INTRODUCTION

The recent 'Deep Hypha' issue of Mycologia (vol. 98, 2006) included 21 phylogenetic studies employing multi-gene phylogenies to resolve major groups of Fungi. These papers provided the foundation for the study of James et al. (2006), in which six genes (SSU, LSU, 5.8S rRNA, rpb1, rpb2 and tef1) for approximately 200 fungal taxa were used to present the first kingdom-level phylogeny, and a new classification for the Fungi (Hibbett et al. 2007). These studies also illustrated clearly that it was merely the ‘tip of the iceberg’, and that numerous genera must now be accommodated in this phylogenetic framework. A major problem encountered during the Assembling the Fungal Tree of Life (AFTOL, www.aftol.org) project, was that many genera are insufficiently known, and have never been cultivated, or subjected to DNA analyses. This is especially true for the majority of apparently asexual microfungi, namely the

coelomycetes (Sutton 1980, Nag Raj 1993) and hyphomycetes (Ellis 1971, 1976, Carmichael et al. 1980). The only means to deal with this problem is, therefore, to encourage mycologists to recollect these genera and species, to establish cultures for them and to ultimately generate DNA sequence data (Shenoy et al. 2007), a process which can be described as ‘leafing out the fungal tree of life’. Ten genera of hyphomycetes not previously known from culture, or for which the phylogenetic classification is uncertain, are treated in the present study. These fungi were collected from diverse hosts from various continents, isolated in axenic culture, and subjected to DNA sequence analysis. They are shown to belong to the Chaetothyriales (Brycekendrickomyces, Cyphellophora, Vonarxia), Pleosporales (Chalastospora, Dictyosporium, Edenia, Xenostigmia), Helotiales (Thegdonia), and the Capnodiaceae, Mycosphaerellaceae (Trochophora, Verrucospora).

The present paper represents a further contribution in a series aiming to clarify the morphology and DNA phylogeny of obscure genera of microfungi. Other than resolving their phylogenetic relationships, several novelties are described, and keys are provided to the accepted species in these genera.

MATERIAL AND METHODS

Isolates

Symptomatic leaves and leaf litter were collected on various continents, and sent to the Centraalbureau voor Schimmelcultures (CBS) for isolation of microfungi. Leaves with visible fruiting were immediately subjected to direct isolation of hyphomycetes, or alternatively were first incubated in moist chambers to
| Species | Strain no. | Substrate | Country | Collector(s) | GenBank Accession no.1 | GenBank Accession no.2 |
|---------|------------|-----------|---------|--------------|------------------------|------------------------|
| Brycekendrickomyces acaciae | CBS 124104; CPC 140978 | Acacia auriculiformis | Indonesia | M.J. Wingfield | FJ839644 | FJ839684 |
| Chalastospora cetera | CBS 121340; E.G.S. 41.072 | Elymus scabrus | Australia | R.G. Rees | FJ839607 | FJ839642 |
| Chalastospora ellipsoidea | CBS 121331; E.G.S. 22.060 | sp. | Australia | H.L. Harvey & S. Perth | FJ839608 | FJ839643 |
| Chalastospora gossypii | CBS 112844; CPC 4571 | USA | F.M. Dugan | AY251081 | AY251081 |
| Chalastospora gossypii var. polymorpha | CBS 112048; CPC 4570 | Dormant buds (overwintered) of Vitis vinifera | USA | F.M. Dugan | AY251080 | AY251080 |
| Chalastospora obclavata | CBS 124120; E.G.S. 12.128 | Air | USA | C.T. Rogerson | FJ839616 | FJ839651 |
| Cyphellophora eugeniae | CBS 124105; CPC 15172 | Living leaves of Stenocalyx uniflorus | Brazil | A.C. Alfenas | FJ839617 | FJ839652 |
| Dictyosporium strelitziae | CBS 123359; CPC 15359 | Dead leaves of Strelitzia nicolai | South Africa | A. Wood | FJ839618 | FJ839653 |
| Edenia gomezpompae | CBS 124106; CPC 15689 | Senna alata | Philippines | C.J.R. Cumagun | FJ839619 | FJ839654 |
| Haplographium catenatum | CBS 196.73 | Decaying wood | Germany | W. Gams | FJ839620 | FJ839655 |
| Haplographium calocephalum | CBS 482.67; CMW 754 | Decaying wood | Germany | W. Gams | FJ839660 | FJ839661 |
| Lauriomyces bellulus | CBS 517.93 | Cupule of Castanea sativa | Switzerland | P.W. Crous | FJ839623 | FJ839664 |
| Lauriomyces heliocephalus | CBS 112054; INIFAT CO2/59 | Decaying leaf | Brazil | A. Stchigel & J. Guarro | FJ839624 | FJ839659 |
| Mycosphaerella lupini | CPC 1661 | Lupinus sp. | USA | W. Kaiser | AF362050 | FJ839661 |
| Stenella anthuriicola | CBS 118742 | Anthurium leaf | Thailand | C.F. Hill | FJ839626 | FJ839662 |
| Stigmina platani | CBS 110755; CPC 4296; IMI 36770 | leaves of Acer macrophyllum | USA | C.T. Rogerson | FJ839627 | FJ839663 |
| Stigmina platani | CBS 110755; CPC 4296; IMI 36770 | leaves of Acer macrophyllum | USA | P.W. Crous | FJ839628 | FJ839664 |
| Stigmina platani | CBS 110755; CPC 4296; IMI 36770 | leaves of Acer macrophyllum | USA | C.T. Rogerson | FJ839629 | FJ839665 |
| Stigmina platani | CBS 110755; CPC 4296; IMI 36770 | leaves of Acer macrophyllum | USA | P.W. Crous | FJ839630 | FJ839666 |
| Stigmina platani | CBS 110755; CPC 4296; IMI 36770 | leaves of Acer macrophyllum | USA | C.T. Rogerson | FJ839631 | FJ839667 |
| Thedgonia ligustrina | CPC 14754 | Ligustrum obtusifolium | South Korea | H.-D. Shin | FJ839634 | FJ839670 |
| Verrucisporota daviesiae | CBS 116002; VPRI 31767 | Living leaves of Daviesia mimosoides | Australia | V. Beilharz & R. Beilharz | FJ839633 | FJ839668 |
| Verrucisporota grevilleae | CBS 124107; CPC 14761 | Leaves of Grevillia decurrens | Australia | B. Summerell | FJ839635 | FJ839671 |
| Verrucisporota proteacearum | CBS 116003; VPRI 31812 | Grevillea sp. | Australia | V. Beilharz & R. Beilharz | FJ839636 | FJ839672 |
| Vonarxia vagans | CBS 123533; CPC 15151 | Stenocalyx uniflorus | Brazil | A.C. Alfenas | FJ839639 | FJ839674 |
| Xenostigmina zilleri | CBS 115685; CPC 4011 | Living leaves of Acer macrophyllum | Canada | H. Evans | EU040242 | EU040242 |

1 ATCC: American Type Culture Collection, Virginia, USA; C.F. Hill: Culture collection of C.F. Hill, housed at MAF, New Zealand; CBS: Culture collection of M.J. Wingfield, housed at AMF, New Zealand; CMW: Culture collection of M.J. Wingfield, housed at FABI, Pretoria, South Africa; CPC: Culture collection of P.W. Crous, housed at CBS; E.G.S.: Culture collection of E.G. Simmons, Indiana USA; IMI: Culture collection of fungi, Pretoria, South Africa; VPRI: Victorian Department of Primary Industries, Knoxfield, Australia.

2 ITS: Internal transcribed spacers 1 and 2 together with 5.8S nrDNA; LSU: 28S nrDNA.
stimulate sporulation. Single-conidial isolates were established on malt extract agar (MEA, 20 g/L Biolab malt extract, 15 g/L Biolab agar) using the technique outlined in Crous (1988). Cultures were later plated on fresh MEA, 2% water agar (WA) supplemented with sterile pine needles, 2% potato-dextrose agar (PDA), synthetic nutrient agar (SNA) and/or oatmeal agar (OA) (Crous et al. 2009), and subsequently incubated at 25 °C under near-ultraviolet light to promote sporulation. Reference strains are maintained in the culture collection of the CBS, Utrecht, the Netherlands (Table 1). Descriptions, nomenclature, and illustrations were deposited in MycoBank (www.mycobank.org, Crous et al. 2004b).

**DNA isolation, amplification and analyses**

Genomic DNA was isolated from fungal mycelium grown on MEA, using the UltraClean Microbial DNA Isolation Kit (Mo Bio Laboratories, Inc., Solana Beach, CA, USA) according to the manufacturer’s protocols. The Primers V9G (de Hoog & Gerrits van den Ende 1998) and LR5 (Vilgalys & Hester 1990) were used to amplify part of the nuclear rDNA operon spanning the 3’ end of the 18S rRNA gene (SSU), the first internal transcribed spacer (ITS1), the 5.8S rRNA gene, the second ITS region (ITS2) and the first 900 bases at the 5’ end of the 28S rRNA gene (LSU). The primers ITS4 (White et al. 1990) and LR0R (Rehner & Samuels 1994) were used as internal sequence primers to ensure good quality sequences over the entire length of the amplicon. The PCR conditions, sequence alignment and subsequent phylogenetic analysis followed the methods of Crous et al. (2006b). Alignment gaps were treated as new character states. Sequence data were deposited in GenBank (Table 1) and alignments in TreeBASE (www.treebase.org). The ITS sequences were compared with those sequences available in NCBI’s GenBank nucleotide database using a megablaster search and the results are discussed where applicable under the taxonomic notes. Because the genus _Chalastospora_ is relatively novel, species in this genus were supported by a separate phylogenetic tree.

**Morphology**

Fungal descriptions were based on cultures sporulating in vitro (media indicated). Wherever possible, 30 measurements (× 1000 magnification) were made of structures mounted in lactic acid, with the extremes of spore measurements given in parentheses. Colony colours (surface and reverse) were assessed after 2–4 wk on different media at 25 °C in the dark, using the colour charts of Rayner (1970).

**RESULTS**

**Phylogenetic analysis**

Amplification products of approximately 1700 bases were obtained for the isolates listed in Table 1. The LSU region of the sequences was used to obtain additional sequences from GenBank, which were added to the alignment. Due to the inclusion of the shorter LSU sequences of _Dictyosporium alatum_ (GenBank accession DQ018101), _Dictyosporium elegans_ (GenBank accession DQ018100) and _Dictyosporium toruloides_ (GenBank accession DQ018104) in the alignment, it was not possible to subject the full length of the determined LSU sequences (Table 1) to analyses. The manually adjusted LSU alignment contained 115 sequences (including the two outgroup sequences) and, of the 568 characters used in the phylogenetic analyses, 267 were parsimony informative, 30 were variable and parsimony uninformative, and 271 were constant. Neighbour-joining analyses using three substitution models on the sequence data yielded trees supporting the same tree topology to one another but differed from the most parsimonious tree shown in Fig. 1 with regard to the placement of the clade containing _Ochroconis_ and _Fusciadium_ (in the distance analyses, this clade moves to a more basal position). Forty equally most parsimonious trees (TL = 1 039 steps; CI = 0.477; RI = 0.833; RC = 0.397), the first of which is shown in Fig. 1, were obtained from the parsimony analysis of the LSU alignment.

The manually adjusted ITS alignment contained 28 sequences (including the outgroup sequence) and, of the 521 characters used in the phylogenetic analyses, 97 were parsimony informative, 91 were variable and parsimony uninformative, and 333 were constant. Neighbour-joining analyses using three substitution models on the sequence data yielded trees supporting the same tree topology to one another but differed from the most parsimonious tree shown in Fig. 2 with regard to the placement of _Chalastospora ellipsoidea_ (in the distance analyses, this taxon moves to a more basal position in _Chalastospora_). Six equally most parsimonious trees (TL = 253 steps; CI = 0.913; RI = 0.938; RC = 0.856), the first of which is shown in Fig. 2, were obtained from the parsimony analysis of the ITS alignment. The results of the phylogenetic analyses are highlighted below under the taxonomic notes, or in the Discussion, where applicable.

**Taxonomy**

**Brycekendrickomyces** Crous & M.J. Wingf., _gen. nov._

*MycoBank MB509515*

Mycelium ex hyphis ramosis, septatis, laevibus, pallide brunneis, 1–2 µm latissimis compositum. Conidiophora solitaria, erecta, cylindrica, recta vel leviter flexuosa, cellulara basalibus bulbosa, sinea rhizoideis, stipite modice brunneo vel atro-brunneo, laevi, transverse euseptato, ad apicem cum (1–)2–4–6 cellulis conidiogenisis. Cellulae conidiogenae subcilindricae, allantoideos vel doliformes, rectae vel leviter curvatae, pallide brunneae, polyblasticae, symposidiatleri proliferantes. Conidia hyalina, mucilagine aggregata (sed non catenata), ellipsoidea, apice subobtusa, basi subtruncata.

*Type species._ Brycekendrickomyces acaciae Crous & M.J. Wingf.

Etymology. Named for Bryce Kendrick, husband of Laurie Kendrick, for which _Lauriomyces_ was named and that resembles the current genus.

*Mycelium* consisting of branched, septate, smooth, pale brown, 1–2 µm wide hyphae. _Conidiophores_ solitary, erect, cylindrical, straight to somewhat flexuous, basal cell bulbous, without rhizoids; stalk medium to dark brown, smooth, transversely euseptate; upper cell giving rise to (1–)2–4–6 conidiogenous cells. _Conidiogenous cells_ subcylindrical to allantoid or doliform, straight to gently curved, pale brown, polyblastic, proliferating sympodially. _Conidia_ hyaline, aggregating in slimy mass (never in chains), ellipsoid, apex subobtuse, base subtruncate.

**Brycekendrickomyces acaciae** Crous & M.J. Wingf., _sp. nov._

*MycoBank MB509517*

*Maculae* modice brunneae vel atro-brunneae, margine elevato, rubro-purpureae, oblongae vel ellipsoideae, ad 7 mm diam, in consortione _Acacia_. In vitro (MEA): Mycelium ex hyphis ramosis, septatis, laevibus, pallide brunneis, 1–2 µm latissimis compositum. Conidiophora ex hyphis oriunda, solitaria, erecta, cylindrica, recta vel leviter flexuosa, cellulara basalibus bulbosa, sinea rhizoideis, 4–6 µm lata, ad basim 10–15 µm lata, stipite modice brunneo vel atro-brunneo, laevi, transverse 2–5 euseptato, (15–)30–50–60 µm longo, (3–)4–5 µm lato, ad apicem cum (1–)2–4–6 cellulis conidiogenisis. Cellulae conidiogenae subcilindricae, allantoideos vel doliformes, rectae vel leviter curvatae, pallide brunneae, 5–8 × 2–2.5 µm, polyblasticae, symposidiatleri proliferantes. Conidia hyalina, mucilagine aggregata (sed non catenata), ellipsoidea, apice subobtusa, basi subtruncata, latitudine maxima in parte centrali vel in parte supra centrum, saepe leviter asymmetrica, (3.5–)4–4.5 × (2–2.5) µm.

Etymology. Named after the host genus on which the fungus occurs, _Acacia._
Leaf spots medium to dark brown, margin raised, red-purple, oblong to elliptoid, up to 7 mm diam, associated with 'Phaeo-trichocois' crotalariae. Description based on culture on MEA: Mycelium consisting of branched, secpitate, smooth, pale brown, 1–2 µm wide hyphae. Conidiophores arising from mycelium, solitary, erect, cylindrical, straight to somewhat flexuous; basal cell bulbous, without rhizoids, 4–6 µm wide in upper part, but becoming 10–15 µm wide at basal part; stalk medium to dark brown, smooth, transversely 2–5–euseptate, (15–)30–50(–60) µm tall, (3–)4(–5) µm wide in the middle part; upper cell giving rise to (1–)2–4(–6) conidiogenous cells. Conidiogenous cells subcylindrical to allantoid or doliform, straight to gently curved, pale brown, 5–8 × 2.25 µm; polyblastic, proliferating symmetrically. Conidia hyaline, aggregating in slimy mass (never in chains), ellipsoid, apex subobtuse, base subtruncate, widest in the middle or upper third of the conidium, frequently somewhat asymmetrical, (3.5–)4(–4.5) × (2–2.5) µm.

Characteristics in culture — Colonies on MEA erumpent, spreading, with moderate aerial mycelium; surface folded, margin lobate, smooth; surface olivaceous-grey, outer margin iron-grey; reverse iron-grey; colonies reaching up to 20 mm after 1 mo. Colonies fertile on SNA, OA and MEA.

Specimen examined. Indonesia, Pelalawan, living leaves of Acacia auriculiformis, Mar. 2008, leg. M. J. Wingfield, isol. P. W. Crous, holotype CBS H-20198, culture ex-type CPC 15076 = CBS 124104.

Notes — Castañeda & Kendrick (1990) established the genus Lauriomyces, characterised by dark brown conidiophores, and described various species based on their morphological characteristics. However, the exact taxonomic placement of this species within the broader Mycosphaerellaceae family is not clear from the given text.
Haplographium Castañeda & Kendrick (1990) placed it in chová (1973) to place this species in was an older name for name, other species of Lauriomyces Lauriomyces’ catenatus is not congeneric with shown here, & de Hoog 1986, Castañeda & Kendrick 1990) and type species. Hughes (1958) noted that (Mason 1933), which Saccardo (1886) also reported for the described by Berkeley & Broome as having conidia in chains (Crous & Wingfield 1994), suggesting that the two genera are phologically similar to Lauriomyces heliocephalus (Kendrick & Castañeda 1993). Its confused history is discussed in detail by Zucconi (1993). The genus Haplographium is based on H. delicatum (H. delicatum), which led Holubová-Je- which is somewhat similar to Argopericonia (Sutton & Pascoe 1987), although the latter fungus produces hyaline, apical conidiogenous heads, and it has elliptoidal, single to short catenate conidia, each with a prominent, globose guttule. and a series of branches, giving rise to chains of hyaline conidia via sympodial conidiogenesis. Brycekendrickomyces is mor- mology similar to Lauriomyces, which in turn resembles Haplographium. The genus Haplographium is based on H. delicatum. Its confused history is discussed in detail by Zucconi & Pagano (1993). Haplographium delicatum was originally described by Berkeley & Broome as having conidia in chains (Mason 1933), which Saccardo (1886) also reported for the type species. Hughes (1958) noted that Stilbum catenatum was an older name for H. delicatum, which led Holubová-Je- chová (1973) to place this species in Haplographium, while Castañeda & Kendrick (1990) placed it in Lauriomyces. If Haplographium and Lauriomyces are synonymous, the older name, Haplographium, would have preference. However, as shown here, ‘Lauriomyces’ catenatus is not congeneric with other species of Lauriomyces, such as L. heliocephalus (Rao & de Hoog 1986, Castañeda & Kendrick 1990) and L. bellulus (Crous & Wingfield 1994), suggesting that the two genera are distinct, and that the name Haplographium catenatum should be resurrected. Data from this study, furthermore, suggest that the strains of H. catenatum included here, probably represent a species complex.

Brycekendrickomyces differs from Haplographium and Lauriomyces by the absence of an intricate conidiophile branching system, and in having conidia produced in slimy heads rather than in chains. Furthermore, it is not phylogenetically related to species of Lauriomyces or Haplographium presently known from culture (Fig. 1). Brycekendrickomyces is somewhat similar to Argopericonia (Sutton & Pascoe 1987), although the latter fungus produces hyaline, apical conidiogenous heads, and it has elliptoidal, single to short catenate conidia, each with a prominent, globose guttule.
Chalastospora E.G. Simmons, Alternaria. An identification manual: 668. 2007

Type species. Chalastospora cetera (E.G. Simmons) E.G. Simmons.

Conidiophores solitary, brown, smooth, arising from surface hyphae or as short, lateral branches from ropes of aerial hyphae; short, subcylindrical to flask-shaped, 0–2-transversely euseptate, seldom once geniculate or branched. Conidiogenous cells integrated, terminal or conidiophores reduced to conidiogenous loci visible as minute pores, without or with somewhat thickened rim. Conidia in acropetal, branched chains, narrowly ellipsoid to narrowly ovoid, pale to darkened and slightly thickened rim. Conidial apex functioning as secondary conidiophore, proliferating laterally.

Chalastospora gossypii (Jacz.) U. Braun & Crous, comb. nov. — MycoBank MB509518; Fig. 4

Basionym. Cladosporium gossypii Jacz., Holopkovo Delo 1929, 5–6; 564. 1929 and Trudy Byuro Priklad. Bot. 24 (5): 181–182. 1931.
Notes — The genus *Chalastospora* appears to represent an anamorph lineage in the *Pleosporales* (Fig. 1). *Chalastospora cetera* and *C. gossypii* are clearly congeneric (Fig. 2). Based on the ITS data, there are some point mutations among strains of *C. gossypii*, suggesting that other genes need to be sequenced to fully elucidate the variation within this species (Fig. 2). On SNA, ramoconidia of CBS 114810 were 10–17 × 3–5 µm, and conidia narrowly ellipsoid-ovoid, cylindrical to fusiform, 6–10 × 2–2.5 µm, thus much smaller than that reported by Braun et al. (2003) on PDA. Jaczewski introduced the name *Cladosporium gossypii* in 1929, and provided a brief Russian description, including shape and size of conidia. This description, published before 1935, is, however, valid. In his paper of 1931, he re-introduced *C. gossypii* together with a Latin description and a micrograph of conidia. Type material of *C. gossypii* was re-examined and it is identical to *C. malorum*. However, *C. gossypii* is an older name than *C. malorum*, which was published in 1931, and has priority.

*Chalastospora ellipsoidea* Crous & U. Braun, *sp. nov.* — MycoBank MB509519; Fig. 5

*Chalastosporae gossypii* similis, sed conidia ellipsoideae, longior et leviter latioribus, (8–)10–15(–17) × 3(–3.5) µm.

Etymology. Named after its ellipsoid conidia.
On SNA: **Conidiophores** arising singly from aerial and creeping hyphae; subcylindrical, erect, medium brown, smooth, up to 25 × 3 µm, frequently reduced to conidiogenous cells, 5–13 × 3 µm; seldom once geniculate, mostly straight, with a slight swelling in the apical conidiogenous region; conidiogenous loci 1–3 per conidiogenous cell, medium brown, slightly thickened, darkened, up to 1 µm wide. **Ramoconidia** (0–)1–3-septate, ellipsoid-ovoid, subcylindrical or fusiform, smooth, medium brown, (12–)15–18(–30) × 3(–4) µm; apex at times with short beak, giving rise to lateral branch. **Conidia** ellipsoid to fusoid, medium brown, smooth, in long acropetal chains, simple, or branched with short apical or basal, lateral branches, (8–)10–15(–17) × 3(–3.5) µm, 0–1(–2)-septate; hila thickened and darkened, 0.5–1 µm wide.

**Characteristics in culture** — Colonies on OA spreading, with moderate, flattened aerial mycelium, smoke-grey. On MEA cinnamon with patches of hazel on surface and reverse. On PDA olivaceous-grey, with moderate aerial mycelium; iron-grey in reverse.

**Specimen examined.** Australia, on Triticum, H. L. Harvey & S. Perth, holotype CBS H-20199, culture ex-type E.G.S. 22.060 = CBS 121331.

Notes — The most characteristic features of this species are its short lateral branches, and ellipsoid conidia. It is clearly distinct from *C. cetera* and *C. gossypii* based on ITS sequence data (Fig. 2).

**Chalastospora obclavata** Crous & U. Braun, sp. nov. — MycoBank MB509520; Fig. 6

Differt ab omnibus specibus Chalastosporae conidiis intercalarius obclavis.

*Etymology.* Named after its obclavate conidia.

Sporulating poorly on SNA. **Conidiophores** 17–30 × 3–4 µm, arising singly from aerial and creeping hyphae; subcylindrical, somewhat clavate near apex of conidiogenous region, erect, straight to once geniculate, medium brown, smooth, frequently reduced to conidiogenous cells, 5–10 × 3–4 µm; conidiogenous loci medium brown, slightly thickened, darkened, 1–1.5 µm wide. **Ramoconidia** medium brown, smooth, developing short lateral beaks at apex that give rise to lateral chains (verticillate-like appearance), obclavate, widest at base, 0–3-septate, (28–)30–35 × (3.5–)4–5(–6) µm. **Conidia** obclavate, widest at base, (23–)26–30(–35) × (3.5–)4 µm, 0–3-septate; hila thickened, darkened, 0.5–1.5 µm wide.

**Characteristics in culture** — Colonies on OA spreading, with moderate, white aerial mycelium, grey-olivaceous to smoke grey; reverse grey-olivaceous. On MEA cream with dense aerial mycelial mat.

**Specimen examined.** USA, Kansas, Manhattan, ex air, Jan. 1958, C.T. Rogerson, holotype CBS H-20200, culture ex-type E.G.S. 12.128 = CBS 124120.
Notes — The most characteristic features of this species are its conidial branching pattern and conidial shape. This strain was discussed by Simmons under *Alternaria cetera* (Simmons 1996), and under *Chalastospora* in Simmons (2007). It is clearly distinct from *C. cetera* (ex-type CBS 121340, Fig. 7), *C. ellipsoidea* and *C. gossypii* based on ITS sequence data (Table 1, Fig. 2).

**Cyphellophora G.A. de Vries**, Mycopathol. Mycol. Appl. 16: 47. 1962

*Type species.* *Cyphellophora laciniata* G.A. de Vries.

*Hyphae* fertile, pale brown, 1.5–3 µm wide, at times constricted at septa. *Conidigenous cells* phialidic, intercalary, at times on short lateral branches, with a prominent to indistinct collarette. *Conidia* sickle-shaped, brown, smooth-walled, 1–3-septate, adhering in bundles.

**Cyphellophora eugeniae** Crous & Alfenas, *sp. nov.* — MycoBank MB509521; Fig. 8

*Cyphellophoroae taiwanensis* similis, sed conidiis valde longioribus, (40–)60–75(–90) × 2–2.5(–3) µm.

*Etymology.* Named after the host on which it occurs, *Eugenia*.

On PDA. *Mycelium* consisting of branched, greenish brown, septate, smooth, 3–5 µm wide hyphae, constricted at septa. *Conidigenous cells* phialidic, intercalary, inconspicuous to subdenticulate, 1 µm wide, with minute collarettes, with several loci aggregated at hyphal swellings. *Conidia* subcylindrical, tapering towards obtuse ends, curved, smooth, hyaline to olivaceous.

**KEY TO SPECIES OF CHALASTOSPORA**

1. Intercalary conidia usually longer than 20 µm . . . . . . . . . . 2
2. Intercalary conidia shorter than 20 µm . . . . . . . . . . . . . . . 3
3. Intercalary conidia narrowly ellipsoid to narrowly ovoid, widest in middle or lower third, (10–19–24(–30) × 3(–4) µm, 0–3-septate . . . . . . . . . . . . . . . . . . . . . . . . . . . . C. cetera
4. Intercalary conidia obclavate, widest at base, (23–)26–30(–35) × (3.5–)4 (5–)µm, 0–3-septate . . . . . . . . . . . . . . . . . . . . . . . . . C. obclavata
5. Intercalary conidia narrowly ellipsoid-ovoid to cylindrical or fusiform, 6–10 × 2–2.5 µm, mostly aseptate . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . C. gossypii
6. Intercalary conidia ellipsoid, not cylindrical nor fusiform, (8–)10–15(–17) × 3(–3.5) µm, 0(–2)-septate C. ellipsoidea

1 Colonies cultivated on SNA.
Fig. 6  Chalastospora obclavata (CBS 124120). a, b. Superficial mycelium on SNA showing conidiophores with branched conidial chains; c–e. conidia in chains. — Scale bar = 10 µm.

Fig. 7  Chalastospora cetera (CBS 121340). a–g. Superficial mycelium on SNA showing conidiophores with conidial chains. — Scale bars = 10 µm.
finely guttulate, 4–6(–10)-septate, prominently constricted at septa, widest in the middle of conidium, (40–)60–75(–90) × 2–2.5(–3) µm; conidia also anastomose and undergo microcyclic conidiation in culture.

Characteristics in culture — Colonies on PDA erumpent, with sparse aerial mycelium and even margins; surface olivaceous-grey, with patches of iron-grey; reverse iron-grey. On MEA erumpent, with folded surface and smooth, lobate margin, and sparse aerial mycelium; surface pale olivaceous-grey to olivaceous-grey; reverse iron-grey. On OA spreading, flat, with even, smooth margins and sparse aerial mycelium, olivaceous-grey. Colonies reaching 15 mm diam after 1 mo at 25 °C, fertile, sporulating in slimy sporodochial masses.

Specimen examined. BRAZIL, Rio Grande do Sul, Guaiba, living leaves of Stenocalyx uniflorus, 1 Apr. 2008, leg. A.C. Alfenas, isol. P.W. Crous, holotype CBS H-20201, culture ex-type CPC 15172 = CBS 124105.

Notes — The indistinct conidiogenous loci of C. eugeniae are reminiscent of those of C. taiwanensis (Matsushima 1985). The two species can be distinguished by the much longer conidia in C. eugeniae. Based on the key provided by Decock et al. (2003), C. eugeniae appears to represent a new species. Further collections of this complex are required to confirm the synonymy of the genera Cyphellophora with Pseudomicrodochium and Kumbhayama (Decock et al. 2003, Crous et al. 2007b), which were originally distinguished based on the absence of conidial pigmentation. The ITS sequence of C. eugeniae has 89 % similarity to that of Cyphellophora hylomeconis (GenBank accession EU035415).
KEY TO SPECIES OF CYPHELLOPHORA
(adapted from Decock et al. 2003)

1. Phialides intercalary, reduced to a sessile locus with col-larette ........................................ 2
2. Conidia 1–3-septate .................................................. 3
3. Conidia up to 2.5 µm wide (11–20 × 2–2.5 µm), 1(–2)-sep-tate........................................ C. fusarioïdes
1. Phialides prominent, cylindrical, flask-shaped, sessile or with an elongated base .................. 6
3. Conidia up to 5 µm wide (11–25 × 2–5 µm), 1–3-septate .................................... C. laciniata
2. Conidia 1–3-septate .................................................. 4
4. Conidia up to 2 µm wide, 3–6-septate, sigmoid (16–35 × 1.5–2 µm) ................................ C. taiwanensis
4. Conidia wider than 2 µm ........................................... 5
5. Conidia subcylindrical, 4–6(–10)-septate, (40–)60–75(–90) × 2–2.5(–3) µm ...................... C. eugeniae
5. Conidia sigmoid, 1–5-septate, (15–)25–35(–55) × (2.5–) 3(–4) µm ................................ C. hylomeconis
6. Phialides short to long and cylindrical; conidia 1–1.2 µm wide, 2–3-septate ...................... C. suttonii
6. Phialides prominent, flask-shaped, sessile or with an elongated base ................................ 7
7. Conidia mainly straight, on average smaller than 20 µm, 1–5-septate .................................. 8
7. Conidia straight to more commonly falcate, curved, or sigmoid, on average longer than 20 µm ........................................... 8
8. Conidia (1–)3-septate, wider than 3 µm, 25–40 × 3.5–5.5 µm; phialides commonly with an elongated base C. indica
8. Conidia 2–8-septate, narrower than 3 µm; phialides without elongated base ...................... 9
9. Conidia vermiform, mostly curved, mostly 4–8-septate, 30–55 × 1.2–1.5 µm ...................... C. vermispora
9. Conidia straight, falcate or slightly sigmoid, (2–)3–6-septate, (18–)19.5–28(–29) × 1.5–2 µm ...... C. guyanensis

Dictyosporium Corda, in Weitenweber, Beitr. Gesammten Natur-Heilwiss., Prag 1: 87. 1836

Type species. Dictyosporium elegans Corda.

Conidiomata sporodochial, black, scattered. Mycelium predominantly immersed, consisting of branched, septate, smooth, thin-walled hyphae. Conidiophores micronematous, mononematous, pale brown, smooth to finely verruculose, thinned septate, cylindrical. Conidiogenous cells monoblastic, integrated, pale to medium brown, smooth to finely verruculose, cylindrical, determinate; at times remaining attached to released conidium. Conidia cheiroid, medium to dark brown, smooth, euseptate, one cell-layer thick, cells arranged in 1–2 planes, fan-shaped; cell rows originating from a central basal cell; rows usually attached along their length; outer rows usually shorter than inner rows, at times paler in colour than central rows, and with or without hyaline, thin-walled, 1–2-celled appendages that are allantoid, clavate to globose, or fusoid to cylindrical.

Dictyosporium strelitziae Crous & A.R. Wood, sp. nov. — MycoBank MB509522; Fig. 9

Dictyosporium bulbosum valde simile, sed conidiis leviter longioribus, (30–)40–46(–55), et phylogenetice manifeste divergens.

Etymology. Named after the host genus Strelitzia, on which it occurs.

Leaf spots absent, colonies occurring on dead leaf tissue. Description based on colonies sporulating on WA with pine nee-

Fig. 9 Dictyosporium strelitziae (CBS 123359). a. Colony sporulating on PDA; b, c. conidia attached to conidiogenous cells; d–h. conidia with hyaline, apical appendages. — Scale bars = 10 µm.
dies (colonies also sporulate well on OA and MEA): Mycelium predominantly internal in host tissue, consisting of branched, septate, smooth, brown, 2–2.5 µm wide hyphae. Conidiomata suberosodochial, scattered, black, up to 170 µm diam. Conidiphores subcylindrical, darker brown than hyphae, at times slightly verrucose, irregularly curved to geniculate-sinuous, 1–3-septate, 10–25 × 2–2.5 µm. Conidia solitary, complanate, cheiroid, smooth-walled, uniformly pale brown, becoming uniformly medium brown at maturity; cells arranged in (4–)5–(6)–(6) rows, meeting at basal cell; outer rows with 8–10 cells, with a hyaline, globose, apical appendage, 5–10 × 10–12 µm; older conidiophores curved at septa, up to 170 µm diam.; conidia mostly comprising 5 rows of cells, 46–88 × 26–46 µm; appendages hyaline, curved. D. digitatum

Characteristics in culture — Colonies on OA flat, spreading, without aerial mycelium, and with regular, even margin; on MEA flat, spreading, with moderate aerial mycelium and regular, smooth margin; surface buff, reverse cinnamon; colonies on both media reaching 30 mm diam after 1 mo at 25 °C.

Specimen examined. South Africa, KwaZulu-Natal, Skyline Nature Reserve, Uvongo, on dead leaves of Streptocarpa nicolai, 29 May 2008, leg. A. Wood, isoi. P.W. Crous, CBS H-20202 holotype, cultures ex-type CPC 15359–15361, CBS 122359.

Notes — The genus Dictyosporium is well defined, and separated from similar genera by having smooth-walled, euseptate conidia produced from determinate conidiosporic cells (Sutton et al. 1996, Tsui et al. 2006). Based on the key provided by Cai et al. (2003b), D. strelitziae is morphologically most similar to D. bulbosum (conidia 26–46 × 11–30 µm), but its conidia are somewhat longer, and there is a 10 bp difference between the ITS sequences of D. strelitziae and D. bulbosum (DQ018086). Phylogenetically, D. strelitziae is closest to D. elegans (conidia 44–80 × 24–36 µm; appendages absent) (5 bp difference in the ITS sequence, DQ018087), but it has smaller conidia than the latter species. Furthermore, it also appears distinct from all species not occurring in the key of Cai et al. (2003b) (Arambarri et al. 2001, Cai et al. 2003a, Zhao & Zhang 2003, Kodseue et al. 2006, Cai & Hyde 2007, McKenzie 2008).

KEY TO SPECIES OF DICTYOSPORIUM (adapted from Cai et al. 2003b)

1. Conidia with appendages. ........................................ 2
2. Conidia lacking appendages .................................... 13
3. Appendages apical ................................................ 3
4. Appendages not apical ........................................... 4
5. Apical appendages asetapate .................................. 6
6. Apical appendages frequently 1-septate, cylindrical, 24–51 × 6–10.5 µm; conidia 27.5–47.5 × 20–25 µm, complanate, with 4–5 rows of cells. D. canisporum
7. Appendages subapical, cylindrical to clavate; conidia 52.5–72.5 × 18.5–26.5 µm, not complanate, with 5 rows of cells. D. tetraploides
8. Appendages not subapical, but central or basal ............ 5
9. Appendages central, hyaline, thin-walled, clavate to obovoid; conidia 36–45 × 16–21 µm, not complanate, mostly 7 rows of cells. D. musae
10. Appendages basal, fusoid to cylindrical; conidia 22–28 × 12.5–18 µm, complanate, with 3 rows of cells. D. mangleiatae

11. Conidia with 3 rows of cells, (27–)31–43 × 10–12 µm .......... D. freycinetiae
12. Conidia with more than 3 rows of cells ..................... 7
13. Conidia mostly with 4 rows of cells ...................... 8
14. Conidia with 5 or more rows of cells .................... 10
15. Conidia with darker colour at apex of inner rows; apical cells of outer rows each bearing a hyaline, cylindrical appendage. ........................................ 9
16. Conidia concolorous ........................................... 9
17. Conidia 24–40 × 14–20 µm; appendages clavate ......... 9
18. Conidia 36–45 × 16–21 µm; appendages tapering ...... 9
19. Conidia mostly comprising 5 rows of cells ............. 11
20. Conidia mostly comprising 6–8 rows, 46–88 × 26–46 µm; appendages hyaline, curved. D. digitatum
21. Conidia longer than 32 µm, appendages globose to obovoid ........................................ 12
22. Conidia shorter than above, 26–32 × 15–24 µm; appendages cylindrical to clavate. D. alatum
23. Conidia up to 46 µm long, and 30 µm wide, 27–46 × 11–30 µm; appendages globose to obovoid. D. bulbosum
24. Conidia longer than 46 µm, but not wider than 25 µm, (30–)40–46–(55) × (20–)23–23(–25) µm; appendages globose. D. strelitziae
25. Conidia complanate, one cell layer thick ................ 14
26. Conidia not complanate, more than one cell layer thick 24
27. Conidia regularly consisting of 3 rows of cells ........... 15
28. Conidia consisting of at least 4 rows of cells ............ 16
29. Conidia 15–22.5 × 10–16.5 µm. D. lakefuxianensis
30. Conidia 26–32 × 16–18 µm. D. triseriae
31. Conidia curved, with 5–7 rows of cells, each curving in the same direction, 34–56 × 20–38 µm. D. foliicola
32. Conidia not curved ............................................. 17
33. Conidia less than 25 µm long ................................ 18
34. Conidia more than 25 µm long ............................ 19
35. Conidia 18–24 × 13–19 µm. D. brahmaswarooppii
36. Conidia 15–17 × 11–12 µm. D. schizostachyfolium
37. Conidia with paler outer rows ............................. 20
38. Conidia concolorous ........................................... 21
39. Conidia 25–45 × 22–38 µm, with (5–)5(–7) rows .......... D. yunnanensis
40. Conidia 26–40 × 13–25 µm, mostly with 5 rows ......... D. zeylanicum
41. Conidia with 4 rows, 23.5–40 × 16–21.5 µm .......... D. tetrasporum
42. Conidia with more than 4 rows ........................... 22
43. Conidia 40–80 × 24–36 µm, mostly with 5 rows, slightly constricted at septa. D. elegans
44. Conidia mostly with more than 5 rows, strongly constricted at septa .................................................. 23
45. Conidia 26–34 × 23–34 µm, mostly with 7–9 rows of cells; conidiomata sporodochial. D. polystichum
46. Conidia 38–56 × 25–32 µm, mostly 6–8 rows of cells; conidiomata not sporodochial. D. toruloide
47. Conidia campaniform, with a darker base; with 12–16 rows of cells, 22–40 × 20–30 µm. D. campaniforme
48. Conidia more or less cylindrical, concolorous, comprising 3–7 rows of cells ........................................... 25
49. Conidia regularly with 3 rows of cells; usually 13.5 µm or less wide .................................................. 26
50. Conidia mostly with 4–7 rows of cells; more than 13.5 µm wide .................................................. 28

1 Appearing morphologically similar to D. taishanensis, also described from China; conidia with (3–)5(–7) cell layers, 27–43 × 15–30 µm (Zhao & Zhang 2003). Dictyosporium taishanensis (22 February 2003) is older than D. yunnanensis (March 2003), and would have priority if these fungi are shown to be synonymous.
26. Conidia 40–60 × 10–13.5 µm .......... *D. triramosum*
26. Conidia shorter than 43 µm ..................... 27
27. Conidia 36–43 × 11–12 µm; sporodochia usually covered with gelatinous matrix ............... *D. australiense*
27. Conidia 20–30 × 10–12 µm; sporodochia not as above ........................................ *D. micronesicum*
28. Conidia 40–50 × 18–25 µm, with 4–6 rows of cells, muri-form, with hyaline, subglobose conidiogenous cell remaining attached as basal appendage .......... *D. gauntii*
28. Conidial morphology not as above ................ 29
29. Conidia with rows of cells that are distinctly incurved or hook-like at the apex ................... 30
29. Conidia with more or less straight rows of cells at the apex ........................................ 32
30. Conidia 105–121 × 25–32 µm ........ *D. giganticum*
30. Conidia up to 80 µm long ...................... 31
31. Conidia 50–80 × 20–30 µm ........ *D. heptasporum*
31. Conidia 33–42 × 16–20 µm ........ *D. subramanianii*
32. Colonies effuse, not sporodochial; conidia irregularly cylindrical or oblong, strongly constricted at septa; 30–50 × 12–30 µm ....................... *D. oblongum*
32. Colonies sporodochial; conidia more or less cylindrical, slightly constricted at septa, 53–76 × 19–22 µm ........ .... *D. cocophilum*

*Edenia* M.C. González, Anaya, Glenn, Saucedo & Hanlin, Mycotaxon 101: 254. 2007.

Type species. *Edenia gomezpompeae* M.C. González, Anaya, Glenn, Saucedo & Hanlin.

*Conidiophores* fasciculate, subcylindrical, medium brown, finely roughened, 3–15-septate, straight to variously curved or geniculate-sinusous, irregular in width, constricted at some septa, with percurrent rejuvenation in upper part, situated on a submerged, brown stroma. *Conidiogenous cells* terminal, integrated, becoming paler brown towards apex, tapering to a subtruncate tip, with several lateral loci that are somewhat thickened and protruding (pimple-like), giving rise to conidia.

**Fig. 10** *Edenia gomezpompeae* (CBS 124106). a. Hyphal tufts visible when cultivated on MEA; b. leaf spot with conidiophores; c. fasciculate conidiophores; d. conidiophores arising from conidioma; e–g. conidiophores and conidiogenous cells; h. conidia; i. conidiomata forming on OA; j. conidioma with ostiolar setae; k, l. conidiogenous cells; m. conidia. — Scale bars = 10 µm.
via sympodial proliferation near apex. *Conidia* 11–16 × 3.5–6 µm, subhyaline, smooth, thin-walled, finely guttulate, fusoid-ellipsoidal with obtuse apex and tapering from its widest point in the middle towards a subtruncate base, 1–1.5 µm wide.

**Edenia gomezpompae** M.C. González, Anaya, Glenn, Sauceado & Hanli, Mycotaxon 101: 254. 2007 — Fig. 10

Leaf spots subcircular, 3–12 mm diam, grey-brown, with a dark brown, raised border, surrounded by a diffuse, black halo (absent in smaller spots). *Conidiophores* in fascicles of 5–30, subcylindrical, medium brown, finely roughened, 3–15-septate, straight to variously curved or geniculate-sinuous, 50–170 × 4–6 µm, irregular in width, constricted at some septa, with persistent rejuvenation in upper part; fascicles randomly distributed over lesion, amphiogenous, visible as erect, dark brown to black tufts on lesions, situated on a submerged, brown stroma, up to 60 µm wide and 40 µm high, intermingled among leaf trichomes (fruiting structures of a *Ramularia* sp. and ascomata of another fungus also present in some lesions). *Conidiogenous cells* 15–30 × 3–4 µm, terminal, integrated, becoming paler brown towards apex, tapering to a subtruncate tip, with several lateral loci that are somewhat thickened and protruding (pimple-like), up to 1 µm diam, giving rise to conidia via sympodial proliferation near apex, but this appears to be linked to rejuvenation, not conidiogenesis. *Conidia* (11–)13–15(–16) × (3.5–)4.5–5.5(–6) µm, subhyaline, smooth, thin-walled, finely guttulate, fusoid-ellipsoidal with obtuse apex and tapering from its widest point in the middle towards a subtruncate base, 1–1.5 µm wide.

Characteristics in culture — Colonies fluffy, with white hyphal strands that turn brown with age; surface woolly with abundant aerial mycelium; margins uneven. On MEA buff to rosy-buff, cultures became fertile, and conidiophores were arranged in numerous synnemata. On OA, cultures became fertile, and conidiophores were arranged in numerous synnemata.

**Notes** — The genus *Edenia* was originally introduced for a sterile fungus (suspected to be a member of the *Pleospora*-ceae), isolated as an endophyte from leaves of *Callicarpa acuminate* (Lamiaceae), May 2002, Á. Saucedo-García & A.L. Anaya, holotype MEXU 25346. — PHILIPPINES, on *Senna alata* (= *Cassia alata*) (*Caesalpinioideae*), Oct. 2008, leg. C.J.R. Cumagun, isotype W.P. Crous, epitype designated here CBS H-20203, cultures CPC 15689 = CBS 124106, CPC 15690, 15691.

Morphologically, the hyphomycete state of *Edenia* resembles genera such as *Digitopodium*, although species of this genus have rhizoids, and 1-septate, pale brown conidia that can also occur in short chains (Heuchert et al. 2005). It also shares some similarities with *Blastophorum* (Matsushima 1971), although the latter fungus is distinct in having solitary conidiophores with rhizoids, and a hyaline, upper conidiogenous region.

**Thedgonia** B. Sutton, Trans. Brit. Mycol. Soc. 61: 426. 1973

*Type species.* *Thedgonia ligustrina* (Boerema) B. Sutton.

*Conidiomata* fasciculate, punctiform. *Mycelium* internal, hyphae subhyaline, septate, branched, forming substomatal stromata, hyaline to pale brown. *Conidiophores* fasciculate, arising from stromata, simple, rarely branched, subcylindrical, straight to geniculate-sinuous, continuous to septate, smooth, hyaline to pale yellowish green. *Conidiogenous cells* integrated, terminal, occasionally conidiophores reduced to conidiogenous cells, sympodial, conidiogenous loci more or less planate, unthickened, non-pigmented. *Conidia* in disarticulating chains, rarely in branched chains, subcylindrical to obclavate, with one to several transverse eusepta, hyaline or almost so, apex rounded to truncate, base truncate, hila flat, unthickened, hyaline.

**Thedgonia ligustrina** (Boerema) B. Sutton, Trans. Brit. Mycol. Soc. 61: 428. 1973 — Fig. 11

*Basionym.* Cercospora ligustrina Boerema, Tijdschr. Plantenziekten 68: 117. 1962.

=Cercoseptoria ligustrina (Boerema) Arx, Genera of Fungi Sporulating in Pure Culture, ed. 3: 306, Leithe 1981.

Characteristics in culture — On MEA erumpent, slow growing, 5–8 mm after 2 wk, with moderate, white aerial mycelium and smooth, lobate margins; umber in reverse. On OA 5–8 mm diam after 2 wk, submerged to flattened on surface, sparse aerial mycelium, and smooth, even margins; umber on surface.

**Specimens examined.** Asia, on *Ligustrum*, H. Evans, CPC 4296 = W2072, CPC 4297 = W 2073, CPC 4298 = W 1877. — Netherlands, Eefde, on *Ligustrum ovalifolium*, 23 Mar. 1959, G.H. Boerema, holotype L, ex-type culture CBS 148.59; Bilthoven, on *L. ovalifolium*, 2003, P.W. Crous, CPC 10530 = CBS 124332, CPC 10532, 10533. — SOUTH KOREA, Namyangju, on *L. ovalifolium*, 9 Oct. 2002, leg. H.D. Shin, isotype P.W. Crous, CBS H-20204, CPC 10019, 10861–10863; Suwon, on *L. obtusifolium*, 2 Oct. 2007, leg. H.D. Shin, isotype P.W. Crous, CBS H-20207, CPC 14754–14756.

Notes — Kaiser & Crous (1998) linked *‘Thedgonia’ lupini* as anamorph to *Myкосphaerella lupini*, and thus suggested that *Thedgonia* belongs in the *Myкосphaerellaceae*. Results of this study (Fig. 1), however, show that *Thedgonia* s.str. belongs to the *Helotiales*, and is unrelated to the *Myкосphaerellaceae*. Furthermore, there is presently no separate anamorph genus in the *Myкосphaerellaceae* to accommodate *‘T.’ lupini*. Although *‘T.’ lupini* resembles species of *Pseudocercospora* (Braun 1995), it appears to represent a separate phylogenetic lineage.

**Trocophora** R.T. Moore, Mycologia 47: 90. 1955

*Type species.* *Trocophora fasciculata* (Berk. & M.A. Curtis) Goos (syn. *T. simplex* (Petch) R.T. Moore).

Colonies hypophyllous, medium to dark brown, consisting of numerous synnemata. *Stroma* absent, but a superficial network of hyphae linking the various synnemata. *Conidiophores* synnematus, mostly unbranched and straight, or with 1–2 short branches, straight or curved, cylindrical, individual conidiophores tightly aggregated, but separating near the apex, pale to medium brown, smooth. *Conidiogenous cells* polyblastic, integrated, terminal, determinate to sympodial, with visible
unthickened scar, clavate. Conidia solitary, terminal or lateral on conidiogenous cells, prominently curved to helicoid, pale to medium brown, smooth, transversely septate with a darkened, thickened band at the septa.

**Trochophora fasciculata** (Berk. & M.A. Curtis) Goos (as ‘fasciculatum’), Mycologia 78: 759. 1986 — Fig. 12

Basionym. *Helicoma fasciculatum* Berk. & M.A. Curtis, U.S. North Pacific Exped.: 142. (1853–1856) 1853.
≡ *Helicosporium fasciculatum* (Berk. & M.A. Curtis) Sacc., Syll. fung. 4: 560. 1886.
≡ *Helicomyces fasciculatus* (Berk. & M.A. Curtis) Pound & Clem., Minnesota Bot. Stud. 1: 658. 1896.
≡ *Helicosporium simplex* Syd., Mém. Herb. Boissier 4: 7. 1900.
≡ *Helicoma simplex* (Syd.) Linder, Ann. Missouri Bot. Gard. 16: 315. 1929.
≡ *Helicostilbe simplex* (Petch) R.T. Moore, Mycologia 47: 90. 1955.

Specimen examined. **KOREA**, Pusan, on leaves of *Daphniphyllum macropodum*, 13 Nov. 2002, leg. H.D. Shin, isol. P.W. Crous, KUS-F19414, cultures CPC 10280–10282.

Notes — Two species have been described in the genus, namely *T. fasciculata* and *T. simplex*; the latter recognised as a synonym of the former (Zhao et al. 2007). Within the *Mycosphaerellaceae*, pseudocercospora-like species cluster in two well-defined clades, namely the *P. vitis* clade (*Pseudocercospora* s.str.), and the *P. heimi* clade (*pseudocercospora-like*). Based on LSU DNA phylogeny (Fig. 1), **Trochophora** clusters basal to the pseudocercospora-like clade. Although it is tempting to use the name *Trochophora* for this clade, further collections of *Trochophora* are required to clarify the morphological variation among taxa with this unique conidial morphology. Using sequence data of the ITS gene, the closest taxa obtained from a BLAST search is the *Mycosphaerella heimi* species complex (96% similarity).

Zhao et al. (2007) consider *T. fasciculata* as a pathogen of *Daphniphyllum*, and report it from this host in several Asian countries, namely Sri Lanka, China (incl. Hong Kong and Taiwan) and India.

**Verrucisporota** D.E. Shaw & Alcorn, Austral. Syst. Bot. 6: 273. 1993
≡ *Verrucispora* D.E. Shaw & Alcorn, Proc. Linn. Soc. New South Wales 92: 171. 1967. (nom. illegit.).

Type species. *Verrucisporota proteacearum* (D.E. Shaw & Alcorn) D.E. Shaw & Alcorn.

**Mycelium** consisting of pale brown, septate, verrucose hyphae. *Stroma* forming in substomatal cavities, cells brown-walled, pseudoparenchymatous. *Conidiophores* macroconidial, mononematous, simple, flexuous, often geniculate, septate, mainly smooth, pale to dark brown, tapering towards the apex, but often becoming more swollen, and also verruculose to verrucose at the apex. *Conidiogenous cells* cylindrical, becoming geniculate, integrated, terminal, becoming intercalary, polyblastic, proliferating sympodially, cicatrised; conidiogenous loci planate, conspicuous, protuberant, thickened and darkened. *Conidia* cylindrical, narrowing slightly to an obtuse apex and with a truncate base with a distinctly thickened hilum, medium brown, straight or curved, transversely septate, verrucose to verruculose.
Verrucisporota daviesiae (Cooke & Massee) Beilharz & Pascoe, Mycotaxon 82: 360. 2002

Basionym. Cercospora daviesiae Cooke & Massee, Grevillea 18: 7. 1889.
Teleomorph. Mycosphaerella daviesiicola Beilharz & Pascoe, Mycotaxon 82: 364. 2002.

Characteristics in culture — On MEA erumpent, spreading with folded surface, and sparse aerial mycelium and even, lobate margin; surface iron-grey to olivaceous-grey; reverse iron-grey; colonies reaching 7 mm diam after 2 wk. On PDA erumpent, spreading, with moderate aerial mycelium and uneven margins; surface white in middle, olivaceous-grey in outer region, iron-grey underneath; colonies reaching 8 mm diam after 2 wk. On OA erumpent, spreading, with moderate aerial mycelium and uneven margin; surface white in middle, olivaceous-grey in outer region; colonies reaching 8 mm diam after 2 wk.

Specimen examined. Australia, Victoria, on living leaves of Daviesia mimosoides (= D. corymbosa var. mimosoides), V. & R. Beilharz, VPRI 31767 = CBS 116002.

Notes — The type species of the genus Stenella, S. araguata, clusters in the Teratosphaeriaceae (Crous et al. 2007a), and thus the majority of the stenella-like anamorphs in the Mycosphaerellaceae, will need to be placed in another genus. One option would be Zasmidium (Arzanlou et al. 2007), which clusters in the Mycosphaerellaceae, along with Verrucisporota (Fig. 1). This clade, however, is neither morphologically nor phylogenetically well resolved, and taxa need to be added to improve the phylogeny before a reasonable assessment can be made. The ITS sequence of this species is distinct from the other two species of this genus treated in this paper (Table 1).

Verrucisporota daviesiae (Cooke & Massee) Beilharz & Pascoe, Mycotaxon 82: 360. 2002

Basionym. Cercospora daviesiae Cooke & Massee, Grevillea 18: 7. 1889.
Teleomorph. Mycosphaerella daviesiicola Beilharz & Pascoe, Mycotaxon 82: 364. 2002.

Characteristics in culture — On MEA erumpent, spreading with folded surface, and sparse aerial mycelium and even, lobate margin; surface iron-grey to olivaceous-grey; reverse iron-grey; colonies reaching 7 mm diam after 2 wk. On PDA erumpent, spreading, with moderate aerial mycelium and uneven margins; surface white in middle, olivaceous-grey in outer region, iron-grey underneath; colonies reaching 8 mm diam after 2 wk. On OA erumpent, spreading, with moderate aerial mycelium and uneven margin; surface white in middle, olivaceous-grey in outer region; colonies reaching 8 mm diam after 2 wk.

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Notes — The type species of the genus Stenella, S. araguata, clusters in the Teratosphaeriaceae (Crous et al. 2007a), and thus the majority of the stenella-like anamorphs in the Mycosphaerellaceae, will need to be placed in another genus. One option would be Zasmidium (Arzanlou et al. 2007), which clusters in the Mycosphaerellaceae, along with Verrucisporota (Fig. 1). This clade, however, is neither morphologically nor phylogenetically well resolved, and taxa need to be added to improve the phylogeny before a reasonable assessment can be made. The ITS sequence of this species is distinct from the other two species of this genus treated in this paper (Table 1).
folded, with zones of salmon or smoke-grey mycelium; outer region and reverse olivaceous-grey; colonies reaching 10 mm diam after 1 mo.

Specimen examined, Australia, Northern Territory, Emerald Springs (13°37’13.3’’ 131°36’40’’), on leaves of Grevillea decurrens, 22 Sept. 2007, leg. B. Summerell, isol. P.W. Crous, CBS H-20205, cultures CPC 14761 = CBS 124107, CPC 14762, 14763.

Notes — Conidia of *V. grevilleae* are narrower and longer, and conidiophores shorter than those of *V. protearum* (conidia 23–51 × 5.6–10.5 µm, conidiophores up to 290 µm long, 4.5–8.5 µm wide; Shaw & Alcorn 1967). South African specimens from the genus *Protea* have conidia that are (20–)31–36(–49) × (7–)8.5–9.5(–12) µm (Crous et al. 2004a). These findings suggest that the fungus treated as *V. protearum* on Proteaceae (Shaw & Alcorn 1967, 1993, Beilharz & Pascoe 2002, Crous et al. 2004a), probably represents a complex of several taxa.
Verrucispora proteacearum (D.E. Shaw & Alcorn) D.E. Shaw & Alcorn, Austral. Syst. Bot. 6: 273. 1993

Basionym. Verrucispora proteacearum D.E. Shaw & Alcorn, Proc. Linn. Soc. New South Wales 92: 171. 1967.

Characteristics in culture — On MEA erumpent with sparse aerial mycelium; surface cream to pale olivaceous-grey, folded, with smooth, even margin; reverse brown-vinaceous; reaching 8 mm diam after 2 wk. On PDA erumpent with sparse aerial mycelium and smooth to feathery margin; surface cream to pale olivaceous-grey; reverse olivaceous-grey, reaching 8 mm diam after 2 wk. On OA erumpent, with moderate aerial mycelium and uneven margin, pale white in middle, pale olivaceous-grey in outer region; reaching 10 mm diam after 2 wk.

Specimen examined. AUSTRALIA, Grevillea sp., V. Beilharz, VPR131812 = CBS 116003.

Notes — Because V. proteacearum was originally described from Finschia (conidia 23–51 × 5.6–10.5 µm; Shaw & Alcorn 1967), there is a strong possibility that the strain listed here from Grevillea (conidia 30–45 × 10–13 µm on OA) may represent a different taxon to the one occurring on Finschia. Although apparently identical based on the LSU phylogeny (see Fig. 1), the ITS sequence of this isolate is different to that of V. grevilleae (95% similarity and 4% gaps).

KEY TO SPECIES OF VERRUCISPOROTA

1. Conidia wider than 4.5 µm .......................... 2
2. Conidia narrower than 4.5 µm .......................... 3

3. Conidia up to 56 µm long .......................... 4
4. Conidia longer than 56 µm, 3–7(–12)-septate, (30–)50–100 µm diam; on Grevillea .......................... V. grevilleae
5. Conidia mostly up to 30 µm long, (0–)2–3(–7)-septate, 13–30(–70) × 2.75–4 µm; on Capparis .......................... V. kimberleyana
6. Conidia longer, mostly up to 77 µm long, 1–11-septate, (10–)27–77(–108) × 3–4.5 µm; on Struthanthus .......................... V. struthanthicola

4. Conidia up to 3-septate, obclavate, 1–3-septate, 32.5–55 × 7–10.5 µm; on Celastrus .......................... V. indica
5. Conidia more than 3 septa .......................... 5

5. Conidia up to 32 µm long; (1–)3–4(–5)-septate, 20–32 × 6–10 µm; on Bridelia .......................... V. briddiae
6. Conidia frequently longer than above 6 .......................... 6

6. Conidia 0–6-septate, 18–56 × 4.5–7 µm; on Daviesia (Beilharz & Pascoe 2002) .......................... V. daviesiae
7. Conidia 3–7-septate, 23–51 × 5.6–10.5 µm; on Finschia .......................... V. proteacearum

Vonarxia Bat., Publ. Inst. Micol. Univ. Fed. Pernambuco 283: 5. 1960

Type species. Vonarxia anacardi Vat. & J.L. Bezerra.

Mycelium immersed and superficial, composed of branched, septate, pale to medium brown, smooth to finely roughened hyphae. Conidiomata sporochorial; basal stroma composed of globose-ellipsoidal, brown, slightly roughened cells. Setae irregularly scattered throughout colony, simple, subulate with a bulbous base, straight to slightly curved, dark brown, smooth to slightly roughened, thick-walled, 5–16-euseptate, septa rather thick, but becoming thinner towards apex. Conidiogenous cells arise from upper cells of the stroma, tightly aggregated, doliiform to ellipsoid, pale brown to subhyaline or hyaline, smooth, giving rise to a cluster of conidia by means of sympodial proliferation, with successive conidia forming at a higher level. Conidia hyaline, smooth-walled, tetraradiate, basal cell subcylindrical to clavate to doliiform, 0–1-septate, 10–15 µm long. Conidiogenous cells arise from upper cells of the stroma, tightly aggregated, doliiform to ellipsoid, pale brown to subhyaline or hyaline, smooth, giving rise to a cluster of conidia by means of sympodial proliferation, with successive conidia forming at a higher level. Conidia hyaline, smooth-walled, tetraradiate, basal cell subcylindrical to clavate to doliiform, 0–1-septate, 10–15 µm long. Conidiogenous cells arise from upper cells of the stroma, tightly aggregated, doliiform to ellipsoid, pale brown to subhyaline or hyaline, smooth, giving rise to a cluster of conidia by means of sympodial proliferation, with successive conidia forming at a higher level. Conidia hyaline, smooth-walled, tetraradiate, basal cell subcylindrical to clavate to doliiform, 0–1-septate, 10–15 µm long. Conidiogenous cells arise from upper cells of the stroma, tightly aggregated, doliiform to ellipsoid, pale brown to subhyaline or hyaline, smooth, giving rise to a cluster of conidia by means of sympodial proliferation, with successive conidia forming at a higher level. Conidia hyaline, smooth-walled, tetraradiate, basal cell subcylindrical to clavate to doliiform, 0–1-septate, 10–15 µm long.

Vonarxia vagans (Speg.) Aa, Persoonia 13: 128. 1986 — Fig. 14

Basionym. Ypsilonia vagans Speg., Revista Mus. La Plata, Secc. Bot. 15: 35. 1908.

Notes — The holotype specimen (LPS 12280) was described from leaves of Spirea cantoniensis, Sept. 1905, leg. Usteri no. 15 bis, holotype LPS 12280; Rio Grande do Sul, Guaiba, living leaves of Stenocalyx uniflorus, 1 Apr. 2008, leg. A.C. Alfenas, isotype designated here CBS H-20206, culture ex-type CPC 15151 = CBS 123533, CPC 15152.
Batista et al. (1960) who initially described Vonarxia, showed setae on the outside of the pycnidia, and thus this fungus was regarded as a coelomycete. Later comments from Nag Raj (1977) (as Kazulia) suggest, however, that these bodies are perithecia of a probable teleomorph. In a subsequent study Van der Aa & Van Oorschot (1985) and Van der Aa & Von Arx (1986) showed that Kazulia is a synonym of Vonarxia. Wu & Sutton (1995) were not convinced of the distinction between Vonarxia and another hyphomycete genus, Fumagopsis, due to insufficient material, and chose to use the name Fumagopsis for F. complexa, which they described from Eugenia leaves collected in India. Based on the present collection of V. vagans, it

Fig. 14 Vonarxia vagans (CBS 123533). a, b. Colony on PDA; c. colony with setae; d, e. setae with rounded apices and swollen bases, lacking rhizoids; f–i. conidiogenous cells giving rise to conidia; j–o. conidia. — Scale bars = 10 µm.
is apparent, that these are two distinct genera. In *Fumagopsis* the setae are aseptate, arranged around the sporodochium, and taxa have rhizoid-like structures. In contrast, the setae of *Vonarxia* are septate, irregularly distributed and do not surround the sporodochium, and have a simple, bulbous base.

**KEY TO SPECIES OF **

**Vonarxia**

1. Setae 87–155 µm long; apical conidial arms 12–35 µm long ................................... *V. anacardii*

1. Setae and conidial arms longer; setae 120–220 µm long; apical conidial arms 20–55(–90) µm long .... *V. vagans*

**Xenostigmina** Crous, Mycol. Mem. 21: 154. 1998

*Type species.* *Xenostigmina zilleri* (A. Funk) Crous.

Associated with leaf spots. *Mycelium* internal, consisting of hyaline to pale brown, septate, branched, smooth hyphae. *Conidiomata* sporodochial, brown to black. *Conidiophores* densely aggregated, arising from the upper cells of a pale brown stroma, finely verruculose, hyaline to pale brown, multi-septate, subcylindrical, straight to variously curved, branched. *Conidiogenous cells* terminal and intercalary, hyaline to pale brown, finely verruculose, doliiform to subcylindrical, tapering to flat tipped loci, proliferating sympodially and percurrent; loci not thickened or conspicuous. *Conidia* solitary, pale to medium brown, with pale brown apical and basal regions, finely verruculose, mostly straight, ellipsoidal, apex subtubose, frequently extending into a beak; base truncate at dehiscence, inner part extending later to form a short, subtubose basal appendage; septation muriform; basal marginal frill present.

**Xenostigmina zilleri** (A. Funk) Crous, Mycol. Mem. 21: 155. 1998 — Fig 15

*Basionym.* Stigmina zilleri A. Funk, Canad. J. Bot. 65: 482. 1987. *Synanamorph.* Mycopappus aceris (Dearn. & Barthol.) Redhead & G.P. White, Canad. J. Bot. 63: 1430. 1985.

Although *Stigmina* s.str. has been shown to reside in *Pseudocercospora* s.str. (Crous et al. 2006a, Braun & Crous 2006, 2007), this is not the case for *Xenostigmina* (Crous 1998), which appears to be related to *Seifertia* (Seifert et al. 2007) in the Dothideomycetes. Isolates of the *Xenostigmina* state are shown here (Fig. 1) to be identical to those of the *Mycopappus* state, which proves that these two genera are indeed synanamorphs. No ascospore isolates were obtained, however, to confirm their relationship to ‘*Mycosphaerella* mycopappi,’ though this species is clearly not a member of the *Mycosphaerellaceae.* *Xenostigmina* wolffii (Crous & Corlett 1998), which is the anamorph of *Mycosphaerella stigmina-plantani,* and a *Pseudocercospora* synanamorph, is not congeneric with *X. zilleri,* and would be better accommodated in *Pseudocercospora* (Crous et al. 2006a) than in *Xenostigmina.*

**Fig. 15** *Xenostigmina zilleri* (CBS 124108). a–c. Conidial propagules of *Mycopappus aceris*; d. setae on the surface of conidial propagules; e. colony of *Xenostigmina zilleri*; f, g. fasciculate conidiophores; h. conidia. — Scale bars = 10 µm.
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