm), colourless, smooth, with up to three annellations. Conidia fusoid or obovoid, straight, mostly 3-septate, occasionally 2- or 5-septate, wall smooth, 10–15 × 3–4.5 μm (av. = 13.3 ± 1.17 × 3.9 ± 0.34 μm), bearing appendages; basal cell oblong with a narrow truncate base, hyaline to pale grey, 1.5–2.5 μm (av. = 2.2 ± 0.3 μm) long; median cells mostly 2, cylindrical, fairly thick-walled and pale brown, ± equal, each 2–5 μm (av. = 4 ± 0.57 μm) long; apical cell conic with an acute to almost acute apex when bearing an apical appendage, otherwise broadly conic with an obtuse apex, colourless or concolourous with median cells, 2–3.5 μm (av. = 2.8 ± 0.45 μm) long; apical appendage lacking or, when present, single, unbranched, attenuated, tubular or flexuous, variable in size, 2–20 μm (av. = 12.7 ± 4.71 μm) long; basal appendage lacking or, when present, unbranched, tubular or flexuous, excentric, 2–15.5 μm (av. = 7.3 ± 3.09 μm) long; mean conidium length/width ratio = 3.4:1.

**Material examined**: Sweden, Uppland, Dalby par., Jerusalem, on *Rosa canina* (Rosaceae), 25 Nov. 1987, K.L. Holm (*holotype* CBS H-23551, ex-type culture CBS 114203 = UPSC 2430).

**Notes**: Sporocadus trimorphus is characterised by three types of conidia, i.e. non-appendaged, either apical or basal appendaged, and both apical and basal appendaged conidia. Although it morphologically resembles another *Rosa* related species, *Spor. caudata*, it differs from the latter by the shorter apical (2–20 μm vs. 15–35 μm) and basal (2–15.5 μm vs. 13–30 μm) appendages (Sutton 1963).

**Synnemapestaloides** T. Handa & Y. Harada, Mycoscience 45: 138. 2004, *emend.* F. Liu, L. Cai & Crous.

**Description**: Sexual morph: unknown. Asexual morph: Conidiomata synnematosus or sporodochial, determinate, black, not

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**Fig. 82.** Sporocadus trimorphus (CBS 114203). A–D. Colonies on MEA, CMA, PDA and SNA, respectively. E–F. Conidiomata on OA. G–J. Conidiophores, conidiogenous cells and conidia. K. Conidia. Scale bars = 10 μm.
changing colour in 2% KOH or 85% lactic acid, arising from a basal stroma composed of textura angularis; hyphae of stipe parallel or those of sporodochia loose; conidial mass black, globose to subglobose, subgelatinous. Conidiophores verticillately to sublaterally branched several times. Conidiogenous cells cylindrical to subcylindrical with annellations. Conidia fusoid with a truncate base, straight, septate, pale olivaceous to pale brown; apical appendage single or absent, when present, unbranched or dichotomously branched; basal appendage single or absent, when present, unbranched or irregularly branched, excentric (emended from Handa et al. 2004).

Type species: Synnemapestaloides rhododendri T. Handa & Y. Harada.

Notes: Genera with acervular and pycnidial conidiomata are recognised as coelomycetes, while those with sporodochia and synnemata are usually considered as typical hyphomycetes (Seifert et al. 2011). However, unlike other pestalotioid fungi which are coelomycetes, with acervular and pycnidial conidiomata, Synnemapestaloides produces spores on synnema and was thus previously regarded to be a hyphomycete (Handa et al. 2004, Watanabe et al. 2016). So far, Synnemapestaloides contains two species, namely Syn. rhododendri and Syn. juniperi, and it is notable that the short synnemata of Syn. juniperi are easily confused with acervuli (Watanabe et al. 2016).

In addition, apical and basal appendages as illustrated in Syn. rhododendri (Handa et al. 2004) are not common generic characters, as Syn. juniperi is non-appendaged, or produces very short appendages on the end cells (Fig. 83).

Synnemapestaloides juniperi F. Liu, L. Cai & Crous, sp. nov. MycoBank MB828423. Fig. 83.

Etymology: Named after its host plant, Juniperus phoenicea.

Culture characteristics: Colonies on MEA raised with undulate edge, buff, with white and sparse aerial mycelia, reaching 35 mm diam after 14 d at 21 °C, conidial masses abundant, black, confluent, semi-immersed or immersed, forming circles under
the aerial mycelia; on CMA flat with entire edge, without aerial mycelia, reaching 37–38 mm diam after 14 d at 21 °C, black due to large number of black conidial masses, conidial masses gregarious or confluent, superficial or semi-immersed; on PDA flat with undulate edge, buff to honey, with sparse aerial mycelia, reaching 38–40 mm diam after 14 d at 21 °C, conidial masses brown, confluent, immersed; on SNA hyaline, growing very slowly, reaching 7–8 mm diam after 14 d at 21 °C, conidial masses gregarious or confluent, brown, superficial or semi-immersed.

**Description**: Sexual morph: unknown. Asexual morph: *Conidiophores* septate, branched, colourless, smooth, thin-walled, invested in mucus. *Conidiogenous* cells integrated, mostly subcylindrical, sometimes ampulliform or lageniform, 7–16 × 1.5–2.5 μm (av. = 11.1 ± 2.31 × 2 ± 0.24 μm), colourless, smooth. *Conidia* fusoid, ellipsoidal, straight, mid-brown, 5–septate, occasionally 7-septate, wall smooth or verruculose, without constrictions at the septa, but often collapsed between apical and basal appendages (0.5–1 μm); basal cell obconic with a truncate base, thin-walled, up to 21.5 μm (av. = 2.5 ± 0.47 μm) long; median cells mostly 4, fairly thick-walled, yellowish-brown or mid-brown, doliiform, ± equal, each 3.5–4.5 μm (av. = 3.3 ± 0.51 μm) long; apical cell short-conic with an acute apex, hyaline, 2–3.5 μm (av. = 2.6 ± 0.37 μm) long; mean conidium length/width ratio = 2.9:1.

Material examined: France, Alpes Maritimes, Tende, Armacrene, on Juniperus phoenicea (Cupressaceae), 1961, E. Müller (holotype CBS H-17995, ex-type culture CBS 477.77 = ETH 4611 = NBRC 32676).

**Notes**: Strain NBRC 32676 is phylogenetically closely related but clearly distinct from *Syn. rhododendri* (Figs 1, 2) based on the multi-locus phylogenetic analyses. Morphologically, NBRC 32676 lacks or produces very short, single and unbranched appendages (Li et al. 2015). Further phylogenetic analyses indicated that *Truncatella* might be polyphyletic (Jeewon et al. 2002, Li et al. 2015, Senanayake et al. 2015). In this study, truncatella-like species were separated into two clades, representing *Truncatella* and *Heterotruncatella*, being closely related to genera with a single appendage (e.g. *Moria* and *Hymenolepiella*, Figs 1, 7). The generic type of *Truncatella* was epitypified and characterised with both molecular and morphological data, and other *Truncatella* species included in this study were transferred to *Heterotruncatella*.

The sexual morph of *Truncatella* was presumed to be *Broomeilla* (Shoemaker et al. 1989, Nag Raj 1993). However, the asexual morphology of the generic type species *Bro. vitalbae* differs from *Truncatella* spp. in the conidial shape and appendage numbers (Li et al. 2015). Further phylogenetic analyses indicated that although *Bro. vitalbae* and *Tru. angustata* cluster in a main clade (94 % sequence similarity in ITS, 88 % on rpb2, 88 % on tef-1α, and 74 % on tub2), they were intermixed with the genera *Hyaloctella* and *Diversimediispora* (Fig. 7). Therefore, *Truncatella* and *Broomeilla* should be retained as distinct genera.

**Truncatella angustata** (Persoon : Link) Hughes, Canad. J. Bot. 36: 822. 1958, **emend.** F. Liu, L. Cai & Crous. Figs 84, 85. **Basionym**: Stilbospora angustata Persoon, Syn. meth. fung. (Göttingen) 1: 96. 1801. **Synonyms**: Stilbospora angustata Persoon : Link, Linn. Spec. Pl. Deutschl. Fl. III (Pilze), 2(7): 49. 1829. Sporidesmium angustatum (Persoon : Link) Corda, in Sturm’s deutschl. Fl. III (Pilze), 2(7): 49. 1829. Pestalotia truncata (Pers.) S. Hughes [= Pestalozzia] (J.F.H. Beyma) Steyaert, Bull. Jard. bot. État Brux. 19: 295. 1949. Pestalotia hartigii (Tubef, Beiträge zur Kenntniss der Baumrankheiten: 40. 1888. Truncatella hartigii (Tubef) Steyaert, Bull. Jard. bot. État Brux. 19: 298. 1949. Monochaetia rosenwaldii Khaz. [as ‘rosenwaldia’], J. Agric. Res., Washington 26: 56. 1923. Pestalotia ramulosa J.F.H. Beyma [as ‘Pestalozzia’], Centbl. Bakt. ParasitKde, Abt. II 88: 140. 1933. Truncatella ramulosa (J.F.H. Beyma) Steyaert, Bull. Jard. bot. État Brux. 19: 295. 1949.

**Culture characteristics**: Colonies on MEA flat with entire edge, white to pale grey, reaching 63–64 mm diam after 7 d at 21 °C, conidiomata black, gregarious, semi-immersed, stromatic, covered by aerial mycelia; on CMA flat with entire edge, off-white to grey, reaching 49 mm diam after 7 d at 21 °C, conidiomata black, scattered to gregarious, stromatic, semi-immersed or immersed; on PDA flat with entire edge, pale grey, reaching 71–74 mm diam after 7 d at 21 °C, conidiomata pale brown,
scattered, covered by aerial mycelia, semi-immersed or immersed, stromatic, acervular; on SNA flat with entire edge, pale grey, reaching 44–46 mm diam after 7 d at 21 °C, conidiomata black, scattered, superficial or immersed, acervular.

**Description:** Sexual morph: unknown. Asexual morph: Conidiophores lining the cavity of the conidioma, septate and branched, colourless, smooth. Conidiogenous cells discrete or integrated, cylindrical to lageniform, colourless, smooth. Conidia fusoid, straight or occasionally slightly curved, mostly 3-septate, occasionally 4-septate, smooth, not constricted at the septa, 15–22.5 × 5.5–8 μm (av. = 18.6 ± 1.72 × 7 ± 0.53 μm); basal cell obconic with a truncate base, fairly thick-walled, hyaline to pale brown, 1.5–3.5 μm (av. = 2.3 ± 0.46 μm) long; median cells 2, doliiform, pale to mid-brown, thick-walled, together 11–15 μm (av. = 13 ± 0.98 μm) long, ± equal, each 5.5–7.5 μm (av. = 6.6 ± 0.68 μm) long; apical cell conic, thin-walled, hyaline, 2–4.5 μm (av. = 3.2 ± 0.67 μm) long; 2–4 apical appendages, centric, attenuated, flexuous, branched, 11–26 μm (av. = 18.8 ± 3.5 μm) long; basal appendage absent; mean conidium length/width ratio = 2.7:1.

**Materials examined:** America, on Prunus armeniaca (Rosaceae), unknown collection date, A. Khazanoff, ex-syntype culture of Monochaetia rosenwaldii Khaz. CBS 165.25 = NBRC 32888. Chile, Valdivia, on Grevillea avellana (Proteaceae) necrotic spots on leaves, Jun. 1980, H. Peredo, living culture CBS 393.80. Germany, Bavaria spessart, on Picea abies (Pinaceae), 1892?, V. Tubeuf, probably ex-type culture of Pestalotia hartigii CBS 113.11 [according to Steyaert (1949)]. France, on Vitis vinifera “Prunelard” (Vitaceae) rootstock, 1 Jan. 2012, P. Larignon, living culture CPC 21354; on Vitis vinifera “Prunelard” rootstock, 1 Jan. 2012, P. Larignon, living culture CPC 21366; on Vitis vinifera “Prunelard” rootstock, 1 Jan. 2012, P. Larignon (neotype of Stilbospora angustata designated here CBS H-23508, MBT384088, ex-neotype culture CBS 144025 = CPC 21359). Netherlands, on Lupinus (Fabaceae) leaf, unknown collection date, F.H. van Beyma (holotype of Pestalotia ramulosa CBS H-7543, ex-type culture CBS 338.32); Baarn, garden Eemneserweg 90, on Prunus laurocerasus (Rosaceae) fallen leaves, 8 Jul. 1970, H.A. van der Aa, living culture CBS 938.70; Nijmegen, on food, unknown collection date, Keuringsdienst van Waren, living culture CBS 208.80. Spain, on decaying bark, 20 Jul. 1996, R.F. Castañeda, living culture CBS 135.97 = INIFAT C96/109. Switzerland, from Heterodera carotae cyst egg mass on Daucus carota, unknown collection date and collector, isolated by A. Papert, living culture CBS 642.97; Wädenswil, Edge-güsiissche Forsungsanstalt f. Obst-, Wein- u. Gartenbau, on Pyrus malus (Rosaceae, diseased apple tree), Jul. 1976, R. Grimm, living culture CBS 564.76. Turkey, Izmir, soil, unknown collection date, T. Mahmoud, living culture CBS 398.71; on rhizosphere of Gossypium sp. (Malvaceae), unknown collection date and collector, deposed by K. Türkoglu in Mar. 1977, living culture CBS 231.77 = CBS 296.77. UK, Hampshire, Bramshill Nursery, on Picea abies (Pinaceae), unknown collection date and collector, isolated by F.R. Peace on 23 Oct. 1949, living culture CBS 443.54. USA, Alaska, tundra soil, unknown collection date, K. Tubaki, living culture CBS 591.66 = ATCC 18162 = NBRC

![Fig. 84. Truncatella angustata (CBS 338.32).](image-url)
Unknown location, on Prunus (Rosaceae) wood, unknown collection date, R.M. Nattrass, No. 284, representative culture of Tru. truncata CBS 356.33 (according to Steyaert 1949); on Salix sp. (Salicaceae) or Thuja sp. (Cupressaceae)?, unknown collection date, R. Bouillenne, CBS H-15693, living culture CBS 449.51.

Notes: The sanctioned name Stilbospora angustata was incorporated in Persoon (1801) with a very brief description and no other collection data. Later, it was transferred to Truncatella (Hughes 1958). The holotype was probably collected by Persoon in Europe, and preserved in L (L910264-703, Nag Raj 1993), which unfortunately could not be located from the herbarium in this study. We therefore designate CBS H-23508 as neotype to stabilise the application of the generic type species Tru. angustata, because of its morphological similarity, and the description and illustration of Tru. angustata provided in Nag Raj (1993), which is the concept commonly applied to this genus.
Based on the multi-locus phylogenetic analyses (Figs 1, 7), the type cultures of Pestalotia hartigii, Pestalotia ramulosa, Monochaetia rosenwaldii, and Tru. truncata clustered together with Tru. angustata, which were therefore synonymised in this study.

**Xenoseimatosporium** F. Liu, L. Cai & Crous, gen. nov. MycoBank MB828424.

**Etymology:** Xeno = ξένος in Greek, alien, distinct; seimatosporium = Seimatosporium-like conidia.

**Description:** Sexual morph: unknown. Asexual morph: Conidiomata acervular, stromatic, scattered or gregarious, semi-immersed or immersed, sometimes erumpent, globose to sub-globose, dark brown to black. Conidiophores arising from the base of the cavity, septate, branched at the base, mostly reduced to conidiogenous cells, colourless, smooth. Conidiogenous cells annellidic, cylindrical, subcylindrical, or lageniform, colourless, smooth. Conidia allantoid, subcylindrical, straight or curved, 3-septate, smooth, sometimes constricted at septa; basal cell globose, trapezoid, sub-cylindrical, or obconic with a truncate base, thin-walled, hyaline; median cells cylindrical, colourless, thin-walled; apical cell conical, hyaline; apical appendage single, not smooth, ragged, unbranched; basal appendage absent or single, when present, not smooth, ragged, unbranched.

**Type species:** Xenoseimatosporium quercinum (Goonas. et al.) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828425. Fig. 86.

**Notes:** Xenoseimatosporium is phylogenetically basal to Allelochaeta and Sarcostroma (Figs 1, 2), and shows distinct conidial morphology from these two genera. The conidia of Allelochaeta are generally falcate to elongate-fusoid, 6–24 times as long as their width, with a beak-like apical cell, and the basal cell carries a short exogenous appendage (Swart & Williamson 1983, Nag Raj 1993). Sarcostroma is characterised by fusoid conidia, bearing an attenuated, filiform and smooth apical appendage and excentric basal appendage (Nag Raj 1993). Xenoseimatosporium differs from Allelochaeta in producing filiform apical and basal appendages, and from Sarcostroma by producing subcylindrical or allantoid conidia and ragged appendages.

**Xenoseimatosporium quercinum** (Goonas. et al.) F. Liu, L. Cai & Crous, comb. nov. MycoBank MB828425. Fig. 86.
Conidiogenous cells annelidic, discrete, cylindrical, subcylindrical, or lageniform, or 3–9.5 × 1.5–3.5 μm (av. = 5.9 ± 1.23 × 2.2 ± 0.5 μm), colourless, smooth. *Conidia* allantoid, subcylindrical, straight or curved, 2–4-septate, mostly 3-septate, smooth, sometimes slightly constricted at septa, 14.5–30 × 3.5–6.5 μm (av. = 18.2 ± 3.07 × 4.5 ± 0.72 μm); basal cell trapezoid, sub-cylindrical, thin-walled, hyaline, 2–5.5 μm (av. = 3.4 ± 0.67 μm) long; median cells mostly 2, cylindrical, colourless, thin-walled, ± equal length, each 5.5–9 μm (av. = 7 ± 0.71 μm) long; apical cell conic with an acute or rounded apex, sometimes inflated wider than other cells, hyaline, 2.5–6.5 μm (av. = 4.2 ± 0.84 μm); apical appendage single, not attenuated, not smooth, ragged, unbranched, 8.5–20 μm (av. = 13.4 ± 2.34 μm); basal appendage 0–1, when present not smooth, ragged, unbranched, 4–16.5 μm (av. = 12.1 ± 2.76 μm) long; mean conidium length/width ratio = 4 : 1.

**Materials examined.** Germany, on hornbeam wood (Carpinus sp.), elev. = 40 m, on Quercus robur (Fagaceae) twig, attached on a freshly fallen branch, 23 Feb. 2014, R.K. Schumacher. 23.02.2014-028 (*Quercus robur* 2015), *Sporocadaceae* subdivide tooid and subcylindrical conidia and having ragged appendages. For instance, *Discosiaceae* black, scattered or gregarious, semi-immersed or immersed, stromatic, sometimes erumpent. *Conidiophores* sefallate, reduced to conidigenous cells, colourless, smooth. *Conidiogenous cells* annelidic, discrete, cylindrical, subcylindrical, or lageniform, or 3–9.5 × 1.5–3.5 μm (av. = 5.9 ± 1.23 × 2.2 ± 0.5 μm), colourless, smooth. *Conidia* allantoid, subcylindrical, straight or curved, 2–4-septate, mostly 3-septate, smooth, sometimes slightly constricted at septa, 14.5–30 × 3.5–6.5 μm (av. = 18.2 ± 3.07 × 4.5 ± 0.72 μm); basal cell trapezoid, sub-cylindrical, thin-walled, hyaline, 2–5.5 μm (av. = 3.4 ± 0.67 μm) long; median cells mostly 2, cylindrical, colourless, thin-walled, ± equal length, each 5.5–9 μm (av. = 7 ± 0.71 μm) long; apical cell conic with an acute or rounded apex, sometimes inflated wider than other cells, hyaline, 2.5–6.5 μm (av. = 4.2 ± 0.84 μm); apical appendage single, not attenuated, not smooth, ragged, unbranched, 8.5–20 μm (av. = 13.4 ± 2.34 μm); basal appendage 0–1, when present not smooth, ragged, unbranched, 4–16.5 μm (av. = 12.1 ± 2.76 μm) long; mean conidium length/width ratio = 4 : 1.

**Notes.** This species was originally described as *Sporocadium quercinum* (as “quercina”) (Goonasekara et al. 2016). However, in our phylogenetic analysis it is clearly distinct from *Sporocadium* s. str. and other genera (Figs 1, 2). Therefore, a new genus and combination is introduced to accommodate this species. *Xenoseimatosporium* differs from *Sporocadium* in producing allantoid and subcylindrical conidia and having ragged appendages.

### DISCUSSION

#### Assessment of *Sporocadaceae*

The rDNA sequence data (ITS and LSU) were insufficient to subdivide *Sporocadaceae* as previously proposed, namely *Amphisphaeriaceae* (Winter 1885), *Bartaliniaceae* (Senanayake et al. 2015), *Discosiaceae*, *Pestalotiopsidaceae*, *Pelogycin-드리아* (Senanayake et al. 2015) and *Robillardiaceae* (Crous et al. 2015), as these clades clustered on short branches and were not well supported statistically (Senanayake et al. 2015), even when rpb2 sequence data were added to the dataset (Fig. 1). Furthermore, as these fungi have common asexual morphological characters, being asexual acervular coelomycetes (except *Synnemapestaloides*) with similar modes of conidiogenesis and conidia, it is more reasonable to treat these appended coelomycetous fungi as a single family. Therefore, based on the multi-locus data and morphological similarities presented here, the family concept *Sporocadaceae* in *Xylariales* is the earliest available and most appropriate name for the above-mentioned families.

#### Generic realtionships

The intergeneric relationships have been subject to multiple rearrangements in the past decades, due to different generic concepts, plastic and variable morphological characters and inadequate molecular data (Steyaert 1949, Guba 1961, Sutton 1980, Nag Raj 1993, Kang et al. 1998, Jeewon et al. 2002, Barber et al. 2011, Tanaka et al. 2011, Jaklitsch et al. 2016). Some generic complexes in *Sporocadaceae*, such as *Pestalotio-opsis-Truncatella-Morinia* and *Seimatosporium-Sarcostroma-Diploceras*, that possess similar morphological characters of conidia and appendages, caused difficulties in the intergeneric classification. In addition, the limited sampling of the majority of genera, unavailability of generic type-derived sequences and poorly constructed phylogenies based on too few or largely incomplete datasets also contributed to the contradictions of generic delimitation. The morphological characters, phylogenetic relationships and classification history of these genera have been partially discussed by Nag Raj (1993), Jeewon et al. (2002, 2003b) and Jaklitsch et al. (2016), and will not be repeated here.

The application of multi-locus phylogenetic analyses combined with morphology have provided valuable insights in establishing natural classification at the intergeneric level, and helped to clarify morphological ambiguities. To infer a natural classification system of *Sporocadaceae*, we carried out a more comprehensive analysis of this group based on a hitherto most complete sequence dataset consisting of five loci (ITS, LSU, *rpb2*, *tub2*, *tef-1α*; Table 1). Most genera treated here are based on their generic types, including those typified in this study (e.g. *Diploceras*, *Discosia*, *Monochaetia*, *Sporocadus*, *Truncatella*), which enabled us to define the diagnostic generic characters and propose taxonomic revision more objectively.

Our results resolved 30 well supported monophyletic clades, representing 30 genera (Figs 1, 2, 4, 7). The genus *Seimatosporium* and some of its purported synonyms (e.g. *Diploceras*, *Disaeta*, *Sporocadus*, *Sarcostroma*, and *Allelochaetia*) formed distinct lineages (Fig. 1), which is generally congruent with the morphological hypotheses of Nag Raj (1993). We therefore resurrect some of these generic names.

This study also provides an interpretation of the utility of morphological characters to determine generic delineations, including pigmentation, septation and wall annotation of median cells, position of appendages with respect to the apical and basal cells, as well as number and branching pattern of apical appendages. For instance, *Seiridium* generally produces 5-distoseptate conidia with a single centric apical and single excentric basal appendage. *Sporocadus* is generally characterised by non-appendaged, 3-septate conidia. *Seimatosporium* includes species producing 3–4-septate conidia with a single centric apical and excentric basal appendages or lack of an apical or basal appendage. *Sarcostroma* usually produces 5-septate conidia with undulate or verruculose walls. *Monochaetia* is characterised by a single centric apical appendage and single centric basal appendage (if present). The conidia of
Nonappendiculata and Distononappendiculata are 3-septate and lack appendages, but conidia of the former genus are dis- toseptate, and eusteptate in the latter. Both Truncatella and Heterotruncatella have 3-septate conidia with pigmented me- dian cells, but Heterotruncatella generally has three unbranched apical appendages.

Heterotruncatella, Hymenopleella and Morinia

The most equivocal generic concepts in the present study are Heterotruncatella, Hymenopleella and Morinia, which are het- erogeneous with respect to conidial morphology. Hetero- truncatella encompasses fungi producing 3-septate conidia and generally with three unbranched apical appendages. However, the generic type strain of Het. iutea, residing in the basal lineage of Heterotruncatella, produces a single apical appendage or tubular and attenuated appendage that continues with the conidium body. Morinia pestalozzioides and Mor. longiappendiculata are characterised by appendage-bearing muri- form conidia (Collado et al. 2006), while the conidia of Mor. crini and Mor. acaciae (syn. Zetiasplozna acaciae) only have trans- verse septa. As for Hymenopleella, the terminal branches are considerably longer than the basal branch in the phylogenetic tree (Figs 1, 7). Morphologically, the ascospores of Hym. lake- fuxianensis are muriform (Jeewon et al. 2003a), while they are transversely septate in other species of Hymenopleella.

Truncatella and related genera

Truncatella appeared to be polyphyletic, and a new genus is introduced here as Heterotruncatella (Figs 1, 7). Both genera are morphologically comparable to Pestalotiopsis in producing 3- septate conidia with two pigmented median cells and branched or unbranched apical appendages. However, they are more closely related to Hymenopleella, Morinia, Bartaliniia, Para- bartaliniia and Pseudosarcostrona, and each genus possesses clear distinguishing characters. Although Jaklitsch et al. (2016) recommended that Truncatella should be synonymised with Broomella based on the close relatedness of their generic types and nomenclatural priority, our expanded datasets resolved these clades as distinct genera (Figs 1, 7).

Utility of morphological characters — Appendages

Nag Raj (1993) listed 11 types of appendages, of which most genera in Sporocadaceae possess type A: “Cellular; formation of conidium body precedes formation of appendage; appendage(s) attenuated or filiform, simple or branched, nucleate or enucleate, volume of lumen not altered by centripetal thickening of appendage wall”. Among genera examined in this study, appendages vary in number, origin, position, number of branches and the branching patterns. Such distinct features have been employed in the past to differentiate taxa at both generic and species level (Nag Raj 1993), and have been proven appropriate and useful in delineating certain genera. For example, Bartaliniia and Hyalotelia differ from other genera possessing branched appendages that tend to be dichotomous (Fig. 8); both apical and basal appendages of Discosia are excentric and inserted in the median part of the end cells. The apical appendages of Para- bartaliniia are comparable to Bartaliniia and Hyalotelia, but differ from these two genera in the point of attachment or origin of these appendages.

The presence or absence of conidial appendages was considered an important taxonomic character in separating Seimatosporium and Sporocadus (Brockmann 1976, Nag Raj 1993); however, this morphological distinctness was not congruent with the ITS / LSU phylogeny (Barber et al. 2011). In the present study, the grouping of fungi from both genera based on an expanded dataset with more loci in the phylogenetic an- alyses (Figs 1, 2) is in agreement with the morphology-based grouping. The striking similarity between the original morphology-based grouping and the grouping based on multi- gene phylogenetic analyses highlights the significance of morphological characters and also reflects the excellent work by mycologists (e.g. Nag Raj) predating the use of molecular data.

The number of conidial appendages is not phylogenetically significant in coelomycetes in general (Crous et al. 2012), nor in the Sporocadaceae. Genera with a single apical and basal appendage are scattered throughout Clades 1–3 (Fig. 1), including Broomella, Disaeta, Discosia, Immersidiscosia, Monochaeta, Monochaetinula, Pseudosarcostrona, Sarcostrona, Seirdium and are intermingled with genera that lack appendages (Distononappendiculata, Nonappendiculata, Sporocadus) or with 2–7 appendages (e.g. Truncatella, Pestalotiopsis, Morinia). This indicates that the number of appendages may have evolved more than once among these genera, similar to the number of conidial septa or pigmentation (Crous et al. 2016).

CONCLUSIONS

The present study supports the Sporocadaceae as a well- defined family in the Xylariales (Sordariomycetes). Thirty genera are delimited in Sporocadaceae based on phylogenetic analyses and morphological comparison, which is generally congruent with the classification system proposed by Nag Raj (1993) prior to the DNA phylogeny era. A total of 51 new species, one nomina nova and 15 new combinations are proposed in this study. Although the type species of five genera have been reliably identified and typified to fix their taxonomic position, the phylogeny of several other genera, e.g. Disaeta and Sarcostrona, remain unresolved pending further collections.

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REFERENCES

Ariyawansa HA, Hyde KD, Jayasiri SC, et al. (2015). Fungal diversity notes 111–152—taxonomic and phylogenetic contributions to fungal taxa. Fungal Diversity 75: 27–274.

Barber PA, Crous PW, Groenewald JZ, et al. (2011). Reassessing Vermisporium (Amphisphaeriaceae), a genus of foliar pathogens of eucalypts. Persoonia 27: 90–118.

Batista AC, Lima JA de, Vasconcelos CT de (1960). Fungos ex atmosfera do Recife. Publicações do Instituto de Micologia da Uni- versidade do Recife 276: 1–18.
Nozawa S, Yamaguchi K, van Hop D, et al. (2017). Identification of two new species and a sexual morph from the genus Pseudopestalotiopsis. Mycological Science 55: 328–337.

Nylander JAA (2004). MrModeltest v2. Program distributed by the author. Evolutionary Biology Centre, Uppsala University, Sweden.

O’Donnell K, Cigelink E (1997). Two divergent intragenomic rDNA ITS2 types within a monophyletic lineage of the fungus Fusarium are nonhomologous. Molecular Phylogenetics and Evolution 10: 103–116.

O’Donnell K, Kistler HC, Cigelink E, et al. (1998). Multiple evolutionary origins of the fungus causing Panama disease of banana: concordant evidence from nuclear and mitochondrial gene genealogies. Proceedings of the National Academy of Sciences of the United States of America 95: 2044–2049.

Okane I, Nakagiri A, Ito T (1996). Discostroma tricellulare, a new endophytic ascomycete with a Seimatosporium anamorph isolated from Rhododendron. Canadian Journal of Botany 74: 1338–1344.

Papendorf MC (1967). Two new genera of soil fungi from South Africa. Transactions of the British Mycological Society 50: 69–75.

Perera RH, Maharachchikumbura SSN, Hyde KD, et al. (2018). An appendage-bearing coelomycete Pseudototracilla arezzoensis gen. and sp. nov. (Amphiphasiaerae genera incertae sedis) from Italy, with notes on Monocheatulina. Phytologia 338: 177–186.

Persoon CH (1801). Synopsis Methodica Fungorum 1. Henricus Dieterich, Göttingen, Germany.

Petrik VP (1950). Beiträge zur Pilzflora von Ecuador. Sydowia 4(1–6): 450–587.

Pirozynski KA, Shoemaker RA (1970). Seimatosporium leaf spot of Ledum and Rhododendron. Canadian Journal of Botany 48: 2199–2203.

Rayner RW (1970). A mycological colour chart. CMI and British Mycological Society, Kew, Surrey, UK.

Rehner SA, Samuels GJ (1994). Taxonomy and phylogeny of Gloiocladium analysed from nuclear large subunit ribosomal DNA sequences. Mycological Research 98: 625–634.

Ronquist F, Huelsenbeck JP (2003). MrBayes 3: Bayesian phylogenetic inference under mixed models. Bioinformatics 19: 1572–1574.

Saccardo PA (1892). Sylloge fungorum 10: 1–964.

Samuels GJ, Müller E, Petriti O (1987). Studies in the Amphiphasiaerae (sensu lato) 3. New species of Monographella and Pestalosphaeria and two new genera. Mycotaxon 28: 473–499.

Seifert K, Morgan-Jones G, Games W, et al. (2011). The genera of hyphomycetes. CBS-KNAW Fungal Biodiversity Centre, Utrecht, The Netherlands.

Senanayake IC, Maharachchikumbura SSN, Hyde KD, et al. (2015). Towards unraveling relationships in Xylariomycetidae (Sordariomycetes). Fungal Diversity 73: 73–144.

Shoemaker RA (1964). Seimatosporium (= Cryptostictis) parasites of Rosa, Vits, and Cornus. Canadian Journal of Botany 42: 411–417.

Shoemaker RA, Babcock CE, Müller E (1989). A new mycological colour chart. CMI and British Mycological Society, Kew, Surrey, UK.

Shoemaker RA, Müller E (1969). A new mycological colour chart. CMI and British Mycological Society, Kew, Surrey, UK.

Sivanesan A (1983). Studies on Ascomycetes. Transactions of the British Mycological Society 81: 313–332.

Stamatakis A (2014). RAxML version 8: a tool for phylogenetic analysis and post-analysis of large phylogenies. Bioinformatics 30: 1312–1313.

Steyaert RL (1949). Contribution a l’étude monographique de Pestalotia de Not. et Monochaetia Sacc. (Truncatellaceae gen. nov. et Pestalosphaeria gen. nov.). Bulletin du Jardin botanique de l’État, Bruxelles 19: 285–354.

Sung GH, Sung JM, Hywel-Jones NL, et al. (2007). A multigene phylogeny of Clavicipitaceae (Ascomycota, Fungi): identification of localized incongruence using a combinational bootstrap approach. Molecular Phylogenetics and Evolution 44: 1204–1223.

Sutton BC (1963). Coelomycetes II. Neobarcayla, Mycophyllagille, Bleptosporium and Cryptostictis. Mycological Papers 88: 1–50.

Sutton BC (1964). Coelomycetes III. Annellolacinia gen. nov., Aristostoma, Phaeocyctstroma, Seimatosporium etc. Mycological Papers 97: 1–42.

Sutton BC (1969). Forest microfungi. Ill. The heterogeneity of Pestalotia deNot. section sexiloculateae Klebahn sensu Gaba. Canadian Journal of Botany 47: 2083–2094.

Sutton BC (1973). Coelomycetes. In: The Fungi IVA (Ainsworth GC [Sparrrow FK, Sussman AS, eds]). Academic Press, New York, USA: 513–582.

Sutton BC (1975a). Coelomycetes V. Coryneum. Mycological Papers 138: 1–224.

Sutton BC (1975b). Diploceras, another genetic synonym of Seimatosporium. Transactions of the British Mycological Society 64: 483–487.

Sutton BC (1977). Coelomycetes VI. Nomenclature of generic names proposed for Coelomycetes. Mycological Papers 141: 1–253.

Sutton BC (1980). The Coelomycetes. Fungi imperfecti with pycnidia, acervuli and stromata. Commonwealth Mycological Institute, UK.

Swart HJ (1979). Australian leaf inhabiting fungi. X. Seimatosporium species on Callistemon, Melaleuca and Leptospermum. Transactions of the British Mycological Society 73: 213–221.

Swart HJ, Griffiths DA (1974). Australian leaf-inhabiting fungi. V. Two species of Seimatosporium on Eucalyptus. Transactions of the British Mycological Society 62: 359–366.

Swart HJ, Williamson MA (1983). Australian leaf-inhabiting fungi XVI. Vermiporium, a new genus of coelomycetes on Eucalyptus leaves. Transactions of the British Mycological Society 81: 491–502.

Tanaka K, Endo M, Hirayama K, et al. (2011). Phylogeny of Discomycetes and Seimatosporium, and introduction of Adicoccia and Immersidiscosia genera nova. Persoonia 26: 85–98.

Taylor JW (1995). Making the Deuteromycota redundant: a practical integration of mitosporic and meiosporic fungi. Canadian Journal of Botany 73: 754–759.

Thümen (1979). Contrb. Flor. Mycol. Lusitan.: no. 578.

Tode HJ (1971). Fungi Mecklenburgensens Selecti. 2: 1–64.

Vanev SG (1991). Species conception and sections delimitation of genus Discospora. Mycota 41: 397–396.

Vilgalys R, Hester M (1990). Rapid genetic identification and mapping of enzymatically amplified ribosomal DNA from several Cryptococcus species. Journal of Bacteriology 172: 4238–4246.

von Arx JA (1981). The genera of fungi sporulating in pure culture, 3rd edn. Cramer, Germany.

Wanasinighe DN, Phukhamsakda C, Hyde KD, et al. (2018). Fungal diversity notes 709–839: taxonomic and phylogenetic contributions to fungal latax with an emphasis on fungi on Rosaceae. Fungal Diversity 89: 1–236.

Wang B, Zhang Z, Guo L, et al. (2016). New cytotoxic meroterpenoids from the plant endophytic fungus Pestalotiosis fici. Helvetica Chimica Acta 99: 151–156.

Watanabe K, Sekiguchi M, Sato T, et al. (2016). Phylogenetic analysis of the synnema-producing genus Synnemapestaloides. Journal of Fungi 2: 28.

Wei JG, Xu T, Guo LD, et al. (2005). Endophytic Pestalotiopsis species from southern China. Mycoscience 46: 481–493.

Wei JG, Xu T, Guo LD, et al. (2007). Endophytic Pestalotiopsis species associated with plants of Podocarpaceae, Taxaceae and Taxodaceae in southern China. Fungal Diversity 24: 55–74.

White TJ, Bruns T, Lee S, et al. (1990). Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In: PCR protocols: a guide to methods and applications (times MA, Gelfand DH, Sninsky JJ, et al., eds.). Academic Press, USA: 315–322.

Wijayawardene NN, Goonasekera ID, Camporei E, et al. (2016a). Two new Seimatosporium species from Italy. Mycoscience 7: 204–213.

Wijayawardene NN, Hyde KD, Wanasinighe DN, et al. (2016b). Taxonomy and phylogeny of dematiaceous coelomycetes. Fungal Diversity 77: 1–316.

Wingfield MJ, De Beer ZW, Slippers B, et al. (2012). One fungus, one name promotes progresive plant pathology. Molecular Plant Pathology 13: 604–613.

Winter G (1885). Rabenhorst Kryptogamen-Flora. 604: 138–247.

Winter G (1892). Kryptogamen-Flora. 604: 138–247.