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Allelochaeta (*Sporocadaceae*): pigmentation lost and gained

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Abstract: The appendaged coelomycete genus *Seimatosporium* (*Sporocadaceae*, *Sordariomycetes*) and some of its purported synonyms *Allelochaeta, Diploceras* and *Vermisporium* are re-evaluated. Based on DNA data for five loci (ITS, LSU, *rpb2*, *tub2* and *tef1*), *Seimatosporium* is shown to be paraphyletic. The ex-type species of *Allelochaeta, Discostromopsis* and *Vermisporium* represent a distinct sister clade to which the oldest name *Allelochaeta* is applied. These genera were traditionally separated based on a combination of conidial pigmentation, septation, and the nature of their conidial appendages. *Allelochaeta* is revealed to include taxa with both branched or solitary appendages, that could be cellular or continuous, with conidia being (2–)3(–5)-septate, hyaline, or pigmented, concolourous or versicolourous. This suggests that these characters should be applied at species, and not at the generic level. Conidial pigmentation appears to have been lost or gained several times during the evolution of species within *Allelochaeta*. In total, 25 new species, 15 new combinations, and 10 new epitypifications are proposed.

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INTRODUCTION

The family *Sporocadaceae* (*Xylariales*, *Sordariomycetes*) was recently revived by Jaklitsch *et al.* (2016) to accommodate *Seimatosporium* and allied appendaged coelomycetous fungi. In his treatment of the genus *Seimatosporium* (based on *S. rosae*; sexual morph: *Discostroma*, based on *Disc. rehmii*), Sutton (1980) chose a broad circumscription. Thus, numerous genera as such as *Diploceras* (based on *Dip. hypericinum*; sexual morph *Discostromopsis* based on *Dis. callistemonis*) and *Allelochaeta* (based on *A. gaubae*) were listed as synonyms. The genus *Vermisporium* (based on *V. walkeri*) was subsequently introduced to accommodate a commonly occurring group of leaf-spotting fungi found on *Eucalyptus* (Swart & Williamson 1983), several of which were previously accommodated in *Seimatosporium* (Shoemaker 1964, Swart 1982). Nag Raj (1993) reviewed the assemblage of species included in *Seimatosporium* and placed them into five genera based on conidial characteristics such as shape, pigmentation, septa, and appendages. These genera included *Diploceras*, *Sarcostroma* (based on *Sa. berkeleyi*), *Seimatosporium*, *Sporocadus* (based on *Sp. herbarum*), and *Vermisporium*.

Nag Raj (1993) restricted *Seimatosporium s. str.* to taxa with acervuli and pigmented, appendaged or non-appendaged conidia. *Seimatosporium* was seen as having conidia with cellular, filiform apical appendages and an excentric basal appendage, while *Vermisporium* was circumscribed as having falcate to elongate-fusiform, hyaline to pigmented conidia, with a beak-like apical cell (continuous appendage), and a cuneiform to podiform, tubular, unbranched, excentric basal appendage. Nag Raj (1993) also treated *Diploceras* as having acervuli that give rise to conidia with pigmented central and hyaline end cells, and cellular, branched or unbranched appendages, with the basal appendages being excentric.

Barber *et al.* (2011) produced the first phylogenetic treatment of *Vermisporium* using DNA sequence data of ITS and 28S nrDNA (LSU). They concluded that *Vermisporium* clustered within the larger genus *Seimatosporium*, and suggested that it should be treated as a synonym of that genus. At that time, the circumscription of *Allelochaeta* and *Diploceras* remained unclear due to a lack of isolates for study. In a subsequent investigation, Tanaka *et al.* (2011) distinguished *Discosia* and *Truncatella* from *Seimatosporium*. But based on LSU sequence data, taxa identified as *Sarcostroma* and *Sporocadus* clustered

within the larger *Seimatosporium* complex.

In an attempt to resolve the taxonomy of *Seimatosporium,* we have in the present study recollected the type species as well as several additional isolates of *Allelochaeta, Diploceras*, *Discostromopsis, Seimatosporium* and *Vermisporium*. The aim of this study was thus to generate a multi-gene DNA phylogeny, to compare the morphology of the various type species of these genera and to resolve their taxonomy.

MATERIAL AND METHODS

Isolates

Symptomatic leaves were collected from various hosts and locations (Table 1). These were placed in paper bags, and transferred to the laboratory for further study. Leaf samples were incubated in moist chambers for 3–7 d, and inspected daily for appendaged Coelomycetes. Single conidial colonies were established on 2 % malt extract agar (MEA; Crous *et al.* 1991). Colonies were subcultured onto 2 % potato-dextrose agar (PDA), oatmeal agar (OA), or synthetic nutrient-poor agar (SNA; Crous *et al*. 2009), supplemented with pieces of sterile banana leaf (BLA), or autoclaved pine needles (PNA), and incubated under continuous near-ultraviolet light at 25 °C to induce sporulation. Reference strains and specimens are maintained at the Westerdijk Fungal Biodiversity Institute in Utrecht, the Netherlands (CBS).

DNA isolation, amplification and analyses

Fungal mycelium of strains (Table 1) was harvested with a sterile scalpel and the genomic DNA was isolated using the Wizard® Genomic DNA Purification Kit (Promega Corporation, WI, USA) following the manufacturers' protocols. Four partial nuclear genes were subjected to PCR amplification and sequencing. These included the 28S nrRNA gene (LSU), internal transcribed spacer regions and intervening 5.8S nrRNA gene (ITS) of the nrDNA operon, DNA-directed RNA polymerase II second largest subunit gene (*rpb2*), beta-tubulin (*tub2*) and translation elongation factor 1-alpha (*tef1*) using the primers and conditions explained in Braun *et al*. (2018). The resulting fragments were sequenced in both directions using the respective PCR primers and the BigDye Terminator Cycle Sequencing Kit v. 3.1 (Applied Biosystems Life Technologies, Carlsbad, CA, USA). DNA sequencing amplicons were purified through Sephadex G-50 Superfine columns (Sigma-Aldrich, St. Louis, MO) in MultiScreen HV plates (Millipore, Billerica, MA). Purified sequence reactions were analysed on an Applied Biosystems 3730xl DNA Analyzer (Life Technologies, Carlsbad, CA, USA). The DNA sequences were analysed and consensus sequences were computed using SeqMan Pro v. 13 (DNASTAR, Madison, WI, USA). All novel sequences in this study were deposited in GenBank (Table 1).

The sequences for each gene region were subjected to megablast searches (Zhang *et al*. 2000) to identify closely related sequences in the NCBI GenBank nucleotide database. Loci were aligned with the online version of MAFFT v. 7 (Katoh & Standley 2013) after which the alignments were manually checked and improved where necessary using MEGA v. 7 (Kumar *et al*. 2016).

The phylogenetic methods used in this study included Bayesian analyses performed with MrBayes v. 3.2.6 (Ronquist *et al*. 2012) and Maximum Parsimony analyses performed with PAUP v. 4.0b10 (Swofford 2003) as explained in Videira *et al*. (2017). For the Bayesian analyses, trees were sampled every 100 generations, the temperature parameter was set to 0.2 and the stop value to 0.01. MrModelTest v. 2.2 (Nylander 2004) was used to determine the best nucleotide substitution model settings for each data partition. All resulting trees were printed with Geneious v. 11.0.3 (http://www.geneious.com, Kearse *et al*. 2012) and the layout of the trees was done in Adobe Illustrator v. CC 2017.

Morphology

All descriptions published in this study were derived from isolates incubated at 25 °C under near-ultraviolet light to promote sporulation. Structures were removed with a needle and mounted on microscope slides in water, lactic acid glycerol, and lactic acid cotton blue, respectively. In this generic complex, conidia are either hyaline or pigmented, and conidia are septate. All species have a basal and apical appendage, which can be single or branched. The measured length of the apical cell included the apical appendage if present; the measured length of the basal cell excluded the basal appendage, from the abrupt narrowing (locus of attachment) of the basal cell. Observations were made with a Nikon SMZ25 dissecting microscope, and with a Zeiss Axio Imager 2 light microscope using differential interference contrast (DIC) illumination and a Nikon DS-Ri2 camera and software. Colony characters and pigment production were noted after 2–4 wk of growth on MEA, PDA and OA (Crous *et al*. 2009) incubated at 25 °C. Colony colours (surface and reverse) were scored using the colour charts of Rayner (1970). Sequences derived in this study were deposited in GenBank, the alignment in TreeBASE (www.treebase.org; study number 23257), and taxonomic novelties in MycoBank (www.MycoBank.org; Crous *et al*. 2004).

RESULTS

Phylogenetic analyses

It was not possible to generate sequences for all loci for all isolates included in this study. This was mainly due to the fact that some loci failed to amplify for some isolates, even though several attempts were made to obtain a product suitable for sequencing. Missing or partial data were, therefore, treated as missing data in the alignments and subsequent phylogenetic analyses. The combined ITS/LSU/*rpb2*/*tef1*/*tub2* alignment contained 82 isolates including the outgroup strain of *Neopestalotiopsis protearum* (CBS 114178; GenBank JN712498.1, JN712564.1, LT853151.1, KM199542.1 and KM199463.1, respectively). The final alignment contained a total of 3 826 characters used for the phylogenetic analyses, including alignment gaps. The Maximum Parsimony (MP) analysis generated 179 equally most parsimonious trees, the first of which is shown in Fig. 1 (Tree Length = 6 214, CI = 0.482, RI = 0.764, RC = 0.368), and the bootstrap support values (MP-BS) >74 % were mapped on the tree as the first value. From the analysed characters, 2 230 were constant, 316 were variable and parsimony-uninformative and 1 280 were parsimony-informative. A strict consensus tree was calculated from the equally most parsimonious trees and the strict consensus branches were mapped with a thicker line on the presented phylogenetic tree (Fig. 1). MrModelTest recommended that the Bayesian analysis should use Dirichlet

Table 1. Collection details and GenBank accession numbers of isolates considered in this study (T: ex-type; ET: ex-epitype; IT: ex-isotype; REF: reference culture).

Species name	Substrate (including host)	Country	Collector and Collection date	Culture accession number(s)[1]	GenBank accession number[2]				
					ITS	LSU	*rpb2*	*tef1*	*tub2*
Allelochaeta acuta	*Eucalyptus viminalis*	Australia: Victoria	P.W. Crous, 21 Oct. 2009	CBS 144168[ET]; CPC 17646	MH822973.1	MH823023.1	MH823071.1	MH823113.1	MH823160.1
	Eucalyptus sp.	Australia: New South Wales	B.A. Summerell, 9 Feb. 2006	CPC 12703	MH822974.1	MH823024.1	MH823072.1	MH823114.1	MH823161.1
	Eucalyptus dives	Australia: New South Wales	B.A. Summerell, 27 Mar. 2009	CPC 16629	MH554086.1	MH554297.1	MH555000.1	MH554519.1	MH554758.1
	Eucalyptus resinifera	Australia: Victoria	P.W. Crous, 10 May 2011	CPC 19289	MH822975.1	MH823025.1	MH823073.1	MH823115.1	MH823162.1
Allelochaeta biseptata	*Eucalyptus oresbia*	Australia: New South Wales	A.E. Orme & R. Johnstone, 20 Jul. 2006	CBS 131116[ET]; CPC 13584	JN871199.1	JN871208.1	MH554987.1	MH554510.1	MH554749.1
	Eucalyptus malacoxylon	Australia: New South Wales	B.A. Summerell, Jan. 2006	CBS 144190; CPC 13587	MH554076.1	MH554287.1	MH554988.1	MH554511.1	MH554750.1
Allelochaeta cylindrospora	*Eucalyptus behriana*	Australia: Victoria	H.J. Swart, 12 May 1972	CBS 144169[ET]; CPC 28302; VPRI 15692	MH822976.1	MH823026.1	MH823074.1	MH823116.1	MH823163.1
Allelochaeta dilophospora	*Melaleuca squarrosa*	Australia: Victoria	H.J. Swart, 1 Nov. 1966	CBS 161.67[ET]	MH822977.1	MH823027.1	–	MH823117.1	MH823164.1
	Betula pendula	Australia: Tasmania	W. Quaedvlieg, Dec. 2011	CPC 20124	MH822978.1	MH823028.1	MH823075.1	MH823118.1	MH823165.1
	Melaleuca squarrosa	Australia: Victoria	H.J. Swart, 13 Aug. 1968	CPC 28301; VPRI 15691	MH822979.1	MH823029.1	MH823076.1	MH823119.1	MH823166.1
Allelochaeta elegans	*Melaleuca lanceolata*	Australia: Victoria	H.J. Swart, 24 Aug. 1976	CBS 187.81[ET]	MH554014.1	MH554234.1	MH554927.1	MH554448.1	MH554690.1
	Melaleuca lanceolata	Australia: Victoria	H.J. Swart, 24 Aug. 1976	CPC 28306; VPRI 15697	MH822980.1	MH823030.1	MH823077.1	MH823120.1	MH823167.1
Allelochaeta euabalongensis	*Eucalyptus* sp.	Australia: New South Wales	–, 1999	CBS 112332; CPC 3776	MH822981.1	MH823031.1	–	MH823121.1	–
	Eucalyptus sp.	Australia: New South Wales	–, 1999	CBS 112504[T]; CPC 3777	MH822982.1	MH823032.1	–	MH823122.1	–
Allelochaeta eucalypti	*Eucalyptus nitens*	Australia	P.W. Crous, 22 Nov. 1996	CBS 111386; CPC 1542	MH822983.1	MH823033.1	–	MH823123.1	–
	Eucalyptus delegatensis	Australia: Tasmania	C. Mohammed, Mar. 2011	CBS 144170[ET]; CPC 12458	MH822984.1	MH823034.1	MH823078.1	MH823124.1	MH823168.1
Allelochaeta falcata	*Eucalyptus alligatrix*	Australia: New South Wales	R. Johnstone & A.E. Orme, 17 Aug. 2006	CBS 131117[ET]; CPC 13578	JN871204.1	JN871213.1	MH554907.1	MH554426.1	MH554668.1
	Eucalyptus sp.	Australia: New South Wales	A.J. Carnegie, Feb. 2006	CPC 12992	JN871203.1	MH823035.1	MH823079.1	MH823125.1	MH823169.1

Table 1. (Continued).

Species name	Substrate (including host)	Country	Collector and Collection date	Culture accession number(s)[1]	GenBank accession number[2]				
					ITS	LSU	*rpb2*	*tef1*	*tub2*
	Eucalyptus alligatrix	Australia: New South Wales	R. Johnstone & A.E. Orme, 17 Aug. 2006	CPC 13580	JN871205.1	JN871214.1	MH554985.1	MH704601.1	MH704626.1
Allelochaeta flexuosa	*Eucalyptus rugosa*	Australia: South Australia	W. Quaedvlieg, Dec. 2011	CBS 144171[T]; CPC 20173	MH822985.1	MH823036.1	MH823080.1	MH823126.1	MH823170.1
Allelochaeta fusispora	*Eucalyptus* sp.	Australia: Victoria	P.W. Crous, 14 Oct. 2009	CBS 144172; CPC 17616	MH554094.1	MH554304.1	MH555008.1	MH554528.1	MH554767.1
	Eucalyptus polyanthemos	Australia: Victoria	H.J. Swart, 30 Aug. 1973	CBS 810.73[IT]; ATCC 26928; IMI 163446; C 73.22	MH554067.1	MH554279.1	MH554980.1	MH554503.1	MH554743.1
Allelochaeta kriegeriana	*Callistemon seiberi* (= *C. paludosus*)	Australia: Victoria	H.J. Swart, 12 May 1972	CBS 144173; CPC 28303; VPRI 15693	MH822986.1	MH823037.1	MH823081.1	MH823127.1	MH823171.1
	Callistemon seiberi (= *C. paludosus*)	Australia: Victoria	H.J. Swart, 12 May 1972	CBS 188.81; NBRC 32679	MH554015.1	MH554235.1	MH554928.1	MH554449.1	MH554691.1
Allelochaeta melaleucae	*Melaleuca decussata*	Australia: Victoria	I.G. Stone, 9 Oct. 1973	CBS 144174[T]; CPC 28305; VPRI 15695	MH822987.1	MH823038.1	MH823082.1	MH823128.1	MH823172.1
Allelochaeta minor	*Eucalyptus* sp.	New Zealand	R. Thangavel, 2015	CBS 144175[T]; CPC 29354; MPI T15_06344A	MH822988.1	MH823039.1	MH823083.1	MH823129.1	MH823173.1
	Eucalyptus sp.	New Zealand	R. Thangavel, 2015	CPC 29353	MH822989.1	–	–	MH823130.1	MH823174.1
Allelochaeta neoacuta	*Eucalyptus smithii*	South Africa: Mpumalanga	P.W. Crous, 28 Sep. 1989	CBS 110733; CPC 157	JN871201.1	JN871210.1	MH554999.1	MH704603.1	MH704628.1
	Eucalyptus smithii	South Africa: Mpumalanga	P.W. Crous, 28 Sep. 1989	CBS 110734; CPC 158	MH822990.1	JN871211.1	MH823084.1	MH823131.1	MH823175.1
	Eucalyptus smithii	South Africa: Mpumalanga	P.W. Crous, 28 Sep. 1989	CBS 114876; CPC 159	JN871202.1	JN871212.1	MH823085.1	MH823132.1	MH823176.1
	Eucalyptus smithii	South Africa: Mpumalanga	P.W. Crous, 28 Sep. 1989	CBS 115131[T]; CPC 156	JN871200.1	JN871209.1	MH554998.1	MH704602.1	MH704627.1
Allelochaeta neocylindrospora	*Eucalyptus rugosa*	Australia: South Australia	W. Quaedvlieg, Dec. 2011	CBS 144176[T]; CPC 20115	MH822991.1	MH823040.1	MH823086.1	MH823133.1	MH823177.1
Allelochaeta neodilophospora	*Callistemon pinifolius*	Australia: Queensland	P.W. Crous, 16 Jul. 2009	CBS 144177[T]; CPC 17161	MH554090.1	MH554300.1	MH555004.1	MH554524.1	MH823178.1
Allelochaeta neofalcata	*Eucalyptus radiata*	Australia	P.W. Crous, 7 Nov. 2011	CBS 144178[T]; CPC 25455	MH822992.1	MH823041.1	MH823087.1	MH823134.1	MH823179.1
Allelochaeta neoorbicularis	*Eucalyptus* sp.	Australia: Tasmania	W. Quaedvlieg, Dec. 2011	CBS 144179[T]; CPC 20140	MH822993.1	MH823042.1	MH823088.1	MH823135.1	MH823180.1
	Eucalyptus regnans	Australia: Tasmania	B.A. Summerell, 10 Oct 2006	CPC 13581	MH554074.1	MH554285.1	MH554986.1	MH554509.1	MH554748.1

Table 1. (Continued).

Species name	Substrate (including host)	Country	Collector and Collection date	Culture accession number(s)[1]	GenBank accession number[2]				
					ITS	LSU	*rpb2*	*tef1*	*tub2*
	Eucalyptus radiata	Australia: Victoria	P.W. Crous, 2 Nov. 2014	CPC 25494	MH822994.1	MH823043.1	–	–	–
Allelochaeta neowalkeri	*Eucalyptus regnans*	Australia: Tasmania	W. Quaedvlieg, Dec. 2011	CBS 144181^{T}; CPC 20144	MH822995.1	MH823044.1	MH823089.1	MH823136.1	MH823181.1
	Eucalyptus sp.	Australia: Tasmania	W. Quaedvlieg, Dec. 2011	CPC 20128	MH822996.1	MH823045.1	MH823090.1	MH823137.1	MH823182.1
Allelochaeta obliquae	*Eucalyptus obliqua*	Australia: South Australia	W. Quaedvlieg, 25 Nov. 2011	CBS 144182^{T}; CPC 20191	MH554105.1	MH554315.1	MH555018.1	MH554539.1	MH554778.1
Allelochaeta orbicularis	*Corymbia henryi*	Australia: New South Wales	B.A. Summerell, 1 Jan. 2005	CBS 131118^{ET}; CPC 12935	JN871206.1	JN871215.1	MH554908.1	MH554427.1	MH554669.1
Allelochaeta paracylindrospora	*Eucalyptus* sp.	Australia: South Australia	W. Quaedvlieg, 25 Nov. 2011	CBS 144184^{T}; CPC 20189	MH822997.1	MH823046.1	MH823091.1	MH823138.1	MH823183.1
Allelochaeta paraelegans	*Melaleuca ericifolia*	Australia: Victoria	H.J. Swart, –	CBS 150.71^{T}; NBRC 32674	MH554007.1	MH554228.1	MH554923.1	MH554441.1	MH554683.1
Allelochaeta parafalcata	*Corymbia* sp.	Australia: Western Australia	W. Gams, 13 Jul. 2011	CBS 144185^{T}; CPC 19840	MH822998.1	MH823047.1	MH823092.1	MH823139.1	MH823184.1
Allelochaeta paraleptospermi	*Leptospermum coriaceum*	Australia: Victoria	L. Jobe, 20 Jun. 1985	CBS 144186^{T}; CPC 28294; VPRI 12797	MH822999.1	MH823048.1	MH823093.1	MH823140.1	MH823185.1
Allelochaeta paramelaleucae	*Melaleuca* sp.	Australia: Western Australia	P.W. Crous, 18 Sep. 2015	CBS 144187^{T}; CPC 29542	MH823000.1	MH823049.1	MH823094.1	MH823141.1	MH823186.1
Allelochaeta paraorbicularis	*Eucalyptus* sp.	New Zealand	R. Thangavel, 2015	CBS 144180^{T}; CPC 29356; MPI T15_06344B	MH823001.1	MH823050.1	MH823095.1	MH823142.1	MH823187.1
Allelochaeta polycarpae	*Eucalyptus polycarpa*	Australia: Western Australia	P.W. Crous, 21 Sep. 2015	CBS 144188^{T}; CPC 28916	MH823002.1	MH823051.1	MH823096.1	MH823143.1	MH823188.1
	Eucalyptus diversifolia	Australia: South Australia	W. Quaedvlieg, Dec. 2011	CPC 20119	MH823003.1	MH823052.1	MH823097.1	MH823144.1	MH823189.1
Allelochaeta pseudoacuta	*Eucalyptus* sp.	Australia: Tasmania	W. Quaedvlieg, 4 Jan. 2012	CBS 144189^{T}; CPC 20130	MH823004.1	MH823053.1	MH823098.1	MH823145.1	MH823190.1
Allelochaeta pseudoelegans	*Melaleuca* sp.	Australia: Victoria	P.W. Crous, 8 Nov. 2014	CBS 144191^{T}; CPC 25411	MH823005.1	MH823054.1	MH823099.1	–	MH823191.1
Allelochaeta pseudofalcata	*Eucalyptus crebra*	Australia: Queensland	J. Alcorn, 6 Aug. 1973	CBS 144192^{T}; BRIP 5731; CPC 28308; VPRI 15701	MH823006.1	MH823055.1	MH823100.1	MH823146.1	MH823192.1
Allelochaeta pseudoobtusa	*Eucalyptus viminalis*	Australia: Tasmania	B.A. Summerell, 14 Oct. 2006	CBS 144193^{T}; CPC 13590	MH823007.1	MH823056.1	MH823101.1	MH823147.1	MH823193.1

Table 1. (Continued).

Species name	Substrate (including host)	Country	Collector and Collection date	Culture accession number(s)[1]	GenBank accession number[2]				
					ITS	LSU	*rpb2*	*tef1*	*tub2*
Allelochaeta pseudosamuelii	*Melaleuca lanceolata*	Australia: South Australia	W. Quaedvlieg, Dec. 2011	CBS 144194[T]; CPC 20205	MH823008.1	MH823057.1	MH823102.1	MH823148.1	MH823194.1
Allelochaeta pseudowalkeri	*Eucalyptus* sp.	Australia: Queensland	P.W. Crous, 12 Jul. 2009	CBS 144195[T]; CPC 17043	MH554089.1	MH554299.1	MH555003.1	MH554523.1	MH554762.1
Allelochaeta samuelii	*Eucalyptus angulosa*	Australia: Western Australia	P.W. Crous, 21 Sep. 2015	CBS 144196[ET]; CPC 28912	MH823009.1	–	–	MH823149.1	–
	Eucalyptus angulosa	Australia: Western Australia	P.W. Crous, 20 Sep. 2015	CPC 29046	MH823010.1	MH823058.1	MH823103.1	MH823150.1	MH823195.1
Allelochaeta sp.	*Eucalyptus nitens*	Australia: Tasmania	C. Mohammed, 2007	CPC 12464	MH823011.1	MH823059.1	MH823104.1	MH823151.1	MH823196.1
	Eucalyptus sp.	Australia: Tasmania	W. Quaedvlieg, 4 Jan. 2012	CPC 20142	MH823012.1	MH823060.1	MH823105.1	MH823152.1	MH823197.1
Allelochaeta sparsifoliae	*Eucalyptus sparsifolia* (= *E. oblonga*)	Australia: New South Wales	B.A. Summerell, 23 Sep. 2007	CBS 144183[T]; CPC 14529	MH554083.1	MH554294.1	MH554995.1	MH704605.1	MH704630.1
	Eucalyptus sparsifolia (= *E. oblonga*)	Australia: New South Wales	B.A. Summerell, 1 Jan. 2007	CPC 14502	MH554082.1	MH554293.1	MH554994.1	MH704604.1	MH704629.1
Allelochaeta walkeri	*Eucalyptus* sp.	Australia: Victoria	P.W. Crous, 12 Oct. 2009	CBS 131119[ET]; CPC 17644	JN871207.1	JN871216.1	MH555010.1	MH554530.1	MH554769.1
	Eucalyptus fastigata	Australia: New South Wales	B.A. Summerell, 1 Jan. 2005	CPC 13024	MH823013.1	MH823061.1	MH823106.1	MH823153.1	MH823198.1
	Corymbia gummifera	Australia: New South Wales	B.A. Summerell, Apr. 2011	CPC 19274	MH823014.1	–	–	–	–
	Eucalyptus oreades	Australia: Northern Territory	P.W. Crous, Apr. 2011	CPC 19275	MH554102.1	MH554312.1	MH555016.1	MH554536.1	MH554775.1
	Eucalyptus gregsoniana	Australia: New South Wales	B.A. Summerell, Apr. 2011	CPC 19291	MH823015.1	MH823062.1	MH823107.1	MH823154.1	MH823199.1
	Eucalyptus gregsoniana	Australia: New South Wales	B.A. Summerell, Apr. 2011	CPC 19443	MH823016.1	MH823063.1	MH823108.1	MH823155.1	MH823200.1
	Eucalyptus sp.	Australia: Victoria	P.W. Crous, 7 Nov. 2011	CPC 25391	MH823017.1	MH823064.1	MH823109.1	MH823156.1	MH823201.1
	Eucalyptus sp.	Australia: Victoria	P.W. Crous, 7 Nov. 2011	CPC 25405	MH823018.1	MH823065.1	MH823110.1	MH823157.1	MH823202.1
	Eucalyptus sp.	Australia: Victoria	P.W. Crous, 7 Nov. 2011	CPC 25409	MH823019.1	MH823066.1	MH823111.1	MH823158.1	MH823203.1
	Eucalyptus sp.	Australia: Victoria	P.W. Crous, 9 Nov. 2014	CPC 25453	MH823020.1	MH823067.1	–	–	MH823204.1
Bartalinia robillardoides	*Leptoglossus occidentalis*	Italy	–, –	CBS 122705[ET]; A2	KJ710460.1	KJ710438.1	LT853152.1	LT853202.1	LT853252.1

Table 1. (Continued).

Species name	Substrate (including host)	Country	Collector and Collection date	Culture accession number(s)[1]	GenBank accession number[2]				
					ITS	LSU	*rpb2*	*tef1*	*tub2*
Neopestalotiopsis protearum	*Leucospermum cuneiforme* cv. 'Sunbird'	Zimbabwe	L. Swart, 6 Mar. 1998	CBS 114178[T]; CPC 1765; JT 212	JN712498.1	JN712564.1	LT853151.1	KM199542.1	KM199463.1
Sarcostroma restionis	*Acacia* sp.	Australia: Western Australia	–, 18 Sep. 2015	CPC 29466	MH823021.1	MH823068.1	MH823112.1	MH823159.1	MH823205.1
Seimatosporium botan	*Paeonia suffruticosa*	Japan	S. Hatakeyama, 27 May 2002	H 4619[T]; JCM 12837; NBRC 104200	AB594799.1	AB593731.1	–	–	–
Seimatosporium cornii	*Cornus* sp.	Italy	E. Camporesi, 11 June 2012	MFLUCC 14-0467[T]	KT162918.1	KR559739.1	–	–	–
Seimatosporium lichenicola	*Cotinus coggygria*	Russia	T. Bulgakov, 4 June 2014	CBS 139966[REF]; MFLUCC 14-0623; T-095	MH554003.1	MH554222.1	MH554916.1	MH554433.1	MH554675.1
Seimatosporium physocarpi	*Physocarpus opulifolius*	Russia	T. Bulgakov, 8 May 2014	CBS 139968[T]; MFLUCC 14-0625; T-126	MH823022.1	MH823069.1	MH554917.1	MH554434.1	MH554676.1
Seimatosporium pistaciae	*Pistacia vera*	Iran	M. Mirabolfathy, 29 Apr. 2014	CBS 138865[T]; CPC 24455	KP004463.1	KP004491.1	MH554915.1	MH554432.1	MH554674.1
Seimatosporium rosae	*Rosa kalmiussica*	Russia	T. Bulgakov, 21 May 2014	CBS 139823[ET]; MFLUCC 14-0621; T-056	LT853105.1	MH823070.1	LT853153.1	LT853203.1	LT853253.1
Seimatosporium vitis	*Vitis vinifera*	Italy	N. Camporesi, 3 Mar. 2013	MFLUCC 14-0051[T]	KR920363.1	KR920362.1	–	–	–
Seiridium marginatum	*Rosa canina*	France	A. Gardiennet, 1 Apr. 2015	CBS 140403[ET]; BLO	KT949914.1	KT949914.1	LT853149.1	LT853199.1	LT853249.1

[1] ATCC: American Type Culture Collection, Virginia, USA; CBS: Westerdijk Fungal Biodiversity Institute, Utrecht, The Netherlands; CPC: Culture collection of Pedro Crous, housed at CBS; IMI: International Mycological Institute, CABI-Bioscience, Egham, Bakeham Lane, United Kingdom; JCM: Japan Collection of Microorganism, RIKEN BioResource Center, Japan; MFLUCC: Mae Fah Luang University Culture Collection, Chiang Rai, Thailand; MPI: Ministry for Primary Industries, Auckland, New Zealand; NBRC: NITE Biological Resource Center, Department of Biotechnology, National Institute of Technology and Evaluation, Kisarazu, Chiba, Japan, VPRI: Victorian Department of Primary Industries, Knoxfield, Australia.

[2] ITS: internal transcribed spacers and intervening 5.8S nrDNA; LSU: large subunit (28S) of the nrRNA gene operon; *rpb2*: partial DNA-directed RNA polymerase II second largest subunit gene; *tef1*: partial translation elongation factor 1-alpha gene; *tub2*: partial beta-tubulin gene.

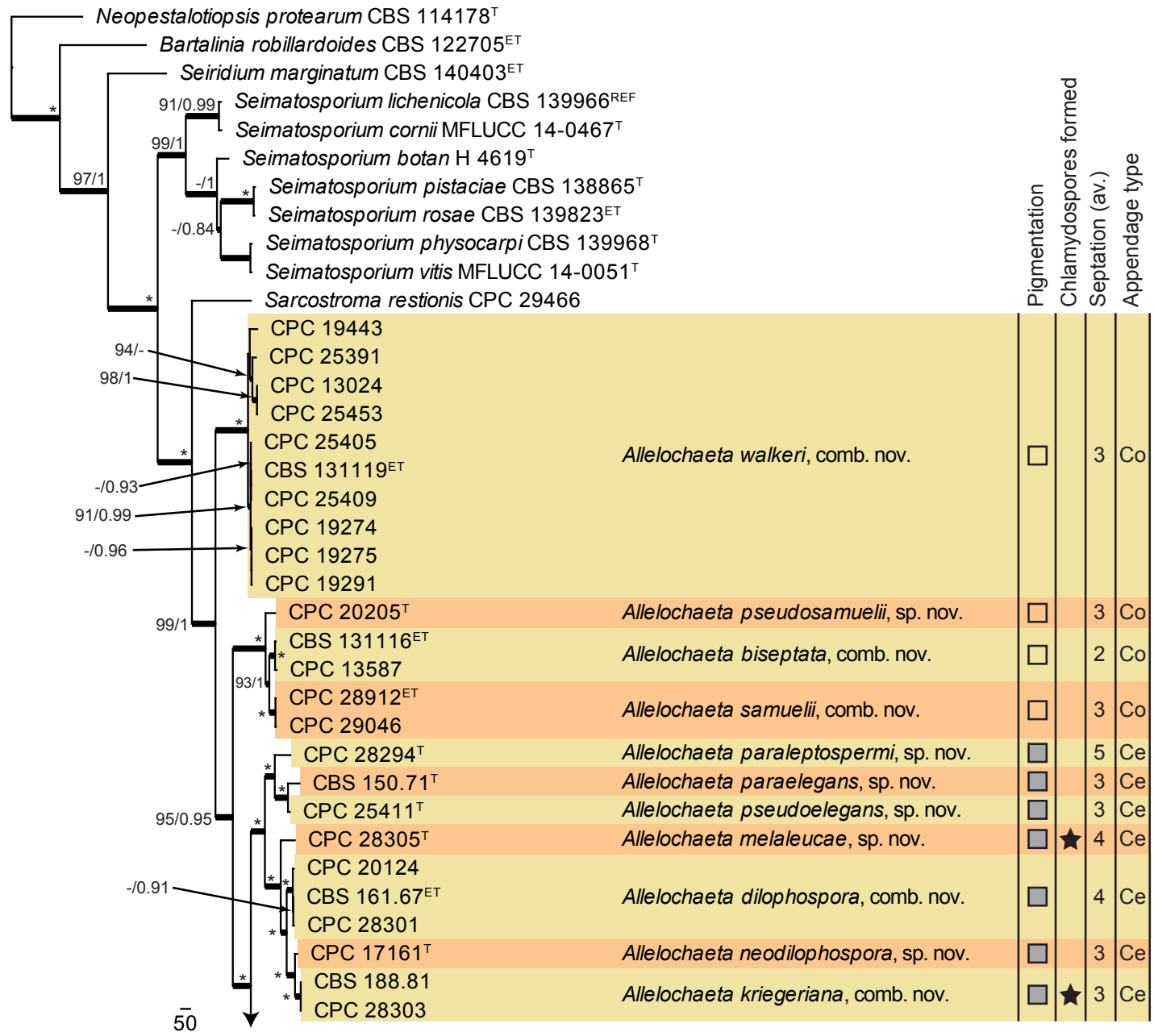

Fig. 1. The first of 180 equally most parsimonious trees obtained from the combined ITS/LSU/*rpb2*/*tef1*/*tub2* sequence alignment. Bayesian posterior probabilities (PP) >0.84 and maximum parsimony bootstrap support values (MP-BS) >74 % are shown at the nodes (MP-BS / PP) and thickened lines represent those branches present in the strict consensus maximum parsimony tree. An asterisk denotes fully-supported branches (MP-BS = 100 % / PP = 1.0). The scale bar represents the number of changes per site. Species of *Allelochaeta* are indicated with coloured blocks on the tree. Culture numbers and type status (T: ex-type; ET: ex-epitype; IT: ex-isotype; REF: reference culture) are indicated for each strain. The tree is rooted to *Neopestalotiopsis protearum* (culture CBS 114178). Pigmentation (empty square: hyaline; filled square: pigmented), presence of chlamydospores (present indicated with filled star), the average septation and the type of appendage (Co: continuous; Ce: cellular) of the *Allelochaeta* species are plotted to the right of the tree.

base frequencies for all data partitions. The GTR+I+G model was proposed for LSU and *rpb2* and the HKY+I+G model for ITS, *tef1* and *tub2*. The Bayesian analysis generated 38 202 trees from which 28 652 trees were sampled after 25 % of the trees were discarded as burn-in. The posterior probability values (PP) were calculated from the 9 528 trees (Fig. 1; second value: PP >0.84 shown). The alignment contained a total of 1 662 unique site patterns (ITS: 218, LSU: 90, *rpb2*: 399, *tef1*: 414, *tub2*: 541).

The Bayesian phylogeny generally supported the same clades as those presented in the phylogeny based on parsimony analysis (Fig. 1; see TreeBASE for individual trees), especially with regard to the order of the basal lineages. The only exception was a tight clade containing *Seimatosporium vitis* / *Seimatosporium physocarpi* that represented two distinct lineages within *Seimatosporium*. This could be explained by the lack of the protein-coding gene sequence data for *Seimatosporium vitis*. Interestingly, *Seimatosporium pistaciae* and *Seimatosporium rosae* differed at 11 nucleotides (including two alignment gaps) in 3 576 alignment positions. In the most terminal part, the order of *Allelochaeta* sp. / *Allelochaeta acuta* / *Allelochaeta falcata* changed in the Bayesian tree. In addition, *Allelochaeta neoacuta* strain CPC 25494 splits off from the remainder of the *Allelochaeta neoacuta* clade, but this isolate was only represented by ITS and LSU sequences in the alignment.

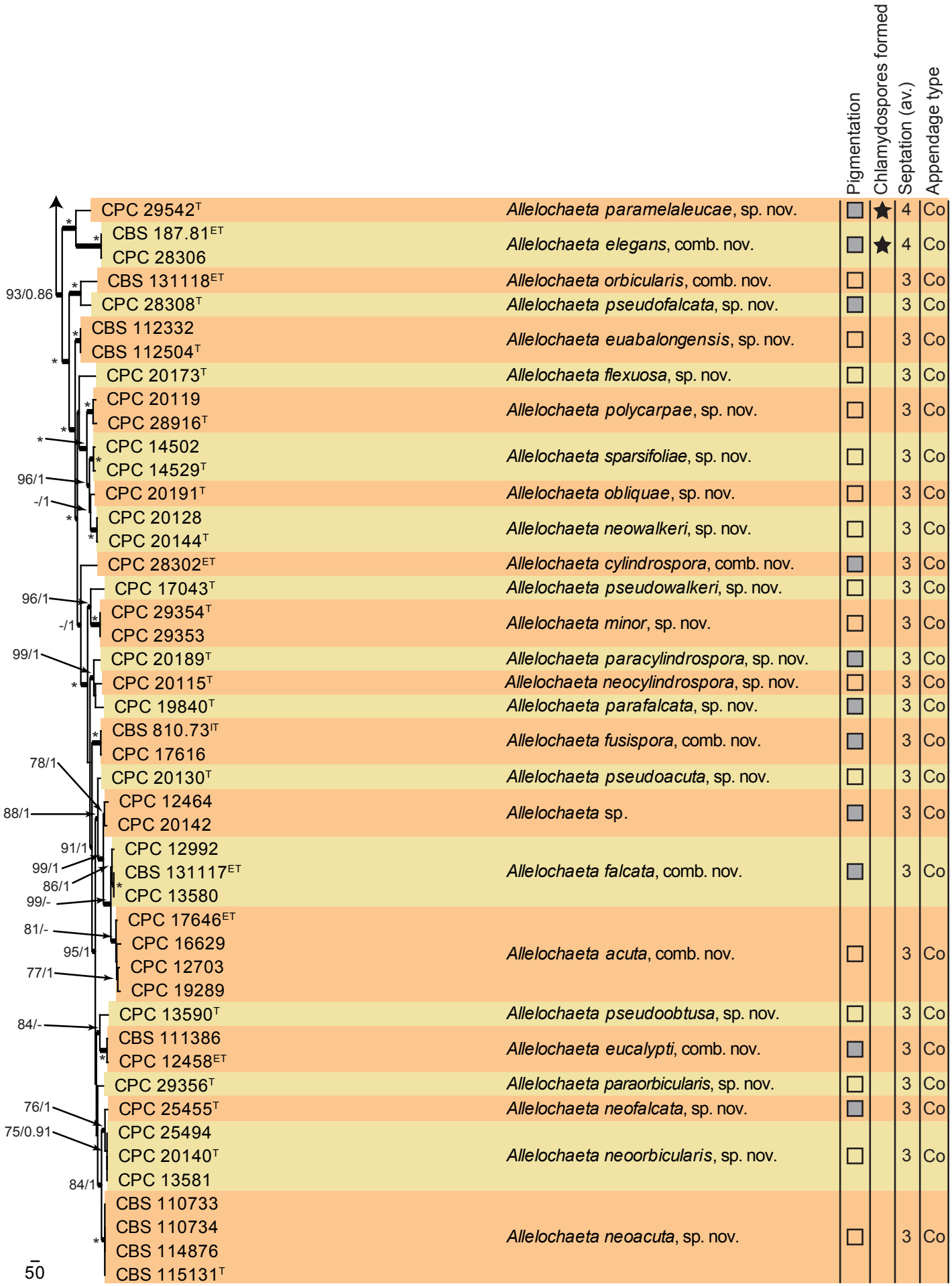

Fig. 1. (Continued).

Overall, the same species clades/lineages were observed in the individual gene trees (data not shown, see TreeBASE). The ITS phylogeny could not clearly resolve *Allelochaeta dilophospora* / *Allelochaeta neodilophospora*, *Allelochaeta acuta* / *Allelochaeta falcata*, *Allelochaeta minor* / *Allelochaeta pseudowalkeri* and *Allelochaeta neoacuta* / *Allelochaeta neoorbicularis*. The LSU phylogeny could resolve only the broader lineages and not most of the closely related species. The *rpb2* phylogeny could not clearly resolve *Allelochaeta obliquae* / *Allelochaeta sparsifoliae* and *Allelochaeta acuta* / *Allelochaeta pseudoacuta* / *Allelochaeta pseudoobtusa*. The *tef1* phylogeny could not clearly resolve the complex of *Allelochaeta acuta* / *Allelochaeta falcata* / *Allelochaeta pseudoacuta* / *Allelochaeta* sp. The *tub2* phylogeny could not clearly resolve the complex of *Allelochaeta acuta* / *Allelochaeta falcata* / *Allelochaeta pseudoacuta* / *Allelochaeta pseudoobtusa* / *Allelochaeta* sp.

Taxonomy

Nine of the 13 species known in the genus *Vermisporium* were included in the present study, along with three species of *Diploceras*, and seven of *Seimatosporium*. Characters used to distinguish species include the relative cell lengths of conidia, appendage morphology, and the presence or absence of conidial pigmentation. Based on support from phylogenetic analyses in this study, an additional 25 species are described as new below:

Classification: *Sporocadaceae*, *Amphisphaeriales*, *Xylariomycetidae*, *Sordariomycetes*.

Allelochaeta Petr., *Sydowia* **9**(1–6): 464. 1955.
Synonyms: *Vermisporium* H.J. Swart & M.A. Will., *Trans. Brit. Mycol. Soc.* **81**: 491. 1983. (*Type species*: *Vermisporium walkeri* H.J. Swart & M.A. Will.).
Discostromopsis H.J. Swart, *Trans. Brit. Mycol. Soc.* **73**: 217. 1979. (*Type species*: *Discostromopsis callistemonis* H.J. Swart).

Foliicolous. *Conidiomata* stromatic and acervular, erumpent, unilocular to plurilocular, glabrous, dark brown to black; basal stroma of *textura angularis*; dehiscing via an irregular split in the overlying host tissue. *Conidiophores* arising from the upper cells of the basal stroma or lining the cavity of the conidioma, reduced to conidiogenous cells or branched and septate, hyaline or pale brown at base, smooth, invested in mucus. *Conidiogenous cells* discrete or integrated, ampulliform, lageniform, cylindrical, subcylindrical, mostly hyaline, or pale brown below, smooth, proliferating percurrently. *Conidia* fusoid, naviculate, subcylindrical or acerose, straight or curved, euseptate, wall thin and with or without slight constrictions at the septa, smooth; median cells hyaline to medium brown; end cells hyaline, bearing mostly a single appendage at each end, which could be branched; appendages continuous with the conidium body or cellular, not separated from the conidium body by septa, branched or unbranched, branches filiform or attenuated and flexuous; basal appendage excentric, narrowly cuneiform to spike-like, podiform or cellular. *Microconidia* present in some species, acerose, unicellular, hyaline, smooth. *Ascomata* perithecial, immersed in host tissue, solitary or aggregated in cultures, covered by a small clypeus, obpyriform; wall composed of several layers of thin-walled, brown cells. *Asci* basal, intermingled among paraphyses that degenerate at maturity, long elliptical, unitunicate with thickened apex and indistinct apical structures. *Ascospores* biseriate, hyaline, 3-septate, ellipsoid, straight to inaequilateral.

Type species: *Allelochaeta gaubae* Petr. [= *A. dilophospora* (Cooke) Crous]

Notes: Swart (1979) introduced the genus *Discostromopsis* to accommodate the sexual morphs of several "*Seimatosporium*" spp. Nag Raj (1993) applied a much narrower definition of *Seimatosporium* than Sutton (1980), and later resurrected *Diploceras* (pigmented, fusiform to naviculate 3–5-septate conidia with mostly singular, cellular, apical and excentric basal appendages) to accommodate these taxa. Although the ex-type strains of *Allelochaeta, Discostromopsis* and *Vermisporium* cluster together in the present study, the type of *Diploceras*, *D. hypericinum*, clusters distant to this complex (F. Liu *et al.* in prep.). Furthermore, all other species of *Diploceras* collected in this study clustered among the species of *Allelochaeta/ Vermisporium*.

Although Nag Raj (1993) applied a much narrower definition of *Seimatosporium* than Sutton (1980), he regarded the genus *Allelochaeta* (based on *A. gaubae*, holotype BPI 407171A, annotated by T.R. Nag Raj and H.J. Swart as "*Seimatosporium*" *dilophosporum*) as synonym of *Diploceras.* Because the type species of *Diploceras* clustered distant from this clade, the oldest available generic name for this genus becomes *Allelochaeta* (Petrak 1955), which is resurrected here.

Allelochaeta acuta (H.J. Swart & M.A. Will.) Crous, ***comb. nov.*** MycoBank MB827138. Figs 2, 3.
Basionym: *Vermisporium acutum* H.J. Swart & M.A. Will., *Trans. Brit. Mycol. Soc*. **81**: 495. 1983.
Synonym: *Seimatosporium acutum* (H.J. Swart & M.A. Will.) P.A. Barber & Crous, *Persoonia* **27**: 93. 2011.

Morphological description on natural substratum: See Barber *et al.* (2011).

Diagnosis: *Conidia* narrowly fusiform, straight or curved, (2–)3(–4)-septate, hyaline, orange in mass, slightly or not constricted at septa, (39–)45–61(–66) × 3–4.5(–5) µm; apical cell narrowly conical, attenuated to an acute apex, (11–)13–22 µm long; second cell from apex cylindrical to sub-cylindrical, (10–)11–17 µm long; third cell from apex cylindrical to sub-cylindrical, 9–15 (av. = 11.7) µm long; basal cell with a truncate base, (7–)9–12(–13) µm long; basal appendage excentric, single, narrowly cuneiform, 2–7 µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and feathery margins, reaching 50 mm diam after 2 wk. Colonies salmon on MEA, OA and PDA, with orange spore masses.

Specimens examined: **Australia**, Victoria, Victoria Valley, Grampians National Park, on *E. camaldulensis*, 6 Oct. 1999, *P.A. Barber*, GR0.05; Victoria, Rutherglen, on *Eucalyptus* sp., 1903, *G.H. Robinson* (**holotype** VPRI 2156); Victoria, Frankston, 33.27.17.1 150.13.50.8, on *E. resinifera*, 10 May 2011, *P.W. Crous*, CPC 19289; New South Wales, Wollemi National Park, on *Eucalyptus* sp., 9 Feb. 2006, *B.A. Summerell*, CPC 12703; Victoria, Woorndoo, S37°53'29.3" E 142°47'51.1", on *E. viminalis*, 21 Oct. 2009, *P.W. Crous* (**epitype** designated here CBS H-23434, MBT382765, culture ex-epitype CPC 17646 = CBS 144168);

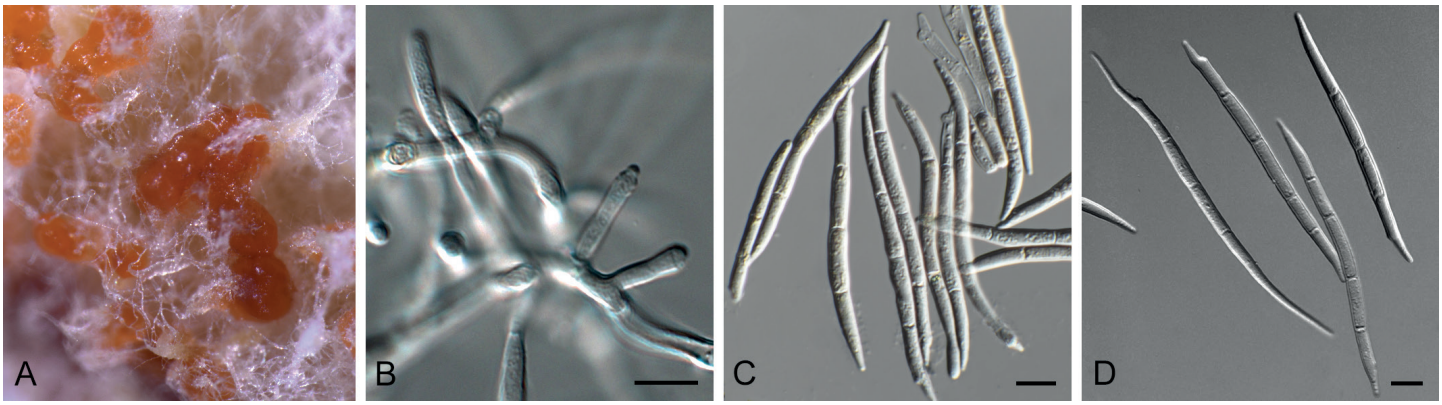

Fig. 2. *Allelochaeta acuta* (CPC 17646). **A.** Conidiomata on OA. **B.** Conidiophores. **C, D.** Conidia. Scale bars = 10 µm.

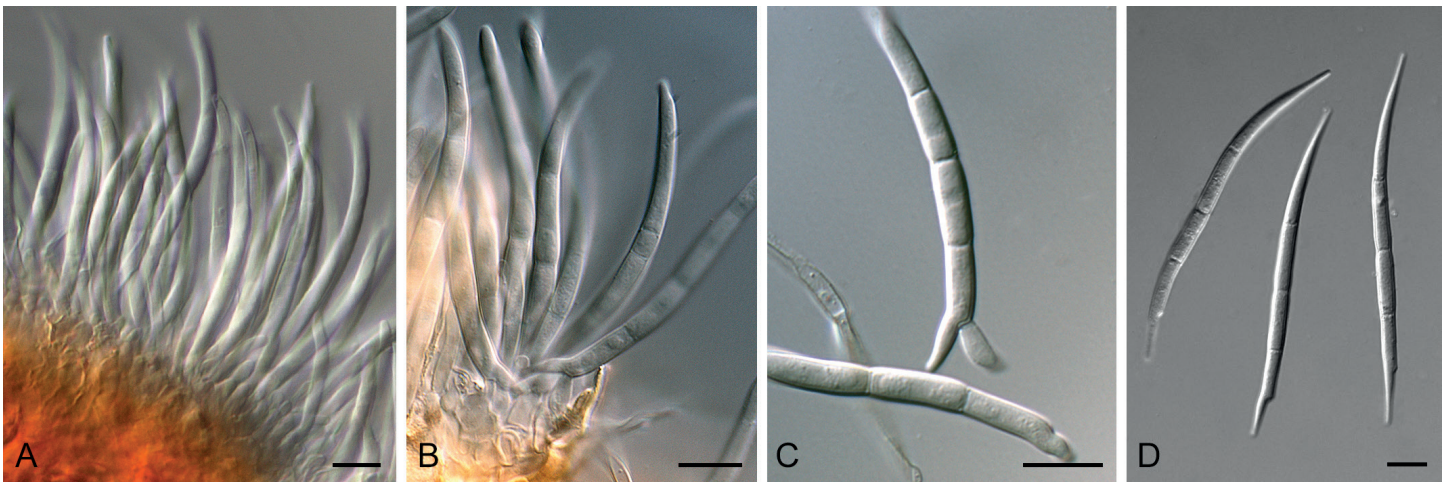

Fig. 3. *Allelochaeta acuta* (CPC 12703). **A, B.** Conidiophores *in vivo*. **C, D.** Conidia. Scale bars = 10 µm.

New South Wales, Paddys River, S34°38'20.2" E 150°07'48.2", on *E. dives*, 27 Mar. 2009, *B.A. Summerell*, CPC 16629. **New Zealand**, Wellington, Botanic Gardens, on *Eucalyptus* sp., 31 October 1996, *B.J. Rogan,* NZFRI-M 3644.

Notes: *Allelochaeta acuta* can be distinguished from *A. cylindrospora* and *A. eucalypti* by its completely hyaline conidia, and the absence of an apical appendage. Isolate CPC 16629 appears somewhat different and could represent a closely related cryptic species, but additional isolates are required to resolve its status. Phylogenetically, it is not possible to distinguish *A. acuta*, *A. falcata*, *A. pseudoacuta*, *A. pseudoobtusa* and *Allelochaeta* sp. based on any of the individual loci and additional markers and more isolates are needed to more accurately delimit the species boundaries.

Allelochaeta biseptata (H.J. Swart & M.A. Will.) Crous, ***comb. nov.*** MycoBank MB827139. Figs 4, 5.
Basionym: *Vermisporium biseptatum* H.J. Swart & M.A. Will., *Trans. Brit. Mycol. Soc*. **81**: 492. 1983.
Synonym: *Seimatosporium biseptatum* (H.J. Swart & M.A. Will.) P.A. Barber & Crous, *Persoonia* **27**: 94. 2011.

Morphological description on natural substratum: See Barber *et al*. (2011).

CPC 13584: *Conidiomata* acervular, 250–400 µm diam, exuding an orange conidial mass. *Conidiophores* subcylindrical, hyaline, smooth, reduced to conidiogenous cells, or with a supporting cell. *Conidiogenous cells* subcylindrical, smooth, hyaline, 15–20 × (2.5–)3(–3.5) µm; proliferating percurrently near apex. *Conidia* subcylindrical, hyaline, smooth, 2-septate (but with age, up to 5 septa can develop in culture), straight to curved, not constricted at septa, guttulate, (45–)52–60(–70) × 2.5(–3) µm; apical cell subcylindrical, tapering to a truncate apex, 22–27 µm long; median cell cylindrical, 10–12 µm long; basal cell with a small truncate base, 19–22 µm; basal appendage single, excentric, podiform, 2–3 µm long.

Culture characteristics: Colonies erumpent, spreading, with sparse to moderate aerial mycelium and feathery margins, reaching 45 mm diam after 2 wk. Colonies salmon on MEA, OA and PDA.

Materials examined: **Australia**, Victoria, Melbourne, Box Hill, on *E. melliodora*, 11 Oct. 1903, *C. French Jr*. (**holotype** VPRI 2168); Victoria, Tennyson, on *E. camaldulensis*, 26 Oct. 1999, *P.A. Barber*, PAB99.01; South Australia, Mundulla, on *E. camaldulensis*, 27 Aug. 1999, *P.A. Barber*, PAB 99.12; New South Wales, Northern Tablelands, 7.5 km E of Nundle on road to Hanging Rock (c. 100 m E of Hanging Rock track turnoff), S31°28'31" E151°10'59", alt. 1 090 m, 20 Jul. 2006, *A.E. Orme* & *R. Johnstone* 732739, on *E. oresbia* (**epitype** designated here CBS H-20743, MBT382766, culture CPC 13584–13586 = CBS 131116 = CPC 13584); *ditto*, cultures CPC 13585–13586; New South Wales, on leaves of *E. malacoxylon*, Jan. 2006, *B.A. Summerell*, CBS H-23464, culture CPC 13587 = CBS 144190.

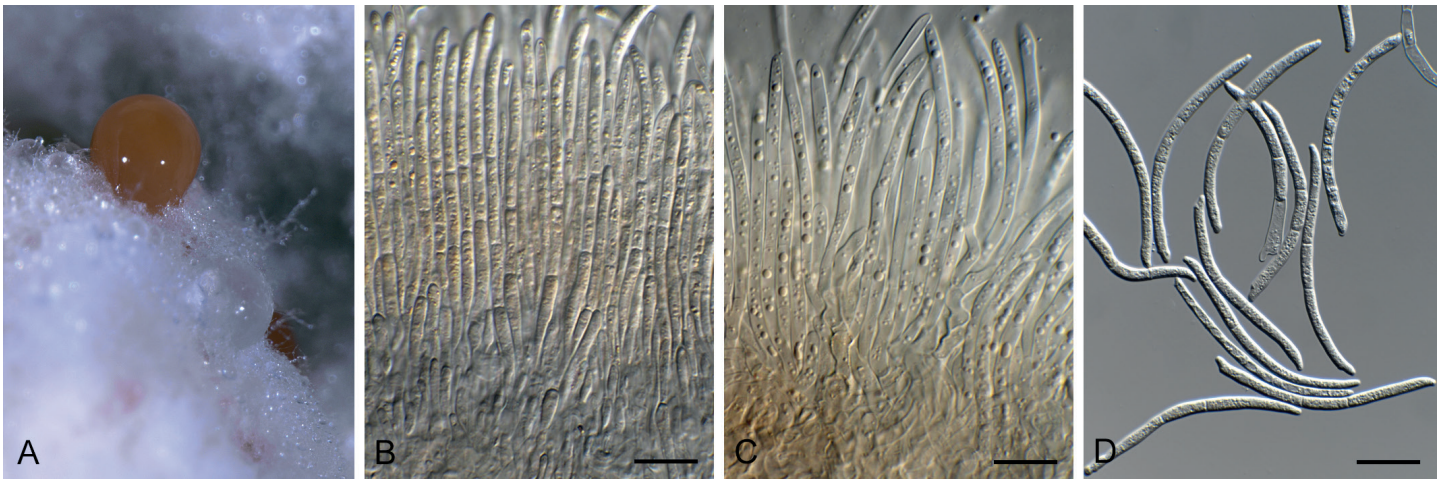

Fig. 4. *Allelochaeta biseptata* (CPC 13584). **A.** Conidiomata on OA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

Note: Conidia of *A. biseptata* closely match the present collection [conidia 45–59(–70) × (1.5–)2–2.5 µm, basal cell 14–26(–29) µm long, median cell 7–12(–13) µm long, apical cell (17–)20–26 µm long, podiform appendage 1–3 µm long; Nag Raj 1993]. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta brevicentra (H.J. Swart & M.A. Will.) Crous, ***comb. nov.*** MycoBank MB827140.
Basionym: Vermisporium brevicentrum H.J. Swart & M.A. Will., *Trans. Brit. Mycol. Soc*. **81**: 493. 1983.
Synonym: Seimatosporium brevicentrum (H.J. Swart & M.A. Will.) P.A. Barber & Crous, *Persoonia* **27**: 96. 2011.

Morphological description on natural substratum: See Barber *et al*. (2011).

Materials examined: **Australia**, Victoria, Whittlesea, on *E. ovata*, 11 Oct. 1999, *P.A. Barber,* PAB99.11; Mt. Burchell, Grampians National Park, on *E. serraensis*, 12 Aug. 2000, *P.A. Barber,* GR0.02. **New Zealand**, Wellington, Karori Cemetery, on *Eucalyptus* sp., 14 Nov. 1996, *B. Rogan,* NZFRI-M 3645; Catchpool Forest, on *E. fastigata*, 16 Oct. 1997, *B.J. Rogan,* NZFRI-M 3756.

Note: This species is not known from culture and needs to be recollected.

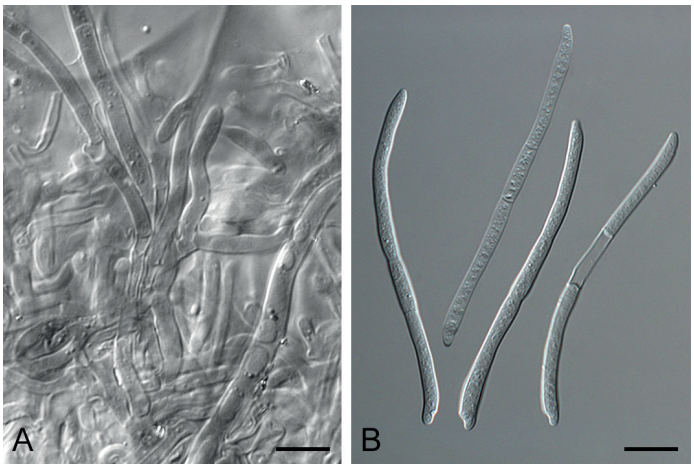

Fig. 5. *Allelochaeta biseptata* (CPC 13584). **A.** Conidiophores. **B.** Conidia. Scale bars = 10 µm.

Allelochaeta cylindrospora (H.J. Swart) Crous, ***comb. nov.*** MycoBank MB827141. Fig. 6.
Basionym: *Seimatosporium cylindrosporum* H.J. Swart, *Trans. Brit. Mycol. Soc*. **78**: 267. 1982.
Synonym: *Vermisporium cylindrosporum* (H.J. Swart) Nag Raj, in Nag Raj, *Coelomycetous anamorphs with appendage-bearing conidia* (Ontario): 965. 1993.

Morphological description on natural substratum: See Barber *et al*. (2011).

CPC 28302 = VPRI 15692: *Conidiomata* stromatic, acervuloid, scattered, oval, 150–200 µm diam, exuding a brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 1–4-septate, pale brown at base, 20–40 × 2–3 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 5–12 × 2–3 µm. *Conidia* falcate, fusoid, 3-septate, slightly constricted at septa, median cells pale brown, end cells hyaline, smooth-walled, (28–)35–45(–50) × (3.5–)4(–5) µm; apical cell narrowly conical, attenuating toward apex with tubular appendage, 13–15(–19) µm long; second cell from apex cylindrical to subcylindrical, (7–)8–10(–12) µm long; third cell from apex cylindrical to subcylindrical, (7–)8–9 µm long; basal cell with narrowly truncate base, 6–7 µm long; basal appendage excentric, single, tubular to cuneiform, (7–)8–12(–17) µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and feathery margins, reaching 50 mm diam after 2 wk. Colonies salmon on MEA, OA and PDA, with brown spore masses.

Materials examined: **Australia**, Victoria, Kamarooka State Forest, on *E. behriana*, 26 Oct. 1999, *P.A. Barber* (PAB 99.06); Victoria, Melton, on *E. behriana*, 19 Mar. 1977, *I. Pascoe* (**isotype** MELU 2002-5-3); Victoria, Djerriwarrh Creek, on *E. behriana*, 12 May 1972, *H.J. Swart* (**epitype** designated here CBS H-23435, MBT382767, culture ex-epitype CPC 28302 = VPRI 15692 = CBS 144169). **New Zealand**, Tokoroa, Kinleith Forest, on *E. radiata* ssp. *radiata*, Oct. 1986, *collector unknown*, NZFRI-M 3167; Tokoroa, Kinleith Forest, on *E. regnans*, July 1985, *collector unknown,* NZFRI-M 3156; Tokoroa, Kinleith Forest, on *E. saligna*, May 1988, *collector unknown,* NZFRI-M 3259; Tokoroa, Kinleith Forest, on *Eucalyptus* sp., Nov. 1982, *collector unknown,* NZFRI-M 3155.

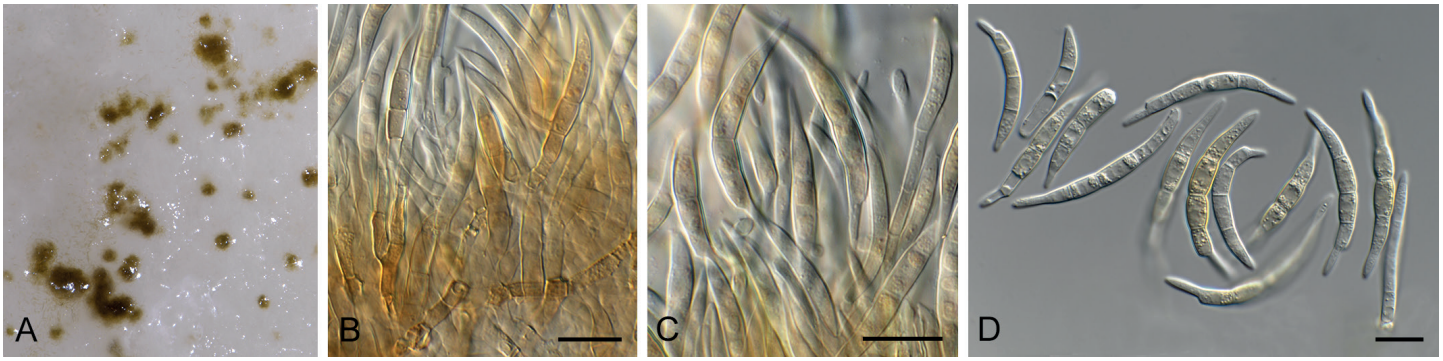

Fig. 6. *Allelochaeta cylindrospora* (CPC 28302). **A.** Conidiomata on OA. **B.** Conidiophores. **C, D.** Conidia. Scale bars = 10 µm.

Notes: The type specimen was collected by I. Pascoe in Victoria, Djerriwarrh Creek, on *E. behriana* on 19 Mar. 1977 (holotype DAR 37065), and the present collection comes from the same area, collected on the same host as in 1972. Morphologically, it closely matches the descriptions provided by Nag Raj (1993) and Barber *et al*. (2011), and is therefore designated as epitype. Conidial cells of *A. cylindrospora* consistently increase in length from the base to the apex and the second cell from the base is approximately only 10 % longer than the basal cell, compared with *A. falcatum* and *A. eucalypti* where it is always more than 20 % longer than the basal cell (Barber *et al.* 2011). This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU, *rpb2*, *tef1* and *tub2*.

Allelochaeta dilophospora (Cooke) Crous, ***comb. nov.*** MycoBank MB827142. Fig. 7.
Basionym: *Hyaloceras dilophosporum* Cooke, *Grevillea* **19**(no. 89): 5. 1890.
Synonyms: *Diploceras dilophosporum* (Cooke) Sacc., *Syll. fung.* (Abellini) **10**: 484. 1892.
Seimatosporium dilophosporum (Cooke) B. Sutton, *Mycol. Pap.* **97**: 35. 1964.
Sarcostroma dilophospora (Cooke) M. Morelet [as *'dilophosphora'*], *Ann. Soc. Sci. Nat. Arch. Toulon et du Var* **37**(4): 233. 1985.
Allelochaeta gaubae Petr., *Sydowia* **9**: 464. 1955.
Discostromopsis stoneae H.J. Swart, *Trans. Brit. Mycol. Soc.* **73**: 217. 1979.
Discostroma stoneae (H.J. Swart) Sivan., *Fungal Diversity* **11**: 152. 2002.

Conidiomata stromatic, acervuloid, scattered, irregular in outline, 250–500 µm diam, exuding a brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 1–3-septate, hyaline, 12–20 × 2.5–4 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 8–10 × 2.5–3 µm. *Conidia* fusoid, straight to curved, 4(–5)-septate, pale brown, smooth-walled, slightly constricted at septa, (23–)26–35(–40) × (4–)4.5(–5) µm; apical cell long conical, attenuating toward apex, subhyaline, (4–)5–6 µm long; median cells cylindrical to subcylindrical, pale brown, together 15–25 µm long; basal cell obconical with narrowly truncate base, subhyaline, 4–8 µm long; appendages tubular, attenuated, branched close to base; apical branches 10–15(–20 µm long; basal appendage excentric, branches, 8–15(–20) µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and feathery margins, reaching 40 mm diam after 2 wk. Colonies on MEA dirty white to lavender grey on surface, iron-grey in reverse; on OA salmon with brown spore masses; on PDA surface and reverse salmon, with brown spore masses.

Materials examined: **Australia**, Victoria, Wilsons Promontory, on *Melaleuca squarrosa*, 13 Aug. 1968, *H.J. Swart*, CPC 28301 = VPRI 15691; Victoria, Waratah Bay, dead leaf of *Melaleuca squarrosa*, 1 Nov. 1966, *H.J. Swart* (**epitype** designated here CBS H-17990, MBT382768, culture ex-epitype CBS 161.67, received as *Seimatosporium dilophosporum*); Tasmania, Arboretum, on *Betula pendula*, Dec. 2011, *W. Quaedvlieg*, CPC 20124; Victoria, Port Philip, on *Melaleuca squarrosa,* May 1890, *C. French* (**holotype** of *Hyaloceras dilophosporum,* IMI 58841 ex K – not seen); New South Wales, near Rylstone, on leaves of *Callistemon citrinus*, 7 Mar. 1954, *E. gauba* (**holotype** of *Allelochaeta gaubae*, BPI 407171A).

Fig. 7. *Allelochaeta dilophospora* (CBS 161.67). **A.** Conidiomata on OA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

Fig. 8. *Allelochaeta elegans* (CBS 187.81). **A.** Conidiomata on PDA. **B.** Chlamydospores. **C.** Conidia. Scale bars = 10 µm.

Notes: The present collection closely matches the morphology of this species and is herewith designated as epitype. This species can easily be distinguished from its closest phylogenetic neighbours based on LSU, *rpb2*, *tef1* and *tub2*. On ITS, it cannot be distinguished from *A. neodilophospora*. *Discostromopsis stoneae* (syn.: *Discostroma stoneae*) was described from a specimen with the same collection details as the culture chosen here to serve as ex-epitype for *A. dilophospora* (Victoria, Waratah Bay, dead leaf of *Melaleuca squarrosa*, 1 Nov. 1966, *H.J. Swart*, DAR 31945). Although the culture studied here was received from H.J. Swart as *Seimatosporium dilophosporum*, it suggests that the sexual and asexual morphs probably occurred on the same leaf material. Unfortunately, it is not known if this culture was derived from a single ascospore or conidium. This link is also discussed by Swart (1979), who referred to the asexual morph as *A. gaubae*, stating that the type preserved in BPI was identical to the asexual morph of *D. stoneae*.

Allelochaeta elegans (H.J. Swart) Crous, ***comb. nov.*** MycoBank MB827143. Fig. 8.
Basionym: *Seimatosporium elegans* H.J. Swart, *Trans. Brit. Mycol. Soc*. **73**: 213. 1979.
Synonyms: *Discostromopsis elegans* H.J. Swart, *Trans. Brit. Mycol. Soc.* **73**: 217. 1979.
Diploceras elegans (H.J. Swart) Nag Raj, in Nag Raj, *Coelomycetous Anamorphs with Appendage-bearing Conidia* (Ontario): 286. 1993.
Discostroma elegans (H.J. Swart) Sivan., *Fungal Diversity* **11**: 152. 2002.

Conidiomata stromatic, acervuloid, scattered, round to irregular, 250–500 µm diam, exuding a brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 0–2-septate, hyaline to pale brown, 20–40 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 8–20 × 2.5–3 µm. *Conidia* acerose, falcate, 4-septate, pale brown, smooth-walled, slightly constricted at septa, (50–)55–60(–70) × (3.5–)–4(–4.5) µm; apical cell long conical, attenuating toward apex, subhyaline, (25–)30–35(–40) µm long; median cells cylindrical to subcylindrical, together 17–25 µm long; basal cell obconical with narrowly truncate base, 5–6 µm long; basal appendage excentric, single, tubular, flexuous, (15–)20–25 µm long. *Chlamydospores* developing in agar, solitary, globose, brown, thick-walled, 12–17 µm diam.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and feathery margins, covering dish after 2 wk. Colonies on MEA surface and reverse ochreous; on OA chestnut due to brown spore masses; on PDA surface and reverse isabelline.

Materials examined: **Australia**, Victoria, Mallee, near Djerriwarrh Creek, leaf spot on *Melaleuca lanceolata*, 24 Aug. 1976, *H.J. Swart* No. 76-28 (**epitype** designated here CBS H-17992, MBT382769, culture ex-epitype CBS 187.81), deposited as *Seimatosporium elegans*, and appears to be a duplicate of culture CPC 28306 = VPRI 15697, collected on the same host and location, 24 Aug. 1976; Victoria, East Gippsland, on *Melaleuca ericifolia*, 29 May 1967, *H.J. Swart* (**holotype** IMI 144633).

Notes: Nag Raj (1993) reported conidia from the type as being 48–78 × 2.5–3.5 µm, median cells 17–32 µm long, apical cell 18–40 µm long, basal cell 15–23 µm long, thus closely matching this culture, which H.J. Swart also deposited as "*Diploceras elegans*". It is therefore designated as epitype. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta euabalongensis Crous, ***sp. nov.*** MycoBank MB827144. Fig. 9.

Etymology: Name reflects the town Euabalong, where this species was collected.

Conidiomata stromatic, acervuloid, scattered, oval, 150–250 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, reduced to conidiogenous cells. *Conidiogenous cells* hyaline, smooth, subcylindrical, proliferating percurrently near apex, 8–16 × 2.5–3.5 µm. *Conidia* subcylindrical to narrowly fusoid, hyaline, smooth, guttulate, flexuous, 3-septate, constricted at septa or not, with prominent taper in apical cell to flexuous appendage, (55–)60–70(–75) × (3–)3.5(–4) µm; apical cell attenuating toward a long thin apical appendage with subobtuse apex, (17–)20–26(–30) µm long; second cell from apex cylindrical to subcylindrical, (12–)13–15(–17) µm long; third cell from apex cylindrical to subcylindrical, (10–)11–12(–13) µm long; basal cell cylindrical to narrowly obconic with narrowly truncate base, (10–)11–12 µm long; basal appendage excentric, single, cuneiform with subobtuse tip, (7–)10–13 µm long.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and feathery margins, covering dish after 2 wk. Colonies salmon on MEA, OA and PDA, with orange spore masses.

Fig. 9. *Allelochaeta euabalongensis* (CPC 3777). Conidia. Scale bar = 10 µm.

Material examined: **Australia**, New South Wales, Euabalong, on leaves of *Eucalyptus* sp., 1999, unknown collector (**holotype** CBS H-23436, cultures ex-type CBS 112504 = CPC 3777); *ditto*, culture CBS 112332 = CPC 3776.

Notes: *Allelochaeta euabalongensis* is a cryptic species in the *A. walkeri* complex but is phylogenetically distinct from that species (see discussion under *A. walkeri*). This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU and *tef1*; both isolates failed to amplify for *rpb2* and *tub2*.

Allelochaeta eucalypti (McAlpine) Crous, ***comb. nov.*** MycoBank MB827145. Fig. 10.
Basionym: *Cylindrosporium eucalypti* McAlpine, *Proc. Linn. Soc. N.S.W.* **28**: 97. 1903.
Synonyms: *Seimatosporium eucalypti* (McAlpine) H.J. Swart, *Trans. Brit. Mycol. Soc.* **78**: 268. 1982.
Vermisporium eucalypti (McAlpine) Nag Raj, in Nag Raj, *Coelomycetous anamorphs with appendage-bearing conidia* (Ontario): 966. 1993.

Morphological description on natural substratum: See Barber *et al*. (2011).

CPC 12458: *Leaf spots* brown, subcircular, up to 15 mm diam. *Conidiomata* acervular, amphigenous, subepidermal, up to 200 µm diam; stroma pale brown, 15–30 µm thick *textura angularis. Conidiophores* subcylindrical, hyaline, mostly reduced to conidiogenous cells, or a single supporting cell, 10–20 × 3–5 µm. *Conidiogenous cells* subcylindrical to ampulliform, smooth, hyaline, 10–15 × 3–4 µm; proliferating percurrently near apex. *Conidia* falcate, fusoid to sigmoid, 3-septate, slightly constricted at septa, guttulate, median cells pale brown, smooth, (43–)55–65(–70) × (4–)4.5–5(–6) µm; apical cell cuneiform, tapering prominently to a tubular apical appendage, up to 20 µm long; apical cell including appendage (16–)20–26(–30) µm; second cell cylindrical, hyaline to pale brown, (10–)11–14(–16) µm long; third cell cylindrical, hyaline to pale brown, (10–)11–13 µm long; basal cell subcylindrical to elongate-obconical, with a small truncate base, 8–10(–12) µm; basal appendage single, excentric, tubular and flexuous, attenuating to a rounded apex, 10–20 µm long.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and smooth, feathery margins, reaching 45 mm diam in 2 wk at 25 ºC. Colonies salmon on MEA, OA and PDA.

Specimens examined: **Australia**, Victoria, Dandenong Creek, on *E. melliodora*, 16 Nov. 1902, *C. French Jr.* (**holotype** VPRI 5927a); Victoria, Benalla, on *E. cinerea*, 29 Oct. 2001, *P. Sebire,* VPRI 30218; Victoria, Mt Buffalo, on *E. delegatensis*, 8 May 2000, *P.J. Keane,* MB0.02; Victoria, Mt Buffalo, on *E. delegatensis*, 8 May 2000, *P.J. Keane,* MB0.06, MB 0.29, MB 0.33, MB 0.35, MB 0.36, MB 0.38, MB 0.39; Victoria, Mt Buffalo, on *E. pauciflora*, 8 May 2000, *P.J. Keane,* MB 0.14b; unknown, on *E. nitens*, 22 Nov. 1996, *P.W. Crous*, CBS 111386 = CPC 1542; Tasmania, Lake St. Claire, on *E. delegatensis*, Mar. 2011, *C. Mohammed* (**epitype** designated here CBS H-23439, MBT382771, culture ex-epitype CPC 12458 = CBS 144170). **New Zealand**, Rotoehu Forest, on *E. saligna,* 12 Aug. 1997, *K. Dobbie,* NZFRI-M 3740; Waimea Forest, on *E. delegatensis*, 11 Aug. 1998, *P. Bradbury,* NZFRI-M 3867.

Notes: Conidial pigmentation varies considerably between specimens of this species. *Allelochaeta eucalypti* is most similar to *A. cylindrospora, A. falcata* and *A. verrucispora* that all have pigmented conidia. The major differences between *A. eucalypti* and *A. falcata* include the overall length of the conidia and the degree of verrucosity. Conidia of *A. eucalypti* are generally longer, although there does appear to be a degree of overlap between the two species (See Barber *et al*. 2011). Furthermore, *A. eucalypti* appears to represent a species complex, but

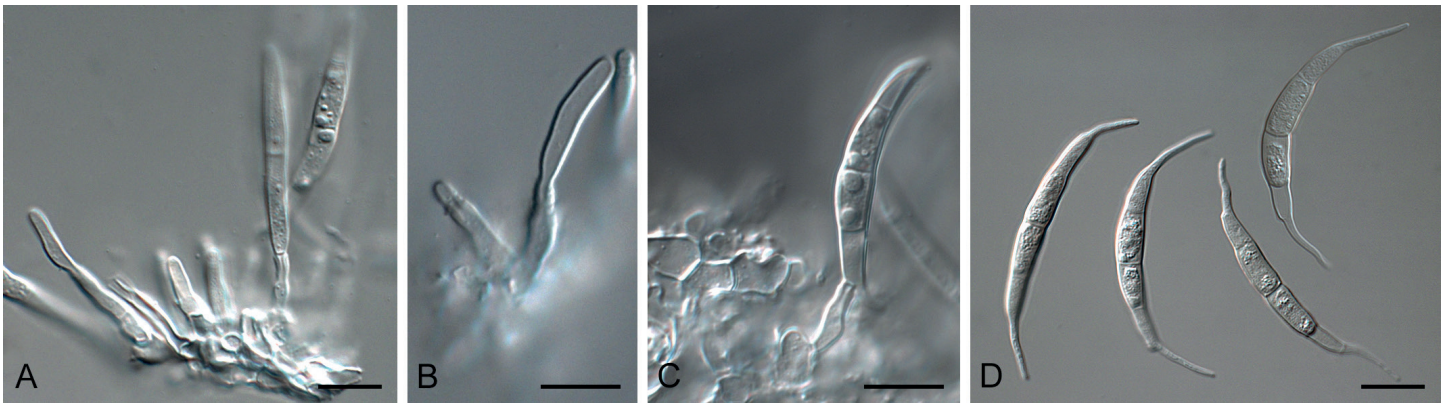

Fig. 10. *Allelochaeta eucalypti* (CPC 12458). **A–C.** Conidiophores *in vivo*. **D.** Conidia. Scale bars = 10 µm.

additional collections would be required to adequately resolve these cryptic taxa. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *tef1*, *tub2* and *rpb2*. Some cultures identified as *Seimatosporium eucalypti* in Barber *et al.* (2011), have been re-identified as *A. neoacuta* (see below).

Allelochaeta falcata (B. Sutton) Crous, ***comb. nov.*** MycoBank MB827147. Figs 11, 12.
Basionym: *Cryptostictis falcata* B. Sutton, *Mycol. Pap*. **88**: 25. 1963.
Synonyms: *Seimatosporium falcatum* (B. Sutton) Shoemaker, *Canad. J. Bot.* **42**: 416. 1964.
Vermisporium falcatum (B. Sutton) Nag Raj, in Nag Raj, *Coelomycetous anamorphs with appendage-bearing conidia* (Ontario): 969. 1993.

Morphological description on natural substratum: See Barber *et al*. (2011).

Diagnosis: *Conidia* falcate, fusiform or sigmoid, 3(–4)-septate, rarely 5-septate, distinct, slightly to strongly constricted at the septa, guttulate or not guttulate, median cells brown to pale brown, apical and basal cells pale brown to almost hyaline to hyaline, periclinal wall verruculose or minutely verruculose, slightly thicker in the median cells, pale brown to dark brown in mass, (31–)34–51(–59) × 4–6 µm; apical cell sub-cylindrical to narrowly conic, pale brown to almost hyaline, upper half hyaline, attenuated into a discernible conical or tubular appendage up to 25 µm, total length including the appendage, (9–)11–24(–31) µm long; second cell from apex cylindrical to sub-cylindrical, brown to pale brown, (6–)7–12(–13) µm long; third cell from apex cylindrical to sub-cylindrical, brown to pale brown, (5–)7–12(–13) µm long; basal cell obconic with a truncate base and basal appendage, pale brown to almost hyaline, lower half hyaline, 5–9(–10) µm long; basal appendage single, excentric, plectronoid to tubular and flexuous, attenuated to a point, (3–)4–14(–17) µm long.

Culture characteristics: Colonies erumpent, spreading, with sparse aerial mycelium and smooth, lobate margins, reaching 55 mm diam after 2 wk. Colonies salmon on MEA, OA and PDA.

Specimens examined: **Australia**, Victoria, Kinglake West, on *E. obliqua*, 7 Nov. 2001, *P.A. Barber,* PAB01.03; Victoria, Hoddles Creek, 'Andrews Farm', on *E. nicholii*, 7 July 2002, *P.A. Barber,* VPRI 30233a; Victoria, on *E. radiata*, 1975, MELU 2002-4-1 (HJS 75.07); Victoria, on *Eucalyptus* sp., 1963, *collector unknown* (**holotype** K(M) 142957); New South Wales, Central Tablelands, *ca*. 200 metres WSW of 'Coomber' homestead, on Coomber property, *ca*. 8 km SW of Rylstone, S32°50'04" E149°56'13", alt. 600 ± 10 m, 17 Aug. 2006, *R. Johnstone* & *A.E. Orme*, 734259, on *E. alligatrix* (**epitype** designated here CBS H-20744, MBT382772**,** cultures ex-epitype CPC 13578 = CBS 131117); *ditto*, cultures CPC 13579–CPC 13580; New South Wales, Bago State Forest, *Eucalyptus* sp., Feb. 2006, *A.J. Carnegie*, CPC 12992; Tasmania, Lovershill, *Eucalyptus* sp., 4 Jan. 2012, *W. Quaedvlieg*, CPC 20142; Tasmania, *E. nitens*, 2007, *C. Mohammed*, CPC 12464. **New Zealand**, Westland, Hochstetter Forest, on *E. delegatensis*, 18 Dec. 1981, *A. Holloway,* NZFRI-M 3158; Westland, Mawhero Forest, on *E. delegatensis*, 1 Jan. 1985, *A. Holloway,* NZFRI-M 3209; Tokoroa, Kinleith Forest, on *E. regnans*, Sep. 1982, *collector unknown*, NZFRI-M 3153.

Notes: Conidial width varied between specimens but was generally between 4 and 6 µm, as described by Nag Raj (1993). Conidia from most collections examined in the present study had either smooth to minutely verruculose walls. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU and *rpb2*; on *tef1* and *tub2* it cannot be resolved from *Allelochaeta* sp.

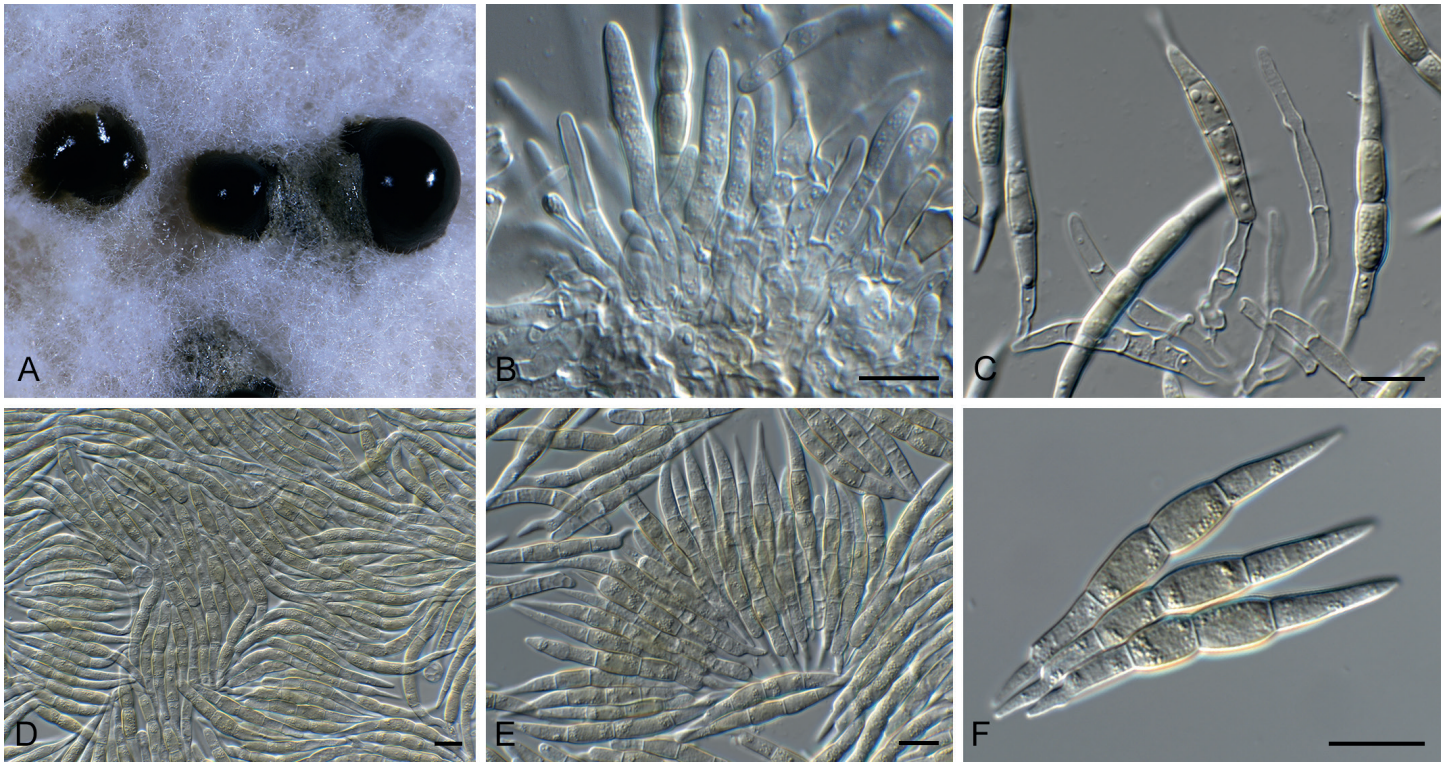

Fig. 11. *Allelochaeta falcata* (CPC 13578). **A.** Conidiomata on PDA. **B, C.** Conidiophores *in vivo*. **D–F.** Conidia. Scale bars = 10 µm.

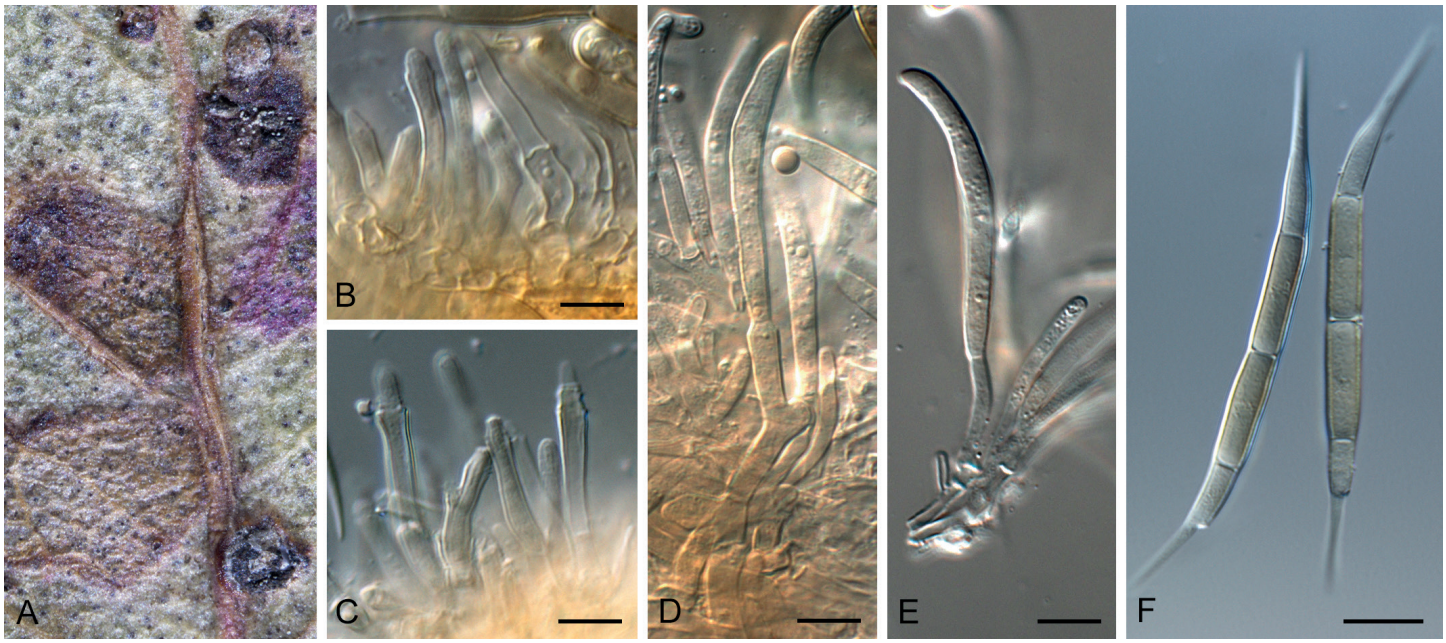

Fig. 12. *Allelochaeta falcata* (CPC 12992). **A.** Leaf spot. **B–E.** Conidiophores *in vivo*. **F.** Conidia. Scale bars = 10 µm.

Allelochaeta flexuosa Crous, ***sp. nov.*** MycoBank MB827148. Fig. 13.

Etymology: Name refers to its conidia with long, thin, flexuous apical cells.

Conidiomata stromatic, acervuloid, scattered, oval, up to 250–450 µm diam, exuding a dirty orange conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, septate, 10–30 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 10–15 × 2.5–3 µm. *Conidia* acerose, straight to curved, 3-septate, hyaline, slightly constricted at septa, (70–)75–80(–85) × (3.5–)4 µm; apical cell long conical, attenuating toward apex, (25–)30–36 µm long; second cell from apex cylindrical to subcylindrical, (15–)17–19(–20) µm long; third cell from apex cylindrical to subcylindrical, 15–16 µm long; basal cell with narrowly truncate base, (9–)10–12 µm long; basal appendage excentric, single, tubular with acute apex, (12–)15–18(–25) µm long.

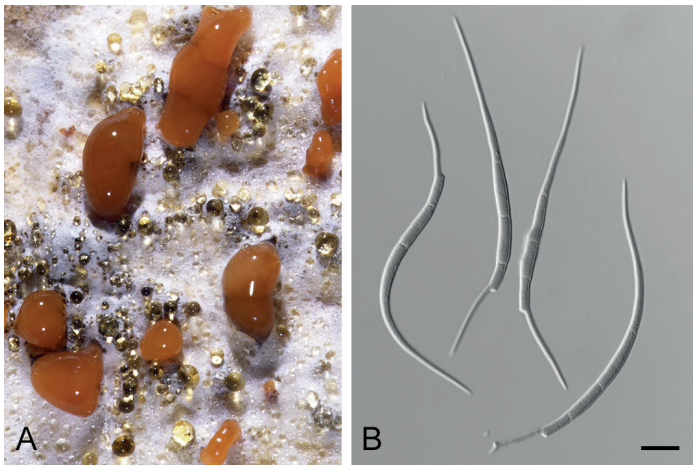

Fig. 13. *Allelochaeta flexuosa* (CPC 20173). **A.** Conidiomata on PDA. **B.** Conidia. Scale bar = 10 µm.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and feathery margins, reaching 50 mm diam after 2 wk. Colonies on MEA surface isabelline, reverse sepia, with diffuse brown pigment; on OA surface cinnamon with diffuse cinnamon pigment; on PDA surface honey, reverse brick, with diffuse brown pigment.

Material examined: **Australia**, South Australia, Kangaroo Island, Ravine des Casours Walk, on *E. rugosa*, Dec. 2011, *W. Quaedvlieg* **(holotype** CBS H-23440, culture ex-type CPC 20173 = CBS 144171).

Notes: *Allelochaeta flexuosa* can be distinguished from other species in the genus based on its distinct conidial shape. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU, *rpb2*, *tef1* and *tub2*.

Allelochaeta fusispora (H.J. Swart & D.A. Griffiths) Crous, ***comb. nov.*** MycoBank MB827149. Fig. 14.
Basionym: *Seimatosporium fusisporum* H.J. Swart & D.A. Griffiths, *Trans. Brit. Mycol. Soc*. **62**: 360. 1974.

CPC 17616: *Leaf spots* amphigenous, circular to subcircular, 2–10 mm diam, medium brown, frequently with darker central region and lobate border. *Conidiomata* black on leaf, amphigenous, stromatic, subepidermal, becoming erumpent, up to 300 µm diam; wall of 3–4 layers of brown *textura angularis*. *Conidiophores* lining the inner cavity, hyaline, smooth, septate, irregularly branched, 10–40 × 1.5–2.5 µm. *Conidiogenous cells* subcylindrical, 7–15 × 1.5–2 µm, hyaline, smooth, with up to three apical percurrent proliferations. *Conidia* fusoid, 3-septate, brown, central cells verruculose, constricted at septa, (18–)20–22(–26) × 5(–6) µm; basal cell obconical, with truncate base, hyaline, smooth, 3–4 µm long; two central cells thick-walled, medium brown, verruculose, 12–17 µm long; apical cell short-conical, 3–4 µm long, with acute apex extending into apical tubular appendage, 10–20 µm long; basal appendage excentric, tubular, 15–20 µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, covering

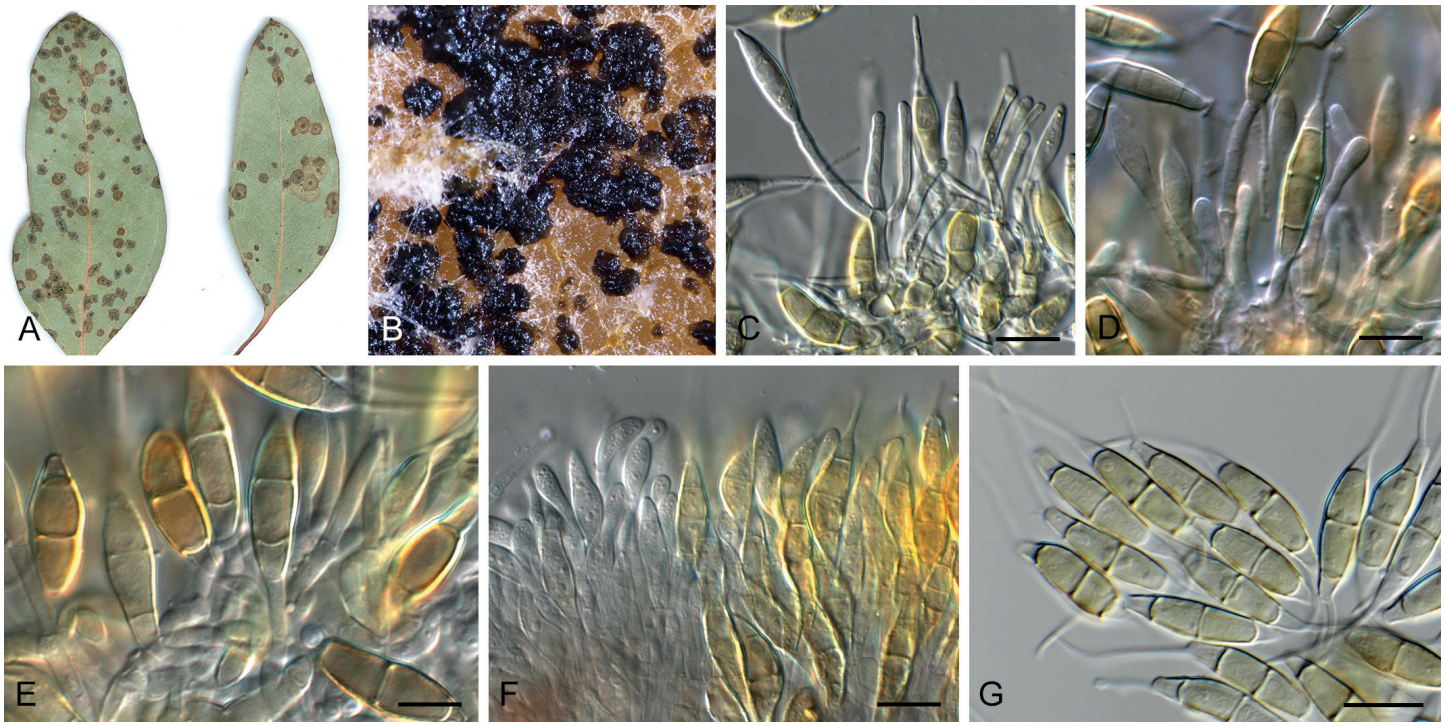

Fig. 14. *Allelochaeta fusispora* (CPC 17616). **A.** Leaf spots. **B.** Conidiomata on PDA. **C–F.** Conidiophores. **G.** Conidia. Scale bars = 10 µm.

dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with black spore masses.

Materials examined: **Australia**, Victoria, near Lake Merrimu, on leaf of *E. polyanthemos*, 30 Aug. 1973, *H.J. Swart* (**isotype** of *Seimatosporium fusisporum*, CBS 810.73 (specimen CBS H-17996) = ATCC 26928 = IMI 163446 (culture and specimen), culture C 73.22; Victoria, Melbourne, Wardinary Sanctuary, *Eucalyptus* sp., 14 Oct. 2009, *P.W. Crous*, CBS H-23442, culture CPC 17616 = CBS 144172.

Notes: Conidia were described as 3-septate, (13–)14(–16) × 5 µm, apical appendage (7–)10.4(–14) µm, basal appendage (6–)8.5(–13) µm (Swart & Griffiths 1974), thus matching the morphology of the new collection (CPC 17616), which also clusters in the same clade. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta kriegeriana (Bres.) Crous, ***comb. nov.*** MycoBank MB827150. Fig. 15.
Basionym: *Pestalotia kriegeriana* Bres., *Hedwigia* **33**: 209. 1894.
Synonyms: *Hyaloceras kriegerianum* (Bres.) Died., in Roumeguère, *Mycoth. Univ.*, cent. **4**: no. 324. 1899.
Monochaetia kriegeriana (Bres.) Sacc., *Rabenh. Krypt.-Fl.*, Edn 2 (Leipzig) **1.7**(7): 669. 1902.
Monoceras kriegerianum (Bres.) Guba, *Monograph of Monochaetia and Pestalotia*: 290. 1961.
Seimatosporium kriegerianum (Bres.) Morgan-Jones & B. Sutton, *Mycol. Pap.* **97**: 37. 1964.
Diploceras kriegerianum (Bres.) Nag Raj, *Coelomycetous Anamorphs with Appendage-bearing Conidia* (Ontario): 289. 1993.
Discostromopsis callistemonis H.J. Swart, *Trans. Brit. Mycol. Soc.* **73**: 217. 1979.
Discostroma callistemonis (H.J. Swart) Sivan., *Fungal Diversity* **11**: 152. 2002.

Conidiomata stromatic, acervuloid, scattered, round in outline, 200–400 µm diam, exuding an orange conidial mass on MEA, but brown on OA. *Conidiophores* lining the basal cavity, subcylindrical, branched, septate, hyaline, 15–50 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 10–16 × 2.5–3 µm. *Conidia* subcylindrical, straight to curved, 3(–5)-septate, pale brown, smooth-walled, constricted at septa, 23–30(–35) × (3.5–)4 µm; apical cell long conical, attenuating toward apex, hyaline, 3–8 µm long; median cells cylindrical to subcylindrical, pale brown, together 11–20 µm long; basal cell obconical with narrowly truncate base, subhyaline, 4–8 µm long; appendages tubular, unbranched, flexuous; apical appendage single, 3–10 µm long; basal appendage excentric, single, 5–10 µm long; occasionally and apical or basal appendage can be forked.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and feathery margins, reaching 50 mm diam after 2 wk. Colonies salmon on MEA and PDA, but greenish grey on OA with salmon border, with brown spore masses.

Materials examined: **Australia**, Victoria, Djerriwarrah Creek, on leaf spot of *Callistemon seiberi* (= *C. paludosus*), 12 May 1972, *H.J. Swart* No. 72-23, CBS 188.81 = NBRC 32679; culture received as VPRI 15693 = CPC 28303 = CBS 144173, with exact collection details, appears to be a duplicate strain.

Notes: The isolates examined here were sufficiently similar to the type, and can be accommodated in this species. *Allelochaeta kriegeriana* can easily be distinguished from its closest phylogenetic neighbours based on ITS and *tub2*; on *rpb2* and *tef1* it only differs with 1 and 3 nts from *A. neodilophospora*.

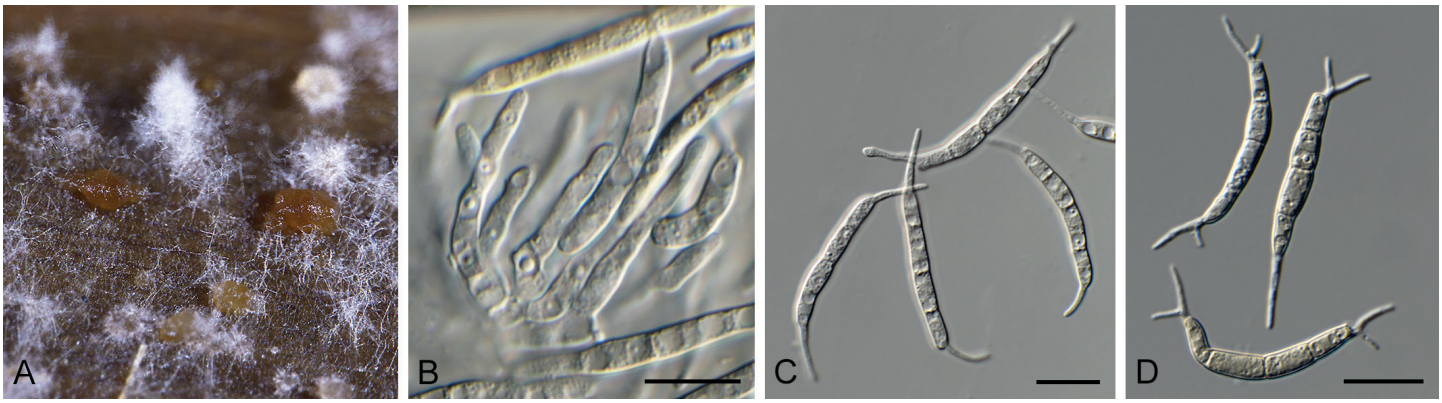

Fig. 15. *Allelochaeta kriegeriana* (CPC 28303). **A.** Conidiomata on PNA. **B.** Conidiophores. **C, D.** Conidia. Scale bars = 10 µm.

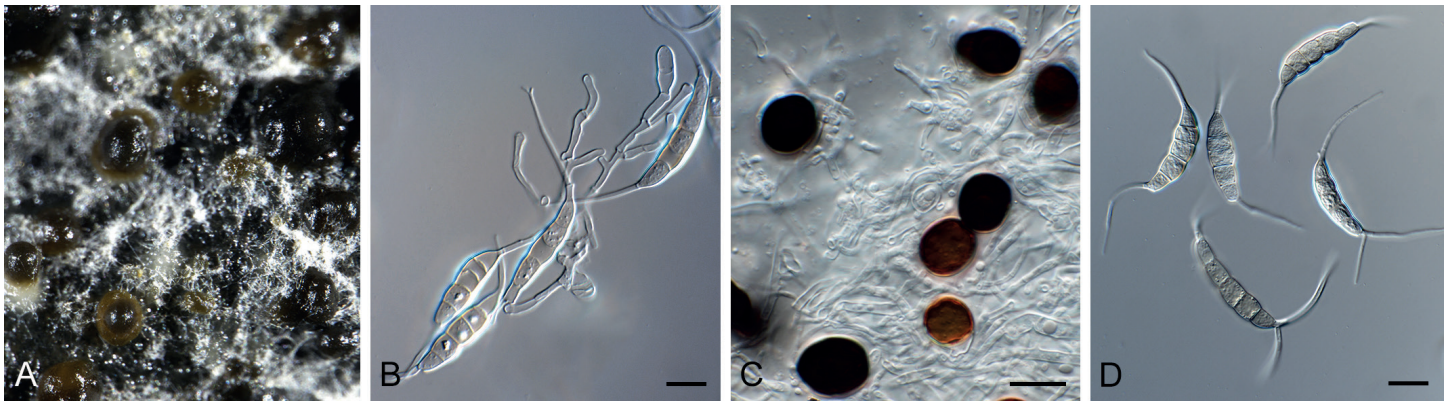

Fig. 16. *Allelochaeta melaleucae* (CPC 28305). **A.** Conidiomata on PDA. **B.** Conidiophores and conidia. **C.** Chlamydospores. **D.** Conidia. Scale bars = 10 µm.

Allelochaeta melaleucae Crous, ***sp. nov.*** MycoBank MB827151. Fig. 16.

Etymology: Name reflects the host genus *Melaleuca*, on which this species occurs.

Conidiomata stromatic, acervuloid, scattered, irregular in outline, 200–250 µm diam, exuding a brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 1–3-septate, hyaline, 15–30 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 10–20 × 2.5–3.5 µm. *Conidia* fusoid, straight to curved, (3–)4-septate, pale brown, smooth-walled, constricted at septa, (25–)26–28(–32) × 6(–6.5) µm; apical cell long conical, attenuating toward apex, subhyaline, 6–7 µm long; median cells cylindrical to subcylindrical, pale brown, together 15–20 µm long; basal cell obconical with narrowly truncate base, subhyaline, 5–6 µm long; appendages tubular, attenuated, branched close to base; apical branches (18–)27–30(–35) µm long; basal appendage excentric, branches, (30–)35–40(–50) µm long. *Chlamydospores* forming in culture in superficial mycelium, solitary, dark brown, globose, smooth, thick-walled, 10–15 µm diam.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and feathery margins, covering dish after 2 wk. Colonies on MEA surface isabelline to hazel, reverse hazel; on OA surface salmon with brown spore masses; on PDA surface and reverse honey, with brown spore masses.

Material examined: **Australia**, Victoria, Rushworth, on *Melaleuca decussata*, 9 Oct. 1973, *I.G. Stone* (**holotype** CBS H-23445, culture ex-type CPC 28305 = VPRI 15695 = CBS 144174).

Notes: *Allelochaeta melaleucae* appears distinct from taxa presently known in the *Diploceras* complex (Nag Raj 1993). Furthermore, it can be distinguished from *A. dilophospora* (also on *Melaleuca*) based on its smaller conidia, with unbranched conidial appendages. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU, *rpb2*, *tef1* and *tub2*.

Allelochaeta minor Crous, ***sp. nov.*** MycoBank MB827152. Fig. 17.

Etymology: Name reflects the small conidia of this species.

Conidiomata stromatic, acervuloid, scattered, oval, 150–250 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 0–2-septate, 8–17 × 2.5–4 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical to doliiform, terminal and intercalary, proliferating percurrently near apex, 8–12 × 2.5–3.5 µm. *Conidia* acerose, straight to curved, 3-septate, hyaline, slightly constricted at septa, (25–)29–32(–35) × (3–)3.5(–4) µm; apical cell narrowly conical, attenuating toward apex, (10–)12–13(–16) µm long; second cell from apex cylindrical to subcylindrical, 6–7 µm long; third cell from apex cylindrical to subcylindrical, (6–)7(–8) µm long; basal cell with narrowly truncate base, 6–7 µm long; basal appendage excentric, single, cuneiform, (4–)5–6(–7) µm long.

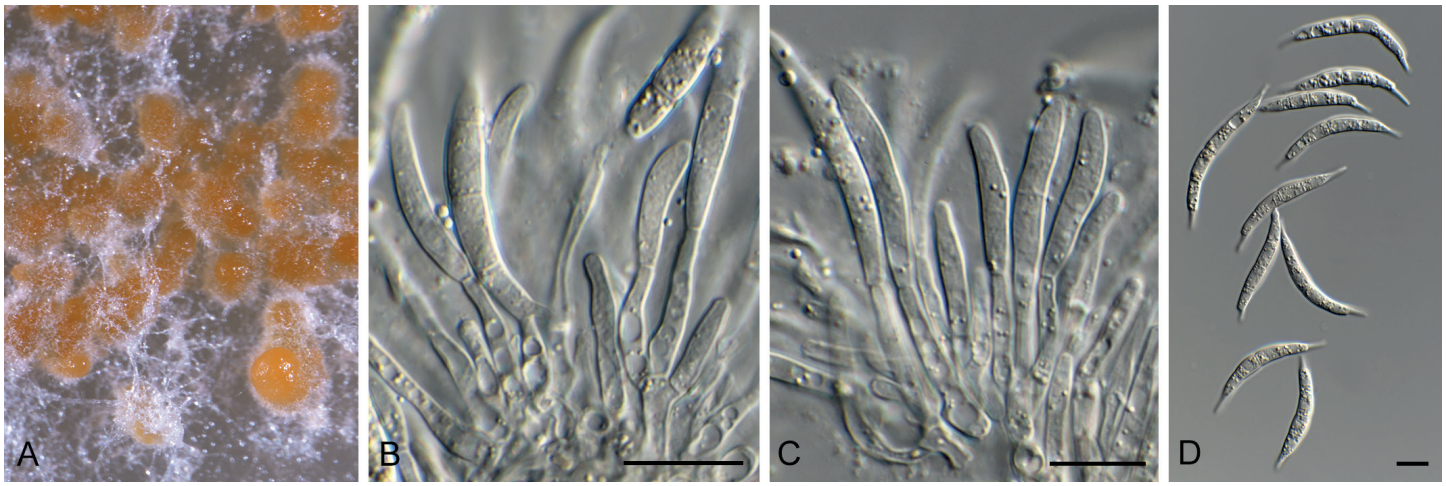

Fig. 17. *Allelochaeta minor* (CPC 29354). **A.** Conidiomata on OA. **B, C.** Conidiophores *in vivo*. **D.** Conidia. Scale bars = 10 µm.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Materials examined: **New Zealand**, Auckland, Warkworth, Kaipara coast road, *Eucalyptus* sp., 2015, *R. Thangavel* (**holotype** CBS H-23446, culture ex-type MPI T15_06344A = CPC 29354 = CBS 144175); *ditto*, CPC 29353.

Notes: *Allelochaeta minor* resembles *A. eucalypti* in general morphology, except that its conidia are hyaline, and much smaller. This species can easily be distinguished from its closest phylogenetic neighbours based on *rpb2*, *tef1* and *tub2*; on ITS it only differs with 2 nt from *Allelochaeta pseudowalkeri*.

Allelochaeta neoacuta Crous, ***sp. nov.*** MycoBank MB827153. Fig. 18.

Etymology: Name reflects a morphological similarity to *A. acuta*.

Conidiomata stromatic, acervular, amphigenous, mainly epiphyllous, scattered, sub-epidermal to intra-epidermal, oval in outline, 200–250 µm diam, exuding an orange conidial mass. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* lageniform, hyaline, annellidic, 5–16 µm long. *Conidia* fusoid, falcate, (2–)3(–5)-septate, hyaline, orange in mass, slightly or not constricted at septa, (43–)49–55(–65) × 3(–4) (av. = 50 × 3) µm; apical cell narrowly conical, attenuated to an acute apex, (11–)16–19(–22) µm long; second cell from apex cylindrical to sub-cylindrical, (11–)12–14(–16) µm long; third cell from apex cylindrical to sub-cylindrical, (8–)10–12 µm long; basal cell with a truncate base, 8–10(–11) µm long; basal appendage excentric, single, cuneiform, (3–)6–8(–10) µm long.

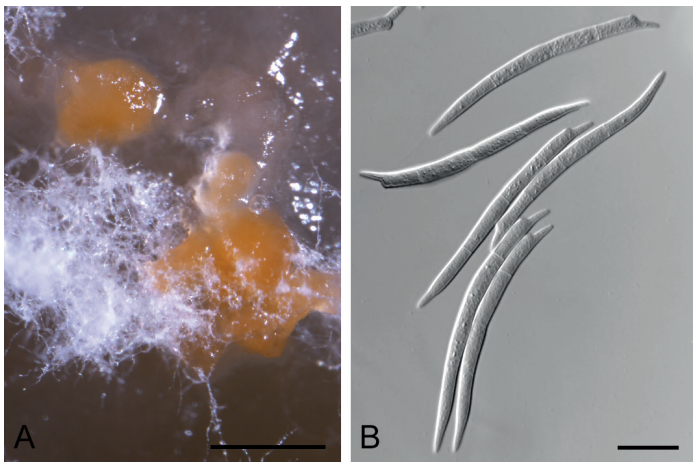

Fig. 18. *Allelochaeta neoacuta* (CBS 115131). **A.** Conidiomata on OA. **B.** Conidia. Scale bars: A = 250 µm, B = 10 µm.

Culture characteristics: Colonies flat, spreading, with moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Materials examined: **South Africa**, Mpumalanga, Sabie, Sabie Forest Station, on leaves of *E. smithii*, 28 Sep. 1989, *P.W. Crous* (**holotype** PREM 50457, isotype CBS H-23448, culture ex-type CBS 115131 = CPC 156); *ditto*, CBS 110733 = CPC 157, CBS 110734 = CPC 158, CBS 114876 = CPC 159.

Notes: *Allelochaeta neoacuta* was originally reported from South Africa as "*Seimatosporium*" *eucalypti* (Crous *et al*. 1990). However, as shown here, it is clearly distinct from *A. eucalypti*, having hyaline conidia, and no clearly delimited apical appendage. It is morphologically more similar to *A. acuta*, from which it can be distinguished because the type specimen of *A. acuta* (VPRI 2156) has longer conidia [52–75 × 3–4 (av. = 63 × 3.5) µm] (Nag Raj 1993). This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU, *rpb2*, *tef1* and *tub2*.

Allelochaeta neocylindrospora Crous, ***sp. nov.*** MycoBank MB827154. Fig. 19.

Etymology: Name reflects a morphological similarity to *A. cylindrospora*.

Conidiomata stromatic, acervuloid, scattered, oval, 250–350 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, reduced to conidiogenous cells. *Conidiogenous cells* hyaline, smooth, subcylindrical, proliferating percurrently near apex, 10–15 × 3–4 µm. *Conidia* narrowly fusoid, straight to curved, 3-septate, hyaline, orange

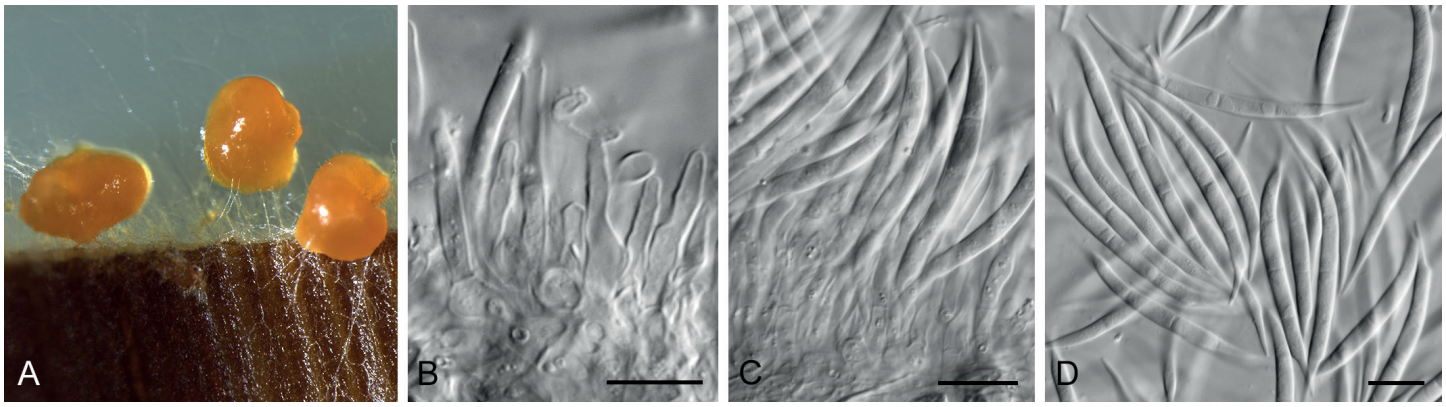

Fig. 19. *Allelochaeta neocylindrospora* (CPC 20115). **A.** Conidiomata on PNA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

in mass, not to slightly constricted at septa, (42–)50–55(–60) × (3–)3.5(–4) µm; apical cell narrowly conical, attenuating toward apex, (15–)20–22 µm long; second cell from apex cylindrical to subcylindrical, 10–13(–16) µm long; third cell from apex cylindrical to subcylindrical, 10–12(–15) µm long; basal cell with narrowly truncate base, 8–9(–10) µm long; basal appendage excentric, single, narrowly cuneiform with subobtuse tip, (7–)9–10(–15) µm long.

Culture characteristics: Colonies flat, spreading, with moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA dirty white to salmon surface and reverse, with orange masses.

Material examined: **Australia**, South Australia, Kangaroo Island, Ravine des Casours Walk, on *E. rugosa*, Dec. 2011, *W. Quaedvlieg* (**holotype** CBS H-23447, culture ex-type CPC 20115 = CBS 144176).

Notes: Mean conidial dimensions of *A. neocylindrospora* [(42–)50–55(–60) × (3–)3.5(–4) µm] are longer than those of *A. paracylindrospora* [(34–)38–45(–50) × 3(–3.5) µm], and *A. cylindrospora* [(40–)43–56(–58) × 2.5–4(–5) µm]. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU, *rpb2*, *tef1* and *tub2*.

Allelochaeta neodilophospora Crous, ***sp. nov.*** MycoBank MB827155. Fig. 20.

Etymology: Name reflects a morphological similarity to *A. dilophospora*.

Foliicolous, associated with small (1–3 mm diam) leaf spots, indistinct, red-purple, predominantly epiphyllous. *Conidiomata* stromatic, acervular, subepidermal, becoming erumpent, up to 700 µm diam; black, glabrous, opening by irregular split in host tissue. *Conidiophores* lining the cavity, unbranched to branched, septate, smooth, hyaline, 10–20 × 3–4 µm. *Conidiogenous cells* subcylindrical, hyaline, smooth, 5–8 × 2–3 µm, with up to three apical percurrent proliferations. *Conidia* narrowly fusoid, straight to slightly curved, 3-euseptate, pale brown, smooth, at times constricted at septa, (17–)27–35(–40) × (3.5–)4–5 µm; apical cell conical, pale brown to hyaline, 4–6 µm long, appendages tubular, attenuated, branched close to point of origin, branches 7–15 µm long; median cells cylindrical, medium brown, guttulate, granular, 8–10 µm long; basal cell obconical with truncate base with minute marginal frill, 4–7 µm long; basal appendage excentric, hyaline, smooth, tubular, branched close to point of origin, branches 9–18(–15) µm long.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and smooth, lobate margins, reaching 40 mm diam in 2 wk at 25 ºC. Colonies on MEA salmon with patches of pale luteous, reverse dark mouse grey in middle, salmon in outer region; on OA dirty white in middle, dark mouse grey in outer region; on PDA salmon surface and reverse.

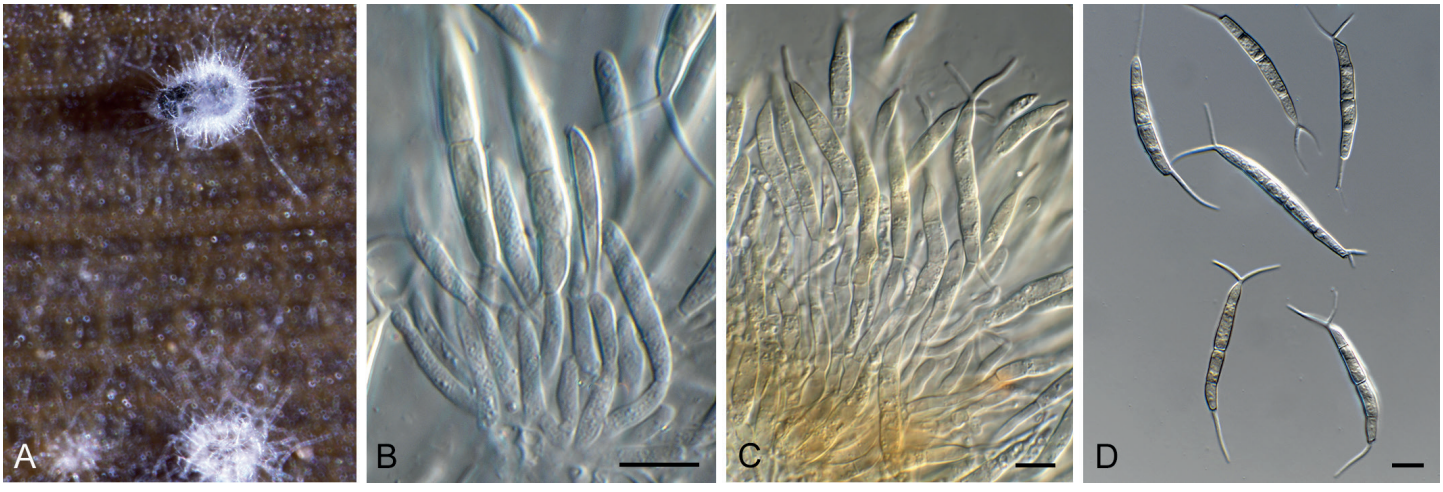

Fig. 20. *Allelochaeta neodilophospora* (CPC 17161). **A.** Conidiomata on PNA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

Material examined: **Australia**, Queensland, Slaughter Falls, S27°28'35" E152°77'48.9", on *Callistemon pinifolius*, 16 Jul. 2009, *P.W. Crous* (**holotype** CBS H-23449, culture ex-type CPC 17161 = CBS 144177).

Notes: In culture, conidia of *A. neodilophospora* [3-septate, (17–)27–35(–40) × (3.5–)4–5 µm] are similar in size to those of *A. dilophospora* [4(–5)-septate, (23–)26–35(–40) × (4–)4.5(–5) µm], but tend to have fewer septa. This species can easily be distinguished from its closest phylogenetic neighbours based on *tub2*. On ITS, it cannot be distinguished from *A. dilophospora* and *A. neodilophospora*, and on *rpb2* and *tef1* it differs 1 and 3 nts from *A. kriegeriana*.

Allelochaeta neofalcata Crous, ***sp. nov.*** MycoBank MB827156. Fig. 21.

Etymology: Name reflects a morphological similarity to *A. falcata*.

Leaf spots amphigenous, medium brown, circular to irregular, up to 15 mm diam, with raised, dark brown border. *Conidiomata* stromatic, acervuloid, scattered, oval, 200–350 µm diam, exuding a black conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 0–3-septate, 10–25 × 2–3 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical or ampulliform, terminal and intercalary, proliferating percurrently near apex, 10–18 × 2–3 µm. *Conidia* falcate, fusoid, 3-septate, pale brown, end cells subhyaline, finely roughened, constricted at septa, (46–)48–55(–60) × 4–5 µm; apical cell subcylindrical to narrowly conical, subhyaline, attenuating toward conical or tubular appendage, 20–22(–23) µm long; second cell from apex cylindrical to subcylindrical, subhyaline, (11–)12–13(–14) µm long; third cell from apex cylindrical to subcylindrical, (12–)13–14(–16) µm long; basal cell obconical with narrowly truncate base, subhyaline, (7–)8–9(–10) µm long; basal appendage excentric, single, tubular, flexuous, (10–)11–13(–15) µm long.

Culture characteristics: Colonies flat, spreading, with moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with black spore masses.

Material examined: **Australia**, Western Australia, Gerby, on *E. radiata*, 7 Nov. 2014, *P.W. Crous* (**holotype** CBS H-23450, culture ex-type CPC 25455 = CBS 144178).

Notes: On average, conidia of *A. neofalcata* are longer **[**(46–)48–55(–60) × 4–5 µm] than those of *A. falcata* [(31–)34–51(–59) × 4–6 (av. 42 × 5) µm]. This species can easily be distinguished from its closest phylogenetic neighbours based on *rpb2*, *tef1* and *tub2*; on ITS it is almost identical to *A. neoorbicularis*.

Allelochaeta neoorbicularis Crous, ***sp. nov.*** MycoBank MB827157. Fig. 22.

Etymology: Name reflects a morphological similarity to *A. orbicularis*.

Conidiomata stromatic, acervuloid, scattered, oval, 150–250 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 1–3-septate, 10–25 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 7–10 × 2.5–3 µm. *Conidia* acerose, curved, 3-septate, hyaline, smooth, constricted at septa, (45–)48–52(–55) × (4–)4.5(–5) µm; apical cell attenuating toward conical, acute apex, (15–)16–17(–18) µm long; second cell from apex cylindrical to subcylindrical, (11–)12–13(–14) µm long; third cell from apex cylindrical to subcylindrical, (9–)10–11(–12) µm long; basal cell with narrowly truncate base, (7–)8–9 µm long; basal appendage excentric, single, cuneiform, (5–)6–7(–8) µm long.

Culture characteristics: Colonies flat, spreading, with moderate aerial mycelium and even, lobate margins, reaching 50 mm diam 2 wk at 25 °. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Materials examined: **Australia**, Tasmania, Rosenberg, *Eucalyptus* sp., Dec. 2011, *W. Quaedvlieg* (**holotype** CBS H-23451, culture ex-type CPC 20140 = CBS 144179); Tasmania, Russell Falls walk, Mt Field National Park, S42°40'42.9" E146°42'47.9", *E. regnans*, 10 Oct. 2006, *B.A. Summerell*, CPC 13581; Victoria, on *E. radiata*, 2 Nov. 2014, *P.W. Crous*, HPC 88, CPC 25494.

Notes: *Allelochaeta neoorbicularis* differs from *A. orbicularis* [(49–)53–66 × 4–4.5 (av. = 57.6 × 4.2) µm] in having shorter conidia [(45–)48–52(–55) × (4–)4.5(–5) µm], with a distinctly tapered apical appendage (more cylindrical in *A. orbicularis*), and narrower basal appendage (slightly swollen apical part in *A. orbicularis*). This species can easily be distinguished from its closest phylogenetic neighbours based on *rpb2*, *tef1* and *tub2*; on ITS it is almost identical to *A. neofalcata*. Isolate CPC 25494 is similar, but has 3(–4)-septate, longer conidia, (43–)55–65(–72) × (4–)4.5(–5) µm. It is therefore possible that this isolate could represent a distinct species, but further collections are needed to clarify the species boundaries of CPC 25455.

Allelochaeta neowalkeri Crous, ***sp. nov.*** MycoBank MB827159. Fig. 23.

Etymology: Name reflects a morphological similarity to *A. walkeri*.

Conidiomata stromatic, acervuloid, scattered, oval, 150–250 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 1–3-septate, 20–40 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 12–17 × 2–3 µm. *Conidia* acerose, hyaline, smooth, slightly curved, 3-septate, constricted at septa, (50–)55–60(–65) × (3–)3.5(–4) µm; apical cell narrowly conical, attenuating toward apex, (16–)20–22 µm long; second cell from apex cylindrical to subcylindrical, (13–)15–16(–17) µm long; third cell from apex cylindrical to subcylindrical, (12–)13–14(–15) µm long; basal cell with narrowly truncate base, 10–12 µm long; basal appendage excentric, single, cuneiform, (4–)6–7 µm long.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and even, lobate margins, reaching 50 mm diam after 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Materials examined: **Australia**, Tasmania, Lovershill, on *E. regnans*, Dec. 2011, *W. Quaedvlieg* (**holotype** CBS H-23453, culture ex-type CPC

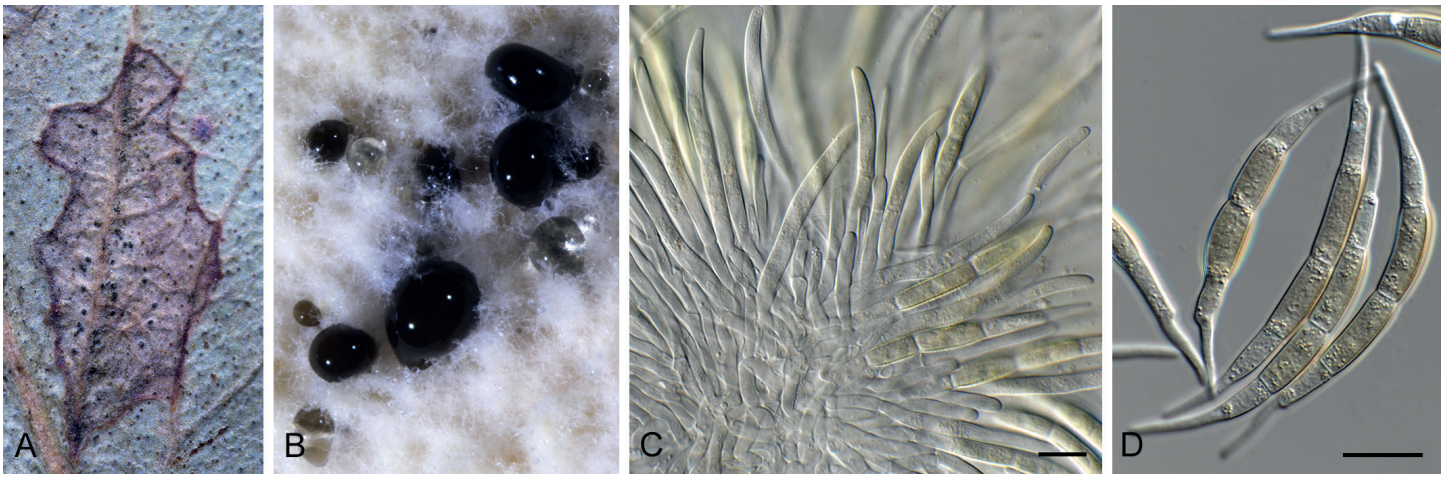

Fig. 21. *Allelochaeta neofalcata* (CPC 25455). **A.** Leaf spot. **B.** Conidiomata on PDA. **C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

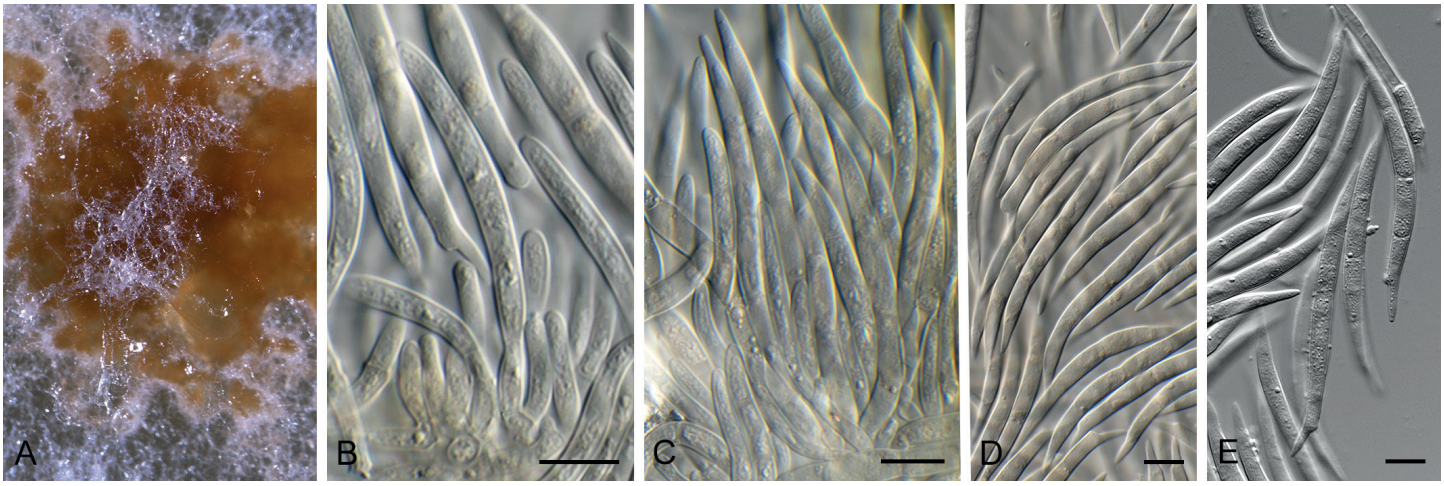

Fig. 22. *Allelochaeta neoorbicularis* (CPC 20140). **A.** Conidiomata on OA. **B, C.** Conidiophores. **D, E.** Conidia. Scale bars = 10 µm.

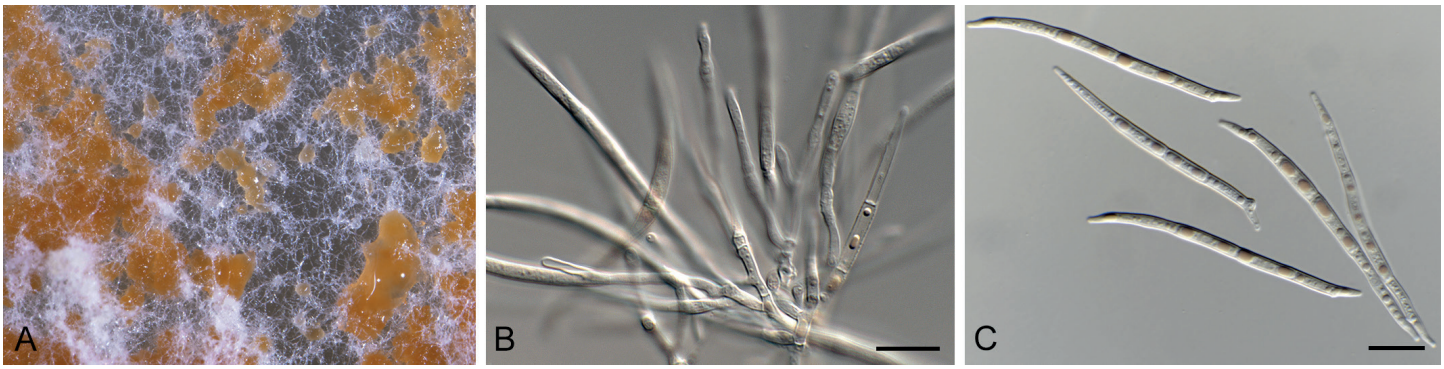

Fig. 23. *Allelochaeta neowalkeri* (CPC 20144). **A.** Conidiomata on OA. **B.** Conidiophores. **C.** Conidia. Scale bars = 10 µm.

20144 = CBS 144181); Tasmania, Lovershill, on *Eucalyptus* sp., Dec. 2011, *W. Quaedvlieg*, CPC 20128.

Notes: Typical characters of this species include the apical taper and acerose conidial shape. These characters are less pronounced in other subclades in this larger clade, e.g. in *A. oblique, A. sparsifoliae* and *A. polycarpae*. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta obliquae Crous, ***sp. nov.*** MycoBank MB827160. Fig. 24.

Etymology: Name refers to the host species *Eucalyptus obliqua,* from which this species was isolated.

Conidiomata stromatic, acervuloid, scattered, oval, 300–350 µm diam, exuding an orange to pale brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 0–3-septate, 15–25 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary,

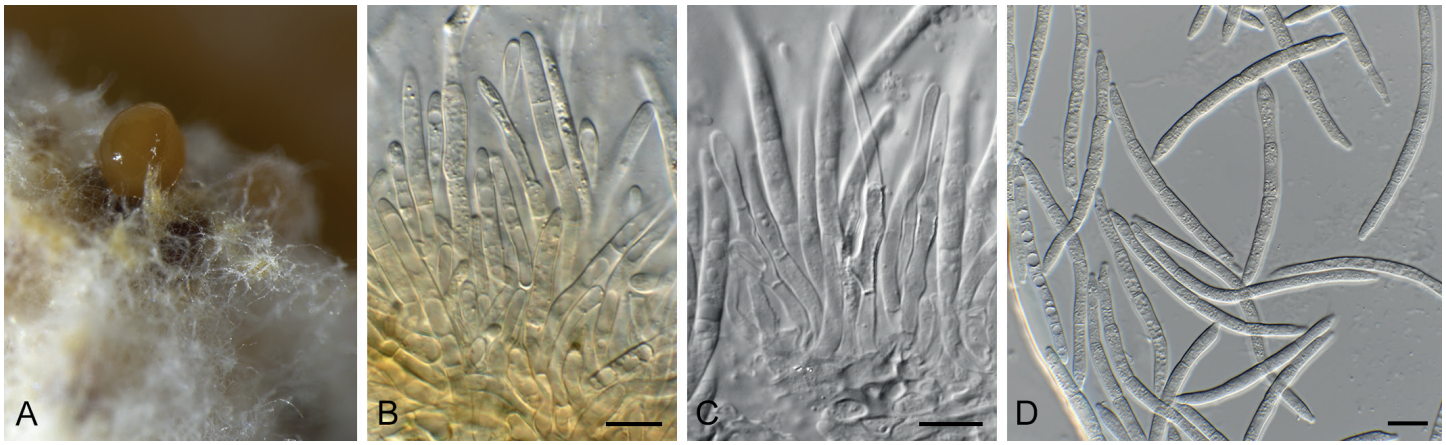

Fig. 24. *Allelochaeta obliquae* (CPC 20191). **A.** Conidiomata on MEA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

proliferating percurrently near apex, 8–12 × 2.5–3 µm. *Conidia* subcylindrical, hyaline, smooth, guttulate, slightly curved, 3-septate, constricted at septa or not, (43–)45–50(–55) × (3–)4 µm; apical cell narrowly conical, attenuating toward a knob-like apex, (13–)15–17 µm long; second cell from apex cylindrical to subcylindrical, (12–)13–14(–15) µm long; third cell from apex cylindrical to subcylindrical, (10–)11–12(–14) µm long; basal cell with narrowly truncate base, (9–)10–11 µm long; basal appendage excentric, single, cuneiform with obtuse apex, 2–3 µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon to rosy buff surface, and cinnamon reverse, with orange to pale brown spore masses.

Material examined: **Australia**, South Australia, Cape Jervis, on *E. obliqua*, 25 Nov. 2011, *W. Quaedvlieg* (**holotype** CBS H-23454, culture ex-type CPC 20191 = CBS 144182).

Notes: *Allelochaeta obliquae* is morphologically intermediate between *A. acuta* and *A. walkeri*, differing based on conidial dimensions, the shape of the apex, and basal appendage. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta obtusa (H.J. Swart & M.A. Will.) Crous, ***comb. nov.*** MycoBank MB827161.
Basionym: *Vermisporium obtusum* H.J. Swart & M.A. Will., *Trans. Brit. Mycol. Soc*. **81**: 499. 1983.
Synonym: *Seimatosporium obtusum* (H.J. Swart & M.A. Will.) P.A. Barber & Crous, *Persoonia* **27**: 107. 2011.

Morphological description on natural substratum: See Barber *et al*. (2011).

Materials examined: **Australia**, Victoria, Toolangi, on *E. regnans*, 16 July 1999, *P.A. Barber,* PAB99.13; Victoria, Gellibrand, Otway State Forest, on *E. obliqua*, 1 May 2002, *P.A. Barber,* PAB02.31.

Note: This species is not known from culture and needs to be recollected to resolve its phylogenetic position.

Allelochaeta orbicularis (Cooke) Crous, ***comb. nov.*** MycoBank MB827162. Fig. 25.
Basionym: *Stagonospora orbicularis* Cooke, *Grevillea* **20**: 6. 1891.
Synonyms: *Seimatosporium orbiculare* (Cooke) P.A. Barber & Crous, *Persoonia* **27**: 109. 2011.
Vermisporium orbiculare (Cooke) H.J. Swart & M.A. Will., *Trans. Brit. Mycol. Soc*. **81**: 497. 1983.

Morphological description on natural substratum: See Barber *et al*. (2011).

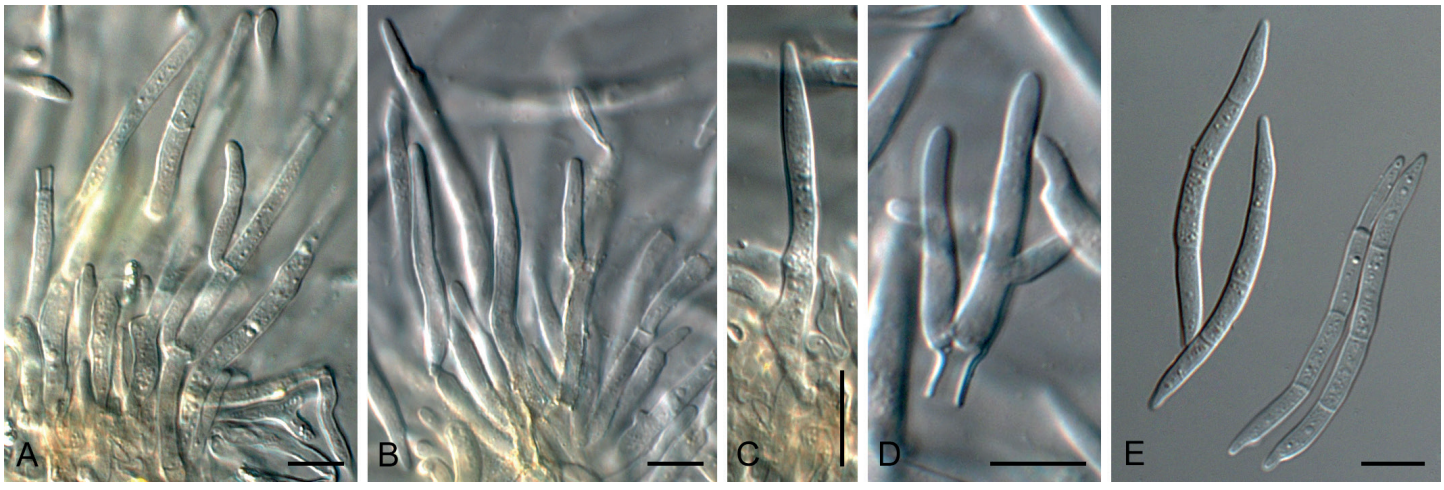

Fig. 25. *Allelochaeta orbicularis* (CPC 12935). **A–D.** Conidiophores. **E.** Conidia. Scale bars = 10 µm.

CPC 12935 = CBS 131118: *Leaf spots* pale brown, subcircular, up to 15 mm diam, with amphigenous conidiomata. *Conidiomata* stromatic, acervular, amphigenous, with orange spore masses on leaves, scattered, subepidermal, round in outline, up to 500 µm diam. *Conidiophores* subcylindrical, hyaline to pale brown and verruculose at base, subcylindrical, tightly aggregated, reduced to conidiogenous cells, or 1–3-septate, branched, 15–30 × 3–4 µm. *Conidiogenous cells* subcylindrical, hyaline or pale brown, smooth to verruculose, 10–16 × 2–3 µm; proliferating percurrently near apex. *Conidia* solitary, ellipsoid-fusoid to subcylindrical, gently curved or sigmoid, guttulate, 3-septate, hyaline, smooth (orange in mass on leaves and in culture), (40–)50–55(–60) × (3–)3.5–4 µm; apical cell subcylindrical, tapering toward an acutely rounded apex, 15–18(–23) µm long; second cell from apex cylindrical, (11–)12–14(–15) µm long; third cell from apex cylindrical, (10–)11–13 µm long; basal cell subcylindrical with narrow, truncate base, (8–)10–11(–12) µm; basal appendage tubular, single, excentric, cuneiform to podiform, tapering towards a subobtuse apex, (2–)3–5(–6) µm long.

Culture characteristics: Colonies flat, spreading, with moderate, fluffy aerial mycelium and even, lobate margins, reaching 60 mm diam in 2 wk at 25 °C. Colonies on MEA dirty white, salmon in reverse; on OA dirty white to salmon; on PDA salmon surface and reverse.

Materials examined: **Australia**: Victoria, on *Eucalyptus* sp., 24 May 1886, *F.M.C.* (**holotype** K (M) 104759); New South Wales, Australian Botanic Garden, Mount Annan, on *Corymbia henryi*, 3 Mar. 2006, *B.A. Summerell* (**epitype** designated here CBS H-20745, MBT382786, culture ex-type CPC 12935 = CBS 131118) (treated as *Seimatosporium obtusum* in Barber *et al.* 2011).

Notes: Isolate CBS 131118 is morphologically similar to *A. orbicularis* in conidium dimensions and taper of the apical conidium cell. *Allelochaeta orbicularis* is most similar to *A. acuta* and *A. obtusa*. However, *A. orbicularis* differs from both these species in having median cells that are somewhat equal in length. *Allelochaeta orbicularis* also differs from *A. obtusa* by having an apical cell and basal appendage with a slightly acute tip. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU, *rpb2*, *tef1* and *tub2*.

Allelochaeta paracylindrospora Crous, ***sp. nov.*** MycoBank MB827163. Fig. 26.

Etymology: Name reflects a morphological similarity to *A. cylindrospora*.

Conidiomata stromatic, acervuloid, scattered, oval, 250–350 µm diam, exuding a brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 0–3-septate, pale brown at base, 10–25 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 8–12 × 2.5–3 µm. *Conidia* cylindrical to acerose, straight to curved, 3-septate, not or slightly constricted at septa, pale brown in mass, smooth-walled, (34–)38–45(–50) × 3(–3.5) µm; apical cell narrowly conical, attenuating toward apex with tubular appendage, (12–)13–14(–15) µm long; second cell from apex cylindrical to subcylindrical, (8–)9–10 µm long; third cell from apex cylindrical to subcylindrical, 8–9(–10) µm long; basal cell with narrowly truncate base, 8–9 µm long; basal appendage excentric, single, tubular to cuneiform with subobtuse apex, 3–4 µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with black spore masses.

Material examined: **Australia**, South Australia, Cape Jervis, on *Eucalyptus* sp., 25 Nov. 2011, *W. Quaedvlieg* (**holotype** CBS H-23457, culture ex-type CPC 20189 = CBS 144184).

Notes: The apical cell of *A. paracylindrospora* conidia is longest, with second, third and basal cells becoming progressively shorter. Conidia of *A. paracylindrospora* are shorter than those of *A. cylindrospora* [(40–)43–56(–58) × 2.5–4(–5) µm]. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta paraelegans Crous, ***sp. nov.*** MycoBank MB827164. Fig. 27.

Etymology: Name reflects a morphological similarity to *A. elegans*.

Conidiomata stromatic, acervuloid, scattered, round to irregular, 250–500 µm diam, exuding a brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 0–2-septate, hyaline to pale brown, 20–40 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal

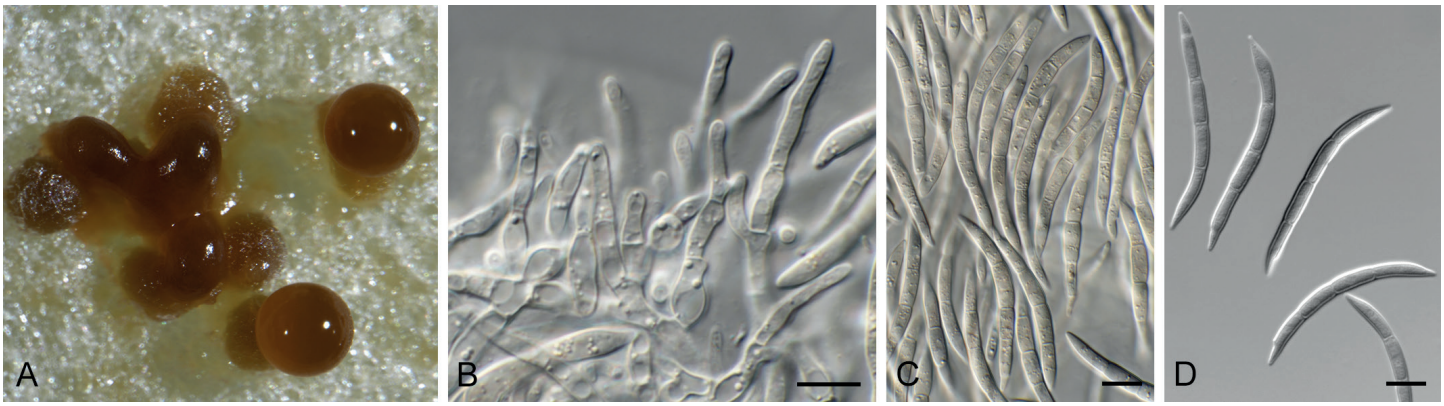

Fig. 26. *Allelochaeta paracylindrospora* (CPC 20189). **A.** Conidiomata on OA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

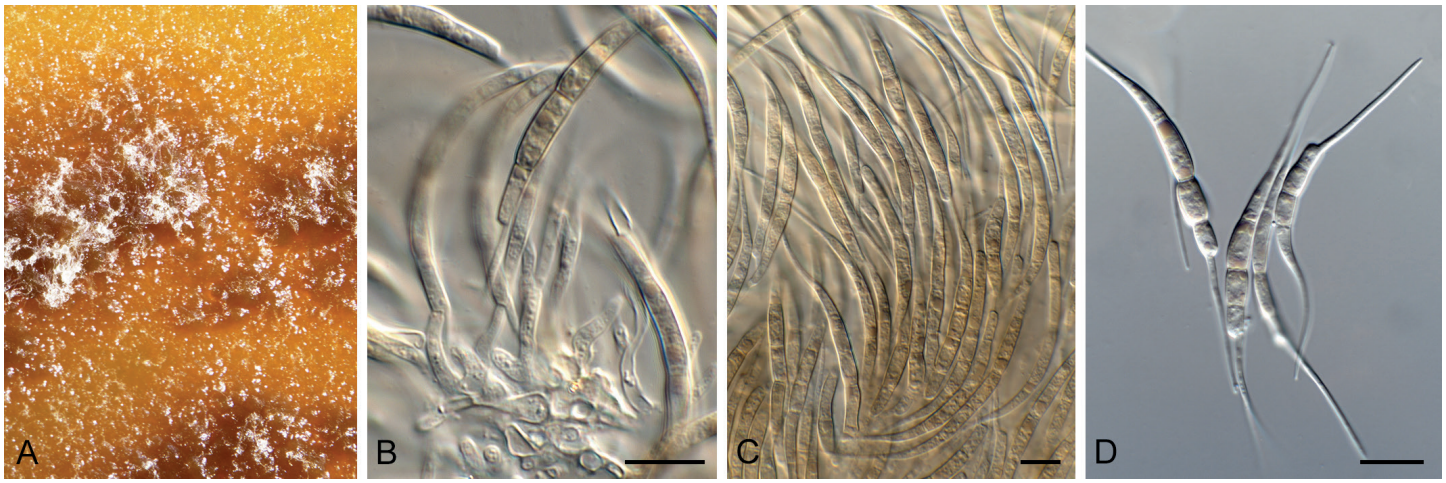

Fig. 27. *Allelochaeta paraelegans* (CBS 150.71). **A.** Conidiomata on OA. **B.** Conidiophores. **C, D.** Conidia. Scale bars = 10 µm.

and intercalary, proliferating percurrently near apex, 8–20 × 2.5–3 µm. *Conidia* acerose, falcate, (1–)3(–4)-septate, pale brown, smooth-walled, slightly constricted at septa, (50–)60–90(–105) × (3.5–)4(–6) µm; apical cell long conical, attenuating toward apex, subhyaline, 35–45(–90) µm long; median cells cylindrical to subcylindrical, together 15–22 µm long; basal cell obconical with narrowly truncate base, 6–12 µm long; basal appendage excentric, single, tubular, flexuous, (25–)32–60 (–80) µm long.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and even, lobate margins, reaching 50 mm diam after 2 wk at 25 ºC. Colonies on MEA surface and reverse sepia; on OA sepia in middle, salmon in outer region; on PDA apricot surface and reverse, with black spore masses.

Material examined: **Australia**, Victoria, Bairnsdale, on leaf of *Melaleuca ericifolia*, deposited 1971 as *Seimatosporium elegans*, *H.J. Swart* No. 67-15 (**holotype** CBS H-23459, culture ex-type CBS 150.71 = NBRC 32674).

Notes: *Allelochaeta paraelegans* [conidia (1–)3(–4)-septate, (50–)60–90(–105) × (3.5–)4(–6) µm] has smaller conidia than *A. pseudoelegans* [conidia 3(–4)-septate, (75–)80–100(–120) × 3–4 µm], but larger than those of *A. elegans* [conidia 4-septate, (50–)55–60(–70) × (3.5–)–4(–4.5) µm]. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta parafalcata Crous, ***sp. nov.*** MycoBank MB827165. Fig. 28.

Etymology: Name reflects a morphological similarity to *A. falcata*.

Conidiomata stromatic, acervuloid, scattered, oval, up to 200–300 µm diam, exuding a dirty orange to pale brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 1–2-septate, 15–30 × 2–3 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 7–15 × 2–2.5 µm. *Conidia* subcylindrical to fusoid, straight to curved, subhyaline to pale brown, finely verruculose, 3(–4)-septate, slightly constricted at septa, (42–)45–55(–70) × (3–)3.5(–4) µm; apical cell narrowly conical, attenuating toward apex, (11–)14–15(–17) µm long; second cell from apex cylindrical to subcylindrical, (10–)11–12(–13) µm long; third cell from apex cylindrical to subcylindrical, (10–)11–12 µm long; basal cell with narrowly truncate base, (5–)6–7(–8) µm long; basal appendage excentric, single, cuneiform, (3–)6–7(–8) µm long.

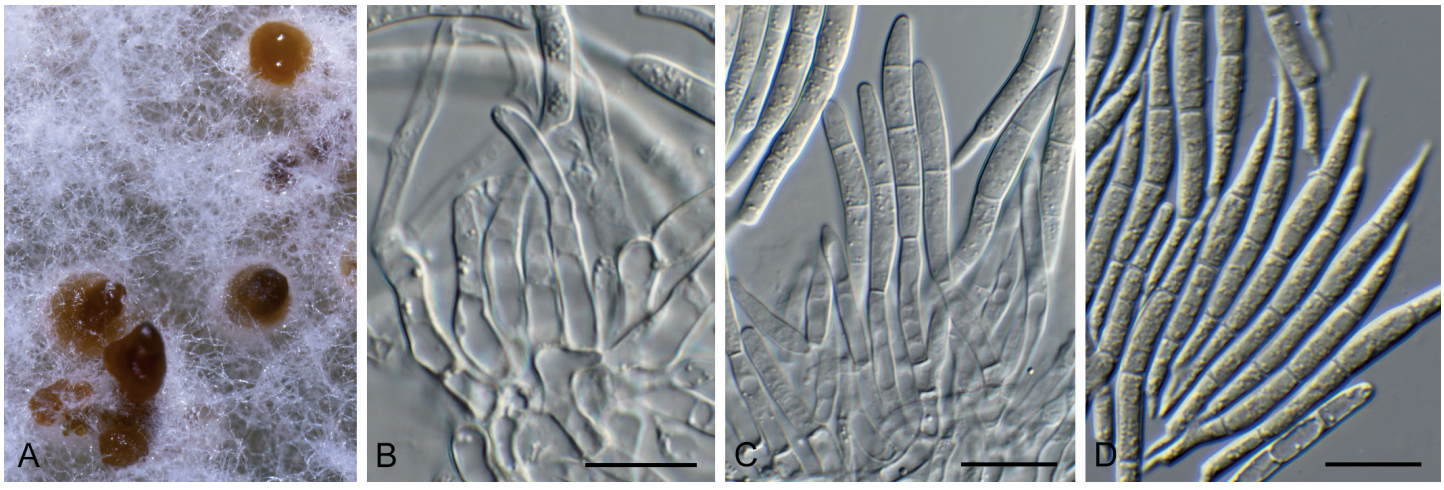

Fig. 28. *Allelochaeta parafalcata* (CPC 19840). **A.** Conidiomata on PDA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with black spore masses.

Material examined: **Australia**, Western Australia, Wandoo National Park, on *Corymbia* sp., 13 Jul. 2011, *W. Gams* (**holotype** CBS H-23458, culture ex-type CPC 19840 = CBS 144185).

Notes: *Allelochaeta parafalcata* [conidia (42–)45–55(–70) × (3–)3.5(–4) µm] resembles *A. falcata* [conidia (31–)34–51(–59) × 4–6 (av. = 42.4 × 5) µm], but can be distinguished from that species based on its somewhat longer, thinner conidia. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta paraleptospermi Crous, ***sp. nov.*** MycoBank MB827166. Fig. 29.

Etymology: Name reflects a morphological similarity to *Seimatosporium leptospermi*.

Conidiomata stromatic, acervuloid, scattered, round in outline, 300–500 µm diam, exuding a brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched below or not, 0–2-septate, hyaline or pale brown, 15–35 × 2.5–4 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 10–15 × 2.5–3 µm. *Conidia* acerose, curved, 5-septate, pale brown, smooth-walled, slightly constricted at septa, (90–)100–120(–130) × (3–)4(–5) µm; apical cell long conical, attenuating toward flexuous appendage, 35–50 µm long; median cells cylindrical to subcylindrical, pale brown, together 40–60 µm long; basal cell obconical with narrowly truncate base, 6–9 µm long; basal appendage excentric, tubular, unbranched, flexuous, 6–25 µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, reaching 40 mm diam 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with brown spore masses.

Material examined: **Australia**, Victoria, Wyperfeld National Park, on *Leptospermum coriaceum*, 20 Jun. 1985, *L. Jobe* (**holotype** CBS H-23460, isotypes VPRI 12797, BRIP 45876, culture ex-type CPC 28294 = VPRI 12797 = CBS 144186).

Notes: The isolate on which *Allelochaeta paraleptospermi* is based, was originally identified as "*Seimatosporium leptospermi*". However, the latter fungus has shorter conidia (44–73 × 3–4 µm), and shorter appendages as reported by Sutton (1980), and probably also belongs to *Allelochaeta* as suspected by Nag Raj (1993). *Allelochaeta paraleptospermi* can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU, *rpb2*, *tef1* and *tub2*.

Allelochaeta paramelaleucae Crous, ***sp. nov.*** MycoBank MB827167. Fig. 30.

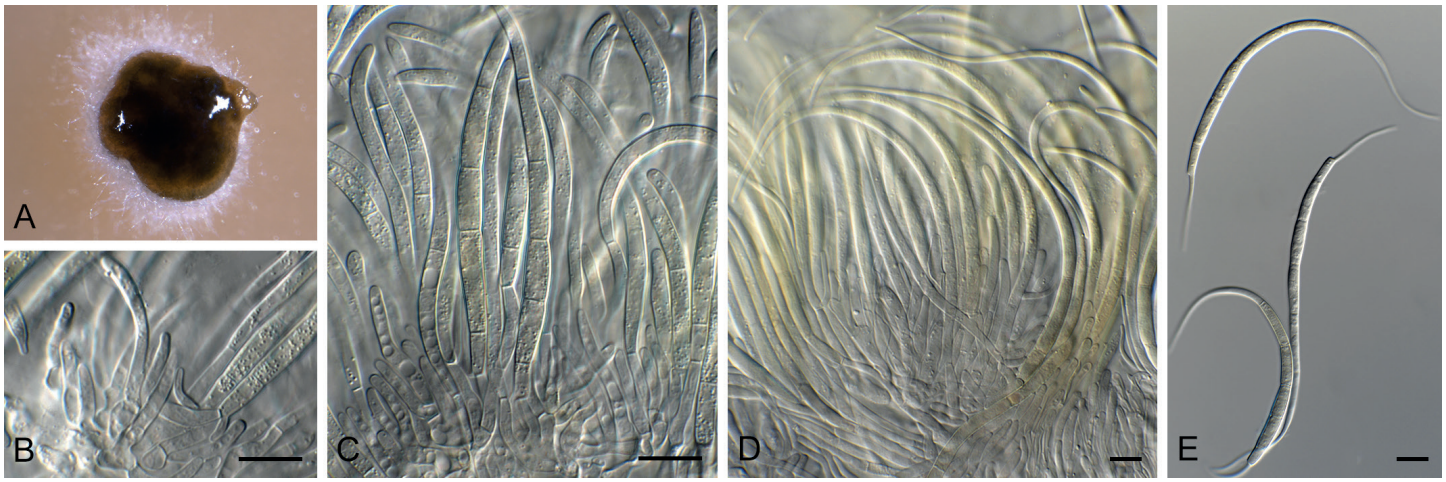

Fig. 29. *Allelochaeta paraleptospermi* (CPC 28294). **A.** Conidiomata on OA. **B–D.** Conidiophores. **E.** Conidia. Scale bars = 10 µm.

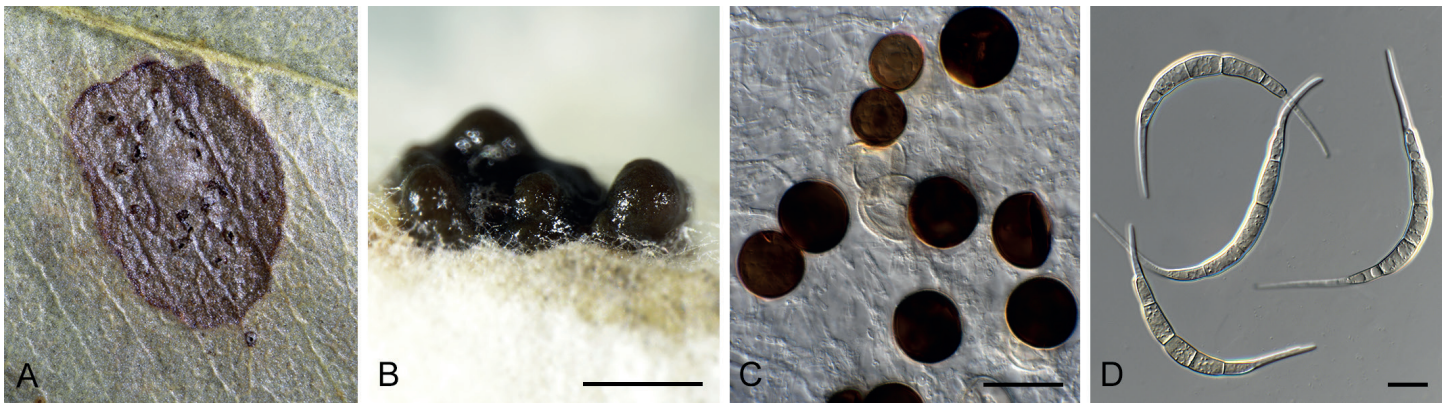

Fig. 30. *Allelochaeta paramelaleucae* (CPC 29542). **A.** Leaf spot. **B.** Conidiomata on OA. **C.** Chlamydospores. **D.** Conidia. Scale bars = 10 µm.

Etymology: Name reflects a morphological similarity to *A. melaleucae*, which also occurs on *Melaleuca*.

Conidiomata acervular, 300–500 µm diam, exuding a brown conidial mass. *Conidiophores* subcylindrical, hyaline, smooth, branched, 1–3-septate, 15–30 × 2.5–3 µm. *Conidiogenous cells* subcylindrical, smooth, hyaline, 10–15 × 2.5–3 µm; proliferating percurrently near apex. *Conidia* falcate, fusoid, 4-septate, slightly constricted at septa, guttulate, median cells pale brown, smooth, (50–)65–75(–80) × 4(–5) µm; apical cell subhyaline, cuneiform, tapering prominently to a tubular apical appendage, 26–32 µm long; median cells cylindrical, pale brown, (22–)25–30 µm long; basal cell subcylindrical to obconical, with a small truncate base, 6–7 µm; basal appendage single, excentric, tubular and flexuous, attenuating to a rounded apex, (15–)20–23 µm long. *Chlamydospores* forming in agar and aerial mycelium, solitary, globose, dark brown, thick-walled, 12–28 µm diam.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA surface and reverse isabelline; on OA rosy buff with patches of isabelline; on PDA surface and reverse honey, with black spore masses.

Material examined: **Australia**, Western Australia, Williams, Williams Nature Reserve, on *Melaleuca* sp., 18 Sep. 2015, *P.W. Crous* (**holotype** CBS H-23461, culture ex-type CPC 29542 = CBS 144187).

Notes: *Allelochaeta paramelaleucae* [conidia 4-septate, (50–)65–75(–80) × 4(–5) µm] can be distinguished from *A. melaleucae* [conidia (3–)4-septate, (25–)26–28(–32) × 6(–6.5) µm] by its longer, flexuous, conidia. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta paraorbicularis Crous, ***sp. nov.*** MycoBank MB827158. Fig. 31.

Etymology: Name reflects a morphological similarity to *A. orbicularis*.

Conidiomata stromatic, acervuloid, scattered, oval, 200–300 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 0–2-septate, 8–20 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 8–12 × 2.5–3 µm. *Conidia* cylindrical to acerose, straight to curved, 3-septate, hyaline, slightly constricted at septa, (35–)42–47(–52) × (3–)3.5(–4) µm; apical cell narrowly conical, attenuating toward apex, (11–)12–13(–15) µm long; second cell from apex cylindrical to subcylindrical, (6–)10–12(–14) µm long; third cell from apex cylindrical to subcylindrical, (9–)10–12(–13) µm long; basal cell with narrowly truncate base, (8–)9–10(–11) µm long; basal appendage excentric, single, cuneiform to podiform, (3–)4–5(–6) µm long.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Material examined: **New Zealand**, Auckland, Warkworth, Kaipara coast road, *Eucalyptus* sp., 2015, *R. Thangavel* (**holotype** CBS H-23452, culture ex-type MPI T15_06344B = CPC 29356 = CBS 144180).

Notes: *Allelochaeta paraorbicularis* is similar to *A. orbicularis* [conidia (49–)53–66 × 4–4.5 µm] in conidium shape, but distinct from that species in having shorter conidia with an apical cell that tapers more abruptly from the septum towards the apex. It differs from *A. neoorbicularis* [(45–)48–52(–55) × (4–)4.5(–5) µm] in having slightly shorter conidia. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta polycarpae Crous, ***sp. nov.*** MycoBank MB827168. Fig. 32.

Etymology: Name reflects one of the host species, *Eucalyptus polycarpa,* from which this species was isolated.

Leaf spots amphigenous, medium brown, large blotches associated with leaf margins or tips up to 25 mm diam. *Conidiomata* stromatic, acervuloid, scattered, oval, 250–400 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, reduced to conidiogenous cells. *Conidiogenous cells* hyaline, smooth, subcylindrical, proliferating percurrently near apex, 8–16 × 2.5–3.5 µm. *Conidia* subcylindrical, hyaline, smooth, guttulate, flexuous, 3-septate, constricted at septa

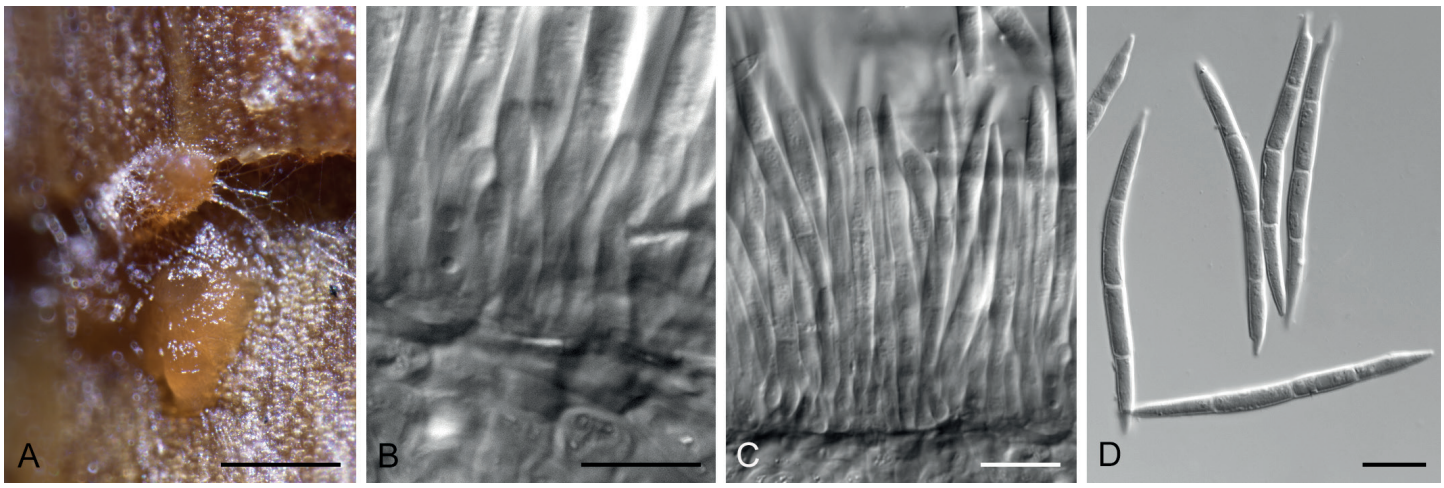

Fig. 31. *Allelochaeta paraorbicularis* (CPC 29356). **A.** Conidiomata on PNA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

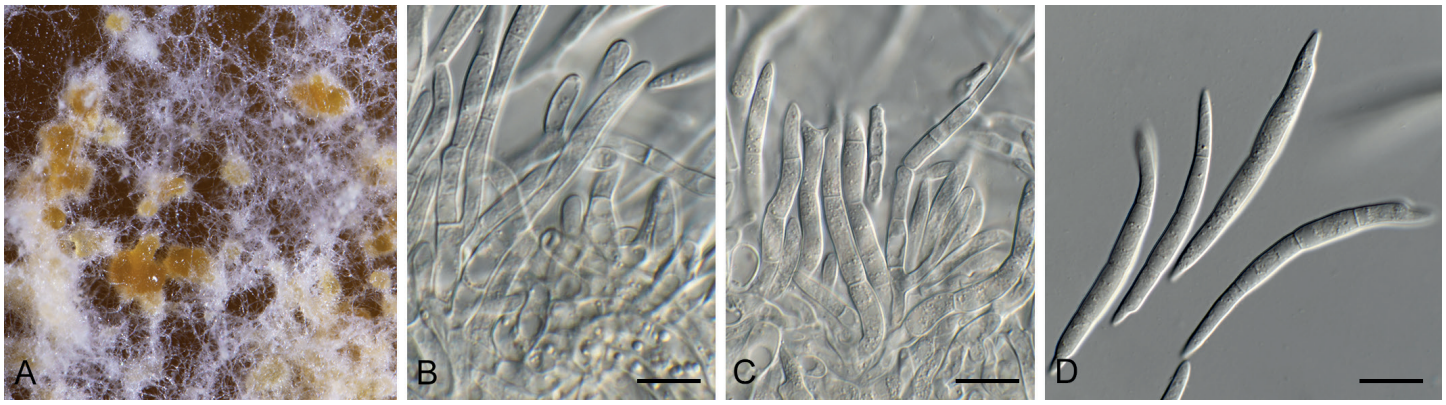

Fig. 32. *Allelochaeta polycarpae* (CPC 28916). **A.** Conidiomata on MEA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

or not, with prominent taper in apical cell, (57–)60–70(–80) × (3–)4 µm; apical cell attenuating toward a long thin apical appendage with subobtuse apex, (25–)30–35 µm long; second cell from apex cylindrical to subcylindrical, (13–)15–17 µm long; third cell from apex cylindrical to subcylindrical, (13–)15–17 µm long; basal cell cylindrical to narrowly obconic with narrowly truncate base, (9–)10–15 µm long; basal appendage excentric, single, cuneiform with subobtuse tip, (12–)15–19 µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Materials examined: **Australia**, Western Australia, Cape Riche, Wellstead, on *E. polycarpa*, 21 Sep. 2015, *P.W. Crous* (**holotype** CBS H-23462, culture ex-type CPC 28916 = CBS 144188); South Australia, Kangaroo Island, Yukka Trail, on *E. diversifolia*, Dec. 2011, *W. Quaedvlieg*, CPC 20119.

Notes: *Allelochaeta polycarpae* is characterised by having a very long apical appendage, second and third cell of equal length, and long basal appendage. It is reminiscent of *A. walkeri*, which is a species complex (see treatment of *A. walkeri* elsewhere in this paper). This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta pseudoacuta Crous, ***sp. nov.*** MycoBank MB827169. Fig. 33.

Etymology: Name reflects a morphological similarity to *A. acuta*.

Conidiomata stromatic, acervuloid, scattered, oval, up to 250 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 1–3-septate, 10–50 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 10–20 × 2.5–3 µm. *Conidia* narrowly fusoid, straight to curved, 3(–4)-septate, hyaline, orange in mass, not to slightly constricted at septa, (50–)57–65(–70) × (3.5–)4(–4.5) µm; apical cell narrowly conical, attenuating toward apex, (15–)19–21(–24) µm long; second cell from apex cylindrical to subcylindrical, (13–)15–16(–17) µm long; third cell from apex cylindrical to subcylindrical, (11–)12–13(–14) µm long; basal cell with narrowly truncate base, (9–)11–12(–17) µm long; basal appendage excentric, single, narrowly cuneiform, (2–)4–6(–8) µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA dirty white to salmon surface and reverse, with orange spore masses.

Materials examined: **Australia**, Tasmania, Lovershill, *Eucalyptus* sp., 4 Jan. 2012, *W. Quaedvlieg* (**holotype** CBS H-23463, culture ex-type CPC 20130 = CBS 144189).

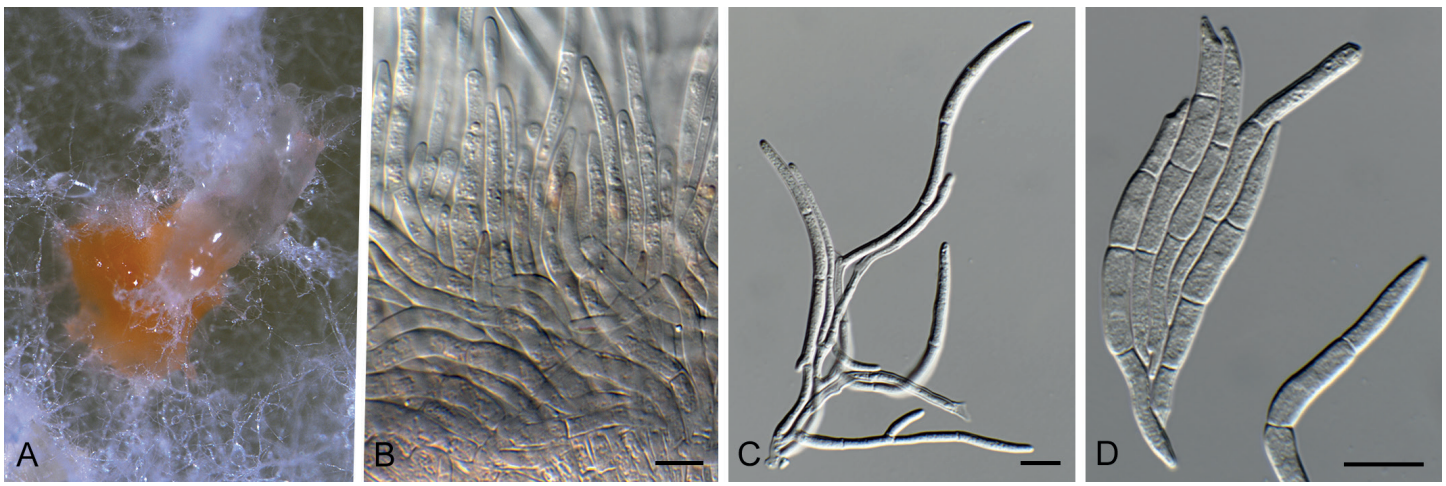

Fig. 33. *Allelochaeta pseudoacuta* (CPC 20130). **A.** Conidiomata on OA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

Notes: *Allelochaeta pseudoacuta* is reminiscent of *A. acuta* [conidia (39–)45–61(–66) × 3–4.5(–6) µm], but has longer conidia. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS and *rpb2*; on *tef1* and *tub2* it only differs with 2 and 5 nts from *A. acuta*.

Allelochaeta pseudoelegans Crous, ***sp. nov.*** MycoBank MB827170. Fig. 34.

Etymology: Name reflects a morphological similarity to *A. elegans*.

Plant pathogenic, causing prominent defoliation on *Melaleuca* sp. *Conidiomata* stromatic, acervuloid, scattered, round to irregular, 250–500 µm diam, exuding a brown conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 0–2-septate, hyaline to pale brown, 20–40 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 8–20 × 2.5–3 µm. *Conidia* acerose, falcate, 3(–4)-septate, pale brown, smooth-walled, slightly constricted at septa, (75–)80–100(–120) × 3–4 µm; apical cell long conical, attenuating toward apex, subhyaline, 35–50 µm long; median cells cylindrical to subcylindrical, together 30–40 µm long; basal cell obconical with narrowly truncate base, 8–10 µm long; basal appendage excentric, single, tubular, flexuous, 25–30 µm long.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and feathery, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA surface dirty white to honey, isabelline in reverse; on OA pale mouse grey in middle, salmon in outer region; on PDA isabelline surface and reverse, with brown spore masses.

Material examined: **Australia**, Victoria, Phillip Island, Conservation Hill, on *Melaleuca* sp., 8 Nov. 2014, *P.W. Crous* (**holotype** CBS H-23465, culture ex-type CPC 25411 = CBS 144191).

Notes: *Vermisporium pseudoelegans* is morphologically similar to *A. elegans* (conidia 48–78 × 2.5–3.5 µm; Nag Raj 1993), although it has much longer conidia. *Allelochaeta pseudoelegans* was found to be associated with significant defoliation on the tree from which it was collected. However, Koch's postulates have not been tested, and its pathogenicity remains unconfirmed. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS and *rpb2*; on *tub2* it differs 7 bp with *A. paraelegans*.

Allelochaeta pseudofalcata Crous, ***sp. nov.*** MycoBank 827171. Fig. 35.

Etymology: Name reflects a morphological similarity to *A. falcata*.

Conidiomata stromatic, acervuloid, scattered, oval, 150–300 µm diam, exuding a black conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 1–3-septate, 20–40 × 3–4 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 8–17 × 2.5–3 µm. *Conidia* falcate, fusoid, 3-septate, pale brown, end cells subhyaline, smooth, slightly constricted at septa, (40–)45–50(–55) × (3–)3.5(–4) µm; apical cell subcylindrical to narrowly conical, subhyaline, attenuating toward conical or tubular appendage, (16–)17–18 µm long; second cell from apex cylindrical to subcylindrical, subhyaline, (10–)11–12 µm long; third cell from apex cylindrical to subcylindrical, (11–)12–14 µm long; basal cell obconical with narrowly truncate base, subhyaline, 8–9 µm long; basal appendage excentric, single, tubular, flexuous, (7–)9–10 µm long.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA salmon on surface and reverse, on OA salmon, on PDA buff surface and buff to salmon in reverse, with black spore masses.

Materials examined: **Australia**, Queensland, Mt. Crosby, on *Eucalyptus crebra*, 6 Aug. 1973, *J. Alcorn* J.L. 73-133a, deposited as "*Seimatosporium falcatum*" (**holotype** CBS H-23466, isotypes BRIP 5731, IMI 179066, culture ex-type BRIP 5731 = VPRI 15701 = CPC 28308 = CBS 144192).

Notes: Average conidial lengths of *A. pseudofalcata* [(40–)45–50(–55) ×(3–)3.5(–4) µm] are shorter than those of *A. neofalcata* [(46–)48–55(–60) × 4–5 µm], and *A. parafalcata* [(42–)45–55(–70) × (3–)3.5(–4) µm], and longer than those of *A. falcata* [(31–)34–51(–59) × 4–6 (av. = 42 × 5) µm]. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta pseudoobtusa Crous, ***sp. nov.*** MycoBank 827172. Fig. 36.

Etymology: Name reflects a morphological similarity to *A. obtusa*.

Conidiomata stromatic, acervuloid, scattered, oval, up to 400 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 1–4-septate, 10–40 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 7–12 × 2.5–3.5 µm. *Conidia* subcylindrical to ellipsoid-fusoid, straight to gently curved, 3-septate, hyaline, smooth, orange in mass, not to slightly constricted at septa, (48–)54–60(–65) × (3–)3.5(–4) µm; apical cell subcylindrical, tip subobtuse, (14–)18–20(–21) µm long; second cell from apex cylindrical to subcylindrical, (14–)15–16(–17) µm long; third cell from apex cylindrical to subcylindrical, (11–)13–14(–17) µm long; basal cell with narrowly truncate base, (10–)11–12(–13) µm long; basal appendage excentric, single, cuneiform to podiform, (3–)5–7(–10) µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Material examined: **Australia**, Tasmania, Tasman Peninsula, 43°11'29.7"S 147°51'00.7"E, on leaves of *E. viminalis*, 14 Oct. 2006, *B.A. Summerell* (**holotype** CBS H-23467, culture ex-type CPC 13590 = CBS 144193).

Notes: Conidia of *A. pseudoobtusa* resemble those of *A. obtusa* [(49–)54–92(–103) × (2.5–)3–4(–4.5) (av. = 70.6 × 3.3) µm], but are shorter that those of that species. This species can easily be distinguished from its closest phylogenetic neighbours

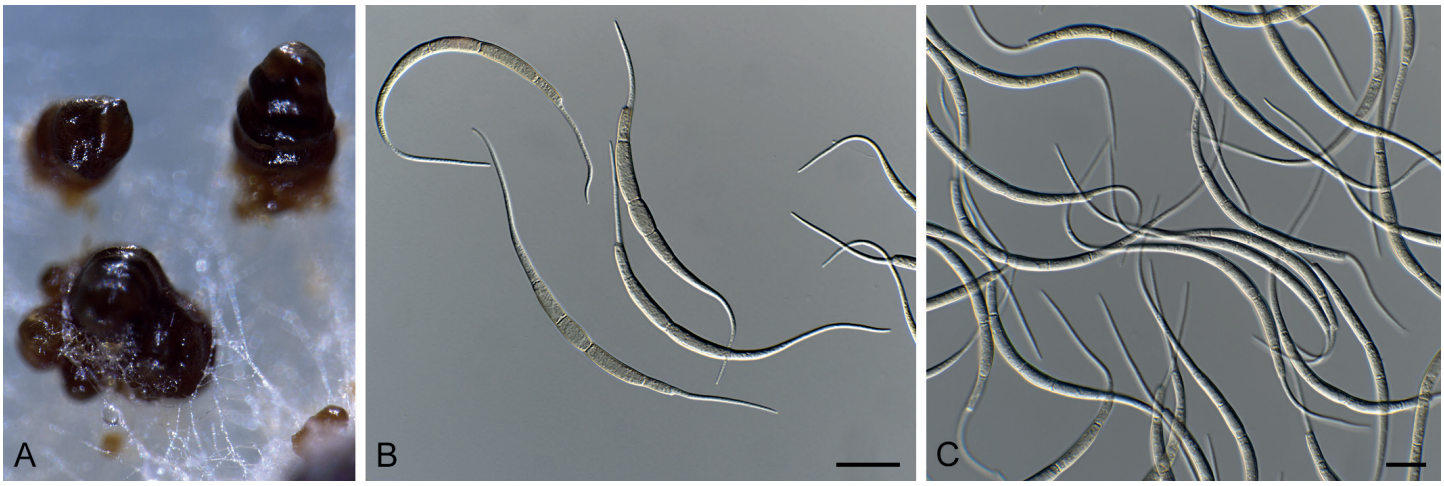

Fig. 34. *Allelochaeta pseudoelegans* (CPC 25411). **A.** Conidiomata on SNA. **B, C.** Conidia. Scale bars = 10 µm.

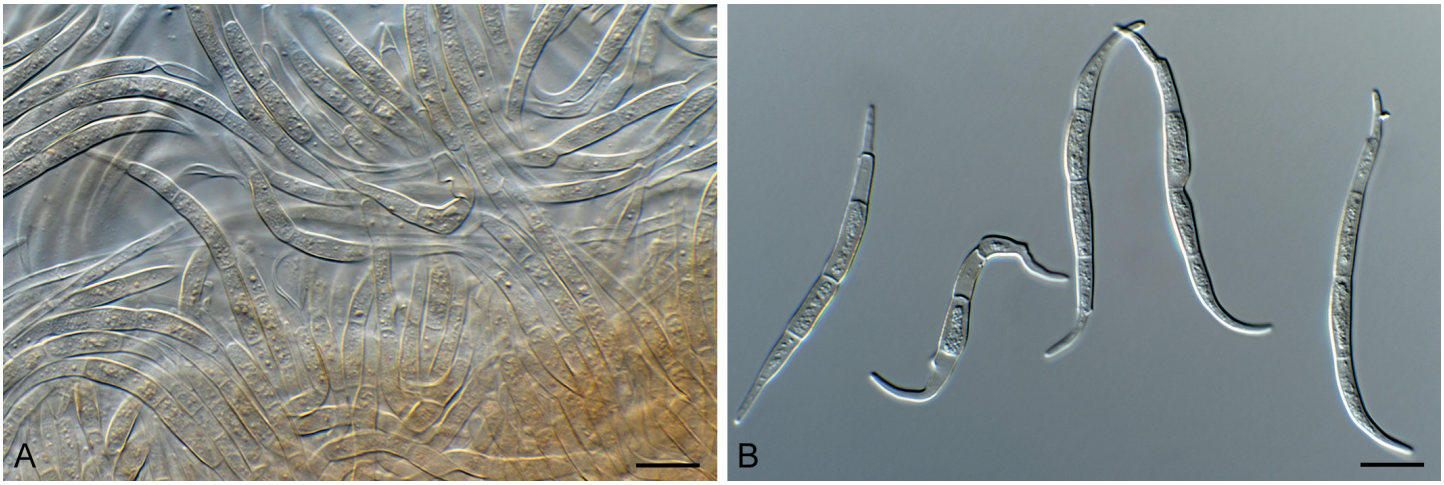

Fig. 35. *Allelochaeta pseudofalcata* (CPC 28308). **A, B.** Conidia. Scale bars = 10 µm.

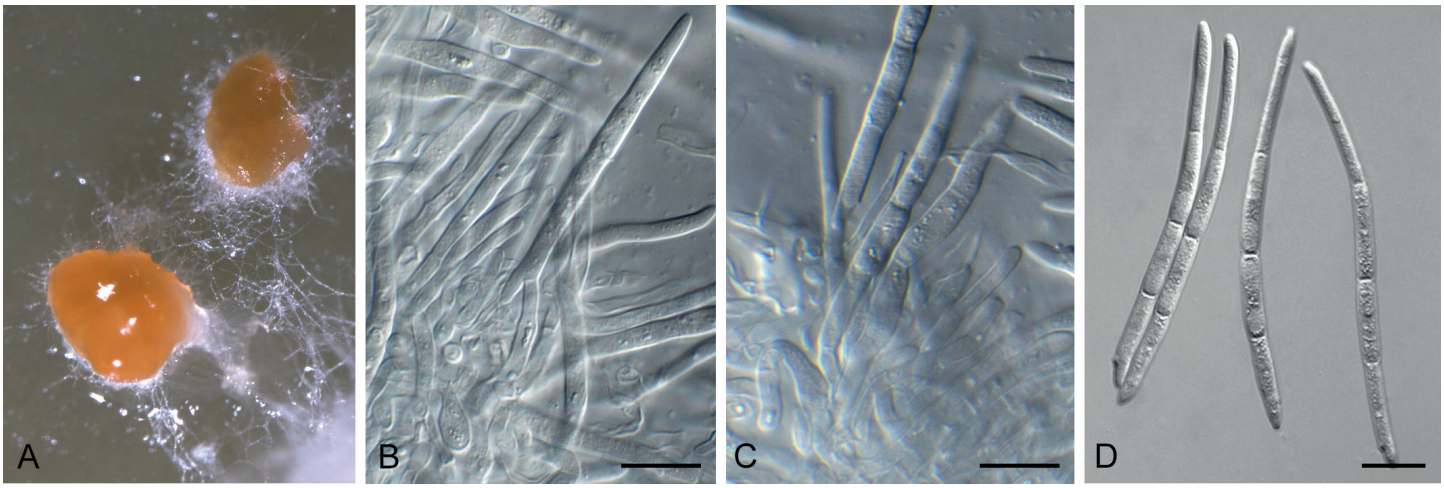

Fig. 36. *Allelochaeta pseudoobtusa* (CPC 13590). **A.** Conidiomata on OA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

based on *rpb2*, *tef1* and *tub2*; on ITS it differs with 2 nts from *A. pseudoacuta* and *A. fusispora*.

Allelochaeta pseudosamuelii Crous, ***sp. nov.*** MycoBank 827173. Fig. 37.

Etymology: Name reflects a morphological similarity to *A. samuelii*.

Leaf spots circular, mostly not extending through the leaf lamina, dark red-purple to dark brown, 1–3(–5) mm diam, with erumpent acervuli. *Conidiomata* stromatic, acervular, scattered to gregarious, oval in outline, 200–350 µm diam, exuding an orange conidial mass. *Conidiophores* arising from the upper layer of the stroma, subcylindrical, hyaline, smooth, 0–3-septate, 10–25 × 2.5–3.5 µm. *Conidiogenous cells* subcylindrical, hyaline, annellidic, 8–15 × 2.5–3 µm. *Conidia* subcylindrical, hyaline,

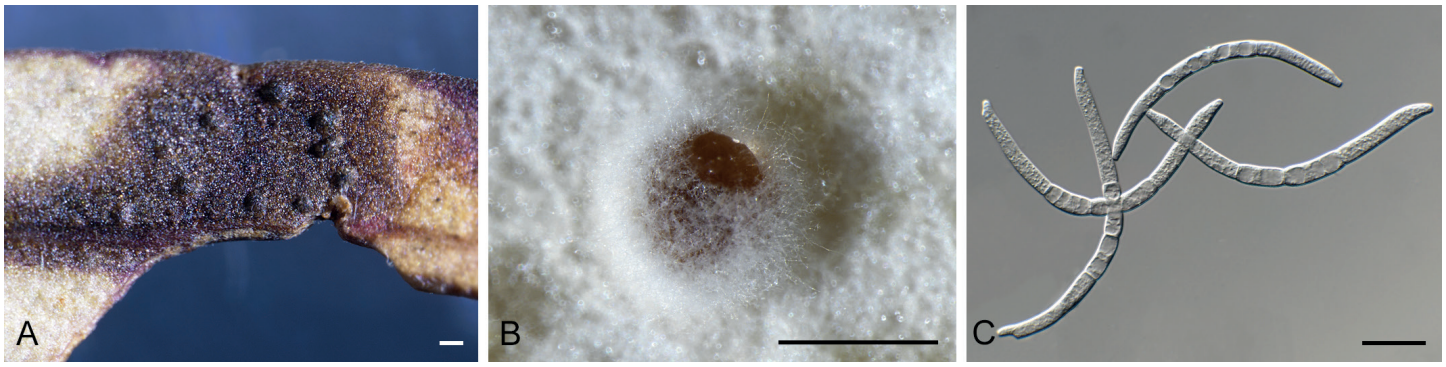

Fig. 37. *Allelochaeta pseudosamuelii* (CPC 20205). **A.** Leaf spot. **B.** Conidioma on PDA. **C.** Conidia. Scale bars = 10 µm.

smooth, curved, 3-septate, constricted or not at septa, (45–)55–65(–70) × 3(–4) µm; apical cell subcylindrical, tapering to a knob-like apex, (18–)20–25 µm long; second cell cylindrical, (8–)10–12(–15) µm long; third cell cylindrical, (8–)9–10(–11) µm long; basal cell obconical with a truncate base, (10–)13–15(–18) µm long; basal appendage excentric, single, cuneiform to podiform with obtuse tip, (2–)3–5 µm long. *Chlamydospores* formed in culture, solitary or in short chains, ellipsoid to globose, brown, thick-walled, 8–17 µm diam.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and feathery, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Material examined: **Australia**, South Australia, Kangaroo Island, Seal Bay, on *Melaleuca lanceolata*, Dec. 2011, *W. Quaedvlieg* (**holotype** CBS H-23468, culture ex-type CPC 20205 = CBS 144194).

Notes: Conidia of *A. pseudosamuelii,* (45–)55–65(–70) × 3(–4) µm, are slightly shorter than those of *A. samuelii*, (45–)50–70(–75) × 3(–4) µm. The apical and basal cells are longer than the median cells, which are more or less equal in length. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU, *rpb2*, *tef1* and *tub2*.

Allelochaeta pseudowalkeri Crous, ***sp. nov.*** MycoBank 827174. Fig. 38.

Etymology: Name reflects a morphological similarity to *A. walkeri*.

Leaf spots circular, brown, up to 10 mm diam, associated with infections of *Plectosphaeria eucalypti*, which is suspected to be the primary pathogen. *Conidiomata* hypophyllous on leaves, subepidermal, round with orange conidial masses on PNA, forming orange conidial masses that turn pale brown with age, acervular, up to 400 µm diam; stroma 20–30 µm of thick *textura angularis*, pale brown. *Conidiophores* reduced to conidiogenous cells or a supporting cell, 0–1-septate, hyaline, smooth, subcylindrical, branched above, 15–25 × 3–4 µm. *Conidiogenous cells* subcylindrical, smooth, 8–17 × 3–4 µm; proliferating several times percurrently near apex. *Conidia* narrowly fusoid, straight to curved, guttulate, hyaline, smooth, becoming pale brown with age, 3-septate, becoming slightly constricted at septa, (45–)48–55(–60) × (3–)3.5–4 µm; apical cell tapering prominently to an acutely rounded apex, (18–)20–22(–25) µm long; second cell cylindrical, (10–)11–13(–14) µm long; third cell cylindrical, (8–)10–12(–13) µm long; basal cell cylindrical with narrowly truncate base, (6–)7–8 µm long; basal appendage excentric, narrowly cuneiform, (8–)10–12(–13) µm long, tapering toward an acutely rounded apex.

Culture characteristics: Colonies flat, spreading, with sparse aerial mycelium and smooth, lobate margins, reaching 45 mm diam in 2 wk at 25 °C. Colonies salmon on MEA, OA and PDA, with orange spore masses.

Material examined: **Australia**, Queensland, on *Eucalyptus* sp., 12 Jul. 2009, *P.W. Crous* (**holotype** CBS H-23469, culture ex-type CPC 17043 = CBS 144195).

Notes: *Allelochaeta pseudowalkeri* is similar to *A. walkeri* [conidia (43–)48–82(–87) × 3–4.5(–5) (av. = 61.9 × 3.5) µm]

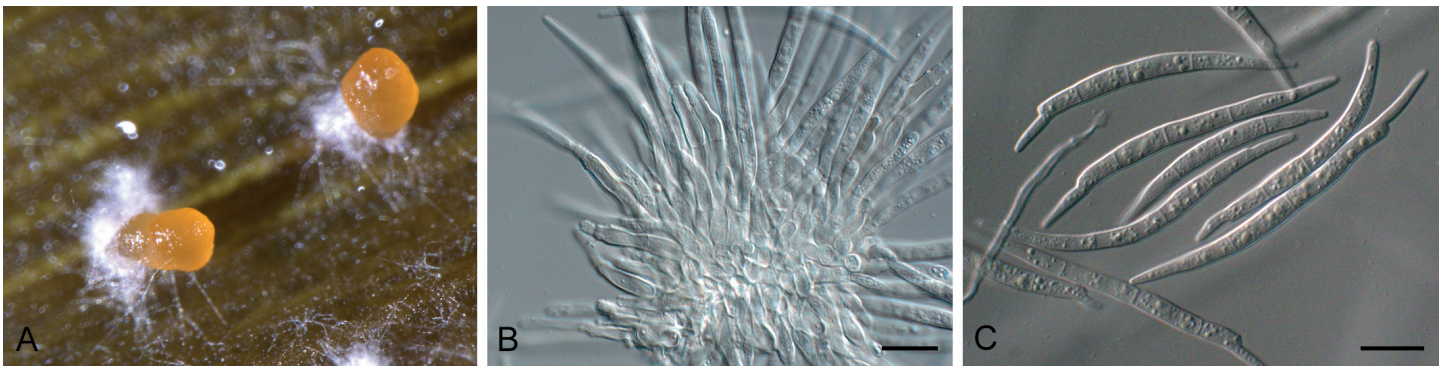

Fig. 38. *Allelochaeta pseudowalkeri* (CPC 17043). **A.** Conidiomata on PNA. **B.** Conidiophores. **C.** Conidia. Scale bars = 10 µm.

in conidial shape, but distinct in having shorter conidia. This species can easily be distinguished from its closest phylogenetic neighbours based on *rpb2*, *tef1* and *tub2*; it differs with 2 nt on ITS from *A. minor.*

Allelochaeta samuelii (Hansf.) Crous, ***comb. nov.*** MycoBank 827175. Fig. 39.
Basionym: *Cylindrosporium samuelii* Hansf., *Proc. Linn. Soc. N.S.W.* **81**: 46. 1956.
Synonyms: *Seimatosporium samuelii* (Hansf.) J. Walker & H.J. Swart, *Trans. Brit. Mycol. Soc*. **90**: 287. 1988.
Vermisporium samuelii (Hansf.) J.A. Simpson & Grgur., *Muelleria* **9**: 239. 1996.

Morphological description on natural substratum: See Barber *et al*. (2011).

CPC 28912: *Leaf spots* amphigenous, subcircular, 5–10 mm diam, medium brown with thin, dark brown border. *Conidiomata* acervular, 200–250 µm diam, exuding an orange conidial mass. *Conidiophores* subcylindrical, hyaline, smooth, reduced to conidiogenous cells, or with a supporting cell. *Conidiogenous cells* subcylindrical, smooth, hyaline, 15–20 × (2.5–)3(–3.5) µm; proliferating percurrently near apex. *Conidia* subcylindrical, hyaline, smooth, 3-septate, straight to curved, slightly constricted at septa, guttulate, (45–)50–70(–75) × 3(–4) µm; apical cell subcylindrical, tapering to a distinct knob-like apex, 18–27 µm long; median cells cylindrical, 13–24 µm long; basal cell obconical with a small truncate base, 16–24 µm; basal appendage single, excentric, cuneiform to podiform, attenuating to an obtuse or truncate tip, 2–4 µm long.

Culture characteristics: Colonies flat, spreading, with sparse to moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Materials examined: **Australia**, South Australia, on *Eucalyptus* sp., Sept. 1924, *G. Samuel* (**holotype** ADW 3840); Western Australia, Cape Riche, Wellstead, on *E. angulosa*, 21 Sep. 2015, *P.W. Crous* (**epitype** specimen here designated CBS H-23470, MBT382799, culture ex-type CPC 28912 = CBS 144196); Western Australia, Gull Cove, Albany, on *E. angulosa*, 20 Sep. 2015, *P.W. Crous*, specimen HPC 723B, culture CPC 29046.

Notes: *Allelochaeta samuelii* has hitherto only been known based on its type collection. It has conidia with a distinct knob-like appendage on the apical cell and a basal appendage. The median cells, like those of *A. brevicentra* and *A. walkeri*, are much shorter than both the apical and basal cells, the apical cell being the longest. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

Allelochaeta sparsifoliae Crous, ***sp. nov.*** MycoBank 827176. Fig. 40.

Etymology: Name reflects the host species, *Eucalyptus sparsifolia*, from which it was isolated.

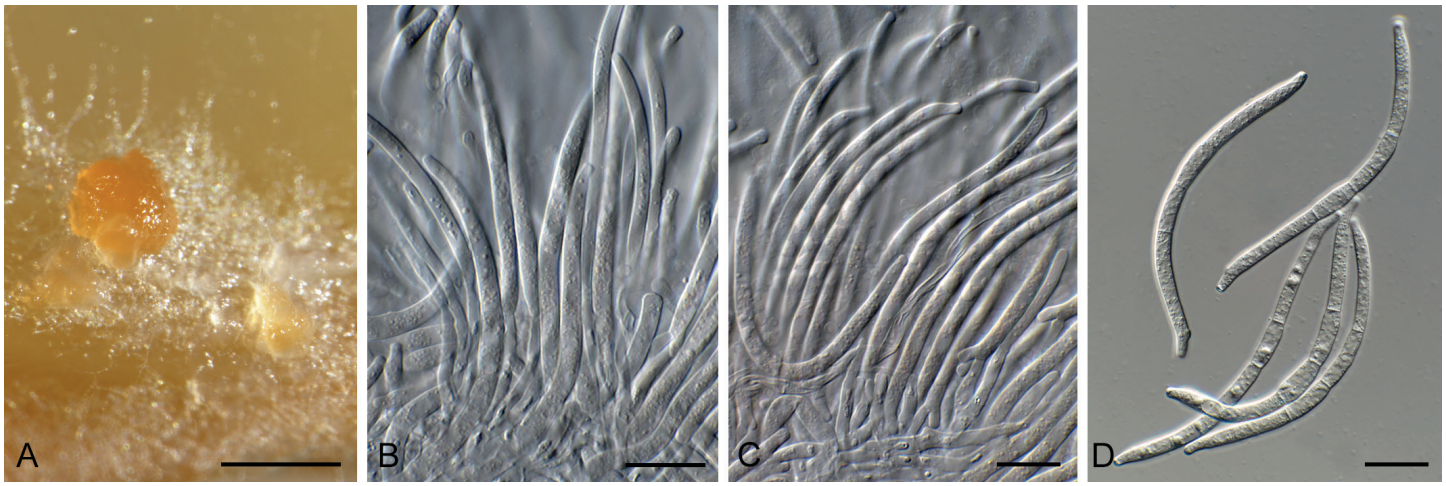

Fig. 39. *Allelochaeta samuelii* (CPC 28912). **A.** Conidiomata on OA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

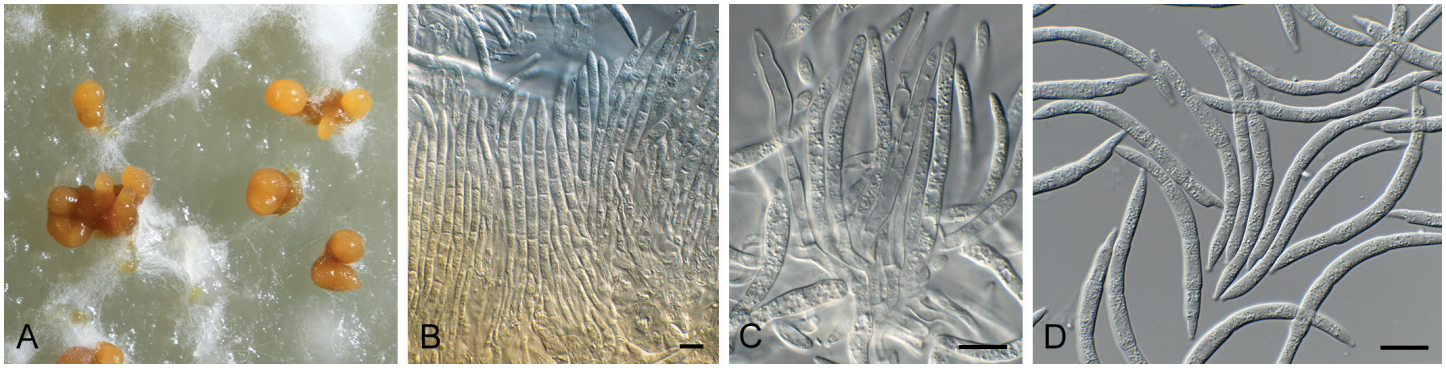

Fig. 40. *Allelochaeta sparsifoliae* (CPC 14529). **A.** Conidiomata on OA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

Conidiomata stromatic, acervuloid, scattered, oval, 300–400 µm diam, exuding an orange conidial mass. *Conidiophores* lining the basal cavity, subcylindrical, branched, 0–2-septate, 10–20 × 2.5–3.5 µm. *Conidiogenous cells* hyaline, smooth, subcylindrical, terminal and intercalary, proliferating percurrently near apex, 8–12 × 2.5–3 µm. *Conidia* subcylindrical to acerose, hyaline, smooth, guttulate, slightly curved, 3-septate, constricted at septa or not, (45–)48–57(–60) × (3.5–)4 µm; apical cell narrowly conical, attenuating toward an apical appendage with blunt apex, (15–)17–21 µm long; second cell from apex cylindrical to subcylindrical, (15–)16–17 µm long; third cell from apex cylindrical to subcylindrical, (12–)13–15 µm long; basal cell cylindrical to narrowly obconic with narrowly truncate base, (9–)10–12(–14) µm long; basal appendage excentric, single, cuneiform to podiform, 5–6 µm long.

Culture characteristics: Colonies flat, spreading, with moderate aerial mycelium and even, lobate margins, covering dish in 2 wk at 25 °C. Colonies on MEA, OA and PDA salmon surface and reverse, with orange spore masses.

Materials examined: **Australia**, New South Wales, Wyong, on *E. sparsifolia* (= *E. oblonga*), 23 Sep. 2007, *B.A. Summerell* (**holotype** CBS H-23455, culture ex-type CPC 14529 = CBS 144183); New South Wales, Forresters Beach, on *E. sparsifolia*, 1 Jan. 2007, *B.A. Summerell*, CPC 14502.

Notes: *Allelochaeta sparsifoliae* is morphologically somewhat reminiscent of *A. obliquae*, having a blunt apex, and a basal appendage that is again reminiscent of *A. walkeri*. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, LSU, *rpb2*, *tef1* and *tub2*.

Allelochaeta verrucispora (Nag Raj) Crous, ***comb. nov.*** MycoBank 827177.
Basionym: *Vermisporium verrucisporum* Nag Raj, in Nag Raj, *Coelomycetous anamorphs with appendage-bearing conidia* (Ontario): 972. 1993.
Synonym: *Seimatosporium verrucisporum* (Nag Raj) P.A. Barber & Crous, *Persoonia* **27**: 111. 2011.

Morphological description on natural substratum: See Barber *et al*. (2011).

Materials examined: **Australia**, Victoria, Miles Creek, on *Eucalyptus regnans*, 1915, *C. French Jr.* (**Isotype** VPRI 1932b). **New Zealand**, Taupo, Kaingaroa Forest: on *E. delegatensis*, 6 Oct. 2000, *R.F. Thum* NZFRI-M 4047; Taupo, Kaingaroa Forest, on *E. delegatensis*, 6 Oct. 2000, *J.A. Bartram* NZFRI-M 4315.

Note: *Allelochaeta verrucispora* is presently not known from culture and its phylogenetic position remains uncertain.

Allelochaeta walkeri (H.J. Swart & M.A. Will.) Crous, ***comb. nov.*** MycoBank 827178. Fig. 41.
Basionym: *Vermisporium walkeri* H.J. Swart & M.A. Will., *Trans. Brit. Mycol. Soc*. **81**: 495. 1983.
Synonym: *Seimatosporium walkeri* (H.J. Swart & M.A. Will.) P.A. Barber & Crous, *Persoonia* **27**: 113. 2011.

Morphological description on natural substratum: See Barber *et al*. (2011).

CPC 25405: *Conidiomata* acervular, 250–400 µm diam, exuding an orange conidial mass. *Conidiophores* subcylindrical, hyaline, smooth, branched, 1–3-septate, 15–30 × 2.5–3.5 µm. *Conidiogenous cells* subcylindrical, smooth, hyaline, 9–15 × 2.5–3 µm; proliferating percurrently near apex. *Conidia* subcylindrical to fusoid, falcate, hyaline, smooth, 3(–4)-septate, slightly constricted at septa, guttulate, (52–)55–62(–67) × 3(–3.5) µm; apical cell conical, tapering to an obtuse apex, 18–27 µm long; second cell cylindrical, 10–15 µm long; third cell cylindrical, 10–13 µm long; basal cell with a small truncate base, 10–15 µm; basal appendage single, excentric, cuneiform to podiform, 6–12 µm long.

Culture characteristics: Colonies erumpent, spreading, fluffy, with moderate aerial mycelium and smooth, lobate margins, reaching 50 mm diam after 2 wk. Colonies salmon on MEA and OA, but pale luteous on PDA.

Materials examined: **Australia**, Victoria, Hume Highway, N. of Wallen, on leaves of *E. obliqua*, 29 Aug. 1980, *H.J. Swart* (**holotype** DAR 43109); Victoria, Yanakie, on *E. obliqua*, 7 Mar. 2000, *P.A. Barber,* PAB00.03; Victoria, Wilson's Promontory, Squeaky Beach Lookout, on *E. sieberi*, 7 Mar. 2000, *P.A. Barber,* PAB00.04; Victoria, Kinglake West, on *E. obliqua*, 7 Nov. 2001, *P.A. Barber,* PAB01.05; Victoria, Kinglake West, on *E. obliqua*, 7 Nov. 2001, *P.A. Barber,* PAB01.07; Victoria, Melbourne, 'Lamatina's Farm', S38°24'26.2", E144°55'9", on *Eucalyptus* sp., 12 Oct. 2009, *P.W. Crous* (**epitype** designated here CBS H-20746, MBT382801, culture ex-epitype CPC 17644 = CBS 131119); *ditto*, CPC 17645; New South Wales, Kurrajong Heights, on *Corymbia gummifera*, Apr. 2011,

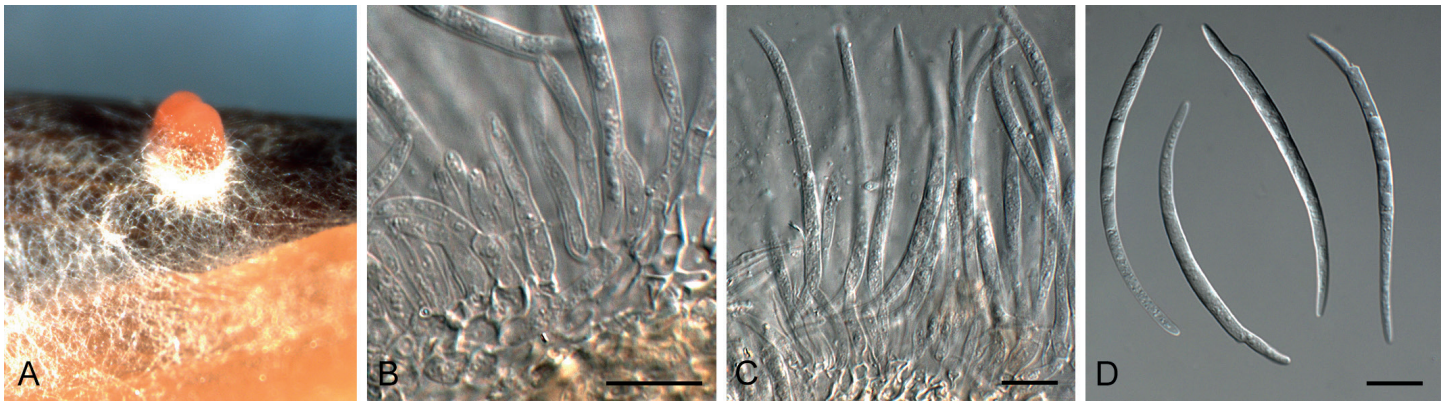

Fig. 41. *Allelochaeta walkeri* (CPC 17644). **A.** Conidiomata on PNA. **B, C.** Conidiophores. **D.** Conidia. Scale bars = 10 µm.

B.A. Summerell, CPC 19274; New South Wales, Neunes Plateau, on *E. gregsoniana*, Apr. 2011, *B.A. Summerell*, CPC 19291; Northern Territory, Darwin, on *E. oreades*, Apr. 2011, *P.W. Crous*, CPC 19275; Victoria, The Gurdies, Gurdies Winery, on *Eucalyptus* sp., 7 Nov. 2011, *P.W. Crous*, HPC 109, CPC 25409; Victoria, Victoria, The Gurdies, Gurdies Winery, Dunbaladin Rd, on *Eucalyptus* sp., 7 Nov. 2014, *P.W. Crous*, HPC 105, CPC 25405; Victoria, Toolangi Forest, on *Eucalyptus* sp., 9 Nov. 2014, *P.W. Crous*, HPC 102, CPC 25453; New South Wales, Neunes Plateau, on *E. gregsoniana*, Apr. 2011, *B.A. Summerell*, CPC 19443; Victoria, Gardies, Dunbaladin Rd, on *Eucalyptus* sp., 7 Nov. 2014, *P.W. Crous*, HPC 105, CPC 25391; New South Wales, Mount Tomah, on *E. fastigata*, 1 Jan. 2005, *B.A. Summerell*, CPC 13024. **New Zealand**, Wellington, Catchpool Forest, on *E. fastigata*, 16 Oct. 1997, *B.J. Rogan,* NZFRI-M 3756.

Notes: *Allelochaeta walkeri* and *A. brevicentra* are distinctly different from all other *Allelochaeta* species in having the median cells shorter than both the apical and basal cells. Although we presently choose to recognise all isolates in this clade as *A. walkeri*, there is some morphological and genetic variation among them. Isolate CPC 25453 has longer conidia, (52–)60–70(–80) × 3(–3.5) µm, basal appendages 6–17 µm long, similar to those in isolate CPC 13024, [conidia (55–)60–75(–80) × 3(–3.5) µm, basal appendages 6–10 µm long]. This species can easily be distinguished from its closest phylogenetic neighbours based on ITS, *rpb2*, *tef1* and *tub2*.

DISCUSSION

The family *Sporocadaceae* (*Xylariales*, *Sordariomycetes*) was resurrected to accommodate *Seimatosporium* and allied appendaged coelomycetous fungi (Jaklitsch *et al.* 2016). *Seimatosporium* accommodates saprobic and plant pathogenic species and has sexual morphs in *Discostroma* (Tanaka *et al.* 2011). Their taxonomy has long been a subject of serious debate. It is interesting to note that the two major treatments on coelomycetous fungi, respectively by Sutton (1980), and Nag Raj (1993), were in disagreement as how to treat species in *Seimatosporium*. Sutton (1980) chose a broad definition for *Seimatosporium*, whereas Nag Raj (1993) divided the complex into five genera, namely *Diploceras, Sarcostroma*, *Seimatosporium*, *Sporocadus* and *Vermisporium*. Takana *et al*. (2011) did not accept the subdivision of *Seimatosporium*, while Barber *et al.* (2011) also recommended that *Vermisporium* be regarded as synonym of *Seimatosporium*.

Species of *Seimatosporium* are morphologically very similar to various genera that have appendaged conidia. Other secondary characteristics that have been used to distinguish between seimatosporium-like genera include conidial pigmentation, septation, and the nature of the conidial appendages (presence/absence, branched/unbranched). Studies treating these appendaged fungi to date have lacked the power of DNA sequence data, commonly due to the lack of cultures on which such investigations must rely, and also because they have largely employed nuclear ribosomal RNA gene data, which tend to be quite conservative in this generic complex.

In the present study the generic type species, as well as several additional species of the genera *Allelochaeta, Diploceras*, *Discostromopsis*, *Seimatosporium* and *Vermisporium* were subjected to DNA analysis and morphological comparisons. These genera had previously been separated based on a combination of conidial pigmentation, septation, and the nature of their conidial appendages. The overall phylogeny presented in this study and based on an analysis of five gene regions (ITS, LSU, *rpb2*, *tub2* and *tef1*) (Fig. 1), showed that these taxa clustered in a well-defined clade, sister to *Seimatosporium*. Although it was originally suspected that *Vermisporium* would be the generic name to apply to this genus, it became clear that there were even older names to be considered. For example, several species of *Diploceras* clustered in this clade, although the type, *D. hypericinum*, clusters distant to this clade (F. Liu *et al.* in prep.). One species of *Diploceras*, *D. dilophospora*, has *Allelochaeta gaubae* as synonym, and the latter is the type species of the genus *Allelochaeta* (1955). *Allelochaeta* is older than *Vermisporium* (type species: *V. walkeri*; 1983), and the genus *Discostromopsis* (type species: *D. callistemonis*; 1979), which is a synonym of *Diploceras kriegerianum*. Other than their asexual morphs, species of *Seimatosporium* also differ from *Allelochaeta* in having *Discostroma* sexual morphs, while those of *Allelochaeta* are placed in *Discostromopsis* (J- apical ascal ring versus J+ apical ring in *Discostroma*, and irregularly biseriate ascospores, vs. uniseriate ascospores in *Discostroma*; see Tanaka *et al*. 2011). Finally, these two genera also appear to differ ecologically, as species of *Seimatosporium* are commonly associated with twigs and branches, while species of *Allelochaeta* are foliicolous.

Allelochaeta appears to be the most appropriate name to apply to the genus that clusters sister to *Seimatosporium*. In doing so, the fact that there is considerable morphological diversity in this genus must be confronted. This diversity includes characteristics such as the number of conidial septa, the nature and the presence/absence of conidial appendages. Most strikingly, however, is the fact that conidial pigmentation appears to have been gained or lost in several subclades of *Allelochaeta* (see Fig. 1). This raises the interesting question if this is known only from genera of *Sporocadaceae*, or whether this is a common feature in other coelomycetous *Ascomycota*. This question is consequently considered below for a number of genera with conidial appendages that have been considered in recent studies.

Alpakesa/Kellermania/Piptarthron

Based on their distinct conidial appendages (number and origin), Sutton (1980) regarded *Alpakesa*, *Kellermania*, and *Piptarthron* as separate genera. However, in the first phylogenetic revision of the group, these genera, as well as their sexual morphs, *Planistroma* and *Planistromella*, were reduced to synonymy under *Kellermania* (Minnis *et al.* 2012). In the latter study, conidial appendages proved insufficiently robust characters to justify the separation of otherwise morphologically similar genera of coelomycetes.

Coniella/Pilidiella

Coniella and *Pilidiella* were regarded as separate genera by von Arx (1973, 1981), based on the dark brown conidia of *Coniella*, in contrast to the hyaline conidia of *Pilidiella.* However, conidial pigmentation was rejected as a distinguishing characteristic by Sutton (1980) and Nag Raj (1993) who used the older name, *Coniella*. Although early studies based on ITS and LSU sequence data supported their separation (Castlebury *et al.* 2002, Van Niekerk *et al.* 2004), a multigene study incorporating numerous species and isolates showed that *Pilidiella* and *Schizoparme*

(sexual morphs linked to taxa with hyaline or brown conidia) should be considered as synonyms of the older generic name, *Coniella* (Alvarez *et al.* 2016, Marin-Felix *et al.* 2017).

Dinemasporium/Stauronema and *Pseudolachnea/ Pseudolachnella*

In a recent study evaluating the taxonomic value of conidial appendages in *Dinemasporium* and allied genera (*Chaetosphaeriaceae*), Crous *et al.* (2012) showed that *Stauronema* (lateral conidial appendages) should be reduced to synonymy with *Dinemasporium.* Furthermore, that lateral conidial appendages should not be used as character for generic separation, while *Pseudolachnea* (1-septate conidia), was again shown as distinct from *Dinemasporium* (aseptate conidia). In a subsequent study Hashimoto *et al.* (2015) found that *Pseudolachnea* and *Pseudolachnella* were distinct, and that differences observed in the conidiomatal structure, such as thickness of basal stroma and the excipulum, were more reliable characters at generic level than conidial septation. Saccardoan characters relating to conidial morphology, such as colour and septation, were thus concluded to be uninformative in many fungal genera (Hirayama & Tanaka 2011).

Pestalotiopsis/Neopestalotiopsis/Pseudopestalotiopsis

Maharachchikumbura *et al*. (2014) distinguished *Neopestalotiopsis* from *Pseudopestalotiopsis* and *Pestalotiopsis* by its versicolourous median cells and indistinct conidiophores. Likewise, *Pseudopestalotiopsis* was distinguished from *Pestalotiopsis* by generally dark coloured concolourous median cells with indistinct conidiophores. However, Liu *et al.* (2017) found that there were exceptions, and that some taxa clustering within *Neopestalotiopsis* produced concolourous median cells, suggesting that conidial pigmentation is more plastic among these genera than originally proposed by Maharachchikumbura *et al*. (2014).

CONCLUSIONS

Conidial septation, pigmentation and appendages have been used extensively in the past to separate genera of coelomycetous fungi (Sutton 1980, Nag Raj 1993). However, it is clear that in many genera of *Ascomycota*, and also specifically in the *Sporocadaceae*, the presence or absence of appendages, and even the nature of these appendages, can vary greatly within the same genus. Likewise, conidial pigmentation has also been gained or lost several times during the evolution of *Allelochaeta*, with some species having hyaline or subhyaline conidia, smooth, or verruculose, or with pale brown or dark brown central cells.

The common denominator for species of *Allelochaeta* appears to be the acervular conidiomata, and a basal stroma of *textura angularis* that gives rise to percurrently proliferating conidiogenous cells. Conidia are fusoid, naviculate, subcylindrical or acerose, straight or curved, euseptate, with or without apical appendages, and with a single excentric basal appendage, that can be branched in some cases. Where known, ascomata of the sexual morph are immersed in host tissue, and covered by a small clypeus, and ascospores are ellipsoid, hyaline, and 3-septate. Further collections may eventually show that more uniform generic characters exist among the sexual morphs of species of *Allelochaeta*. But for the present, the asexual morphs appear highly variable, and the characters on which their taxonomy has been based in the past (Sutton 1980, Nag Raj 1993), appear to represent a continuum, with several features developing more than once within the genus.

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REFERENCES

Alvarez LV, Groenewald JZ, Crous PW (2016). Revising the *Schizoparmaceae*: *Coniella* and its synonyms *Pilidiella* and *Schizoparme*. *Studies in Mycology* **85**: 1–34.

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

Braun U, Nakashima C, Crous PW, *et al.* (2018). Phylogeny and taxonomy of the genus *Tubakia s. lat*. *Fungal Systematics and Evolution* **1**: 41–99.

Castlebury LA, Rossman AY, Jaklitsch WJ, *et al*. (2002). A preliminary overview of the *Diaporthales* based on large subunit nuclear ribosomal DNA sequences. *Mycologia* **94**: 1017–1031.

Crous PW, Gams W, Stalpers JA, *et al.* (2004). MycoBank: an online initiative to launch mycology into the 21st century. *Studies in Mycology* **50**: 19–22.

Crous PW, Verkley GJM, Christensen M, *et al.* (2012). How important are conidial appendages? *Persoonia* **28**: 126–137.

Crous PW, Verkleij GJM, Groenewald JZ, *et al.* (eds). 2009. *Fungal Biodiversity*. CBS Laboratory Manual Series 1. Centraalbureau voor Schimmelcultures, Utrecht, the Netherlands.

Crous PW, Wingfield MJ, Koch SH (1990). New and interesting records of South African fungi: X. New records of *Eucalyptus* leaf fungi. *South African Journal of Botany* **56**: 583–586.

Crous PW, Wingfield MJ, Park RF (1991). *Mycosphaerella nubilosa* a synonym of *M. molleriana*. *Mycological Research* **95**: 628–632.

Hashimoto A, Sato G, Matsuda T, *et al.* (2015). Taxonomic revision of *Pseudolachnea* and *Pseudolachnella*, and establishment of *Neopseudolachnella* and *Pseudodinemasporium* genera nova. *Mycologia* **107**: 383–408.

Jaklitsch WM, Gardiennet A, Voglmayr H (2016). Resolution of morphology-based taxonomic delusions: *Acrocordiella*, *Basiseptospora*, *Blogiascospora*, *Clypeosphaeria*, *Hymenopleella*, *Lepteutypa*, *Pseudapiospora*, *Requienella*, *Seiridium* and *Strickeria*. *Persoonia* **37**: 82–105.

Katoh K, Standley DM (2013). MAFFT Multiple Sequence Alignment Software Version 7: Improvements in Performance and Usability. *Molecular Biology and Evolution* **30**: 772–780.

Hirayama K, Tanaka K (2011). Taxonomic revision of *Lophiostoma* and *Lophiotrema* based on reevaluation of morphological characters and molecular analyses. *Mycoscience* **52**: 401–412.

Kearse M, Moir R, Wilson A, *et al.* (2012). Geneious Basic: an integrated and extendable desktop software platform for the organization and analysis of sequence data. *Bioinformatics* **28**: 1647–1649.

Kumar S, Stecher G, Tamura K (2016). MEGA7: Molecular Evolutionary Genetics Analysis Version 7.0 for Bigger Datasets. *Molecular Biology and Evolution* **33**: 1870–1874.

Liu F, Lingwei H, Mubashar R, *et al.* (2017). *Pestalotiopsis* and allied genera from *Camellia*, with description of 11 new species from China. *Scientific Reports* **7**: 866.

Maharachchikumbura SSN, Hyde KD, Groenewald JZ, *et al.* (2014). *Pestalotiopsis* revisited. *Studies in Mycology* **79**: 121–186.

Marin-Felix Y, Groenewald JZ, Cai L, *et al.* (2017). Genera of phytopathogenic fungi: GOPHY 1. *Studies in Mycology* **86**: 99–216.

Minnis AM, Kennedy AH, Grenier DB, *et al.* (2012). Phylogeny and taxonomic revision of the *Planistromellaceae* including its coelomycetous anamorphs: contributions towards a monograph of the genus *Kellermania*. *Persoonia* **29**: 11–28.

Nag Raj TR (1993). *Coelomycetous anamorphs with appendage-bearing conidia*. Mycologue Publications: Waterloo, Canada.

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

Petrak F (1955). *Allelochaeta* n. gen., eine neue, biciliate Melanconieen-Gattung. *Sydowia* **9**: 464–466.

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

Ronquist F, Teslenko M, Van der Mark P, *et al.* (2012). MrBayes 3.2: Efficient Bayesian phylogenetic inference and model choice across a large model space. *Systematic Biology* **61**: 539–542.

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

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

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 (1982). Australian leaf-inhabiting fungi XIII. *Seimatosporium* species on *Eucalyptus*. *Transactions of the British Mycological Society* **78**: 265–269.

Swart HJ, Griffiths DA (1974). Australian leaf inhabiting fungi. VI. *Cooksonomyces banksiae* gen. et sp. nov. *Transactions of the British Mycological Society* **63**: 151–155.

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

Swofford DL (2003). *PAUP*: phylogenetic analysis using parsimony. (*and other methods).* Version 4.0b10. Sinauer Associates, Sunderland.

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

Van Niekerk JM, Groenewald JZ, Verkley GJM, *et al.* (2004). Systematic reappraisal of *Coniella* and *Pilidiella*, with specific reference to species occurring on *Eucalyptus* and *Vitis* in South Africa. *Mycological Research* **108**: 283–303.

Von Arx JA (1973). Centraalbureau voor Schimmelcultures Baarn and Delft. Progress Report 1972. *Verhandelingen der Koninklijke Nederlandsche Akademie van Wetenschappen, Afdeling Natuurkunde*. **61**: 59–81.

Von Arx JA (1981). *The genera of fungi sporulating in pure culture* (3rd edn). J Cramer, Vaduz.

Videira SIR, Groenewald JZ, Nakashima C, *et al.* (2017). *Mycosphaerellaceae* – Chaos or clarity? *Studies in Mycology* **87**: 257–421.

Zhang Z, Schwartz S, Wagner L, *et al.* (2000). A greedy algorithm for aligning DNA sequences. *Journal of Computational Biology* **7**: 203–214.