

# Venturiales

M. Shen<sup>1</sup>, J.Q. Zhang<sup>1</sup>, L.L. Zhao<sup>1</sup>, J.Z. Groenewald<sup>2</sup>, P.W. Crous<sup>2</sup>, and Y. Zhang<sup>1\*</sup>

<sup>1</sup>School of Ecology and Nature Conservation, Beijing Forestry University, P.O. Box 61, Beijing, 100083, PR China; <sup>2</sup>Westerdijk Fungal Biodiversity Institute, Uppsalalaan 8, 3584 CT, Utrecht, The Netherlands

\*Correspondence: Y. Zhang, [y Zhang@bjfu.edu.cn](mailto:y Zhang@bjfu.edu.cn)

**Abstract:** Members of *Venturiales* (*Dothideomycetes*) are widely distributed, and comprise saprobes, as well as plant, human and animal pathogens. In spite of their economic importance, the general lack of cultures and DNA data has resulted in taxa being poorly resolved. In the present study five loci, ITS, LSU rDNA, *tef1*, *tub2* and *rpb2* are used for analysing 115 venturialean taxa representing 30 genera in three families in the current classification of *Venturiales*. Based on the multigene phylogenetic analysis, morphological and ecological characteristics, one new family, *Cylindrosympodiaceae*, and eight new genera are described, namely *Bellamyces*, *Fagicola*, *Fraxinicola*, *Fuscohilum*, *Neofusicladium*, *Parafusicladium*, *Pinaceicola* and *Sterila*. In addition, 12 species are described as new to science, and 41 new combinations are proposed. The taxonomic status of 153 species have been re-evaluated with 20 species excluded from *Venturiales*. Based on this revision of *Venturiales*, morphological characteristics such as conidial arrangement (solitary or in chains) or conidiogenesis (blastic-solitary, sympodial or annellidic), proved to be significant at generic level. *Venturia* as currently defined represents a generic complex. Furthermore, plant pathogens appear more terminal in phylogenetic analyses within *Venturiaceae* and *Sympoventuriaceae*, suggesting that the ancestral state of *Venturiales* is most likely saprobic.

**Key words:** Multigene analysis, New taxa, Scab disease, Systematics, *Venturia*.

**Taxonomical novelties: New family:** *Cylindrosympodiaceae* Crous, M. Shen & Y. Zhang ter. **New genera:** *Bellamyces* Crous, Coppins & U. Braun, *Fagicola* Crous, M. Shen & Y. Zhang ter, *Fraxinicola* Crous, M. Shen & Y. Zhang ter, *Fuscohilum* Crous, M. Shen & Y. Zhang ter, *Neofusicladium* Crous, M. Shen & Y. Zhang ter, *Parafusicladium* Crous, M. Shen & Y. Zhang ter, *Fuscohilum* Crous, M. Shen & Y. Zhang ter, *Pinaceicola* Crous, M. Shen & Y. Zhang ter, *Sterila* Crous, M. Shen & Y. Zhang ter. **New species:** *Bellamyces quercus* Crous, Coppins & U. Braun, *Fraxinicola europaea* Crous, M. Shen & Y. Zhang ter, *Fraxinicola italica* Crous, M. Shen & Y. Zhang ter, *Neocoleroa cameroonensis* Crous, M. Shen & Y. Zhang ter, *Sterila eucalypti* Crous, M. Shen & Y. Zhang ter, *Tyrannosorus lichenicola* Crous, M. Shen & Y. Zhang ter, *Tyrannosorus pini-sylvestris* Crous & R.K. Schumach., *Venturia albae* Crous, M. Shen & Y. Zhang ter, *Venturia australiana* Crous, M. Shen & Y. Zhang ter, *Venturia caesia* Crous, M. Shen & Y. Zhang ter, *Venturia finlandica* Crous, M. Shen & Y. Zhang ter, *Venturia quebecensis* Crous, M. Shen & Y. Zhang ter. **New combinations:** *Fagicola fagi* (Crous & de Hoog) Crous, M. Shen & Y. Zhang ter, *Fraxinicola fraxini* (Aderh.) Crous, M. Shen & Y. Zhang ter, *Fraxinicola orni* (M. Ibrahim *et al.*) Crous, M. Shen & Y. Zhang ter, *Fuscohilum rhodensis* (Crous & M.J. Wingf.) Crous, M. Shen & Y. Zhang ter, *Fuscohilum siciliana* (Koukol) Crous, M. Shen & Y. Zhang ter, *Neofusicladium eucalypti* (Crous & R.G. Shivas) Crous, M. Shen & Y. Zhang ter, *Neofusicladium eucalypticola* (Crous & M.J. Wingf.) Crous, M. Shen & Y. Zhang ter, *Neofusicladium regnans* (Crous) Crous, M. Shen & Y. Zhang ter, *Niesslia iridicola* (M.E. Barr) Crous, M. Shen & Y. Zhang ter, *Niesslia parasitica* (Ellis & Everh.) M. Shen & Y. Zhang ter, *Niesslia vaccinii* (Ellis & Everh.) Crous, M. Shen & Y. Zhang ter, *Parafusicladium amoenum* (R.F. Castañeda & Dugan) Crous, M. Shen & Y. Zhang ter, *Parafusicladium intermedium* (Crous & W.B. Kendr.) Crous, M. Shen & Y. Zhang ter, *Parafusicladium paraamoenum* (Crous *et al.*) Crous, M. Shen & Y. Zhang ter, *Pinaceicola cordae* (Koukol) Crous, M. Shen & Y. Zhang ter, *Pinaceicola pini* (Crous & de Hoog) Crous, M. Shen & Y. Zhang ter, *Pseudosigmoidea excentrica* (R.F. Castañeda *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium aquaticum* (Samerp. *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium atlanticum* (A.M. Wellman) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium bacilliforme* (Samerp. *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium capsici* (Crous & Cheew.) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium cordanae* (Samerp. *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium dracaenae* (Crous) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium globale* (Samerp. *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium icarus* (Samerp. *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium macrozamia* (Crous & R.G. Shivas) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium minimum* (Fassat.) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium musicola* (Crous) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium olivaceum* (A. Giraldo *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium pandanicola* (Crous & M.J. Wingf.) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium phaeophorum* (Samerp. *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium podocarp* (Crous) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium ramosum* (A. Giraldo *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium robustum* (Samerp. *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium sexuale* (Samerp. *et al.*) Crous, M. Shen & Y. Zhang ter, *Scolecobasidium verrucosum* (Zachariah *et al.*) Crous, M. Shen & Y. Zhang ter, *Sympoventuria africana* (Crous) Crous, M. Shen & Y. Zhang ter, *Tyrannosorus hanlinianus* (U. Braun & Feiler) Crous, M. Shen & Y. Zhang ter, *Tyrannosorus hystrioides* (Dugan *et al.*) Crous, M. Shen & Y. Zhang ter, *Venturia peltigericola* (Crous & Diederich) Crous, M. Shen & Y. Zhang ter, *Verruconis terricola* (J. Ren *et al.*) Crous, M. Shen & Y. Zhang ter.

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## INTRODUCTION

*Venturiales* represent an important order within *Dothideomycetes* (*Ascomycota*), members of which are widely distributed in temperate and tropical areas of the world, and have diverse lifestyles. *Venturiales* include plant pathogens causing leaf spots, necroses, scab diseases, leaf and fruit deformations, opportunistic neurotropic pathogens of aquatic animals or humans, and saprobes in soil or plant debris, with some even being thermophilic, living in hot springs (Barron & Busch 1962, Sivanesan

1977, Yarita *et al.* 2007, 2010, Schoch *et al.* 2009a, Zhang *et al.* 2011, Giraldo *et al.* 2014, Samerpitak *et al.* 2014).

Members of *Venturiaceae* occupy about 80 % of the order, and represent the type family of *Venturiales*. Before the name “*Venturiaceae*” was introduced, genera of this family were assigned to various families, such as *Venturia* in *Pleosporaceae*, *Coleroa* in *Trichosphaeriaceae*, *Gibbera* in *Cucurbitariaceae* and *Stigmatea* in *Stigmateaceae* (Winter 1887). Petrak (1924, 1927, 1947) compared the morphology of some genera, *i.e.*, *Antennularia*, *Coleroa*, *Eriosphaeria*, *Gibbera*, *Trichosphaeria* and

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*Venturia* and proposed a possible relationship among them. Subsequently, the name *Venturiaceae* was introduced by Müller & von Arx (1950) to accommodate some morphologically comparable genera, such as *Antennularia*, *Coleroa*, *Endostigma*, *Gibbera*, *Spilosticta*, *Stigmatea* and *Venturia*, and the *Venturiaceae* was assigned to *Pseudosphaerales*. von Arx (1952) redefined the morphological characteristics of *Venturiaceae*, and circumscribed it to include immersed, semi-immersed or superficial ascomata with or without setae, filiform pseudoparaphyses, clavate, obclavate, bitunicate, 8-spored (sometimes 4-spored) asci, hyaline, pale-olivaceous to brown, and 1-septate, often asymmetrical ascospores. Twelve genera were accepted in the family by von Arx (1952), which later increased to 25 (Müller & von Arx 1962), and eventually to 30 (Luttrell 1973). In further studies members of *Venturiaceae* of particular host genera or families were investigated (Menon 1956, Müller 1958). Nüesch (1960) studied five species of *Venturia* on *Salix*, while Bachmann (1963) reported five species of *Venturia* on *Geraniaceae*. Sivanesan (1977) studied the type or authentic materials of 58 venturiaceous species, of which 52 species were accepted within *Venturia*.

Barr (1979) validated the description of *Venturiaceae* with *Venturia* Sacc. (vs. *Venturia* De Not.) designated as the type genus, and accepted 12 genera, viz., *Acantharia*, *Apiosporina*, *Coleroa*, *Gibbera*, *Metacoleroa*, *Phaeocryptopus*, *Platychora*, *Protoventuria*, *Pyrenobotrys*, *Trichodothis*, *Venturia* and *Xenomeris*. *Venturiaceae* was assigned to *Pleosporales* based on its "Pleospora type of centrum and bitunicate asci" (Barr 1968, 1979). This proposal was supported by subsequent molecular phylogenetic studies (Kodsueb et al. 2006, Kruys et al. 2006, Winton et al. 2007, Zhang et al. 2009, 2011). A phylogeny of concatenated SSU, LSU and mtSSU DNA sequences indicated that the *Venturiaceae* clustered outside of *Pleosporales* (Kruys et al. 2006), being closely related to *Tubeufiaceae* (Kodsueb et al. 2006). Winton et al. (2007) further demonstrated the polyphyletic status of *Venturiaceae* and pointed out that the core members of *Venturiaceae* are monophyletic, while their taxonomic placement was undetermined.

Based on morphological, ecological and multi-locus (SSU, LSU, *tef1*, *rpb1*, *rpb2*) phylogenetic investigations, Zhang et al. (2011) redefined the *Venturiaceae* as parasitic or saprobic, with immersed, semi-immersed or superficial, gregarious or scattered ascomata, with or without setae, narrow-cellular, evanescent pseudoparaphyses, bitunicate, obclavate, obpyriform asci, and hyaline, yellowish, pale olivaceous to brown, 1-septate, mostly asymmetrical ascospores. Eight genera were accepted within *Venturiaceae*, viz., *Acantharia*, *Apiosporina*, *Caproventuria*, *Coleroa*, *Dibotryon*, *Metacoleroa*, *Pseudoparodiella* and *Venturia* (Zhang et al. 2011).

Asexual morphs of *Venturiales* include *Fusicladium*, *Pollaccia*, *Spilocaea* and *Pseudocladosporium*, of which *Fusicladium* is the most common. *Fusicladium* was introduced by Bonorden (1851) based on *Fusicladium virescens*, which is parasitic on pear. Subsequently, *F. virescens* was treated as a synonym of the older name *F. pyrurum* (Saccardo 1886, Lindau 1907, Viennot-Bourgin & Fernier 1950, Tai 1979, Sivanesan 1984, von Arx 1987). Lindau (1907) and Ferraris (1912) redefined *Fusicladium s. lat.* to include conidiogenous cells with sympodial and percurrent proliferation, including pollaccia- and spilocaea-like members. Baldacci & Ciferri (1937) separated *Pollaccia* from *Fusicladium*, and resurrected the name *Pollaccia*. Viennot-

Bourgin (1949) accepted *Fusicladium s. str.*, which includes species with percurrently proliferating conidiogenous cells, and those with sympodial conidiogenous cells were assigned to a new genus *Megacladosporium*. *Megacladosporium*, however, was invalid as it lacked a generic type. Hughes (1953) circumscribed *Fusicladium s. str.* as having sympodially proliferating conidiogenous cells and somewhat denticle-like conidiogenous loci and assigned the species with obvious percurrently proliferating conidiogenous cells to *Spilocaea*. Schubert et al. (2003) accepted *Fusicladium s. lat.*, with *Pollaccia* and *Spilocaea* as synonyms.

Phylogenetic analyses of ITS and LSU sequences indicated that species of *Pollaccia* and *Spilocaea* were intermingled among *Fusicladium* species, and *Pollaccia*, *Spilocaea* as well as *Pseudocladosporium* were considered as synonyms of *Fusicladium* (Beck et al. 2005, Crous et al. 2007b). Crous et al. (2007b) indicated that the arrangement of the conidiophores (solitary, fasciculate or sporodochial), the proliferation of conidiogenous cells (sympodial, percurrent) and shape, size as well as formation of conidia (solitary, catenate) had little taxonomic value at generic level. However, a DNA phylogeny based on five loci, namely SSU, LSU, *rpb1*, *rpb2* and *tef1*, supported a narrower circumscription of *Venturia*, which included only a small number of species closely related to the generic type of *Venturia* (*V. inaequalis*) (Zhang et al. 2011). Thus *Pollaccia*, *Pseudocladosporium* and *Spilocaea* were again treated as separate genera (Zhang et al. 2011).

Based on an ecological, morphological and molecular phylogenetic analysis, a second family, *Sympoventuriaceae*, was introduced to accommodate *Sympoventuria*, *Veronaeopsis* and fusicladium-like species (Zhang et al. 2011). *Scolecobasidium*, a soil-borne genus, was described based on two species, i.e., *S. terreum* (type species) and *S. constrictum* (Abbott 1927). Subsequently, more soil-borne or saprotrophic species were described within *Scolecobasidium* (Barron & Busch 1962, Roy et al. 1962). *Ochroconis* was separated from *Scolecobasidium* based on its ellipsoidal, clavate or fusiform conidia, in contrast to the trilobate conidia of *Scolecobasidium* (De Hoog & von Arx 1974). This proposal was not supported by subsequent molecular phylogenetic analyses, in which members of *Scolecobasidium* and *Ochroconis* clustered in a single clade (Hao et al. 2013, Ren et al. 2013). *Verruconis* was introduced as a thermophilic genus, which includes *V. gallopava*, an opportunistic neurotropic pathogen, and its sibling, *V. calidifluminalis* (Samerpitak et al. 2014). *Neocoleroa metrosideri* was described as a pathogen causing leaf spots on *Metrosideros excelsa*, which was widespread in *M. excelsa* forests in northern New Zealand (Johnston & Park 2016). Although DNA sequences were not available for the type species of *Neocoleroa*, *N. sibirica*, the comparable morphological characteristics with *N. metrosideri* argued for their congeneric status (Barr 1987, Johnston & Park 2016). *Clavatispora* was introduced as monotypic genus within *Sympoventuriaceae* represented by *Clavatispora thailandica*, which is characterised by its muriformly septate ascospores (Boonmee et al. 2014). A further asexual genus, *Yunnanomyces*, was introduced to accommodate *Y. pandanicola*, with globose to broadly oval, yellow-brown, muriformly septate conidia (Tibpromma et al. 2018). *Pseudosigmoidea* was separated from *Sigmoidea* based on its enteroblastic conidia and phialidic conidiogenesis (Ando & Nakamura 2000), and *Sympodiella* was emended to include a repetophragma-like

synasexual morph within *Sympoventuriaceae* (Crous *et al.* 2019a).

Numerous strains belonging to *Venturiales* were examined in the present study, including the established genera *Clavatispora*, *Ochroconis*, *Scolecobasidium*, *Sympodiella*, *Sympoventuria*, *Veronaepsis*, *Verruconis* and *Yunnanomyces*. The primary objectives were: 1) to delineate the phylogenetic lineages, families and generic boundaries; 2) and to designate appropriate types to stabilise the application of names. To address these issues, we performed multi-locus phylogenetic analyses based on ITS, LSU rDNA, *tef1*, *tub2* and *rpb2* DNA sequence data.

## MATERIALS AND METHODS

### Isolates

Cultures were obtained from the culture collection (CBS) of the Westerdijk Fungal Biodiversity Institute (WI), Utrecht, the Netherlands, and the working collection of Pedro Crous (CPC) housed at the WI, and the Chinese General Microbiological Culture Collection Center (CGMCC) (Table 1). Isolates were subcultured onto fresh malt extract agar (MEA), oatmeal agar (OA), potato dextrose agar (PDA) and synthetic nutrient-poor agar (SNA) (Crous *et al.* 2019b) and incubated at 25 °C under continuous near-ultraviolet light to induce sporulation.

### DNA extraction, amplification (PCR) and phylogeny

Total genomic DNA was extracted from fungal colonies using the FastDNA kit (MP Biomedicals, CA, USA), PrepMan Ultra sample preparation reagent (Applied Biosystems, Foster City, CA, USA) and the Wizard® Genomic DNA Purification Kit (Promega Corporation, WI, USA), following the manufacturer's protocols. The primer sets LR0R/LR5 and ITS5/ITS4 (Vilgalys & Hester 1990, White *et al.* 1990), were used to amplify part of the nuclear rDNA LSU and ITS. The EF1-728F and EF-2 primers (Qiao *et al.* 2016) were used for the amplification of the partial *tef1* (translation elongation factor 1- $\alpha$ ) gene. The fRPB2-5F2 and fRPB2-7cR primers were used for the amplification of the partial *rpb2* (DNA-directed RNA polymerase II second largest subunit) gene (Liu *et al.* 1999, Reeb *et al.* 2004). Several primer pairs including T1/Bt-2b, T1/Tub4Rd, and/or Bt-2a/Bt-2b were used to amplify the partial *tub2* (Beta-tubulin) gene (Glass & Donaldson 1995, Aveskamp *et al.* 2009, Guo *et al.* 2014). The amplification cycles were performed following Cano *et al.* (2004). PCR products were purified and sequenced with an Applied Biosystems 3730xl DNA Analyzer (Life Technologies, Carlsbad, CA, USA). The program SeqMan v. 7.0 (Lasergene, Madison, WI, USA) was used to obtain consensus sequences. The combined ITS, LSU, *tef1*, *tub2* and *rpb2* sequence dataset was used to infer the phylogenetic relationships among the new taxa and other reported taxa of *Venturiales*. Sequences generated were analysed with other sequences obtained from GenBank (Table 1). Phylogenetic trees were generated using Bayesian analyses performed with MrBayes v. 3.2.6 (Ronquist *et al.* 2012). MrModeltest v. 2.2 (Nylander 2004) was used to determine the best nucleotide substitution model settings for each data partition. The Markov Chain Monte Carlo (MCMC) analysis of four

chains started in parallel from a random tree topology, the heat parameter was set at 0.15 and trees were saved every 100 generations until the average standard deviation of split frequencies reached 0.01 (stop value). Burn-in was set to 25 % after which the likelihood values were stationary. Obtained trees were viewed in FigTree v. 1.1.2 (Rambaut 2009) and subsequently printed with Geneious v. 11.0.3 (<http://www.geneious.com>, Kearse *et al.* 2012) and edited in Adobe® Illustrator v. CC 2017. Posterior probability values (PP) were plotted on the branches.

### Morphology

Specimens were loaned from the following herbaria: Herbarium Plant Pathology and Microbiology Herbarium (PPMH), Chinese Academy of Sciences (HMAS), Cornell University (CUP), New Zealand Fungarium (PDD), University of Michigan (MICH), The Royal Botanic Gardens, Kew (K), the New York Botanical Garden (NY), New York State Museum (NYS), Eidgenössische Technische Hochschule Zürich (ZT), Naturhistorisches Museum Wien (W), the Queensland Plant Pathology Herbarium (BRIP), the Chinese General Microbiological Culture Collection Center (CGMCC), and the Victorian Plant Pathogen Herbarium (VPRI). Attempts were made to trace and borrow type specimens of *Venturia* from herbaria worldwide, but only some of them could be obtained.

For sexual morphs, ascostromata and ascomata were examined under an Olympus SZ H10 dissecting microscope. Measurements and descriptions of sections of the ascomata, hamathecia, asci and ascospores were carried out after immersing ascomata in water, cotton blue, Melzer's reagent or in 10 % lactic acid. Terminology follows Ulloa & Hanlin (2000). For asexual morphs, measurements and descriptions of microscopic structures including conidiophores, conidiogenous cells and conidia, were taken from specimens mounted in water or lactic acid. Photomicrographs were taken using differential interference contrast and phase contrast optics with a Zeiss Axio Imager M1 compound microscope (Zeiss, Oberkochen, Germany) and a DeltaPix Infinity X digital camera or a Nikon Eclipse Ni microscope, using a Nikon DS-U3 digital camera (Nikon, Tokyo, Japan) and NIS-Element imaging software v. 4.20.

## RESULTS

### Phylogeny

The concatenated DNA sequence dataset (ITS, LSU, *tef1*, *tub2* and *rpb2*) used to infer delimitations at family and genus levels comprised 120 isolates (including outgroup sequences) of *Venturiales* and related fungi and the same concatenated alignment focused on *Venturiaceae* comprised 96 isolates (including outgroup sequences). The optimal substitution models recommended by MrModelTest and used in the Bayesian analyses. The number of generations ran and the number of trees from the two runs used to generate the 50 % consensus tree and posterior probabilities. The number of unique site patterns and the number of characters including alignment gaps used for each locus.

The phylogenetic tree distinguished three well-supported clades corresponding to the families *Venturiaceae* (PP = 1)

**Table 1.** Collection details and GenBank accession number of isolatea belonging to species treated in this study.

Taxa	Culture accession number(s) <sup>1</sup>	Host, substrate	Country	Collector and collection date	GenBank accession numbers <sup>2</sup>				
					ITS	LSU	<i>rpb2</i>	<i>tef1</i>	<i>tub2</i>
<b>Cylindrosympodiaceae</b>									
<i>Cylindrosympodium lauri</i>	CBS 240.95 <sup>T</sup>	<i>Laurus</i> sp., leaf litter	Spain	R.F. Castañeda, 4 Jan. 1995	EU035414	EU035414	–	–	–
<i>C. variabile</i>	CBS 563.82 <sup>T</sup>	<i>Pinus</i> sp., decaying needle	Netherlands	G.S. de Hoog, 5 Sep. 1982	<i>C. variabile</i>	KX228353	–	–	–
<i>Pseudoanungitea syzygii</i>	CBS 520.93 <sup>T</sup>	<i>Syzygium cordatum</i> , leaf litter	South Africa	W.J. Swart, Mar. 1993	MH107911	MH107957	–	–	–
<i>P. vaccinii</i>	CBS 143164 <sup>T</sup>	<i>Vaccinium myrtillus</i> , stem	Germany	R.K. Schumacher, 16 Jan. 2016	<b>MK810899</b>	<b>MK810786</b>	<b>MK887794</b>	<b>MK888724</b>	<b>MK926466</b>
	CPC 30523	<i>Vaccinium myrtillus</i> , stem	Germany	R.K. Schumacher, 16 Jan. 2017	<b>MK810900</b>	<b>MK810787</b>	<b>MK887795</b>	<b>MK888725</b>	<b>MK926467</b>
<i>P. variabilis</i>	CBS 132716 <sup>T</sup>	Dead wood	Spain	M. Hernández-Restrepo, J. Mena & J. Guarro, May 2011	KY853424	KY853484	–	–	–
<i>Septonema crispulum</i>	CBS 735.96 <sup>T</sup>	<i>Pinus pinea</i> , needle litter	Italy	D. Lunghini, –	MH862607	MH874232	–	–	–
<i>Symptodiella acicola</i>	CBS 425.76	<i>Pinus sylvestris</i> , decaying needle	Netherlands	W. Gams, Mar. 1976	KY853467	KY853529	–	–	–
	CBS 487.82	<i>Pinus sylvestris</i> , needle	Netherlands	–	KY853468	KY853530	–	–	–
<i>S. goidanichii</i>	CBS 987.70	<i>Betula</i> sp., old leaf litter	UK	–	MH860019	MH871803	–	–	–
	CBS 136.58 <sup>T</sup>	<i>Fagus sylvatica</i> , cupule	Italy	–	MH857722	MH869262	–	–	–
<i>Tothia fuscella</i>	CBS 130266	<i>Teucrium chamaedrys</i>	Austria	H. Voglmayr, 15 Sep. 2010	MH865619	MH877042	–	–	–
	WU 31396 <sup>T</sup>	<i>Teucrium chamaedrys</i> , stalks	Austria	W. Jaklitsch, 3 Jul. 2010	JF927787	JF927787	–	–	–
<i>T. spartii</i>	MFLUCC 14-0615 <sup>T</sup>	<i>Spartium junceum</i> , living and dead branches	Italy	E. Camporesi, 17 Mar. 2012	NR132917	KR025865	–	–	–
<b>Sympoventuriaceae</b>									
<i>Bellamyces quercus</i>	CBS 46217 <sup>T</sup> = CPC 28858	<i>Lecanora chlarotera</i> on <i>Quercus</i> trunks	UK	B.J. Coppins, 24 Aug. 2015	<b>MK810901</b>	<b>MK810788</b>	<b>MK887796</b>	<b>MK888726</b>	–
<i>Echinocatena arthrinoides</i>	CBS 144202	<i>Acacia crassicarpa</i>	Malaysia	M.J. Wingfield, 1 Jul. 2015	MH107890	MH107937	–	–	–
<i>Fuscohilum rhodensis</i>	CBS 121641 <sup>T</sup>	<i>Ceratonia siliqua</i> , branches	Greece	P.W. Crous & M.J. Wingfield, 1 Jun. 2006	<b>MK810909</b>	<b>MK810796</b>	<b>MK887802</b>	<b>MK888733</b>	<b>MK926471</b>
<i>F. siciliana</i>	CBS 105.85 <sup>T</sup>	<i>Chamaerops humilis</i>	Italy	W. Gams, Nov. 1984	<b>MK810910</b>	<b>MK810797</b>	<b>MN091924</b>	<b>MK888734</b>	<b>MK926472</b>
<i>Neocoleroa metrosideri</i>	ICMP 21139 <sup>T</sup>	<i>Metrosideros excelsa</i>	New Zealand	P.R. Johnston, 6 Oct. 2015	KU131678	KU131677	–	–	–
<i>Nc. cameroonensis</i>	CBS 129041 <sup>T</sup>	<i>Crematogaster</i> sp. (ant) carton on <i>Barteria nigriflora</i>	Cameroon	R. Blatrix, 19 Dec. 2009	<b>MK810902</b>	<b>MK810789</b>	<b>MK887797</b>	<b>MK888727</b>	<b>MN078219</b>
<i>Neofusicladium eucalypti</i>	CBS 128216 <sup>T</sup>	<i>Eucalyptus regnans</i> , leaf litter	Australia	P.W. Crous & R.G. Shivas, 12 Jul. 2009	<b>MK810903</b>	<b>MK810790</b>	<b>MK887798</b>	<b>MK888728</b>	<b>MK926468</b>
<i>Nf. eucalypticola</i>	CBS 141301 <sup>T</sup>	<i>Eucalyptus robusta</i> , leaf litter	France	P.W. Crous & M.J. Wingfield, 8 Mar. 2015	<b>MK810904</b>	<b>MK810791</b>	<b>MK887799</b>	<b>MK888729</b>	–
	CBS 143427	<i>Eucalyptus dunnii</i> , leaves	Australia	A.J. Carnegie, 20 Jan. 2016	<b>MK810905</b>	<b>MK810792</b>	–	–	–
<i>Nf. regnans</i>	CBS 143411 <sup>T</sup>	<i>Eucalyptus regnans</i> , leaves	Australia	P.W. Crous, 30 Nov. 2016	MG386066	MG386119	–	–	MG386169
<i>Parafusicladium amoenum</i>	CBS 254.95 <sup>T</sup>	<i>Eucalyptus</i> sp., fallen leaves	Cuba	R.F. Castañeda, 2 Nov. 1994	<b>MK810906</b>	<b>MK810793</b>	–	<b>MK888730</b>	<b>MK926469</b>

Table 1. (Continued).

Taxa	Culture accession number(s) <sup>1</sup>	Host, substrate	Country	Collector and collection date	GenBank accession numbers <sup>2</sup>				
					ITS	LSU	<i>rpb2</i>	<i>tef1</i>	<i>tub2</i>
<i>Pa. intermedium</i>	CBS 110746 <sup>T</sup>	<i>Eucalyptus</i> sp., leaf litter	Madagascar	P.W. Crous, 30 Apr. 1994	<b>MK810907</b>	<b>MK810794</b>	<b>MK887800</b>	<b>MK888731</b>	<b>MK926470</b>
<i>Pa. paraamoenum</i>	CBS 141322 <sup>T</sup>	<i>Eucalyptus regnans</i> , leaf litter	Australia	P.W. Crous, J. Edwards & P.W.J. Taylor, 9 Nov. 2014	<b>MK810908</b>	<b>MK810795</b>	<b>MK887801</b>	<b>MK888732</b>	–
<i>Pinaceicola cordae</i>	CBS 126959 <sup>T</sup>	<i>Pinus sylvestris</i> , litter needles	Czech Republic	O. Koukol, 11 Dec. 2006	<b>MK810911</b>	<b>MK810798</b>	–	<b>MK888735</b>	<b>MK926473</b>
	CBS 675.82	<i>Pinus sylvestris</i> , litter needles	Netherlands	G.S. de Hoog, 8 Nov. 1982	<b>MK810912</b>	<b>MK810799</b>	–	<b>MK888736</b>	<b>MK926474</b>
	CBS 143494	<i>Pinus sylvestris</i> , litter needles	Germany	R.K. Schumacher, 5 Feb. 2016	<b>MK810913</b>	<b>MK810800</b>	–	<b>MK888737</b>	<b>MK926475</b>
<i>Pi. pini</i>	CBS 462.82	<i>Pinus</i> sp., litter needles	Netherlands	G.S. de Hoog, 12 Apr. 1982	<b>MK810914</b>	<b>MK810801</b>	<b>MK887803</b>	<b>MK888738</b>	<b>MK926476</b>
	CBS 463.82 <sup>T</sup>	<i>Pinus sylvestris</i> , litter needles	Netherlands	G.S. de Hoog, 12 Apr. 1982	<b>MK810915</b>	<b>MK810802</b>	<b>MK887804</b>	<b>MK888739</b>	<b>MK926477</b>
<i>Pseudosigmoidea excentrica</i>	CBS 469.95 <sup>T</sup>	<i>Lauraceae</i> , leaf litter	Cuba	R.F. Castañeda, 6 Aug. 1994	HQ667543	KF282669	–	KF155975	<b>MK926478</b>
<i>Ps. ibarakiensis</i>	NBRC 107891 <sup>T</sup>	Natural forest soil	Japan	–, 2008	LC146758	LC146759	–	–	–
<i>Scolecobasidium anellii</i>	CBS 284.64 <sup>T</sup>	Stalactite	Italy	A. Graniti, –	FR832477	KF156138	KF282684	KF155995	KF156184
<i>Sc. anomalum</i>	CBS 131816 <sup>T</sup>	Cave sediment	France	F. Bastian, –	HE575201	KF156137	HE575205	KF155986	KF156194
<i>Sc. aquaticum</i>	CBS 140316 <sup>T</sup>	Silicone seal in shower of fish-processing company	Germany	K. Gloyna, 28 Oct. 2014	KX668258	KX668259	–	–	–
<i>Sc. constrictum</i>	CBS 211.53 <sup>T</sup>	Soil	Canada: Ontario	R.G. Atkinson, 1952	HQ667519	KF282653	KF282686	KF156005	KF156187
<i>Sc. cordanae</i>	CBS 475.80 <sup>T</sup>	<i>Mauritia minor</i> , leaf litter	Colombia	W. Gams & O. Vargas, 10 Dec. 1979	KF156022	KF156122	KF282687	KF155981	–
<i>Sc. dracaenae</i>	CBS 141323 <sup>T</sup>	<i>Dracaena reflexa</i> , leaf spots	USA	P.W. Crous, Aug. 20113	KX228283	KX228334	KX228370	KX228377	–
<i>Sc. ellipsoideum</i>	CBS 131796 <sup>T</sup>	Soil	China	Hui-Mei Liu, –	<b>MN077367</b>	–	KC337073	–	–
<i>Sc. gamsii</i>	CBS 239.78 <sup>T</sup>	<i>Caryota plumosa</i> , leaf	Sri Lanka	W. Gams, Jan. 1973	KF156019	KF156150	–	KF155982	KF156190
<i>Sc. globale</i>	CBS 119644 <sup>T</sup>	Indoor sample, house	Germany	–, 2002	KF961086	KF961097	–	KF961075	KF961065
<i>Sc. icarus</i>	CBS 536.69 <sup>T</sup>	Forest soil	Canada: Ontario	–	HQ667524	KF156132	–	–	KF156174
<i>Sc. lascauxense</i>	CBS 131815 <sup>T</sup>	Black stain on cave sediment	France	Fabiola Bastian, 26 Aug. 2008	FR832474	KF156136	FR832481	KF155994	KF156183
<i>Sc. macrozamia</i>	CBS 137971 <sup>T</sup>	<i>Macrozamia</i> , leaf litter	Australia	P.W. Crous & R.G. Shivas, 16 Jul. 2009	KJ869123	KJ869180	–	–	–
<i>Sc. minimum</i>	CBS 510.71 <sup>T</sup>	<i>Gossypium arboreum</i> , rhizosphere	Nigeria	M. Dransfield, –	HQ667522	KF156134	–	KF156007	KF156172
<i>Sc. musae</i>	CBS 729.95 <sup>T</sup>	Regulator of diver	–	Streeklab voor Volksgezondheid Haarlem, –	KF156029	KF156144	KF282693	KF155999	KF156171
<i>Sc. musicola</i>	CBS 144441 <sup>T</sup>	<i>Musa</i> sp., leaf	Malaysia	P.W. Crous, 2010	MH327824	MH327860	–	MH327887	–
<i>Sc. olivaceum</i>	CBS 137170 <sup>T</sup>	Man, bronchoalveolar lavage fluid	USA: Utah	D.A. Sutton, 2010	LM644521	LM644564	–	–	LM644605
<i>Sc. pandanicola</i>	CBS 140660 <sup>T</sup>	<i>Pandanus utilis</i> , leaves	France	P.W. Crous & M.J. Wingfield, 6 Mar. 2014	KT950850	KT950864	–	–	–

(continued on next page)

Table 1. (Continued).

Taxa	Culture accession number(s) <sup>1</sup>	Host, substrate	Country	Collector and collection date	GenBank accession numbers <sup>2</sup>				
					ITS	LSU	<i>rpb2</i>	<i>tef1</i>	<i>tub2</i>
<i>Sc. phaeophorum</i>	CBS 206.96 <sup>T</sup>	Leaf in coastal rain forest	Papua New Guinea	A. Aptroot & A. van Iperen, 1995	KP798631	KP798634	KF282692	KT272098	KT272062
<i>Sc. podocarp</i>	CBS 143174 <sup>T</sup>	<i>Podocarpus grayae</i> , leaves	Australia	P.W. Crous, 25 Nov. 2016	MG386032	MG386085	–	MG386162	–
<i>Sc. ramosum</i>	UTHSC 12-1082 <sup>T</sup>	Man, nail	USA: California	D.A. Sutton, 2012	LM644524	LM644524	–	–	LM644608
<i>Sc. sexuales</i>	CBS 135765 <sup>T</sup>	Swabs (control in a laboratory providing medical supplies)	South Africa	E.J. van der Linde, 2012	KF156018	KF156118	–	KF155976	KF156189
<i>Sc. terreum</i>	CBS 203.27 <sup>T</sup>	Soil	USA: Louisiana	E.V. Abbott, 1927	HQ667544	–	KF282698	–	HQ877665
<i>Sc. tshawytschae</i>	CBS 100438 <sup>T</sup>	Fish	–	M.S. Doty	HQ667562	KF156126	KF282697	KF155990	KF156180
<i>Sc. verrucosum</i>	CBS 383.81 <sup>T</sup>	Soil	India	S. Zachariah, –	KF156015	KF156129	–	KT272099	KF156185
<i>Sterila eucalypti</i>	CPC 14942	<i>Eucalyptus</i> sp.	Portugal	P.W. Crous, 24 Jan. 2008	<b>MK810916</b>	<b>MK810803</b>	<b>MK887805</b>	<b>MK888740</b>	–
	CPC 14943	<i>Eucalyptus</i> sp.	Portugal	P.W. Crous, 24 Jan. 2008	<b>MK810917</b>	<b>MK810804</b>	<b>MK887806</b>	<b>MK888741</b>	–
	CBS 144019 <sup>T</sup>	<i>Eucalyptus</i> sp.	Portugal	P.W. Crous, 24 Jan. 2008	<b>MK810918</b>	<b>MK810805</b>	<b>MK887807</b>	<b>MK888742</b>	–
<i>Sympoventuria africana</i>	CBS 121639 <sup>T</sup>	<i>Eucalyptus</i> sp., leaf litter	South Africa	P.W. Crous, 2006	<b>MK810919</b>	<b>MK810806</b>	<b>MK887808</b>	<b>MK888743</b>	<b>MK926479</b>
	CBS 121640	<i>Eucalyptus</i> sp., leaf litter	South Africa	P.W. Crous, 2006	<b>MK810920</b>	<b>MK810807</b>	<b>MK887809</b>	<b>MK888744</b>	<b>MK926480</b>
<i>Sy. capensis</i>	CBS 120136 <sup>T</sup>	<i>Eucalyptus</i> sp., leaf litter	South Africa	P.W. Crous, Jan. 2006	<b>MK810921</b>	<b>MK810808</b>	<b>MK887810</b>	<b>MK888745</b>	<b>MK926481</b>
	CPC 12839	<i>Eucalyptus</i> sp., leaf litter	South Africa	P.W. Crous, Jan. 2006	<b>MK810922</b>	<b>MK810809</b>	<b>MK887811</b>	<b>MK888746</b>	<b>MK926482</b>
	CPC 12840	<i>Eucalyptus</i> sp., leaf litter	South Africa	P.W. Crous, Jan. 2006	<b>MK810923</b>	<b>MK810810</b>	<b>MK887812</b>	<b>MK888747</b>	<b>MK926483</b>
<i>Sy. melaleuca</i>	CBS 143407 <sup>T</sup>	<i>Melaleuca</i> sp., leaves	Australia	P.W. Crous, 2 Dec. 2016	MG386059	MG386112	–	–	MG386168
<i>Troposporella fumosa</i>	CBS 351.94	Plant litter	Italy	A. van Beverwijk, Sep. 1954	<b>MK810924</b>	MH874121	–	–	–
<i>T. monilipes</i>	MUCL 19867	–	Sweden	G.L. Hennebert, –	DQ351723	AY856871	–	–	–
<i>T. olivaceum</i>	CBS 728.83	<i>Dicksonia antarctica</i> , dead petiole	Australia	W. Gams, Aug. 1983	MH861681	MH873393	–	–	–
<i>Veronaepsis simplex</i>	CBS 588.66 <sup>T</sup>	<i>Acacia karroo</i> , leaf litter	South Africa	M.C. Papendorf, –	EU041820	EU041877	<b>MN091925</b>	–	–
<i>Verruconis calidifluminalis</i>	CBS 125818 <sup>T</sup>	Water of a hot stream	Japan	–, 1 Mar. 2004	AB385698	KF156108	–	KF155959	–
<i>V. gallopava</i>	CBS 118.91	Man	USA: Georgia	A.A. Padhye, –	HQ667551	KF282655	KF282688	JF440539	HQ877643
	CBS 437.64 <sup>T</sup>	<i>Meleagris gallopavo</i> (turkey), brain abscess	USA: South Carolina	W.B. Cooke, –	HQ667553	KF282656	KF282689	KF155968	KF156203
	CBS 867.95	Sputum from patient with angina and left ventricular heart dysfunction	USA: Maryland	A.A. Padhye, CDC, Atlanta, USA, –	HQ667561	KF282657	KF282690	KF155972	KF156213
<i>V. panacis</i>	CGMCC 3.18302 <sup>T</sup>	<i>Panax notoginseng</i> , root	China: Yunnan province	Y. Zhang, 15 Oct. 2015	MF536882	MF536880	–	MF536881	MF536883
<i>V. terricola</i>	CBS 131795 <sup>T</sup>	Soil	China	Y.L. Zhang, Dec. 2009	<b>MK810925</b>	<b>MK810811</b>	KC337072	–	–
<i>V. verruculosa</i>	CBS 119775	<i>Hevea</i> sp., root	Malaysia	–	KF156014	KF282668	–	KF155974	KF156193
<b>Venturiaceae</b>									
<i>Apiosporina collinsii</i>	CBS 118973	<i>Amelanchier alnifolia</i>	Canada: Ontario	–	<b>MK810926</b>	<b>MK810812</b>	<b>MK887813</b>	<b>MK888748</b>	–

Table 1. (Continued).

Taxa	Culture accession number(s) <sup>1</sup>	Host, substrate	Country	Collector and collection date	GenBank accession numbers <sup>2</sup>				
					ITS	LSU	<i>rpb2</i>	<i>tef1</i>	<i>tub2</i>
<i>A. morbosa</i>	dimosp	<i>Prunus</i> sp.	USA: Washington	–	–	EF114694	–	–	–
<i>Coleroa circinans</i>	CBS 457.64	<i>Geranium rotundifolium</i>	France	C. Bachmann, 26 Jun. 1961	MK810931	MK810817	MK887818	MK888753	MN078220
<i>C. robertiani</i>	CBS 458.64 <sup>T</sup>	<i>Geranium robertianum</i>	Switzerland	C. Bachmann, 28 Sep. 1960	MK810932	MK810818	MK887819	MK888754	MK926488
<i>Coleroa</i> sp. 1	CBS 372.53	<i>Acer pseudoplatanus</i>	Switzerland	–	MK810927	MK810813	MK887814	MK888749	MK926484
	CBS 372.55	<i>Cephalaria alpina</i>	Switzerland	–	MK810930	MK810816	MK887817	MK888752	MK926487
<i>Coleroa</i> sp. 2	CBS 378.49	<i>Gentiana lutea</i>	Switzerland	J.A. von Arx, 5 Jun. 1949	MK810929	MK810815	MK887816	MK888751	MK926486
<i>Coleroa</i> sp. 3	CBS 370.55	<i>Anemone alpina</i>	France	–	MK810928	MK810814	MK887815	MK888750	MK926485
<i>Cylindrosymptodioides brabeji</i>	CBS 141285 <sup>T</sup>	<i>Brabejum stellatifolium</i> , leaf litter	South Africa	P.W. Crous & M.J. Wingfield, 17 Jan. 2015	KX228256	KX228308	–	–	–
<i>Fagicola fagi</i>	CBS 621.84 <sup>T</sup>	<i>Fagus sylvatica</i> , decaying leaves	Netherlands	G.S. de Hoog, 1 Oct. 1984	MK810933	MK810819	MK887820	MK888755	MK926489
<i>Fraxinicola europaea</i>	CBS 472.61 <sup>T</sup>	<i>Betula alba</i>	Switzerland	E. Müller, 8 Apr. 1959	MK810934	MK810820	MK887821	MK888756	MK926490
	CBS 477.61	<i>Populus tremula</i>	France	–	MK810935	MK810821	MK887822	MK888757	MK926491
	CBS 689.85	<i>Populus tremula</i> , leaf litter	France	–	MK810936	MK810822	MK887823	MK888758	MK926492
	CBS 377.53	<i>Epilobium montanum</i>	France	–	MK810937	MK810823	MK887824	MK888759	MK926493
<i>F. fraxini</i>	CBS 130599 <sup>T</sup>	Leaves of <i>Protea</i> sp., in association with <i>Vizella interrupta</i>	South Africa	P.W. Crous, 5 May 2010	MK810938	MK810824	MK887825	MK888760	MK926494
	CBS 140929	<i>Fraxinus ornus</i> , leaf endophyte	Italy	M. Schlegel, –	MK810939	MK810825	MK887826	MK888761	MK926495
	CBS 140930 <sup>T</sup>	<i>Fraxinus excelsior</i> , leaf endophyte	Switzerland	M. Schlegel, –	MK810940	MK810826	MK887827	MK888762	MK926496
	CBS 140935	<i>Fraxinus excelsior</i> , leaf litter	Switzerland	M. Ibrahim, –	MK810941	MK810827	MK887828	MK888763	MK926497
<i>F. italica</i>	CBS 374.55	<i>Fraxinus excelsior</i>	Switzerland	E. Müller, 10 Jul. 1953	MK810942	MK810828	MK887829	MK888764	MK926498
	CBS 140918 <sup>T</sup>	<i>Fraxinus ornus</i> , leaf endophyte	Italy	M. Ibrahim, 5 Nov. 2013	MK810943	MK810829	MK887830	MK888765	MK926499
<i>F. omi</i>	CBS 140919	<i>Fraxinus ornus</i> , leaf endophyte	Italy	M. Ibrahim, 5 Nov. 2013	MK810944	MK810830	MK887831	MK888766	MK926500
	CBS 140920	<i>Fraxinus ornus</i> , leaf endophyte	Italy	M. Ibrahim, 5 Nov. 2013	MK810945	MK810831	MK887832	MK888767	MK926501
	CBS 140921	<i>Fraxinus ornus</i> , leaf endophyte	Italy	M. Ibrahim, 5 Nov. 2013	MK810946	MK810832	MK887833	MK888768	MK926502
	CBS 140922	<i>Fraxinus ornus</i> , leaf endophyte	Switzerland	M. Ibrahim, 13 Nov. 2013	MK810947	MK810833	MK887834	MK888769	MK926503
	CBS 140924 <sup>T</sup>	<i>Fraxinus ornus</i> , leaf litter	Switzerland	M. Schlegel, 4 May 2015	MK810948	MK810834	MK887835	MK888770	MK926504
<i>Gibbera conferta</i>	CBS 191.53	<i>Vaccinium uliginosum</i>	Switzerland	E. Müller, –	–	GU301814	–	–	–
<i>Helicoon myosuroides</i>	CBS 743.96 <sup>T</sup>	<i>Betula pubescens</i> , leaf	Austria	H. Voglmayr, 23 Oct. 1993	MH862608	MH874233	–	–	–
<i>Metacoleroa dickiei</i>	medipc	<i>Linnaea borealis</i>	USA: Oregon	–	–	EF114695	–	–	–
<i>Protoventuria barriae</i>	CBS 300.93	<i>Vaccinium macrocarpon</i>	USA	L.M. Carris, –	MK810949	JQ036232	MK887836	MK888771	MK926505
<i>Tyrannosorus hystrioides</i>	CBS 117727 <sup>T</sup>	<i>Prunus avium</i> cv. Bing, Bing cherry fruit	USA	–	MK810950	MK810835	MK887837	MK888772	MK926506

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Table 1. (Continued).

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					ITS	LSU	<i>rpb2</i>	<i>tef1</i>	<i>tub2</i>
<i>T. lichenicola</i>	CBS 144018 <sup>T</sup>	<i>Letharia</i> sp.	USA	A. Smith, 27 May 2013	MK810953	MK810838	MK887840	MK888775	MK926509
<i>T. pini-sylvestris</i>	CBS 143393 <sup>T</sup>	<i>Pinus sylvestris</i> , needles	Germany	R.K. Schumacher, 5 Feb. 2016	MK810952	MK810837	MK887839	MK888774	MK926508
<i>T. pinicola</i>	CBS 124.88 <sup>T</sup>	<i>Pinus</i> wood, from river	Pakistan	O. Petrini, –	MK810951	MK810836	MK887838	MK888773	MK926507
<i>Venturia albae</i>	CBS 468.61	<i>Salix alba</i>	Liechtenstein	J. Nüesch, 13 May 1958	MK810954	MK810839	MK887841	MK888776	MK926510
	CBS 471.61 <sup>T</sup>	<i>Salix alba</i>	Liechtenstein	–	MK810955	MK810840	MK887842	MK888777	MK926511
<i>V. atriseda</i>	CBS 371.55	<i>Gentiana punctata</i>	Switzerland	–	EU035448	–	–	–	KF808265
<i>V. aucupariae</i>	CBS 365.35	<i>Sorbus aucuparia moravica</i>	Germany	–	MK810956	MK810841	MK887843	MK888778	MK926512
	CBS 366.35	<i>Sorbus aucuparia moravica</i>	Germany	–	MK810957	MK810842	MK887844	MK888779	MK926513
<i>V. australiana</i>	CBS 128286 <sup>T</sup>	Leaf spot of unknown plant	Australia	–	MK810958	MK810843	–	–	MK926514
<i>V. caesia</i>	CBS 466.61 <sup>T</sup>	<i>Salix caesia</i>	Switzerland	J. Nüesch, 2 Jul. 1959	MK810959	MK810844	MK887845	MK888780	MK926515
<i>V. catenospora</i>	CGMCC 3.18369	<i>Salix</i> sp.	China	Y. Zhang & Y. Zhou, 22 Aug. 2014	MK810960	MK810845	–	MK888781	–
	CBS 447.91 <sup>T</sup>	<i>Salix triandra</i> , brown leaf spot	Germany	H. Butin, 7 Aug. 1990	MK810961	MK810846	MK887846	MK888782	MK926516
	CBS 469.61	<i>Salix caprea</i>	Switzerland	J. Nüesch, 10 Jun. 1958	MK810962	MK810847	MK887847	MK888783	MK926517
<i>V. cerasi</i>	CBS 160.55	<i>Prunus amygdalus</i> , fruit	USA: California	–	MK810963	MK810848	MK887848	MK888784	MK926518
	CBS 444.54	<i>Prunus cerasus</i> 'Schattenmorelle'	Germany	–	MK810964	MK810849	MK887849	MK888785	MK926519
	CBS 497.62	<i>Prunus domestica</i> subsp. <i>syriaca</i> 'Mirabelle'	Switzerland	–	MK810965	MK810850	–	MK888786	MK926520
<i>V. chinensis</i>	CGMCC 3.17685 <sup>T</sup>	<i>Lonicera praeflorens</i>	China	Y. Zhang & Y. Zhou, 26 Aug. 2014	MK810966	MK810851	MK887850	MK888787	MK926521
<i>V. chlorospora</i>	CBS 467.61	<i>Salix daphnoides</i>	Switzerland	J. Nüesch, 2 Jul. 1959	MK810967	MK810852	MK887851	MK888788	MK926522
	CBS 470.61	<i>Salix daphnoides</i>	France	J. Nüesch, 25 Jun. 1958	MK810968	MK810853	MK887852	MK888789	MK926523
<i>V. convolvularum</i>	CBS 112706 <sup>T</sup>	<i>Convolvulus arvensis</i> , leaves	New Zealand	C.F. Hill, 7 Nov. 2000	MK810969	MK810854	MK887853	MK888790	MK926524
<i>V. crataegi</i>	CBS 367.35	<i>Sorbus aucuparia rossica</i>	Germany	–	MK810970	MK810855	MK887854	MK888791	MK926525
	CBS 368.35	<i>Crataegus</i> sp.	Germany	–	MK810971	MK810856	MK887855	MK888792	MK926526
	CBS 369.35	<i>Crataegus</i> sp.	Germany	–	MK810972	MK810857	MK887856	MK888793	MK926527
<i>V. ditricha</i>	CBS 115426	<i>Betula pubescens</i> var. <i>tortuosa</i>	Finland	M. Helander, 1 Aug. 1992	MK810973	MK810858	MK887857	MK888794	MK926528
	CBS 118894	<i>Betula pubescens</i> var. <i>tortuosa</i> , leaves	Finland	M. Helander, –	MK810974	MK810859	MK887858	MK888795	MK926529
	CBS 257.38	<i>Populus tremula</i>	Italy	O. Servazzi, –	MK810975	MK810860	MK887859	MK888796	MK926530
<i>V. finlandica</i>	CBS 112703	<i>Betula pubescens</i> var. <i>tortuosa</i>	Finland	M. Helander, 1 Jul. 1993	MK810976	MK810861	–	MK888797	MK926531
	CBS 115442 <sup>T</sup>	<i>Betula pubescens</i> var. <i>tortuosa</i>	Finland	M. Helander, –	MK810977	MK810862	–	MK888798	MK926532
<i>V. fuliginosa</i>	CGMCC 3.18370 <sup>T</sup>	<i>Salix capitata</i>	China	Y. Zhang & Y. Zhou, 27 Aug. 2014	MK810978	MK810863	MK887860	MK888799	MK926533



Table 1. (Continued).

Taxa	Culture accession number(s) <sup>1</sup>	Host, substrate	Country	Collector and collection date	GenBank accession numbers <sup>2</sup>				
					ITS	LSU	<i>rpb2</i>	<i>tef1</i>	<i>tub2</i>
<i>V. helvetica</i>	CBS 474.61	<i>Salix helvetica</i>	Switzerland	J. Nüesch, 2 Jul. 1959	MK810979	MK810864	MK887861	MK888800	MK926534
	CBS 475.61	<i>Salix helvetica</i>	Switzerland	J. Nüesch, 1 Jul. 1959	MK810980	MK810865	MK887862	MK888801	MK926535
<i>V. inaequalis</i>	CGMCC 3.18372	<i>Malus</i> sp.	China	F. Ma, 27 Jul. 2015	MK810981	MK810866	MK887863	MK888802	MK926536
	CBS 120625	Apple ( <i>Malus x domestica</i> )	South Africa	–	MK810982	MK810867	MK887864	MK888803	MK926537
	CBS 120627 <sup>T</sup>	Apple ( <i>Malus x domestica</i> )	Sweden	–	MK810983	MK810868	MK887865	MK888804	MK926538
<i>V. loniceræ</i>	CBS 445.54	<i>Lonicera coerulea</i>	Switzerland	–	MK810984	MK810869	MK887866	MK888805	MK926539
<i>V. mandshuricum</i>	CBS 112235 <sup>T</sup>	<i>Populus simonii</i>	China	–, 20 Apr. 1993	MK810985	MK810870	MK887867	MK888806	MK926540
<i>V. martianoffiana</i>	CGMCC 3.18375	<i>Populus</i> sp.	China	Y. Zhang, 27 Aug. 2014	MK810986	MK810871	MN091926	MK888807	MK926541
	CGMCC 3.18377	<i>Populus</i> sp.	China	Y. Zhang, 4 Nov. 2015	MK810987	MK810872	MK887868	MK888808	MK926542
<i>V. minuta</i>	CBS 478.61 <sup>T</sup>	<i>Salix nigricans</i>	Switzerland	J. Nüesch, 20 May 1959	MK810988	MK810873	–	MK888809	MK926543
	CBS 479.61	<i>Salix cinerea</i>	Switzerland	J. Nüesch, 20 May 1959	MK810989	MK810874	–	MK888810	MK926544
<i>V. nashicola</i>	CBS 793.84	<i>Pyrus serotina</i> var. <i>culta</i>	Japan	–	MK810990	MK810875	MK887869	MK888811	MN078221
	CBS 794.84	<i>Pyrus serotina</i> var. <i>culta</i>	Japan	–	MK810991	MK810876	MK887870	MK888812	MK926545
<i>V. oleaginea</i>	CBS 113427	<i>Olea europaea</i>	New Zealand	–	MK810992	MK810877	MK887871	–	MN078222
	CBS 113539	–	Portugal	B. d'Oliveira, –	MK810993	MK810878	MK887872	–	MN078223
	CBS 120629	<i>Olea europaea</i>	Morocco	–	MK810994	MK810879	MK887873	–	MK926546
<i>V. peltigericola</i>	CBS 370.35	<i>Betula verrucosa</i>	Germany	–	MK810995	MK810880	MK887874	MK888813	MK926547
	CBS 371.35	<i>Betula verrucosa</i>	Germany	–	MK810996	MK810881	MK887875	MK888814	MN078224
	CBS 128206 <sup>T</sup>	Lichen on ground surface, <i>Peltigera rufescens</i> , along with <i>Hawksworthiana peltigericola</i>	Luxembourg	P. Diederich, May 2008	HQ599579	HQ599579	–	–	–
<i>V. phaeosepta</i>	CGMCC3.18373	<i>Populus</i> sp.	China	Y. Zhang, 6 Aug. 2015	MK810997	MK810882	MK887876	MK888815	MK926548
	CGMCC3.18371	<i>Populus</i> sp.	China	Y. Zhang, 20 May 2014	MK810998	MK810883	MK887877	MK888816	MK926549
	CGMCC3.18368 <sup>T</sup>	<i>Populus</i> sp.	China	Y. Zhang, 20 May 2014	MK810999	MK810884	MK887878	MK888817	MK926550
<i>V. polygoni-vivipari</i>	CBS 114207	<i>Polygonum viviparum</i>	Norway	K. & L. Holm, 12 Aug. 1988	MK811003	MK810888	MK887882	MK888821	MK926554
<i>V. populina</i>	CBS 256.38	<i>Populus canadensis</i>	Italy	–	MK811004	MK810889	MK887883	MK888822	MK926555
	CBS 316.58	<i>Populus</i> sp.	Italy	–	MK811005	–	MK887884	MK888823	MK926556
<i>V. pyrina</i>	CBS 120825	<i>Pyrus communis</i>	Brazil	–	MK811000	MK810885	MK887879	MK888818	MK926551
	CBS 123189	<i>Pyrus communis</i>	New Zealand	C.F. Hill, 20 Apr. 2008	MK811001	MK810886	MK887880	MK888819	MK926552
	CBS 379.35	–	Germany	–	MK811002	MK810887	MK887881	MK888820	MK926553
<i>V. quebecensis</i>	CBS 695.85 <sup>T</sup>	<i>Populus tremuloides</i> , leaf spot	Canada: Quebec	–	MK811006	MK810890	MK887885	MK888824	MK926557

(continued on next page)

Table 1. (Continued).

Taxa	Culture accession number(s) <sup>1</sup>	Host, substrate	Country	Collector and collection date	GenBank accession numbers <sup>2</sup>				
					ITS	LSU	<i>rpb2</i>	<i>tef1</i>	<i>tub2</i>
<i>V. saliciperda</i>	CBS 480.61 <sup>T</sup>	<i>Salix cordata</i>	Switzerland	–	<b>MK811007</b>	<b>MK810891</b>	<b>MK887886</b>	<b>MK888825</b>	<b>MK926558</b>
	CBS 481.61	<i>Salix elegantissima</i>	Switzerland	–	<b>MK811008</b>	<b>MK810892</b>	<b>MK887887</b>	<b>MK888826</b>	<b>MK926559</b>
<i>V. tremulae</i>	CBS 112625	<i>Populus tremula</i>	France	–, 1 Sep. 1977	<b>MK811009</b>	<b>MK810893</b>	<b>MK887888</b>	<b>MK888827</b>	<b>MK926560</b>
	CBS 694.85	<i>Populus alba</i> , leaf spot	France	–	<b>MK811010</b>	<b>MK810894</b>	<b>MK887889</b>	<b>MK888828</b>	<b>MK926561</b>
	CBS 692.85	<i>Populus tremula</i> , leaf spot	France	–	<b>MK811011</b>	<b>MK810895</b>	<b>MK887890</b>	<b>MK888829</b>	<b>MK926562</b>
	CBS 693.85	<i>Populus tremula</i> , leaf spot	France	–	<b>MK811012</b>	<b>MK810896</b>	<b>MK887891</b>	<b>MK888830</b>	<b>MK926563</b>
	CBS 690.85	<i>Populus tremula</i> , leaf litter	France	–	<b>MK811013</b>	<b>MK810897</b>	–	<b>MK888831</b>	<b>MK926564</b>
<i>V. viennotii</i>	CBS 691.85	<i>Populus tremula</i> , leaf litter	France	–	<b>MK811014</b>	<b>MK810898</b>	–	<b>MK888832</b>	<b>MK926565</b>
	<b>Outgroup</b>								
<i>Microthyrium microscopicum</i>	CBS 115976	–	Netherlands	–	JGI project 1011369	GU301846	GU371734	GU349042	JGI project 1011369

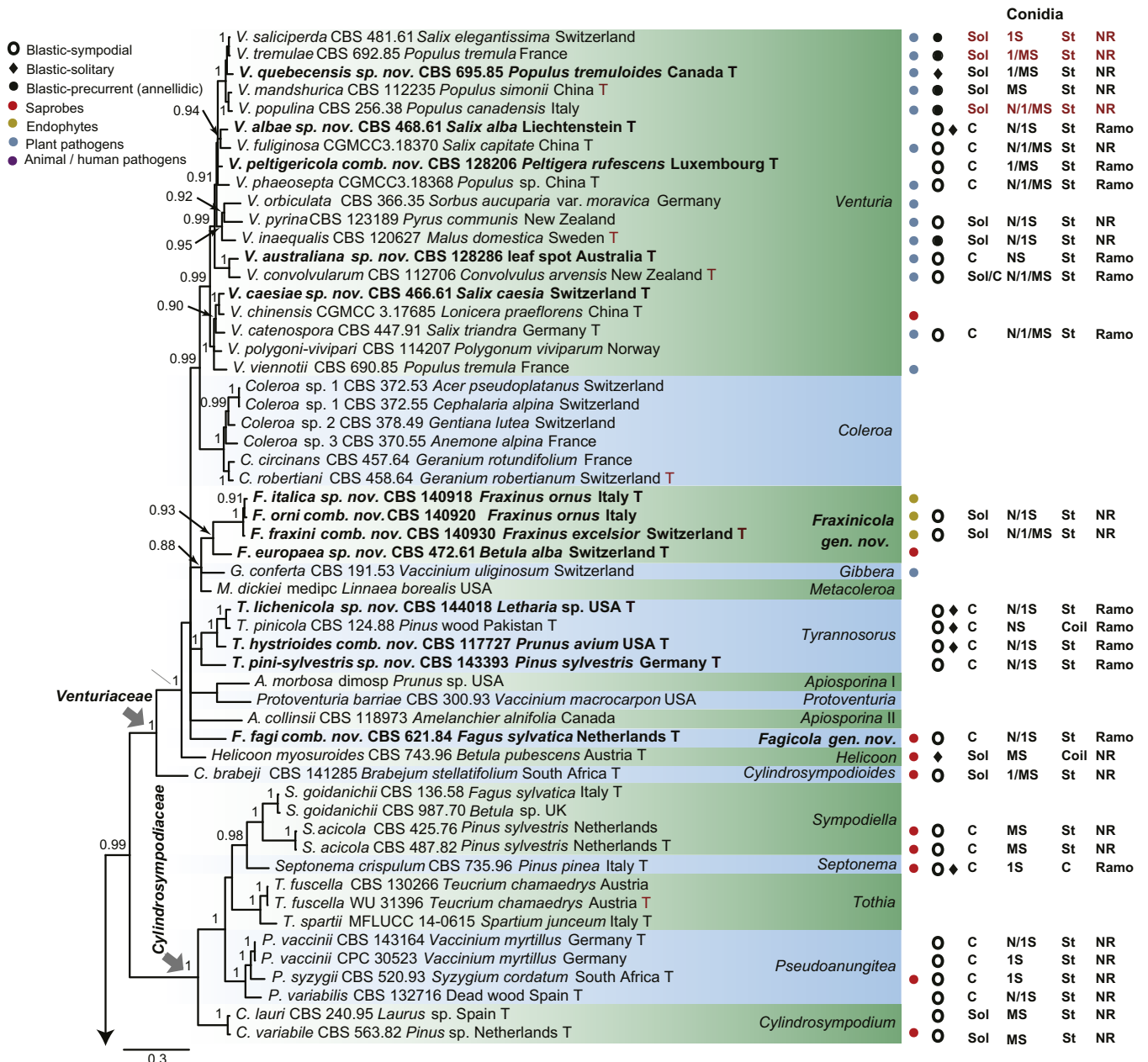
<sup>1</sup> CBS: Westerdijk Fungal Biodiversity Institute, Utrecht, the Netherlands; CGMCC: Chinese General Microbiological Culture Collection Center, Beijing, China; CPC: Culture collection of Pedro Crous, housed at Westerdijk Fungal Biodiversity Institute; MFLUCC: Mae Fah Luang University Culture Collection, Chiang Rai, Thailand; MUCL: Université Catholique de Louvain, Louvain-la-Neuve, Belgium; PDD Herbarium of Plant Diseases Division; UTHSC: Fungus Testing Laboratory, Department of Pathology at the University of Texas Health Science Center, San Antonio, Texas, USA. A superscript T denotes cultures with a type status.

<sup>2</sup> ITS: internal transcribed spacers and intervening 5.8S nrDNA; LSU: partial 28S large subunit RNA gene; *tef1*: partial translation elongation factor 1-alpha gene; *tub2*: partial beta-tubulin gene; *rpb2*: partial DNA-directed RNA polymerase II second largest subunit gene. Bold GenBank accession numbers represent sequences generated in this study; – indicates unavailable sequences or unknown collection data.

and *Sympoventuriaceae* (PP = 1), as well as the new family *Cylindrosympodiaceae* (PP = 1) (Fig. 1). The *Venturiaceae* clade comprised 11 generic lineages, including two new genera, *Fagicola* and *Fraxinicola* (Figs 1, 2). The fully supported clade of *Venturia* s. str. comprised 31 species including five newly described species, *V. quebecensis*, *V. albae*, *V. australiana*, *V. caesia* and *V. finlandica* (Figs 1, 2). The *Coleroa* clade (PP = 1) comprised five taxa, including *C. circinans* and *C. robertiani*, and three unidentified taxa (Figs 1, 2). *Fraxinicola*, a newly described genus of *Venturiaceae*, comprised two new species, *F. italica* and *F. europaea*, as well as two new combinations *F. orni* and *F. fraxini* (Figs 1, 2). *Gibbera* and *Metacoleroa* comprised one

species each, namely *G. conferta* and *M. dickiei*, respectively (Figs 1, 2). *Tyrannosorus* (PP = 1) comprised four species including two new species (*T. lichenicola* and *T. pini-sylvestris*) and one new combination (*T. hystrioides*) (Figs 1, 2). Species of *Apiosporina*, *A. morbosa* and *A. collinsii*, did not cluster in a monophyletic clade, but were separated by *Protoventuria barriae* (Fig. 1). *Helicoon myosuroides* was basal in *Venturiaceae*, but its inclusion in the family was fully supported (Fig. 1).

The *Cylindrosympodiaceae* clade (PP = 1), representing a new family of *Venturiales*, comprised four genera, namely *Sympodiella* (*S. goidanichii* and *S. acicula*), *Tothia* (*T. fuscella* and *T. spartii*), *Pseudoanungitea* (*P. vaccinii*, *P. syzygii* and



**Fig 1.** Consensus phylogram (50 % majority rule) of 691 952 trees resulting from a Bayesian analysis of the combined alignment of ITS, LSU, *tef1*, *tub2* and *rbp2* sequences of *Venturiales*. Bayesian posterior probabilities (PP) > 0.80 are shown at the nodes and the scale bar represents the expected changes per site. Some branches were shortened to facilitate layout. The tree was rooted with *Microthyrium microscopium* (CBS 115976). Culture collection numbers, substrates and countries are indicated behind the species names. Those highlighted in bold are new taxa or new combinations proposed in this study, and type strains are marked with "T" (ex-type in black, ex-epitype in red). Relevant morphological characteristics plotted are abbreviated as follows: Sol – conidia solitary, C – conidia in chains, NS – aseptate conidia, 1S – 1-septate conidia, MS – multi-septate conidia (septa ≥ 2), St – straight or slightly curved conidia, Coil – coiled conidia, Y – Y-shaped conidia; Ramo – ramoconidia present, NR – ramoconidia not observed; ? – asexual morphology not available (either from references or from sporulation induced in this study); and morphological characters plotted in red means strains failed to sporulate in this study and plotted values are taken from the original description, observation of this study or related references. Other characteristics are explained in the legend.

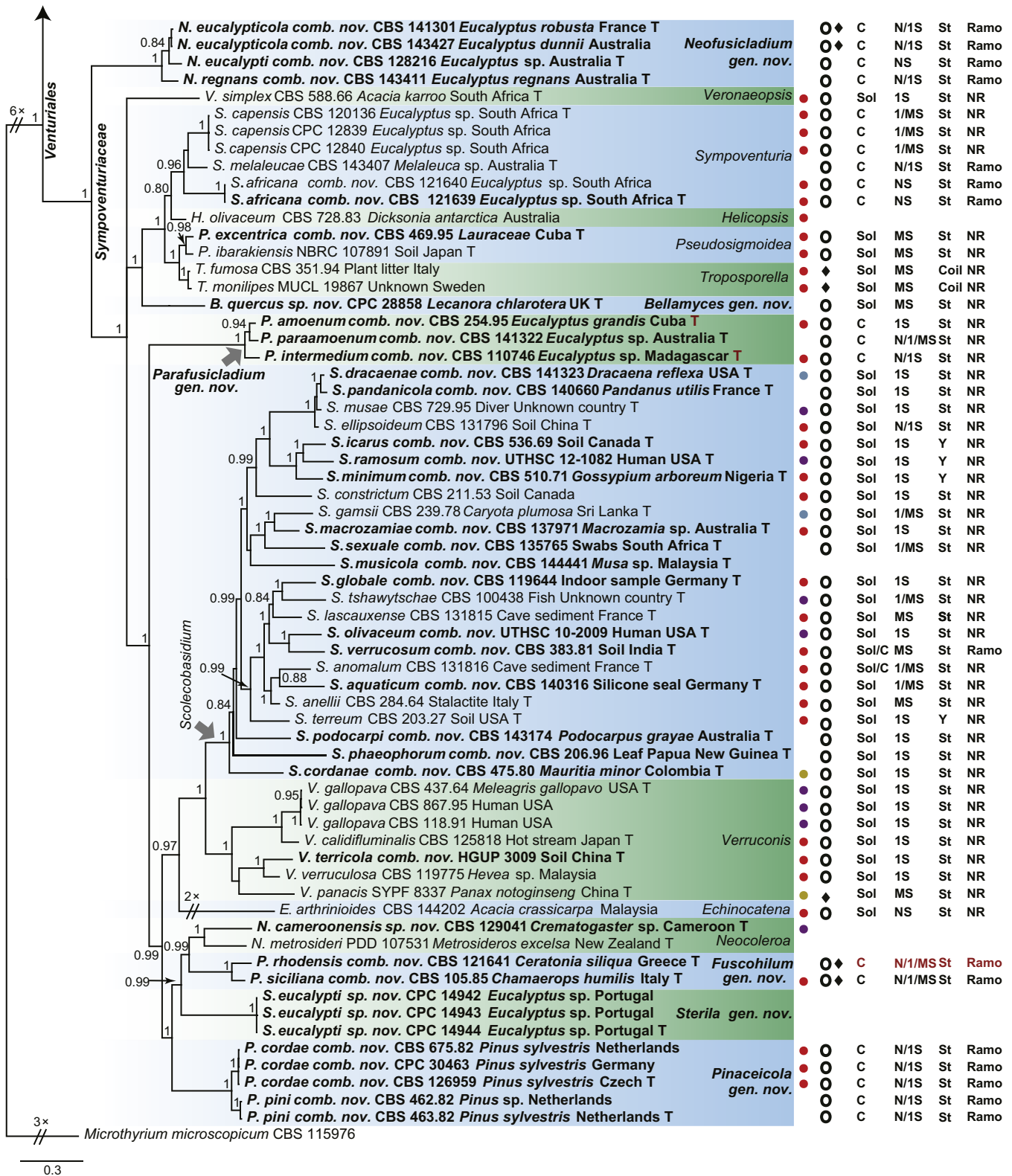


Fig 1. (Continued).

*P. variabilis*), and *Cylindrosyndonium* (*C. lauri* and *C. variabile*) (Fig. 1). Also included in this clade is *Septonema crispulum*, which is not congeneric with other *Septonema* species such as *S. fasciculare* and *S. secedens* (data not shown).

The Sympoventuriaceae (PP = 1; Fig. 1) comprised 14 genera, including six proposed here as new, viz., *Neofusicladium*, *Parafusicladium*, *Bellamyces*, *Fuscohilum*, *Sterila* and *Pinaceicola* (Fig. 1). The new genus *Neofusicladium*

(PP = 1) (*N. eucalypticola*, *N. eucalypti* and *N. regnans*), is basal in Sympoventuriaceae (Fig. 1). The Sympoventuria clade (PP = 0.96) comprised *S. capensis*, *S. melaleuca* and *S. africana*. *Troposporella* is paraphyletic with the type species *T. fumosa* clustering with *T. monilipes* (PP = 1) and *T. olivaceum* forming a distinct lineage (Fig. 1). *Pseudosigmoidea* (*P. excentrica* and *P. ibarakiensis*) formed a well-supported lineage (PP = 0.98) (Fig. 1). Three species formerly of *Fusicladium*,

namely *F. amoenum*, *F. paraamoenum* and *F. intermedium*, formed a well-supported clade (PP = 1; Fig. 1), and are allocated here to a new genus, *Parafusicladium* (as *P. amoenum*, *P. intermedium* and *P. paraamoenum*). *Parafusicladium* is basal to *Echinocatena*, *Neocoleroa*, *Fuscohilum*, *Pinaceicola*, *Scolecobasidium*, *Sterila* and *Verruconis*.

*Scolecobasidium* (PP = 1; Fig. 1) comprised 24 species, which chiefly clustered in two subclades, with one comprising *S. dracaenae*, *S. pandanicola*, *S. musae*, *S. ellipsoideum*, *S. icarus*, *S. ramosum*, *S. minimum*, *S. constrictum*, *S. gamsii*, *S. macrozamiaae*, *S. sexuales* and *S. musicola*, and the other comprising *S. globale*, *S. tshawytschae*, *S. lascauxense*, *S. olivaceum*, *S. verrucosum*, *S. anomalum*, *S. aquaticum*, *S. anellii* and *S. terreum* (Fig. 1). Another three species, namely *S. podocarp*, *S. phaeophorum* and *S. cordanae* were basal to other species of *Scolecobasidium* (Fig. 1). Members of *Verruconis* formed a fully supported clade (PP = 1; Fig. 1), which comprises *V. gallopava*, *V. calidifluminalis*, *V. terricola*, *V. verruculosa* and *V. panacis* (Fig. 1). *Echinocatena*, a monotypic genus represented by *E. arthrinioides*, was basal to the subclades comprising *Scolecobasidium* and *Verruconis* (Fig. 1). *Neocoleroa* included *N. cameroonensis* and *N. metrosideri*, which formed a robust clade with another three new genera, viz., *Fuscohilum*, *Sterila* and *Pinaceicola* (Fig. 1). These four genera formed a fully supported subclade which is sister to *Scolecobasidium*, *Verruconis* and *Echinocatena* (Fig. 1).

## Taxonomy

**Venturiales** Y. Zhang *et al.*, Fungal Diversity 51: 251. 2011.

**Description and illustration:** Habitat saprophytic, endophytic, parasitic on leaves or stems of plants, animals or human beings, rarely thermotrophic. Sexual morph: *Ascomata* immersed, erumpent to superficial, scattered or gregarious, globose, subglobose, mostly with setae around papilla or covering whole ascomata when superficial, ostiolate. *Hamathecium* of narrowly cellular pseudoparaphyses, mostly evanescent and rarely persistent when mature. *Asci* 8-spored, bitunicate, fissitunicate, usually obclavate, pedicel knob-like or lacking. *Ascospores* hyaline, light greenish olivaceous to brown, 1-septate, symmetrical, asymmetrical or apiosporous. Asexual morph: *Mycelium* consisting of branched, pale brown to medium brown, smooth, septate hyphae. *Conidiophores* solitary or loosely to densely fasciculate, arising from internal hyphae, or formed in sporodochia, arising from small to moderately large stromata, conidiophores often reduced to conidiogenous cells or composed of several cells, erect, cylindrical, pyriform, subclavate, narrowly obclavate, slightly to distinctly geniculate-sinuous, unbranched or occasionally branched, pale olivaceous to dark brown, tips sometimes paler, smooth to somewhat verruculose, sometimes only as short lateral conical prolongations of hyphae, occasionally irregular in shape. *Conidiogenous cells* integrated, terminal or intercalary or conidiophores reduced to conidiogenous cells, mono- to polyblastic, proliferation percurrent or sympodial; conidiogenous loci terminal or lateral, sometimes denticle-like, apex truncate to slightly convex, wall unthickened or almost so, sometimes slightly darkened-refractive. *Conidia* solitary or mostly catenate, in simple or branched chains, subcylindrical, ampulliform to fusoid-ellipsoid, acicular, straight, slightly curved or coiled, base truncate, septate or aseptate, subhyaline, pale to

dark brown, but mostly olivaceous, sometimes constricted at septa, smooth to verruculose, ends pointed or rounded to truncate, hila truncate, thickened or not, occasionally darkened-refractive.

**Type family:** *Venturiaceae* E. Müll. & Arx ex M.E. Barr

**Notes:** *Venturiales* was introduced by Zhang *et al.* (2011) based on morphological and ecological characteristics, as well as DNA data. It comprised two families, viz., *Venturiaceae* (*Venturia* and its allied genera) and *Sympoventuriaceae* (*Sympoventuria* and its allied genera) (Zhang *et al.* 2011). A third familial lineage comprising *Cylindrosyndium*, *Pseudoanungitea*, *Sympodiella* and *Tothia*, is retrieved in the present phylogenetic analysis (Fig. 1). Thus, a new family, *Cylindrosyndiaceae*, is introduced here. Members of *Venturiales* could be saprophytic on woody substrates or in soil, endophytic, parasitic on leaves or stems of plants, animals or human beings. Some species of *Verruconis* are thermophilic, such as *V. calidifluminalis* and *V. gallopava*, both of which occur in hot springs (Samerpitak *et al.* 2014). Phylogenetically, *Venturiales* are closely related to *Microthyriales*, *Natipusillales* and *Asterinales* (Hyde *et al.* 2013).

**Cylindrosyndiaceae** Crous, M. Shen & Y. Zhang *ter*, **fam. nov.** MycoBank MB831510.

*Mycelium* consisting of branched, pale to medium brown, smooth, septate hyphae. *Conidiophores* solitary, erect, septate, subcylindrical to cylindrical, medium brown to brown, smooth, straight to flexuous, sometimes rejuvenating percurrently. *Conidiogenous cells* terminal or intercalary, subcylindrical to clavate, pale to medium brown, mono- or polyblastic, sometimes sympodial; *conidiogenous loci* sometimes arranged in a rachis, flat or prominent, thickened or unthickened, somewhat darkened and refractive. *Conidia* in chains or rarely solitary, subcylindrical, ampulliform to fusoid-ellipsoid, acicular, hyaline, pale to medium brown, smooth, prominently guttulate, septate or aseptate; *hila* truncate, sometimes darkened and refractive (adapted from De Hoog 1985, Crous *et al.* 2007a, b, 2018, 2019a).

**Type genus:** *Cylindrosyndium* W.B. Kendr. & R.F. Castañeda

**Notes:** Phylogenetically, *Cylindrosyndium*, *Pseudoanungitea*, *Sympodiella* and *Tothia* formed a fully supported clade (PP = 1), sister to the *Venturiaceae* (Fig. 1). Morphologically, the hyphomycetous asexual morph, blastic conidiogenesis, subcylindrical to clavate, pale to medium brown conidiogenous cells, as well as the solitary or concatenate, subcylindrical, ampulliform to fusoid-ellipsoid conidia point to *Venturiales*. Ecologically, members of *Cylindrosyndium*, *Pseudoanungitea*, *Sympodiella* and *Tothia* are mostly saprophytic on woody plant hosts, such as *Pinaceae*, *Lauraceae*, *Myrtaceae* or *Ericaceae* (Crous *et al.* 2007b, 2018, 2019a). Thus, a new family, *Cylindrosyndiaceae*, is proposed to accommodate these genera.

**Cylindrosyndium** W.B. Kendr. & R.F. Castañeda, Univ. Waterloo Biol. Ser. 32: 9. 1990.

**Type species:** *Cylindrosyndium variabile* (de Hoog) W.B. Kendr. & R.F. Castañeda

**Notes:** *Cylindrosyndium* was introduced based on *Subulispora variabilis* (as *Cyl. variabile* (Castañeda & Kendrick 1990)). Subsequently, more species have been assigned to

*Cylindrosyndium* (Marvanová & Laichmanová 2007, Crous et al. 2007b, Paulus et al. 2003, Castañeda & Kendrick 1991, Castañeda-Ruiz et al. 2012). Phylogenetically, *Cylindrosyndium* is basal to other genera of *Cylindrosyndiaceae*, while closely related to *Pseudoanungitea*. Morphologically, *Cylindrosyndium* can be readily distinguished from *Pseudoanungitea* by its conidia that are subhyaline to pale olivaceous, and the conidiogenous loci that are slightly darkened, but not refractive (De Hoog 1985, Crous et al. 2007b).

***Cylindrosyndium lauri*** Crous & R.F. Castañeda, Stud. Mycol. 58: 204. 2007.

**Typus:** Spain, Canary Islands, on leaf litter of *Laurus* sp. (*Lauraceae*), 4 Jan. 1995, R.F. Castañeda (**holotype** CBS H-19909, culture ex-type CBS 240.95).

**Notes:** *Cylindrosyndium lauri* introduced by Crous et al. (2007b) was isolated from leaf litter of *Laurus* sp. in Spain. It can be distinguished from *Cyl. variabile* (De Hoog 1985) by its longer conidiophores, subhyaline to pale olivaceous conidia, and the thin, slightly darkened but not refractive conidiogenous loci and hila (Crous et al. 2007b). *Cylindrosyndium lauri* is sister to *C. variabile* in Fig. 1.

***Cylindrosyndium variabile*** (de Hoog) W.B. Kendr. & R.F. Castañeda, Univ. Waterloo Biol. Ser. 32: 10. 1990.

**Basionym:** *Subulispora variabilis* de Hoog, Stud. Mycol. 26: 56. 1985.

**Typus:** Netherlands, Utrecht Province, Baarn, De Vuursche, on rotten needle of *Pinus* sp. (*Pinaceae*), Sep. 1982, G.S. de Hoog (**holotype** CBS H-1634, culture ex-type CBS 563.82).

**Notes:** Ecologically, *C. variabile* has a broader host spectrum than *C. lauri* (Crous et al. 2007b). Phylogenetically, *Cyl. variabile* and *Cyl. lauri* form a fully supported clade representing the genus *Cylindrosyndium* (Fig. 1).

***Pseudoanungitea*** Crous, Fungal Syst. Evol. 1: 199. 2018.

**Type species:** *Pseudoanungitea syzygii* (Crous et al.) Crous

**Notes:** *Pseudoanungitea* was separated from *Anungitea* based on its terminal and intercalary conidiogenous cells, and refractive, thickened conidiogenous loci that give rise to short conidial chains with somewhat darkened and refractive hila (Crous et al. 2018). So far three species, viz., *P. syzygii*, *P. vaccinii* and *P. variabilis* have been assigned *Pseudoanungitea* (Crous et al. 2018).

***Pseudoanungitea syzygii*** (Crous et al.) Crous, Fungal Syst. Evol. 1: 199. 2018.

**Basionym:** *Anungitea syzygii* Crous et al., Canad. J. Bot. 73: 225. 1995.

**Typus:** South Africa, Mpumalanga Province, Sabie, on leaf litter of *Syzygium cordatum* (*Myrtaceae*), Mar. 1993, W.J. Swart (**holotype** PREM 51687, culture ex-type CPC 578 = CBS 520.93).

**Notes:** *Anungitea syzygii* was originally described on leaf litter of *Syzygium cordatum* (South Africa), which was subsequently assigned to *Pseudoanungitea* (as *P. syzygii*) (Crous et al. 1995, 2018). Together with *P. vaccinii* and *P. variabilis*, this species formed a monophyletic clade representing the genus *Pseudoanungitea* (Fig. 1).

***Pseudoanungitea vaccinii*** Crous & R.K. Schumach., Fungal Syst. Evol. 1: 199. 2018.

**Typus:** Germany, near Berlin, on stem of *Vaccinium myrtillus* (*Ericaceae*), 16 Jan. 2016, R.K. Schumacher (**holotype** CBS H-23422, culture ex-type CBS 143164 = CPC 30522).

**Notes:** *Pseudoanungitea vaccinii* was described from stems of *Vaccinium myrtillus* (Crous et al. 2018). Based on a multigene phylogenetic analysis, *P. vaccinii* was closely related to *P. syzygii* (Crous et al. 2018; Fig. 1 in present study). Morphologically, *P. vaccinii* can be distinguished from *P. syzygii* based on its conidial dimensions (Crous et al. 1995, 2018).

***Pseudoanungitea variabilis*** Hern.-Restr., Fungal Syst. Evol. 1: 200. 2018.

**Typus:** Spain, Castilla la Mancha, Hayedo de la Tejera Negra Natural Park, on dead wood, May 2011, M. Hernández-Restrepo, J. Mena & J. Guarro (**holotype** CBS H-23494, culture ex-type CBS 132716).

**Notes:** *Pseudoanungitea variabilis* differs from other species of *Pseudoanungitea* in having dimorphic conidia, i.e., type 1 are fusoid-ellipsoid resembling those of *P. syzygii* and *P. vaccinii*, and type 2 are globose (Crous et al. 1995, 2018). It is basal in *Pseudoanungitea* in the present study (Fig. 1).

***Septonema*** Corda, Icon. Fung. 1: 9. 1837.

**Type species:** *Septonema secedens* Corda

**Notes:** *Septonema secedens* is represented on GenBank by two cultures (both not ex-type): CBS 469.48 (GenBank MH856437 and MH867983 for ITS and LSU respectively) and CBS 174.74 (LSU GenBank MH878272). The former LSU sequence blasts with *Alternaria/Stemphyllium* while the latter is related to *Septonema fasciculare* strain CBS 127862 (GenBank MH876104; 898/916 (98 %) similar including 11 gaps) and *Helicoon pluriseptatum* strain CBS 812.68 (GenBank MH878409; 836/856 (98 %) similar including 9 gaps).

***Septonema crispulum*** Lunghini & F. Toscano, Mycotaxon 63: 329. 1997.

**Typus:** Italy, on decaying needles of *Pinus pinea* (*Pinaceae*), 15 Nov. 1992, F. Toscano (**holotype** ROHB 187, culture ex-type CBS 735.96).

**Notes:** *Septonema crispulum* was introduced based on a taxon found on pine-needle litter in central Italy, which morphologically agrees with *Septonema* by having 1-septate and slightly thick-walled conidia (Lunghini & Toscano 1997). The LSU sequence of *S. crispulum* does not appear to be congeneric with the *S. secedens* strain CBS 174.74 LSU sequence (GenBank MH878272; 859/923 (93 %) similar including 24 gaps). We refrain from designating a new genus for *S. crispulum* (Fig. 1) pending recollection and molecular investigation of suitable authentic material of *S. secedens*.

***Sympodiella*** W.B. Kendr., Trans. Brit. Mycol. Soc. 41: 519. 1958.

**Type species:** *Sympodiella acicola* W.B. Kendr.

***Sympodiella acicola*** W.B. Kendr., Trans. Brit. Mycol. Soc. 41: 519. 1958. emend. Hern.-Restr. & Crous

*Typus*: **UK**, Cheshire, on *Pinus sylvestris* (*Pinaceae*), 1956, W.B. Kendrick (**holotype** IML 69967). **Netherlands**, Baarn, De Vuursche, on *P. sylvestris*, 12 Apr. 1982, G.S. de Hoog (**epitype** CBS H-1620 MBT385535, ex-epitype culture CBS 487.82).

*Note*: This species is sister to *S. goidanichii* (Fig. 1).

**Sympodiella goidanichii** (Rambelli) Crous & Hern.-Restr., *Fungal Syst. Evol.* 3: 116. 2019.

*Basionym*: *Ceratosporella goidanichii* Rambelli, R.C. Secc. *Atti Accad. Sci. Ist. Bologna, Cl. Sci. Fis., Rendiconti, Ser. 11, 5*: 3. 1958.

*Synonym*: *Repetophragma goidanichii* (Rambelli) W.P. Wu, *Fungal Diversity Res. Ser.* 15: 80. 2005.

*Typus*: **Italy**, on capsule of *Fagus sylvatica* (*Fagaceae*), collection date unknown, A. Rambelli (culture ex-type CBS 136.58).

*Notes*: *Ceratosporella goidanichii* was first described from withered fruit of *Fagus sylvatica*. Subsequently, *Ceratosporella goidanichii* was assigned to *Sympodiella* as *S. goidanichii* based on its phylogenetic position (Crous *et al.* 2019a). In Fig. 1, *S. goidanichii* is sister to *S. acicola*.

**Tothia** Bat., *Ann. Hist.-Nat. Mus. Natl. Hung.* 52: 105. 1960.

*Type species*: *Tothia fuscella* (Sacc.) Bat.

**Tothia fuscella** (Sacc.) Bat., *Ann. Hist.-Nat. Mus. Natl. Hung.* 52: 106. 1960.

*Basionym*: *Microthyrium fuscillum* Sacc., *Michelia* 2 (no. 6): 57. 1880.

*Typus*: **Hungary**, on stems of *Teucrium chamaedrys* (*Lamiaceae*), further data not available (**holotype** URM 8210) (not seen). **Austria**, Kärnten, St. Margareten im Rosental, Aussicht, grid square 9452/3, on stalks of *T. chamaedrys*, soc. *Ophiobolus erythrosporus*, 3 July 2010, W. Jaklitsch (**epitype** WU31396, designated in Wu *et al.* 2011; ex-epitype culture TF1; **iso-epitype** IFRD8982) (not seen).

*Note*: This species is sister to *T. spartii* (Fig. 1).

**Tothia spartii** Qing Tian *et al.*, *Fungal Diversity* 72: 159. 2015.

*Typus*: **Italy**, Province of Forlì-Cesena, Fiumicello, Premilcuore, on living and dead branches of *Spartium junceum* (*Fabaceae*), 17 Mar. 2012, E. Camporesi (**holotype** MFLU 14-0739, culture ex-type MFLUCC 14-0615) (not seen).

*Notes*: Despite the thyrothecial ascomata, the yellowish, greenish brown to brown, two-celled ascospores and obclavate asci of *Tothia* agree well with *Venturiales* (Zhang *et al.* 2011, Liu *et al.* 2015). Phylogenetically, *Tothia* nests in *Cylindrosympodiaceae*, and is sister to *Sympodiella* and *Septonema* (Fig. 1). So far two species, *T. fuscella* and *T. spartii*, were accommodated within *Tothia* (Wu *et al.* 2011, Liu *et al.* 2015). The ascospores of *T. spartii* are ellipsoid to fusiform with rounded ends, while the ascospores of *T. fuscella* are fusiform or oblong-ellipsoid with tapering ends (Wu *et al.* 2011, Liu *et al.* 2015).

**Sympoventuriaceae** Y. Zhang *et al.*, *Fungal Diversity* 51: 255. 2011.

Habitat saprophytic, endophytic, parasitic on leaves or stems of plants, animals or humans, or as thermotrophic fungi living in hot springs. Sexual morph: *Ascomata* subglobose, immersed, black, papillate, ostiolate. *Pseudoparaphyses*

hyaline, septate, constricted at septa, anastomosing, extending above the asci. *Asci* 8-spored, bitunicate, fissitunicate, subcylindrical, pedicellate. *Ascospores* hyaline, fusoid-ellipsoidal, constricted at median septum. Asexual morph: *Mycelium* consisting of smooth to finely roughened, pale to medium brown, branched, septate hyphae, sometimes forming hyphal coils. *Conidiophores* reduced to conidiogenous cells that are terminal or lateral on hyphae, or with basal supporting cell, solitary, erect, mono- to polyblastic, pale to dark brown, smooth, subcylindrical to doliiform, aseptate or septate, sometimes thick-walled, branched or rarely branched below, sometimes dimorphic; *conidiogenous loci* flat-tipped, somewhat darkened and thickened. *Conidiogenous cells* terminal or lateral, integrated, mono- or polyblastic and sympodial, subcylindrical or doliiform, pale to medium brown, smooth, proliferating sympodially; *loci* somewhat thickened and darkened, not refractive or sometimes slightly refractive. *Ramiconidia* present or not, brown, smooth, subcylindrical or fusoid-ellipsoid, aseptate or septate. *Conidia* solitary or occurring in branched or unbranched chains, pale brown to brown, smooth, subcylindrical to fusoid-ellipsoidal, aseptate or septate, straight, widest in middle to lower third, apex subobtuse, with or without transverse eusepta; *hila* truncate, sometimes thickened and darkened.

*Type genus*: *Sympoventuria* Crous & Seifert

*Notes*: The genus *Sympoventuria* is typified by *S. capensis*, which was originally collected on *Eucalyptus* leaf litter from the Western Cape Province of South Africa (Crous *et al.* 2007a). *Sympoventuria* was assigned to *Venturiales* based on its morphological and preliminary DNA data (Crous *et al.* 2007a, b). *Sympoventuriaceae* was introduced to accommodate *Sympoventuria* (Zhang *et al.* 2011). It can be distinguished from other members of *Venturiales* by its saprophytic life style, presence of pseudoparaphyses, and hyaline, symmetrical ascospores (Zhang *et al.* 2011). Species of *Sympoventuriaceae* have mostly been collected from leaf litter, and some species have been reported from soil, hot springs, or even animals or humans (Crous *et al.* 2007a, b, Zhang *et al.* 2011, Samerpitak *et al.* 2014). Based on a multigene phylogenetic analysis, morphological and ecological comparisons, eight genera have been included in *Sympoventuriaceae*, viz., *Clavatispora*, *Ochroconis*, *Scolecobasidium*, *Sympodiella*, *Sympoventuria*, *Veronaeopsis*, *Verruconis* and *Yunnanomyces*. Phylogenetically, *Sympoventuriaceae* forms a well-supported familial clade within *Venturiales* (Arzanlou *et al.* 2007, Crous *et al.* 2007a, b, Zhang *et al.* 2011, Samerpitak *et al.* 2014, Johnston & Park 2016).

**Bellamyces** Crous, Coppins & U. Braun, **gen. nov.** MycoBank MB831519.

*Etymology*: Named after “Bella”, the beautiful dog that always accompanies Brian J. Coppins on his lichen excursions.

*Mycelium* consisting of branched, septate, medium brown, smooth hyphae. *Conidiophores* erect, brown, smooth, subcylindrical, straight to geniculate-sinuous, reduced to conidiogenous cells, or 0–1-septate. *Conidiogenous cells* terminal, subcylindrical, brown, smooth, proliferating sympodially and inconspicuously 1–2 times percurrently at apex. *Conidia* solitary, brown, smooth, subcylindrical, straight, widest in middle to lower third, apex subobtuse, transversely euseptate, rarely with 1–2 oblique septa; *hila* truncate, neither thickened, nor darkened.

*Type species: Bellamyces quercus* Crous, Coppins & U. Braun

*Note:* Phylogenetically, *Bellamyces quercus* clusters basal to *Sympoventuria*, *Pseudosigmoidea* and *Troposporella* (Fig. 1).

***Bellamyces quercus*** Crous, Coppins & U. Braun, *sp. nov.* MycoBank MB831520. Fig. 3.

*Etymology:* The epithet refers to *Quercus*, the host genus on which apothecial discs of *Lecanora chlarotera* were collected.

*Mycelium* consisting of branched, septate, medium brown, smooth, 3–4 µm diam hyphae. *Conidiophores* erect, brown, smooth, subcylindrical, straight to geniculate-sinuous, reduced to conidiogenous cells, or 0–1-septate, unbranched, 2–10 × 4–6 µm. *Conidiogenous cells* terminal, subcylindrical, brown, smooth, proliferating sympodially and inconspicuously 1–2 times percurrently at apex, 2–5 × 4–5 µm. *Conidia* solitary, brown, smooth, subcylindrical, straight, widest in middle to lower third, apex subobtuse, transversely 3–8-euseptate, rarely with 1–2 oblique septa, (13–)18–22(–25) × (4–)5–6(–6.5) µm; *hila* truncate, neither thickened, nor darkened, 3–4 µm diam.

*Culture characteristics:* Colonies erumpent, with sparse aerial mycelium and smooth, lobate margin, reaching 7 mm diam after 1 wk at 25 °C. On MEA surface and reverse umber, on PDA surface umber, reverse chestnut, on OA surface bay with diffuse umber pigment.

*Typus:* **UK**, Scotland, VC 82, East Lothian, Spott, the Brunt, oak wood, S facing (former oak coppice), on apothecial discs of *Lecanora chlarotera* (*Lecanoraceae*) on *Quercus* (*Fagaceae*) trunks, 24 Aug. 2015, B.J. Coppins, Coppins no. 24965 = HPC 571 (**holotype** CBS H-23838, culture ex-type CBS 146217 = CPC 28858; **isotype** HAL 2918 F).

*Notes:* The conidia of *Bellamyces* are solitary, and transversely multiseptate, rarely oblique. Phylogenetically, it is not related to any other species known from sequence data (Fig. 1).

***Echinocatena*** R. Campb. & B. Sutton, Trans. Brit. Mycol. Soc. 69: 126. 1977.

*Type species: Echinocatena arthrinioides* R. Campb. & B. Sutton

*Notes:* *Echinocatena* is a monotypic genus represented by *E. arthrinioides*, which was collected from leaf litter of an unknown plant in Rajasthan, India (Campbell & Sutton 1977). Morphologically, its straight to flexuous conidiophores and polyblastic conidiogenous cells are consistent with those of *Venturiales*. The spherical, aseptate conidia of *E. arthrinioides*, however, differ from other genera (Campbell & Sutton 1977, Crous et al. 2018). Crous et al. (2018) retrieved an isolate from leaves of *Acacia crassicarpa* in Malaysia, which morphologically agrees well with *Echinocatena arthrinioides*, but has larger conidia [(4–)5–6(–7) µm vs. 3.5–4.5 µm]. Phylogenetically, *Echinocatena* clusters on a long branch basal to *Scolecobasidium* and *Verruconis* (Fig. 1).

***Echinocatena arthrinioides*** R. Campb. & B. Sutton, Trans. Brit. Mycol. Soc. 69: 130. 1977.

*Typus:* **India**, Jodhpur, on decaying leaves of unknown plant, 25 Nov. 1975, K.S. Panwar (**holotype** IMI 199279).

*Notes:* Isolate CPC 28754 was identified as *Echinocatena arthrinioides* by Crous et al. (2018), which morphologically agrees well with the original description of *Echinocatena*

*arthrinioides* (Campbell & Sutton 1977), but has slightly larger conidia (see comments above).

***Fuscohilum*** Crous, M. Shen & Y. Zhang ter, *gen. nov.* MycoBank MB831514.

*Etymology:* The epithet refers to the thickened and darkened conidial hila.

*Mycelium* consisting of smooth to finely roughened, pale to medium brown, branched, septate hyphae, sometimes frequently forming hyphal coils. *Conidiophores* reduced to conidiogenous cells that are terminal or lateral on hyphae, medium brown, smooth, cylindrical or subcylindrical, erect to subdenticulate, or more distinct, mono- to polyblastic; *conidiogenous loci* flat-tipped, somewhat darkened and thickened, but not refractive. *Ramiconidia* present, aseptate or septate. *Conidia* formed in branched or unbranched chains, pale to medium brown, smooth, subcylindrical, 0–3-septate, slightly tapering towards the subtruncate ends, straight, but at times slightly curved; *hila* somewhat darkened and thickened, not refractive (adapted from Crous et al. 2007b, Koukol 2010).

*Type species: Fuscohilum rhodensis* (Crous) Crous, M. Shen & Y. Zhang ter

***Fuscohilum rhodensis*** (Crous & M.J. Wingf.) Crous, M. Shen & Y. Zhang ter, *comb. nov.* MycoBank MB831553.

*Basionym:* *Fusicladium rhodense* Crous & M.J. Wingf., Stud. Mycol. 58: 212. 2007.

*Description and illustration:* Crous et al. (2007b).

*Typus:* **Greece**, Rhodos, on branches of *Ceratonia siliqua* (*Fabaceae*), 1 Jun. 2006, P.W. Crous & M.J. Wingfield (**holotype** CBS H-19910, culture ex-type CBS 121641 = CPC 13156).

*Notes:* *Fusicladium rhodense* was introduced by Crous et al. (2007b) having a pseudocladosprium-like morphology and conidial hila that are somewhat darkened and thickened. Phylogenetically, *F. rhodense* and *F. sicilianum* formed a separate generic clade within *Sympoventuriaceae* (Fig. 1). These two species were therefore assigned to a new genus, *Fuscohilum*.

***Fuscohilum siciliana*** (Koukol) Crous, M. Shen & Y. Zhang ter, *comb. nov.* MycoBank MB831554. Fig. 4.

*Basionym:* *Fusicladium sicilianum* Koukol, Mycol. Progr. 9(3): 373. 2010.

*Description and illustration:* Koukol (2010).

*Typus:* **Italy**, Palermo, Botanic Garden, rotten plant of *Chamaerops humilis* (*Arecaceae*), Nov. 1984, W. Gams (**holotype** CBS H-3654, culture ex-type CBS 105.85).

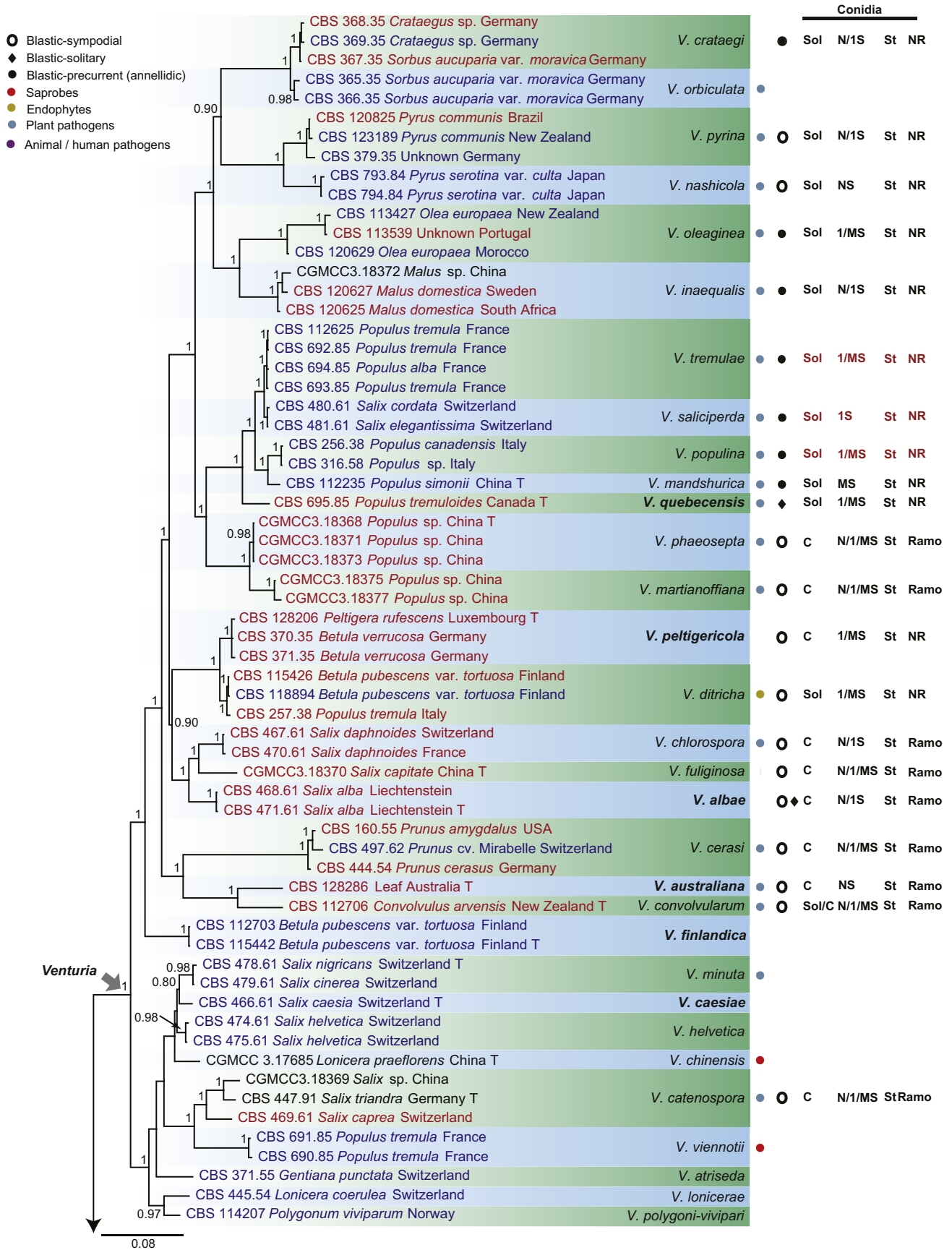
*Notes:* According to the original description provided by Koukol (2010), the smaller-sized conidia [(8–)10–12(–18) × (1.5–)2–2.5(–3) µm vs. (8–)12–16(–20) × (2–)2.5–3(–4) µm] and the absence of hyphal coils of *F. siciliana* differs from those of *F. rhodensis* (Crous et al. 2007b). The two species are phylogenetically distinct (Fig. 1).

***Helicopsis*** P. Karst., Rev. Mycol. (Toulouse) 11: 96. 1889.

*Type species: Helicopsis olivacea* P. Karst.

***Helicopsis olivacea*** P. Karst. [as “*olivaceus*”], Rev. Mycol. (Toulouse) 11 (no. 42): 96. 1889.





**Fig 2.** Consensus phylogram (50 % majority rule) of 42 902 trees resulting from a Bayesian analysis of the combined alignment of ITS, LSU, *tef1*, *tub2* and *rpb2* sequences of *Venturiaceae*. Bayesian posterior probabilities (PP) > 0.80 are shown at the nodes and the scale bar represents the expected changes per site. Some branches were shortened to facilitate layout. The tree was rooted with *Pseudoanungitea vaccinii* (CBS 143164). See title of Fig. 1 for an explanation of the characters plotted on the tree. Strains in red text sporulated in this study, while those in blue text failed to sporulate and those in black text were not studied.

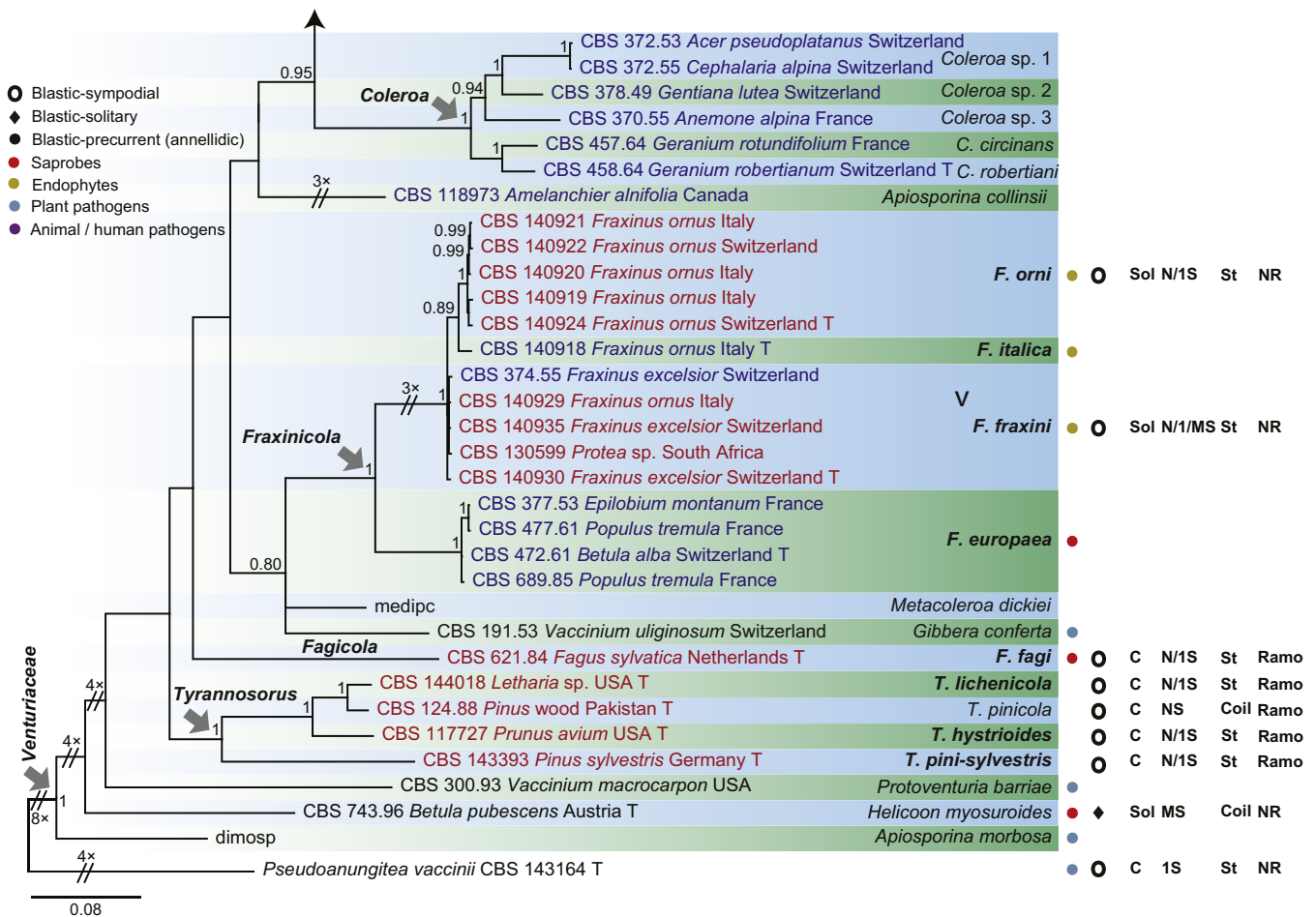


Fig 2. (Continued).

*Synonym: Helicopsis punctata* Peck, Bull. New York St. Mus. 167: 26. 1913 [1912].

*Tropospora olivaceum* (P. Karst.) C.K.M. Tsui & Berbee [as "olivaceum"], Mycoscience 51: 147. 2010.

*Typus: Finland*, near the village of Surikat, on the hymenium of *Lyomyces roseus* (*Corticaceae*), Nov. 1886 (not seen).

*Notes: Helicopsis* was introduced as a monotypic genus, based on *H. olivacea*, and was assigned to *Tubeufiaceae* (Karsten 1888). Subsequently, a second species of *Helicopsis*, *H. punctata*, was described, which was treated as conspecific with *H. olivacea* (Peck 1913, Tsui & Berbee 2010). Based on the phylogenetic analysis of the small subunit (SSU) and internal transcribed spacers (ITS) rDNA sequences, *H. olivacea* was assigned to *Tropospora* as *T. olivacea* (Tsui & Berbee 2010). The phylogenetic analysis of Tsui & Berbee (2010) focused on class level (*Dothideomycetes*), and was too general to reflect a detailed classification of *Helicopsis*. This treatment is rejected in this study, as a strain representing *Helicopsis olivacea* clustered apart from the clade representing *Tropospora* (*T. fumosa* and *T. monilipes*) (Fig. 1).

**Neocoleroa** Petr., Hedwigia 74: 38. 1934.

*Type species: Neocoleroa sibirica* Petr.

*Notes: Neocoleroa* was introduced based on its lobed to dichotomously branched, blunt-tipped setae and persistent

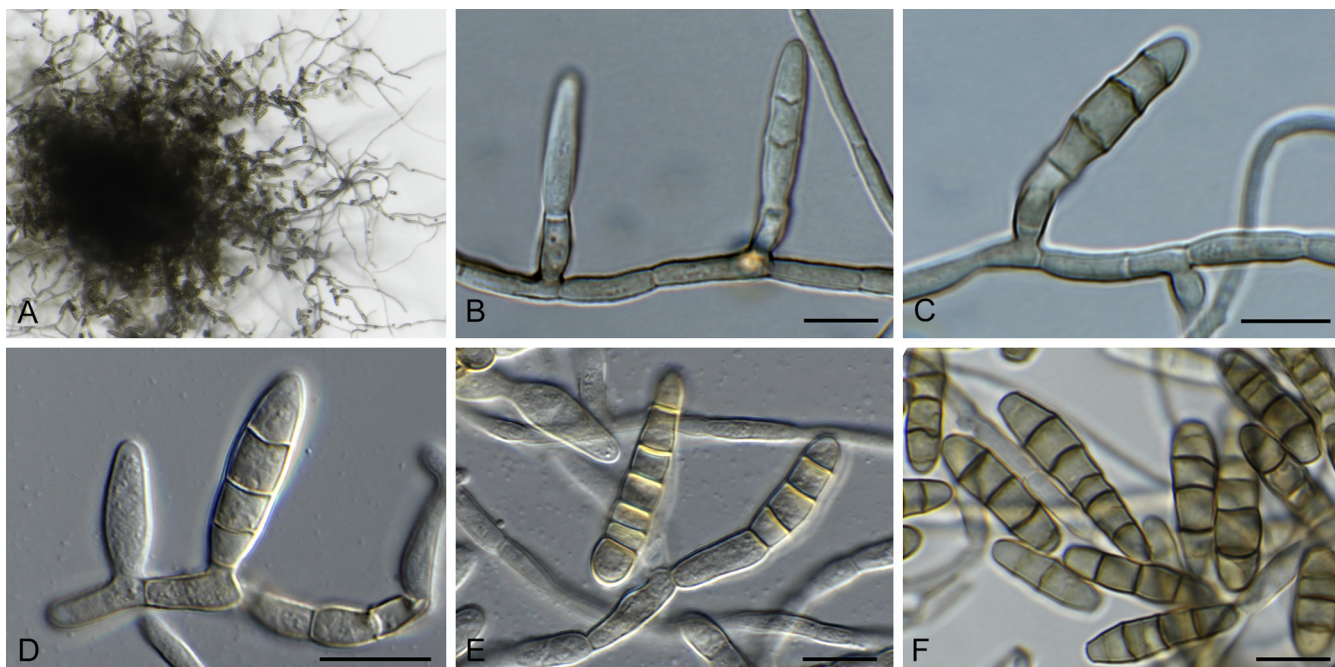
pseudoparaphyses, which was typified by *N. sibirica* (Petrak 1934). Morphologically, *Neocoleroa* is most comparable with *Wentomyces* (Koorders 1907), and they both were assigned to *Pseudoperisporiaceae* (*Dothideomycetes incertae sedis*) (Barr 1997, Kirk et al. 2008). Barr (1987) noted that some species of these two genera are morphologically similar to members of *Venturiaceae*. *Neocoleroa metrosideri* was reported from *Metrosideros excelsa*, and morphologically agrees with *Symptoventuria* in having broadly clavate to obclavate asci, hyaline, 1-septate ascospores and persistent pseudoparaphyses (Johnston & Park 2016). Phylogenetically, *Neocoleroa metrosideri* nested with a novel species *N. cameroonensis* described below, in *Symptoventuriaceae*, being sister to other genera of the family (Fig. 1). No DNA data are presently available for the generic type.

**Neocoleroa metrosideri** P.R. Johnst., Phytotaxa 253: 216. 2016.

*Description and illustration: Johnston & Park (2016).*

*Typus: New Zealand*, Auckland, Glen Innes, Auckland University Tamaki campus (S36.883037, E174.849881), on living leaves of *Metrosideros excelsa* (*Myrtaceae*), 6 Oct. 2015, P.R. Johnston (**holotype** PDD 107531, culture ex-type ICMP 21139) (not seen).

*Notes: Neocoleroa metrosideri* was introduced as the causal agent of leaf spots on *Metrosideros excelsa* in New Zealand



**Fig. 3.** *Bellamyces quercus* (culture ex-type CPC 28858) asexual morph. **A.** Colony on OA. **B–E.** Conidiogenous cells producing conidia. **F.** Multi-septate conidia. Scale bars: B–F = 10 µm.

(Johnston & Park 2016). This species is sister to *N. cameroonensis* (Fig. 1).

***Neocoleroa cameroonensis*** Crous, M. Shen & Y. Zhang ter, **sp. nov.** MycoBank MB831521.

**Etymology:** Named after Cameroon, the country where this fungus was collected.

Cultures sterile. *Neocoleroa cameroonensis* (CBS 129041) differs from its closest phylogenetic neighbour *N. metrosideri* (PDD 107531) (Fig. 1) by unique fixed alleles in two loci based on alignments of the separate loci deposited in TreeBASE (S24573), by 56 bp in ITS (14 %) and 26 bp in LSU (3 %).

**Culture characteristics:** Colonies spreading, erumpent, with aerial mycelium and regular, smooth margins on OA, dark olivaceous brown (surface); reverse fuscous-black; on MEA dark brown (surface); reverse fuscous-black; on SNA dark brown (surface); reverse fuscous-black. Colonies reaching 8 mm diam after 2 wk on OA at 25 °C in the dark.

**Typus:** **Cameroon**, Londji, *Crematogaster* sp. (ant) on *Barteria nigritana* (Passifloraceae), 19 Dec. 2009, R. Blatrix (**holotype** CBS H-23598, culture ex-type CBS 129041).

**Notes:** Based on the multigene phylogenetic analysis, *Neocoleroa cameroonensis* clusters together with the type specimen of *N. metrosideri* in *Neocoleroa* (Fig. 1). The species was isolated from a *Crematogaster* sp. (ant) but did not sporulate in culture on any of the media used here.

***Neofusicladium*** Crous, M. Shen & Y. Zhang ter, **gen. nov.** MycoBank MB831512.

**Etymology:** Named after the genus *Fusicladium*, to which it is morphologically similar, and neo- to new.

**Mycelium** consisting of pale to medium brown, smooth, branched, septate hyphae. **Conidiophores** reduced to conidiogenous cells, or with basal supporting cell, solitary, erect,

pale brown, smooth, subcylindrical to doliiform, sometimes dimorphic. **Conidiogenous cells** terminal or lateral, integrated, subcylindrical or doliiform, pale to medium brown, smooth, proliferating sympodial; conidiogenous loci somewhat thickened and darkened, not refractive. **Ramiconidia** brown, smooth, subcylindrical or fusoid-ellipsoid, aseptate or septate. **Conidia** mostly occurring in branched chains, pale brown, smooth, subcylindrical to fusoid-ellipsoidal, aseptate or septate, sometimes widest in middle, truncate at the ends; **hila** somewhat darkened and thickened, but not refractive (adapted from Crous et al. 2010, 2016, 2017).

**Type species:** *Neofusicladium eucalypti* (Crous & R.G. Shivas) Crous, M. Shen & Y. Zhang ter

**Notes:** So far, *Neofusicladium* comprises three species, viz., *N. eucalypti*, *N. eucalypticola* and *N. regnans*. All three *Neofusicladium* species were isolated from *Eucalyptus* leaves (Crous et al. 2010, 2016, 2017). The diagnostic characteristics of *Neofusicladium* includes sympodial conidiophores with somewhat thickened and darkened, non-refractive conidiogenous loci, mostly branched conidial chains, and the presence of ramiconidia (Crous et al. 2010, 2016, 2017). Phylogenetically, *Neofusicladium* is basal in *Sympoventuriaceae* and is introduced as a new genus (Fig. 1).

***Neofusicladium eucalypti*** (Crous & R.G. Shivas) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831541. **Fig. 5.** **Basionym:** *Fusicladium eucalypti* Crous & R.G. Shivas, *Perseonia* 25: 149. 2010.

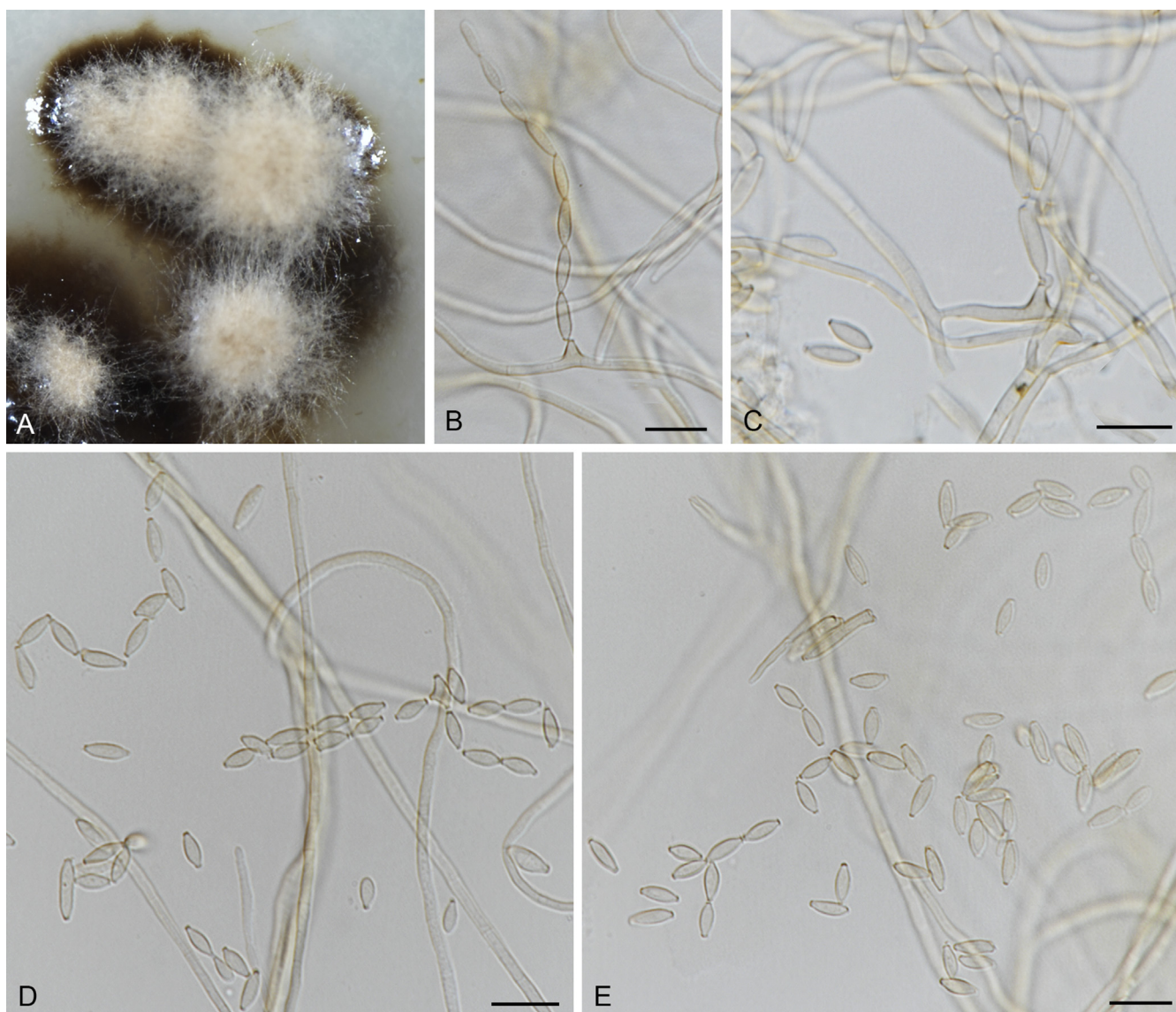
**Description and illustration:** Crous et al. (2010).

**Typus:** **Australia**, Queensland, Brisbane, Mt. Coot-tha, Bardon Trail, on leaves of *Eucalyptus* sp. (Myrtaceae), 12 Jul. 2009, P.W. Crous & R.G. Shivas (**holotype** CBS H-20497, culture ex-type CBS 128216 = CPC 17324).

**Notes:** *Neofusicladium eucalypti* was first described (as *Fusicladium eucalypti*) from *Eucalyptus* leaves in Australia (Crous



**Fig. 4.** *Fuscohilum siciliana* (culture ex-type CBS 105.85) asexual morph. **A.** Colony on OA. **B, C.** Conidia arising from hyphae. **D–H.** Cylindrical and subcylindrical conidia in chains. Scale bars: B–H = 10 μm.



**Fig. 5.** *Neofusicladium eucalypti* (culture ex-type CBS 128216) asexual morph. **A.** Colony on OA. **B–D.** Concatenated conidia arising from hypha. **E.** Pale brown, fusiform and aseptate conidia. Scale bars: B–E = 10  $\mu$ m.

*et al.* 2010). Its dimorphic conidiophores can serve as a diagnostic character for this species (Crous *et al.* 2010). This species is sister to *N. eucalypticola* in Fig. 1.

***Neofusicladium eucalypticola*** (Crous & M.J. Wingf.) Crous, M. Shen & Y. Zhang *ter*, **comb. nov.** MycoBank MB831542. Fig. 6. *Basionym:* *Fusicladium eucalypticola* Crous & M.J. Wingf., *Persoonia* 36: 369. 2016.

*Description and illustration:* Crous *et al.* (2016).

*Typus:* **France**, La Réunion, on leaves of *Eucalyptus robusta* (*Myrtaceae*), 8 Mar. 2015, P.W. Crous & M.J. Wingfield (**holotype** CBS H-22614, culture ex-type CBS 141301 = CPC 27238).

*Notes:* The broader conidia of *N. eucalypticola* [(2.5–)3(–4)  $\mu$ m] distinguish it from *N. eucalypti* [(2–)2.5(–3)  $\mu$ m]. Furthermore, secondary ramoconidia of *N. eucalypticola* (15–20  $\times$  3–5  $\mu$ m) are larger than those of *N. eucalypti* (10–15  $\times$  2–3  $\mu$ m) and *N. regnans* (10–20  $\times$  3–4  $\mu$ m) (Crous *et al.* 2010, 2016, 2017). This species is sister to *N. eucalypti* in Fig. 1.

***Neofusicladium regnans*** (Crous) Crous, M. Shen & Y. Zhang *ter*, **comb. nov.** MycoBank MB831543.

*Basionym:* *Sympoventuria regnans* Crous, *Persoonia* 39: 425. 2017.

*Description and illustration:* Crous *et al.* (2017).

*Typus:* **Australia**, Victoria, La Trobe State Forest, on leaves of *Eucalyptus regnans* (*Myrtaceae*), 30 Nov. 2016, P.W. Crous (**holotype** CBS H-23304, culture ex-type CBS 143411 = CPC 32720).

*Notes:* *Neofusicladium regnans* was first described (as *Sympoventuria regnans*) on leaves of *Eucalyptus regnans* collected in Victoria, Australia (Crous *et al.* 2017). The larger-sized conidia of *N. regnans* (8–20  $\times$  2.5–3  $\mu$ m) are easily distinguishable from those of *N. eucalypti* (7–10  $\times$  2–3  $\mu$ m) and *N. eucalypticola* (5–12  $\times$  2.5–4  $\mu$ m) (Crous *et al.* 2010, 2016, 2017). *Neofusicladium regnans* represents the most basal species in the *Neofusicladium* clade (Fig. 1).

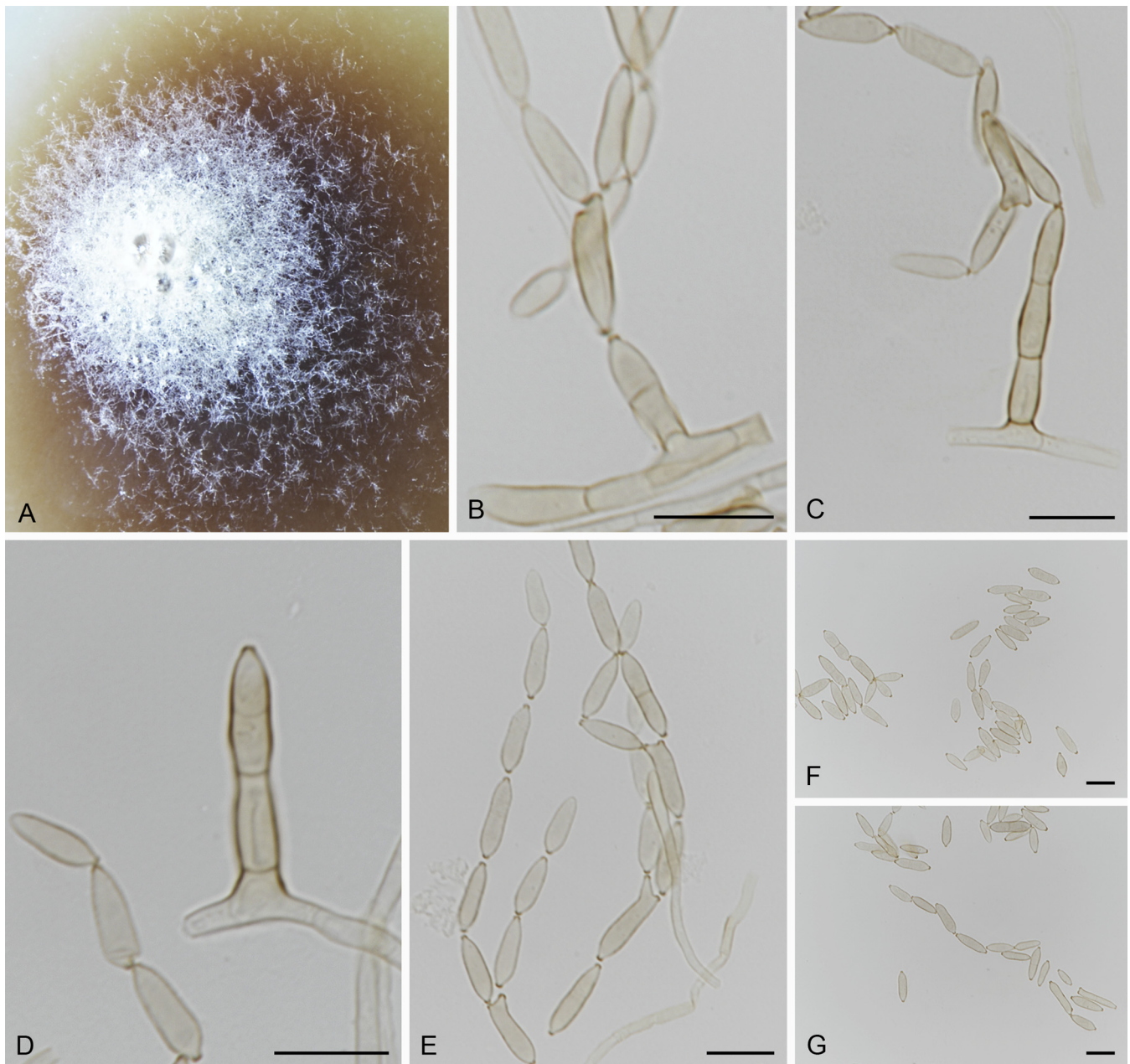


Fig. 6. *Neofusicladium eucalypticola* (culture ex-type CBS 141301) asexual morph. A. Colony on OA. B–E. Concatenated conidia arising from hypha. F, G. Pale brown and aseptate or 1-septate conidia. Scale bars: B–G = 10 μm.

***Parafusicladium*** Crous, M. Shen & Y. Zhang ter, **gen. nov.** MycoBank MB831513.

**Etymology:** Named after *Fusicladium*, the morphologically most comparable genus. *Para-* means false.

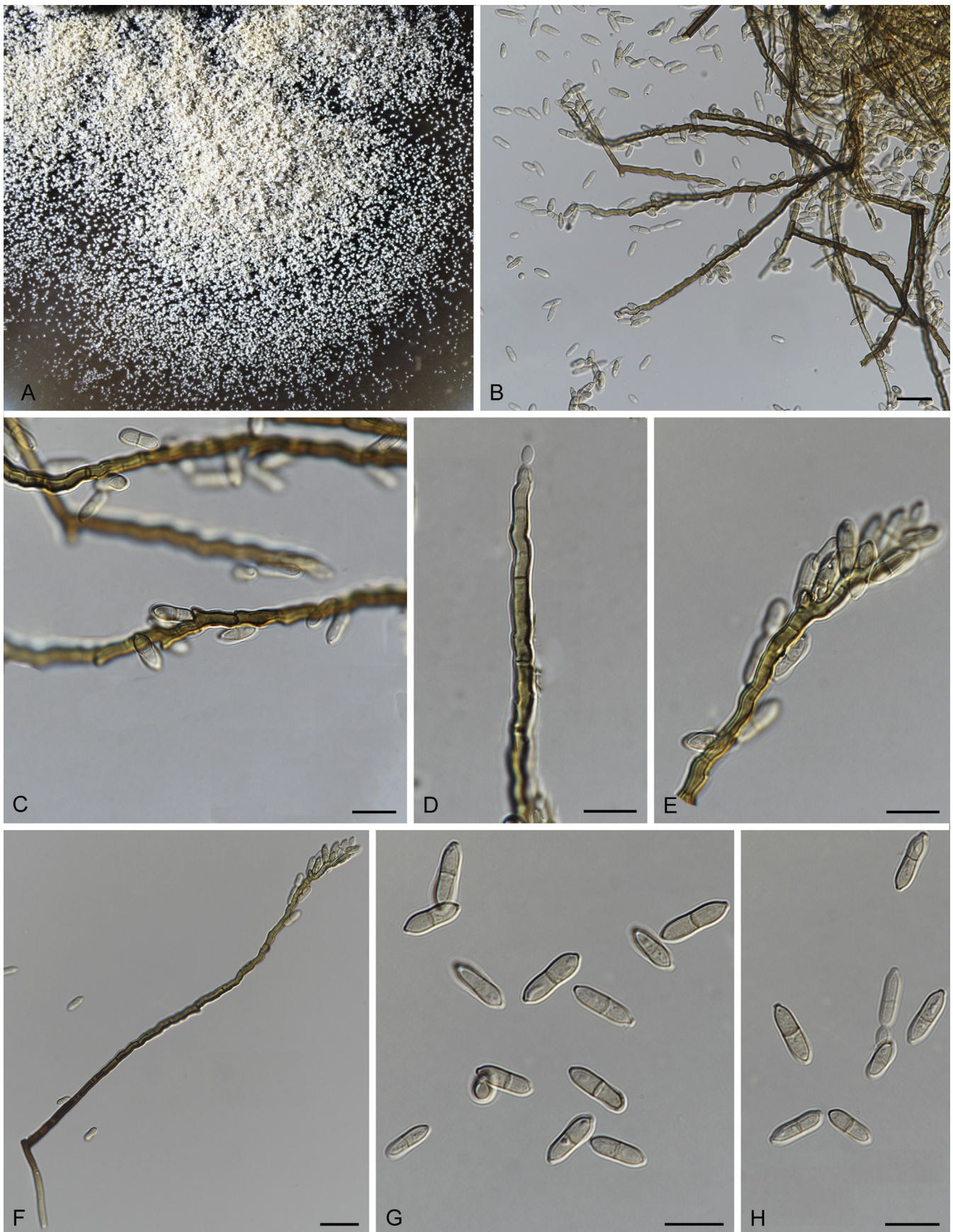
**Mycelium** consisting of pale brown, smooth, branched, septate hyphae. **Conidiophores** erect, solitary, subcylindrical, brown to dark brown, septate, sometimes thick-walled, smooth, rarely branched below, sometimes dimorphic. **Conidiogenous cells** integrated, terminal, rarely lateral, brown, smooth, with several or numerous sympodial denticle-like loci, somewhat thickened and darkened, but not refractive. **Conidia** sometimes occurring in short chains, straight, cylindrical, subcylindrical, subhyaline to pale brown, smooth, guttulate, mostly 1-septate, ends obtusely

rounded; **hila** somewhat thickened and darkened (adapted from Ho et al. 1999, Crous et al. 2007b, 2016).

**Type species:** *Parafusicladium amoenum* (R.F. Castañeda & Dugan) Crous, M. Shen & Y. Zhang ter

**Notes:** The sympodial conidiogenous cells and subcylindrical conidia with somewhat thickened and darkened hila of *Parafusicladium* point to *Sympoventuriaceae*. Based on a multigenic phylogenetic analysis, it forms a subclade sibling to other genera of *Sympoventuriaceae* (Fig. 1). *Parafusicladium* is thus introduced here comprising three species, viz., *P. amoenum*, *P. intermedium* and *P. paraamoenum*.

***Parafusicladium amoenum*** (R.F. Castañeda & Dugan) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831544. Fig. 7.



**Fig. 7.** *Parafusicladium amoenum* (culture ex-type CBS 254.95) asexual morph. **A.** Colony on OA. **B–F.** Long conidiophores reduced to sympodial conidiogenous cells. **G, H.** Pale brown and 1-septate conidia. Scale bars: B–H = 10 μm.

**Basionym:** *Anungitopsis amoena* R.F. Castaneda & Dugan, Mycotaxon 72: 118. 1999.

**Synonyms:** *Fusicladium amoenum* (R.F. Castañeda & Dugan) Crous et al., Stud. Mycol. 58: 207. 2007.

*Cladosporium amoenum* R.F. Castañeda, BCCM MUCL Agro-industrial fungi-yeasts. 1998. *Nom. inval.*, Art. 38.1(a) (Shenzhen).

**Description and illustration:** Untereiner et al. (1998), Ho et al. (1999), Crous et al. (2007b).

**Typus:** Cuba, Santiago de Cuba, La Gran Piedra, fallen leaves of *Eucalyptus* sp. (*Myrtaceae*), 2 Nov. 1994, R.F. Castañeda (Ho et al. 1999: 117, Figs 2, 3, **holotype**; **epitype** ATCC 200947 (designated in Ho et al. 1999), culture ex-epitype CBS 254.95 = ATCC 200947 = IMI 367525 = INIFAT C94/155 = MUCL 39143).

**Notes:** *Cladosporium amoenum* was first described from fallen leaves of *Eucalyptus* sp. collected in Cuba, which was, unfortunately, invalid because it lacked a Latin diagnosis (Untereiner et al. 1998). Ho et al. (1999) validated its name and assigned it to *Anungitopsis* (as *A. amoena*), which was subsequently assigned to *Fusicladium* (as *F. amoenum*) (Crous et al. 2007b). The colony of *Fusicladium amoenum* is pseudocladosporium-like, while the loci of the conidiogenous cells are neither prominently thickened, nor refractive (Ho et al. 1999, Crous et al. 2007a). Phylogenetically, *Fusicladium amoenum* clusters in *Parafusicladium*, sister to *P. paraamoenum* (Fig. 1).

***Parafusicladium intermedium*** (Crous & W.B. Kendr.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831545. Fig. 8. **Basionym:** *Anungitopsis intermedia* Crous & W.B. Kendr., S. African J. Bot. 63: 286. 1997.

**Synonym:** *Fusicladium intermedium* (Crous & W.B. Kendr.) Crous, Stud. Mycol. 58: 209. 2007.

**Descriptions and illustrations:** Crous et al. (1997, 2007b).

**Typus:** Madagascar, Tamatave, leaf litter of *Eucalyptus* sp. (*Myrtaceae*), Apr. 1994, P.W. Crous (**epitype** CBS H-19918 (designated in Crous et al. 2007b), culture ex-epitype CBS 110746 = CPC 778 = IMI 362702). **South Africa**, Mpumalanga, from leaf litter of *Eucalyptus* sp., Oct. 1992, M.J. Wingfield (**holotype** PREM 51438).

**Notes:** *Anungitopsis intermedia* was described from leaf litter of *Eucalyptus* sp. in South Africa, and was subsequently assigned to *Fusicladium* (as *F. intermedium*) (Crous et al. 1997, 2007b). Morphologically, the conidiophores are dimorphic in culture, being either macronematous, anungitopsis-like, or micronematous, more pseudocladosporium-like (Crous et al. 1997, 2007b). This species is the most basal species in *Parafusicladium* (Fig. 1).

***Parafusicladium paraamoenum*** (Crous et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831552. Fig. 9.

**Basionym:** *Fusicladium paraamoenum* Crous et al., Persoonia 36: 377. 2016.

**Description and illustration:** Crous et al. (2016).

**Typus:** Australia, Victoria, Toolangi State Forest, on leaves of *Eucalyptus regnans* (*Myrtaceae*), 9 Nov. 2014, P.W. Crous, J. Edwards & P.W.J. Taylor (**holotype** CBS H-22618, culture ex-type CBS 141322 = CPC 25596).

**Notes:** Morphologically, *P. paraamoenum* is most comparable with *P. amoenum*, but has larger conidia [(13–)15–20(–28) × (3–)3.5(–4) μm vs. (6–)10.5–12.8(–17.3) × (1.5–)2.4–3(–3.8) μm] (Ho et al. 1999, Crous et al. 2016). They also differ in their dimorphic conidiophores (Crous et al. 2016). Phylogenetically, the two species are siblings (Fig. 1).

***Pinaceicola*** Crous, M. Shen & Y. Zhang ter, **gen. nov.** MycoBank MB831515.

**Etymology:** The epithet refers to *Pinaceae*, the host family from which the genus was described.

**Mycelium** consisting of branched, septate, pale to medium brown, smooth hyphae. **Conidiophores** erect, pale to dark brown, subcylindrical, smooth, straight, reduced to conidiogenous cells, with one to several conidiogenous loci, subcylindrical to almost conical, widest at the base, tapering to a subtruncate or truncate apex; **conidiogenous loci** flat-tipped, somewhat darkened and thickened. **Ramoconidia** present, aseptate or septate. **Conidia** in branched or unbranched chains, pale to medium brown or pale olivaceous, smooth, narrowly ellipsoid, subcylindrical or fusoid, straight to slightly curved, 0–1-septate, mostly widest in the middle, tapering to subtruncate or truncate ends; **hila** somewhat darkened and thickened, not refractive (adapted from Crous et al. 2007b, Koukol 2010).

**Type species:** *Pinaceicola pini* (Crous) Crous, M. Shen & Y. Zhang ter

**Note:** The two species of *Pinaceicola* presently recognised were both reported as saprobes on needles of *Pinaceae* (Crous et al. 2007b, Koukol 2010).

***Pinaceicola cordae*** (Koukol) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831555. Fig. 10.

**Basionym:** *Fusicladium cordae* Koukol, Mycol. Progr. 9(3): 371. 2010.

**Description and illustration:** Koukol (2010).

**Typus:** Czech Republic, Doubice, Tokáň, on needle litter of *Pinus sylvestris* (*Pinaceae*), 11 Dec. 2006, O. Koukol (**holotype** PRM 915688, culture ex-type CBS 126959 = CCF 3843).

**Additional materials examined:** Germany, on litter needles of *Pinus sylvestris* (*Pinaceae*), 5 Feb. 2016, R.K. Schumacher (culture CBS 143494 = CPC 30463; *ibid.*, CPC 30466). Netherlands, Kootwijk, needles of *P. sylvestris*, 8 Nov. 1982, G.S. de Hoog (culture CBS 675.82).

**Notes:** *Pinaceicola cordae* was first described from the Czech Republic and the Netherlands (as *Fusicladium cordae*; Koukol 2010), and subsequently collected in Germany (present study). *Pinaceicola cordae* is thus far only known from needles of *Pinus sylvestris*. Together with *Pinaceicola pini*, *P. cordae* clusters in *Symptoventuriaceae*, and basal to *Sterila*, *Fuscohilum* and *Neocoleroa* (Fig. 1).

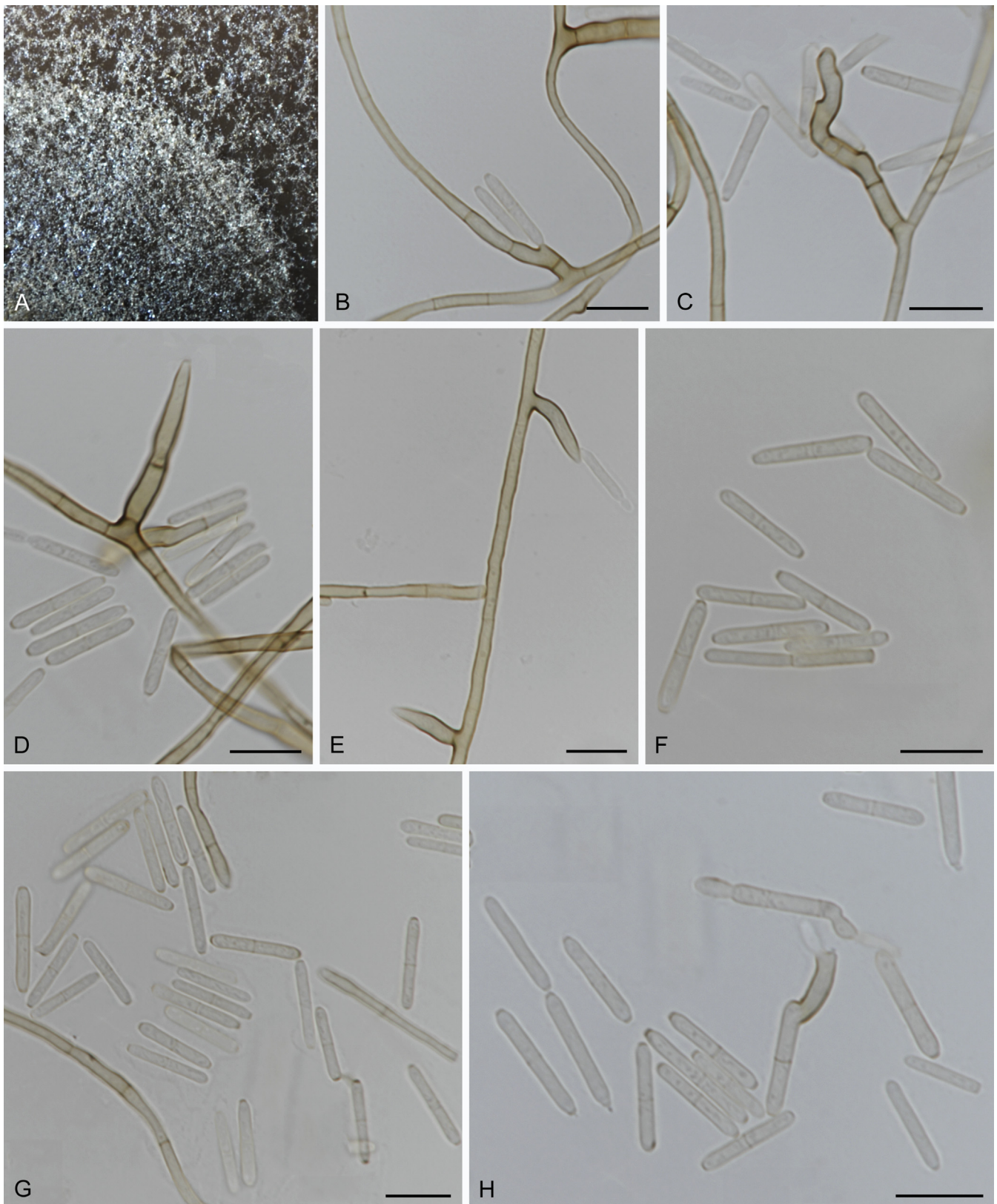
***Pinaceicola pini*** (Crous & de Hoog) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831556. Fig. 11.

**Basionym:** *Fusicladium pini* Crous & de Hoog, Stud. Mycol. 58: 210. 2007.

**Synonym:** *Fusicladium ramoconidii* Crous & de Hoog, Stud. Mycol. 58: 211. 2007.

**Description and illustration:** Crous et al. (2007b).





**Fig. 8.** *Parafusicladium intermedium* (culture ex-epitype CBS 110746) asexual morph. **A.** Colony on OA. **B–E.** Brown conidiophores with sympodial conidiogenous loci. **F–H.** Subhyaline and cylindrical conidia. Scale bars: B–H = 10  $\mu$ m.

**Typus:** Netherlands, Baarn, De Vuursche, on litter needle of *Pinus* sp. (*Pinaceae*), 12 Apr. 1982, G.S. de Hoog (**holotype** CBS H-19908, culture ex-type CBS 463.82).

**Additional material examined:** Netherlands, Baarn, De Vuursche, on needle of *Pinus sylvestris* (*Pinaceae*), 12 Apr. 1982, G.S. de Hoog (dried culture CBS H-1610, ex-type culture of *Fusicladium ramoconidii* CBS 462.82).

**Notes:** *Fusicladium pini* and *F. ramoconidii* were introduced as different species based on differences in their ITS sequences (13 bp), and the absence of ramoconidia in *F. pini* (Crous *et al.* 2007b). However, the multigene data [Fig.1; ITS sequences (identity: 99 %), LSU sequences (identity: 100 %), *tef1* sequences (identity: 99 %), *tub2* sequences (identity: 99 %), *rpb2*

sequences (identity: 99 %) suggest them to be conspecific belonging in the newly erected genus, *Pinaceicola*.

***Pseudosigmoidea*** K. Ando & N. Nakam., J. Gen. Appl. Microbiol., Tokyo 46: 55. 2000.

*Type species: Pseudosigmoidea cranei* K. Ando & N. Nakam.

***Pseudosigmoidea alnicola*** Crous & R.K. Schumacher, Fungal Syst. Evol. 3: 109. 2019.

*Description and illustration: Crous et al. (2019a).*

*Typus: Germany*, near Berlin, leaf litter of *Alnus glutinosa* (*Betulaceae*), 3 May 2017, R.K. Schumacher, HPC 2100 (**holotype** CBS H-23826, culture ex-type CBS 145034 = CPC 33776).

*Note: The phylogenetic position of this species is shown and discussed by Crous et al. (2019a).*

***Pseudosigmoidea cranei*** K. Ando & N. Nakam., J. Gen. Appl. Microbiol., Tokyo 46: 55. 2000.

*Typus: USA*, Maryland, Frederick County, Appalachian Trail, Bear Spring, from fresh water, collection date and collector unknown (**holotype** TNS F-100793, culture ex-type ATCC 16660) (not seen).

*Note: This species is not known from molecular data, thus its phylogenetic position is unknown.*

***Pseudosigmoidea excentrica*** (R.F. Castañeda et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831557.

*Basionym: Scolecobasidium excentricum* R.F. Castañeda et al., Nova Hedwigia 64: 473. 1997.

*Typus: Cuba*, Santiago de Las Vegas, Ciudad de la Habana, Pinar del Rio, isolated from dead leaves of unidentified *Lauraceae*, 6. Aug. 1994, coll. R.F. Castañeda Ruiz (**holotype** CBS H-7739, **isotype** CBS H-6052, culture ex-type CBS 469.95 = INIFAT C94/202 = MUCL 39227).

*Notes: Scolecobasidium excentricum* was introduced based on its “eccentrically inflated” conidia, which are quite clearly illustrated (figs 1–3 in Castañeda-Ruis et al. 1997). In this study, the ex-type of *Scolecobasidium excentricum* (INIFAT C94/202 = CBS 469.95) was sequenced, showing it to cluster in *Pseudosigmoidea* (Fig. 1). Morphologically, *Scolecobasidium excentricum* has straight to flexuous conidiophores, and polyblastic or sympodial conidiogenous cells, which agree with *Venturiales* (Castañeda-Ruis et al. 1997).

***Pseudosigmoidea ibarakiensis*** Diene & Narisawa, Microbes and Environm. 28: 384. 2013.

*Typus: Japan*, Ibaraki, obtained from natural forest soil, 2008, unknown collector (**holotype** NIAES H-20615, culture ex-type I.4-2-1 = NBRC 107891) (not seen).

*Note: This species is sister to P. excentrica (Fig. 1).*

***Scolecobasidium*** E.V. Abbott, Mycologia 19: 30. 1927.

*Synonym: Ochroconis* de Hoog & Arx, Kavaka 1: 57. 1974 [1973].

*Type species: Scolecobasidium terreum* E.V. Abbott.

*Notes: Scolecobasidium* was introduced based on *S. terreum* and *S. constrictum*, with *S. terreum* designated as the generic type (Abbott 1927). The slow-growing, olivaceous colonies of

these two species agree well with *Venturiales*. Morphologically, the diagnostic characteristics of *Scolecobasidium* includes that conidia are produced on “sterigmata” left as tubular appendages on conidiophores, and are produced singly (never in chains).

Although Barron & Busch (1962) considered species of *Scolecobasidium* with darker, unbranched conidia to be congeneric with *S. terreum*, this opinion was not shared by von Arx, and therefore De Hoog & von Arx (1974) introduced a separate genus, *Ochroconis*, typified by *O. constricta*, for species with ellipsoidal conidia. *Ochroconis* proved to be a rather common genus of saprotrophic soil hyphomycetes, some of which occasionally grow on plant litter, humans or fish (Samerpitak et al. 2014). Gams (2015) regarded *Ochroconis* as synonym of *Scolecobasidium*, which was supported by Seifert et al. (2011). Although the ex-type strains of both *S. terreum* (CBS 203.27) and *O. constricta* (CBS 202.27) are now sterile, together with other species of *Ochroconis* and *Scolecobasidium*, they nest in the clade of *Scolecobasidium* (Fig. 1). Based on these results as well as their morphology, we therefore resurrect the older generic name *Scolecobasidium*, and reduce *Ochroconis* to synonymy with it.

***Scolecobasidium aquaticum*** (Samerp. et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831640.

*Basionym: Ochroconis aquatica* Samerp. et al., Mycoscience 58: 292. 2017.

*Typus: Germany*, Mecklenburg-Vorpommern, isolated from silicone seal in shower of fish-processing company, 28 Oct. 2014, K. Gloyna (**holotype** CBS H-22391, culture ex-type CBS 140316).

*Note: This species is sister to S. anomalum (Fig. 1).*

***Scolecobasidium atlanticum*** (A.M. Wellman) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831641.

*Basionym: Ochroconis atlantica* A.M. Wellman, Canad. J. Bot. 53: 1631. 1975.

*Typus: Atlantic Ocean*, 44.30'' N, 26.00'' W, on tar, cultured on Difco Marine 2216 agar, Jun. 1973, A.M. Wellman (**holotype** IMI 183133).

***Scolecobasidium bacilliforme*** (Samerp. et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831642.

*Basionym: Ochroconis bacilliformis* Samerp. et al., Mycopathologia 180: 4. 2015.

*Typus: Germany*, Mülheim, from biofilm on stainless steel in drinking water, 1998, E. Göttlich (**holotype** CBS H-22032, culture ex-type CBS 100442 = M 37/2).

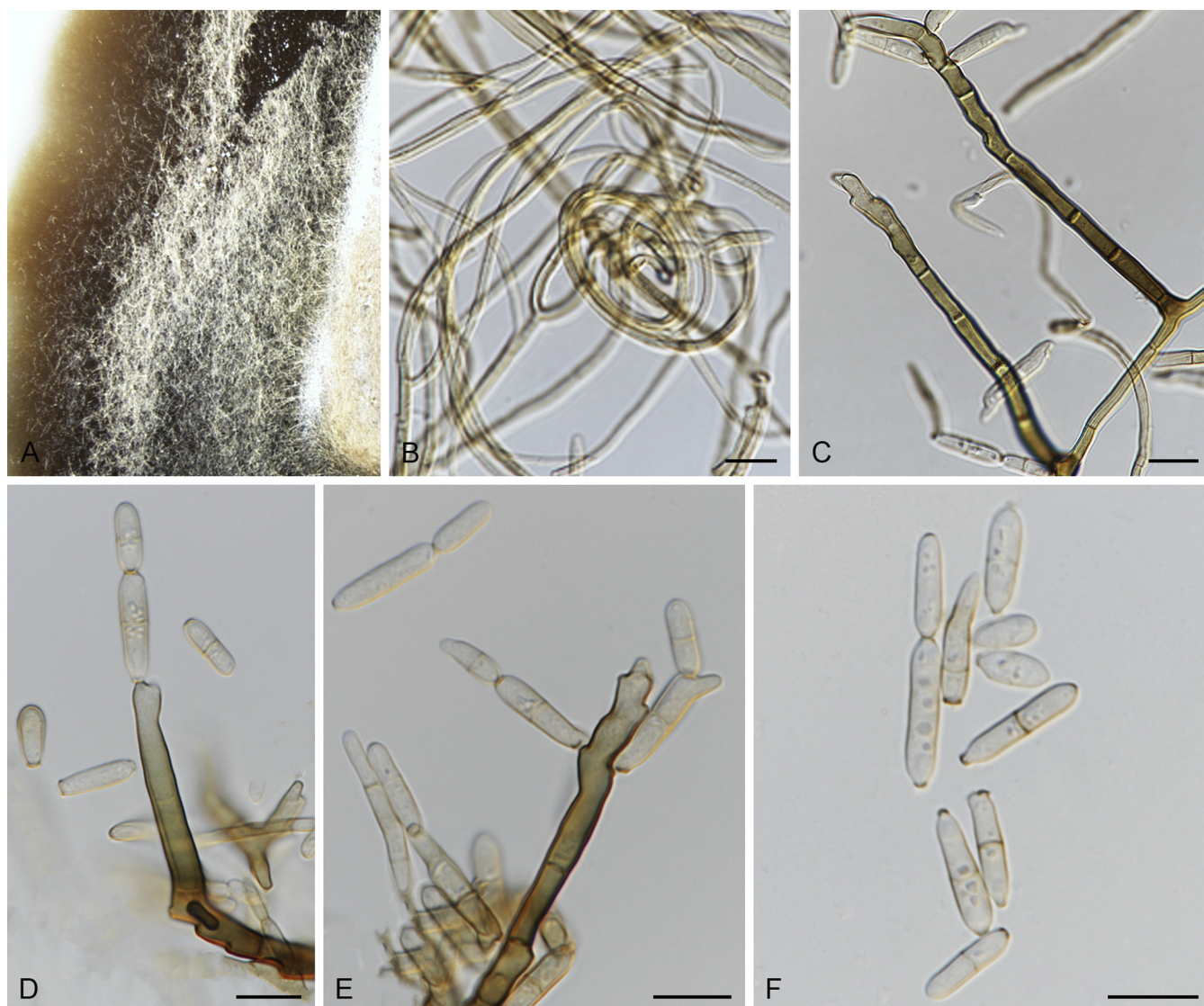
***Scolecobasidium capsici*** (Crous & Cheew.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831643.

*Basionym: Ochroconis capsici* Crous & Cheew., Persoonia 37: 333. 2016.

*Typus: Thailand*, Chiang Rai, N19°48'01'' E99°41'27'', on *Capsicum annuum* (*Solanaceae*), 2013, R. Cheewangkoon (**holotype** CBS H-22883, culture ex-type CPC 28782 = CBS 142096).

***Scolecobasidium cordanae*** (Samerp. et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831644.

*Basionym: Ochroconis cordanae* Samerp. et al., Fungal Diversity 65: 105. 2013 [2014].



**Fig. 9.** *Parafusicladium paraemoenum* (culture ex-type CBS 141322) asexual morph. **A.** Colony on OA. **B.** Hyphal coil. **C–E.** Conidia arising from sympodial conidiogenous cells. **F.** Pale brown, aseptate or 1-septate conidia. Scale bars: B–F = 10 µm.

**Typus:** Colombia, Villavicencio, from dead leaf, Dec. 1979, W. Gams (culture ex-type CBS 475.80).

**Note:** This species represents one of three basal lineages in the *Scolecobasidium* clade (Fig. 1).

***Scolecobasidium dracaenae*** (Crous) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831645.

**Basionym:** *Ochroconis dracaenae* Crous, Persoonia 36: 379. 2016.

**Typus:** USA, Texas, Austin, on leaf spots of *Dracaena reflexa* (Asparagaceae), Aug. 2013, P.W. Crous (**holotype** CBS H-22619, culture ex-type CPC 26115 = CBS 141323).

**Note:** This species is sister to *S. pandanicola* (Fig. 1).

***Scolecobasidium globale*** (Samerp. et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831646.

**Basionym:** *Ochroconis globalis* Samerp. et al., Mycol. Progr. 14 (no. 6): 3. 2015.

**Typus:** Germany, Düsseldorf, from indoor sample, dwelling house, 2002 (**holotype** CBS H-21940, culture ex-type CBS 119644).

**Note:** This species is sister to *S. tshawytschae* (Fig. 1).

***Scolecobasidium icarus*** (Samerp. et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831647.

**Basionym:** *Ochroconis icarus* Samerp. et al., J. Clin. Microbiol. 52: 4195. 2014.

**Typus:** Canada, Ontario, from forest soil, 1969, G.L. Barron (**holotype** CBS H-21643, cultures ex-type CBS 536.69 = MUCL 15054 = OAC 10212).

**Note:** This species is sister to *S. ramosum* (Fig. 1).

***Scolecobasidium macrozambiae*** (Crous & R.G. Shivas) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831648.

**Basionym:** *Ochroconis macrozambiae* Crous & R.G. Shivas, Persoonia 32: 205. 2014.

**Typus:** Australia, Queensland, Brisbane, Slaughter Falls, on *Macrozamia* (Zamiaceae) leaf litter, 16 Jul. 2009, P.W. Crous & R.G. Shivas (**holotype** CBS H-21682, culture ex-type CPC 17262 = CBS 137971).

**Note:** This species is sister to *S. gamsii* (Fig. 1).

***Scolecobasidium minimum*** (Fassat.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831649.

*Basionym:* *Humicola minima* Fassat., Česká Mykol. 21: 87. 1967.

*Synonym:* *Ochroconis minima* (Fassat.) Samerp. & de Hoog, Fungal Diversity 65: 110. 2013 [2014].

*Typus:* **Nigeria**, Samaru, Zaria, from rhizosphere of *Gossypium arboretum* (*Malvaceae*), M. Dransfield (**holotype** PRC 981, ex-type CBS 510.71 = ATCC 22631 = IMI 082933).

*Note:* This species is sister to *S. ramosum* / *icarus* (Fig. 1).

***Scolecobasidium musicola*** (Crous) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB832011.

*Basionym:* *Ochroconis musicola* Crous, Persoonia 40: 387. 2018.

*Typus:* **Malaysia**, leaves of *Musa* sp. (*Musaceae*), 2010, P.W. Crous (**holotype** CBS H-23562, culture ex-type CBS 144441).

*Note:* This species is sister to *S. sexuale* / *macrozamia* / *gamsii* (Fig. 1).

***Scolecobasidium olivaceum*** (A. Giraldo et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831652.

*Basionym:* *Ochroconis olivacea* A. Giraldo et al., J. Clin. Microbiol. 52: 4195. 2014.

*Typus:* **USA**, Utah, from bronchoalveolar lavage fluid, 2010, D.A. Sutton (**holotype** CBS H-21779, cultures ex-type CBS 137170 = FMR 12509 = UTHSC 10-2009).

*Note:* This species is sister to *S. verrucosum* (Fig. 1).

***Scolecobasidium pandanicola*** (Crous & M.J. Wingf.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831653.

*Basionym:* *Ochroconis pandanicola* Crous & M.J. Wingf., Persoonia 35: 277. 2015.

*Typus:* **France**, La Réunion, S21°21'30.7" E55°44'32.3", Route Forestiere Mare Longue, on leaves of *Pandanus utilis* (*Pandanaceae*), 6 Mar. 2014, P.W. Crous & M.J. Wingfield (**holotype** CBS H-22397, culture ex-type CPC 26317 = CBS 140660).

*Note:* This species is sister to *S. dracaenae* (Fig. 1).

***Scolecobasidium phaeophorum*** (Samerp. et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831654.

*Basionym:* *Ochroconis phaeophora* Samerp. et al., Mycopathologia 180: 4. 2015.

*Typus:* **Papua New Guinea**, Madang, Balek, from leaf in coastal rain forest, 1995, A. Aptroot & A. van Iperen (**holotype** CBS H-22033, culture ex-type CBS 206.96 = 36599/No. A 165).

*Note:* This species represents one of three basal lineages in the *Scolecobasidium* clade (Fig. 1).

***Scolecobasidium podocarp*** (Crous) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831655.

*Basionym:* *Ochroconis podocarp* Crous, Persoonia 39: 361. 2017.

*Typus:* **Australia**, New South Wales, Australian Botanic Garden, Mount Annan, on leaves of *Podocarpus grayae* (*Podocarpaceae*), 25 Nov. 2016, P.W. Crous (**holotype** CBS H-23267, culture ex-type CPC 32829 = CBS 143174).

*Note:* This species represents one of three basal lineages in the *Scolecobasidium* clade (Fig. 1).

***Scolecobasidium ramosum*** (A. Giraldo et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831656.

*Basionym:* *Ochroconis ramosa* A. Giraldo et al., J. Clin. Microbiol. 52: 4197. 2014.

*Typus:* **USA**, California, from human nail, 2012, D.A. Sutton (**holotype** CBS H-21780, culture ex-type CBS 137173 = FMR 12514 = UTHSC 12-1082).

*Note:* This species is sister to *S. icarus* (Fig. 1).

***Scolecobasidium robustum*** (Samerp. et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831657.

*Basionym:* *Ochroconis robusta* Samerp. et al., Mycopathologia 180: 5. 2015.

*Typus:* **Spain**, from leaf litter of *Quercus ilex* (*Fagaceae*), 1996, R.F. Castañeda (**holotype** CBS H-22031, culture ex-type CBS 112.97 = INIFAT C96/119).

***Scolecobasidium sexuale*** (Samerp. et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831658.

*Basionym:* *Ochroconis sexualis* Samerp. et al., Fungal Diversity 65: 114. 2013 [2014].

*Typus:* **South Africa**, Durban, obtained from quality control swabs in a laboratory providing medical supplies, collection date and collector unknown (culture ex-type PPRI 12991).

*Note:* This species is sister to *S. macrozamia* / *gamsii* (Fig. 1).

***Scolecobasidium verrucosum*** (Zachariah et al.) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831659.

*Basionym:* *Septonema verrucosum* Zachariah et al. [as "verrucosa"], Mycologia 73: 208. 1981.

*Synonym:* *Ochroconis verrucosa* (Zachariah et al.) Samerp. & de Hoog, Fungal Diversity 65: 117. 2013 [2014].

*Typus:* **India**, Kerala, from soil, Jun. 1981, S. Zachariah (**holotype** CUCC F164, ex-type CBS 383.81 = IMI 211655).

*Note:* This species is sister to *S. olivaceum* (Fig. 1).

***Sterila*** Crous, M. Shen & Y. Zhang ter, **gen. nov.** MycoBank MB831516.

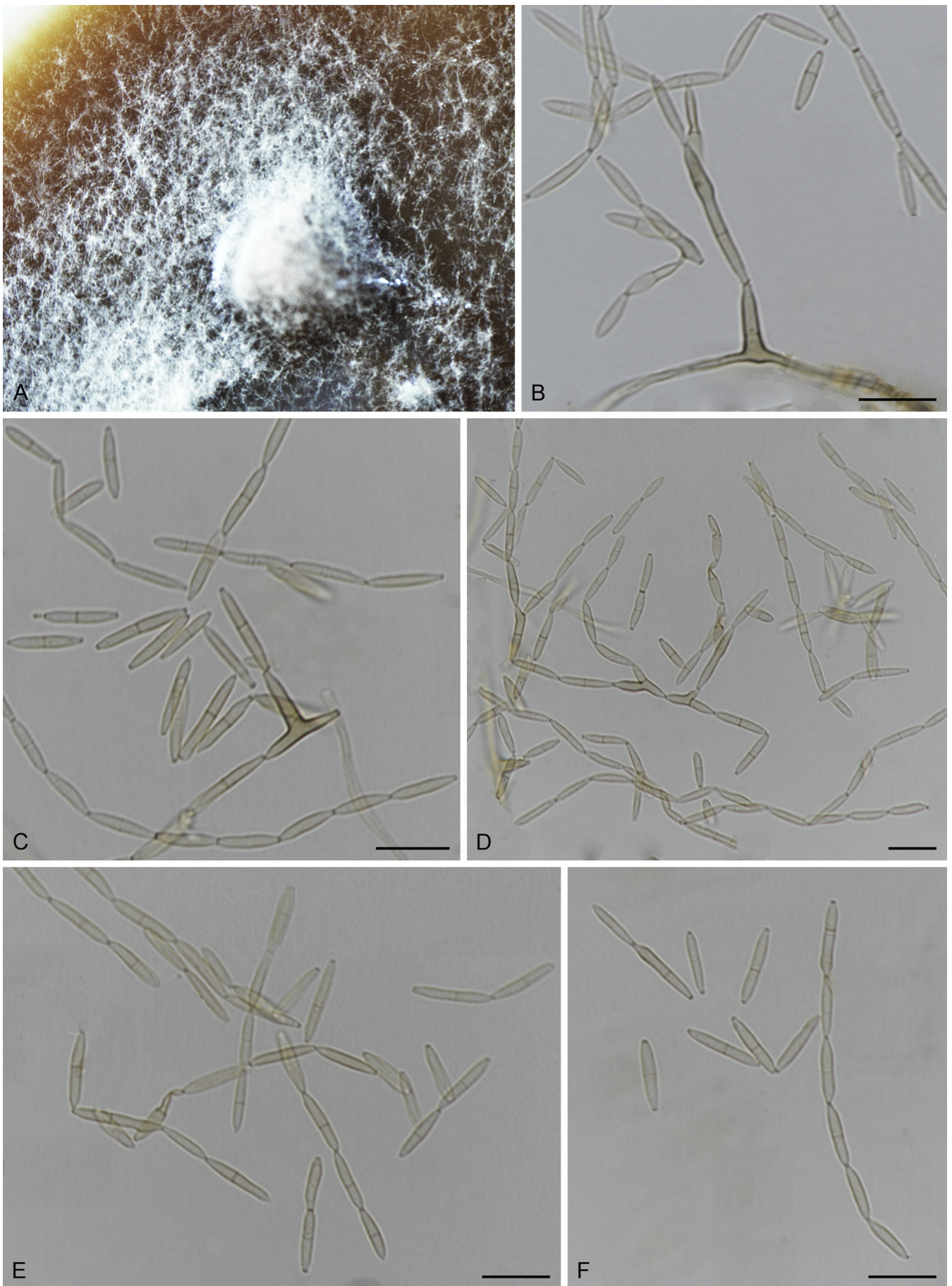
*Etymology:* The epithet refers to the fact that colonies are sterile in culture.

*Type species:* *Sterila eucalypti* Crous, M. Shen & Y. Zhang ter

***Sterila eucalypti*** Crous, M. Shen & Y. Zhang ter, **sp. nov.** MycoBank MB831522.

*Etymology:* The epithet refers to *Eucalyptus*, the host from which the fungus was isolated.

Cultures sterile. *Sterila eucalypti* differs from its closest phylogenetic neighbours *Fuscohilum rhodensis* and *F. siciliana* (Fig. 1) by unique fixed alleles in four loci based on alignments of the separate loci deposited in TreeBASE (S24573): *Sterila eucalypti* (CBS 144019) vs. *Fuscohilum rhodensis* (CPC13156) by 26 bp in ITS (10%), 67 bp in LSU (8%), 71 bp in *rpb2* (22%), 112 bp in *tef1* (24%); *S. eucalypti* (CBS 144019) vs. *P. siciliana* (CBS 105.85) by 23 bp in ITS (9%), 61 bp in LSU (8%), 174 bp in *rpb2* (22%), 108 bp in *tef1* (23%).



**Fig. 10.** *Pinaceicola cordae* (culture CBS 675.82) asexual morph. **A.** Colony on OA. **B, C.** Conidia arising from conidiogenous cells. **D–F.** Pale brown, aseptate or 1-septate conidia in branched chains. Scale bars: B–F = 10  $\mu$ m.

**Culture characteristics:** Colonies spreading, erumpent, with sparse aerial mycelium and regular margins on OA, olivaceous brown (surface), margins dark olivaceous; reverse fuscous-black; on MEA pale grey (surface), margins brownish red; reverse fuscous-black; on SNA olivaceous brown (surface), margins pale olivaceous; reverse olivaceous to dark olivaceous. Colonies reaching 18 mm diam after 2 wk on OA at 25 °C in the dark.

**Typus:** **Portugal**, on *Eucalyptus* sp. (*Myrtaceae*), 24 Jan. 2008, P.W. Crous (**holotype** CBS H-23601, culture ex-type CBS 144019 = CPC 14944, CPC 14942, CPC 14943).

**Notes:** *Sterila eucalypti* was collected from leaves of a *Eucalyptus* sp. Unfortunately, it does not sporulate in culture. Although cultured from single ascospores, no ascomata could be located on the leaves of the fungarium specimen. According to multigene phylogenetic analysis, it forms a separate fully supported clade distinguishing it from other genera of *Sympoventuriaceae* (Fig. 1).

***Sympoventuria*** Crous & Seifert, *Fungal Diversity* 25: 31. 2007.

**Description and illustration:** Crous et al. (2007a).

**Type species:** *Sympoventuria capensis* Crous & Seifert

**Notes:** The genus *Sympoventuria* was first introduced by Crous et al. (2007a) based on *S. capensis*, which was saprophytic on *Eucalyptus* leaves collected in South Africa. Although the small-sized immersed ascomata agree with *Venturia*, the persistent pseudoparaphyses, saprophytic lifestyle, hyaline, 1-septate, symmetric ascospores and subcylindrical asci of *Sympoventuria capensis* differ from those of *Venturia* s. str. (Sivanesan 1977, Crous et al. 2007a, Zhang et al. 2011).

***Sympoventuria africana*** (Crous) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831585.

**Basionym:** *Fusicladium africanum* Crous, *Stud. Mycol.* 58: 205. 2007.

**Description and illustration:** Crous et al. (2007b).

**Typus:** **South Africa**, Western Cape Province, Malmesbury, on leaf litter of *Eucalyptus* sp. (*Myrtaceae*), Jan. 2006, P.W. Crous (**holotype** CBS H-19904, culture ex-type CBS 121639 = CPC 12828, CBS 121640 = CPC 12829).

**Notes:** Both *S. africana* and *S. capensis* were collected from *Eucalyptus* leaf litter in South Africa (Crous et al. 2007a, b). Morphologically, the fusiform conidia of *S. africana* can be distinguished from the cylindrical conidia of *S. capensis*. *Sympoventuria africana* represents the most basal species in the *Sympoventuria* clade (Fig. 1).

***Sympoventuria capensis*** Crous & Seifert, *Fungal Diversity* 25: 32. 2007.

**Description and illustration:** Crous et al. (2007a).

**Typus:** **South Africa**, Western Cape Province, Malmesbury, on leaf litter of *Eucalyptus* sp. (*Myrtaceae*), Jan. 2006, P.W. Crous (**holotype** CBS H-19757, culture ex-type CPC 12838 = CBS 120136, CPC 12839, CPC 12840).

**Notes:** See the notes for *Sympoventuria africana*. This species is sister to *S. melaleuca* in Fig. 1.

***Sympoventuria melaleuca*** Crous, *Persoonia* 39: 413. 2017.

**Description and illustration:** Crous et al. (2017).

**Typus:** **Australia**, Victoria, Royal Botanic Gardens Victoria, Melbourne Gardens, on leaves of *Melaleuca* sp. (*Proteaceae*), 2 Dec. 2016, P.W. Crous (**holotype** CBS H-23298, culture ex-type CBS 143407 = CPC 32576).

**Notes:** *Sympoventuria melaleuca* was introduced for a fungus which is occurring on leaves of *Melaleuca* sp. in Australia (Crous et al. 2017). Morphologically, *S. melaleuca* is distinct from *S. capensis* in that it has smaller conidia [(8–)11–17(–25) × 2–3 μm vs. up to (40–)55–65 × 4–5 μm], with fewer septa (0–1-septate vs. (1–)3(–5)-septate) (Crous et al. 2007a, b). DNA sequence data also place *S. melaleuca* within *Sympoventuria*, sister to *S. capensis* (Fig. 1).

***Troposporella*** P. Karst., *Hedwigia* 31: 299. 1892.

**Type species:** *Troposporella fumosa* P. Karst.

***Troposporella fumosa*** P. Karst., *Hedwigia* 31: 299. 1892.

**Typus:** **Finland**, Mustiala, on the old bark of *Populus tremula* (*Salicaceae*), 13 Nov. 1892, P.A. Karsten 4286 (H6052538).

**Note:** *Troposporella fumosa* formed a robust clade with *T. monilipes* (Fig. 1). Linder (1929: 335) examined type material of *T. fumosa* deposited at H and provided a description based on this material.

***Troposporella monilipes*** (Ellis & L.N. Johnson) C.K.M. Tsui & Berbee, *Mycoscience* 51: 147. 2010.

**Basionym:** *Helicoma monilipes* Ellis & L.N. Johnson, *Proc. Acad. Nat. Sci. Philadelphia* 46: 376. 1894.

**Typus:** **USA**, Michigan, Ann Arbor, on decayed wood of *Quercus* (*Fagaceae*), Oct. 1893 (L.N. Johnson No. 666) (not seen).

**Note:** This species is sister to *T. fumosa* (Fig. 1).

***Veronaepsis*** Arzanlou & Crous, *Stud. Mycol.* 58: 91. 2007.

**Type species:** *Veronaepsis simplex* (Papendorf) Arzanlou & Crous

**Notes:** *Veronaepsis* was separated from *Veronaea* based on its shorter conidiophores, geniculate rachis and prominent conidiogenous loci (Papendorf 1969, Arzanlou et al. 2007). Phylogenetically, *Veronaepsis simplex* nests in the *Sympoventuriaceae*, and is sister to other genera of *Sympoventuriaceae* (Fig. 1).

***Veronaepsis simplex*** (Papendorf) Arzanlou & Crous, *Stud. Mycol.* 58: 91. 2007.

**Basionym:** *Veronaea simplex* Papendorf, *Trans. Brit. Mycol. Soc.* 52: 486. 1969.

**Typus:** **South Africa**, Potchefstroom, leaf-litter and top soil of a mixed *Acacia karroo* (= *Vachellia karroo*) (*Fabaceae*) community, Apr. 1966, J.W. du Toit (**holotype** PREM 43728, culture ex-type CBS 588.66).

**Notes:** According to Arzanlou et al. (2007), *Veronaepsis simplex* is saprobic on leaf litter of *V. karroo* in South Africa, and distinct from species of other genera by having a well-developed rachis with densely aggregated conidiogenous loci.

***Verruconis*** Samerp. et al., *Fungal Diversity* 65: 117. 2013 [2014].

*Type species: Verruconis gallopava* (W.B. Cooke) Samerp. & de Hoog

*Notes:* The genus *Verruconis* was separated from *Scolecobasidium* based on its ecological and physiological traits and morphological differences (Samerpitak *et al.* 2014). Presently there are seven species included in *Verruconis* (see below). Morphologically, the light to dark brown, verrucose to coarsely ornamented conidia of *Verruconis* are readily distinguishable from *Scolecobasidium* (Samerpitak *et al.* 2014, Zhang *et al.* 2018). Some species of *Verruconis* are thermophilic, such as *V. calidifluminalis* and *V. gallopava*, both of which originate from a hot spring (Samerpitak *et al.* 2014). *Verruconis verruculosa* and *V. panacis* originate from the soil environment, with *V. verruculosa* from grassland soil, and *V. panacis* from roots of *Panax notoginseng* (Roy *et al.* 1962, Samerpitak *et al.* 2014, Zhang *et al.* 2018). *Verruconis hainanensis* and *V. pseudotricladiata* were isolated from submerged dicotyledonous leaves in a stream of Hainan island, China (Qiao *et al.* 2019). Based on the morphological and phylogenetic characteristics, *Scolecobasidium terricola* was assigned to *Verruconis* (as *V. terricola*). Species of *Verruconis* form a separate clade basal to *Scolecobasidium* (Fig. 1).

***Verruconis calidifluminalis*** (Yarita *et al.*) Samerp. & de Hoog, Fungal Diversity 65: 117. 2013 [2014].

*Basionym:* *Ochroconis calidifluminalis* Yarita *et al.*, Mycopathologia 170: 29. 2010.

*Typus:* **Japan**, Hakone, Kanagawa Prefecture, from hot spring river water, Mar. 2004, K. Nishimura (**holotype** IFM 54738, not seen).

*Notes:* *Ochroconis calidifluminalis* was described by Yarita *et al.* (2010) from a hot spring in Japan, and was subsequently assigned to *Verruconis* (Samerpitak *et al.* 2014). *Verruconis calidifluminalis* was isolated concomitantly with *V. gallopava* as thermophilic fungi from a hot spring (Yarita *et al.* 2010, Samerpitak *et al.* 2014). Although *V. calidifluminalis* and *V. gallopava* are comparable in their ecology, morphology as well as culture characteristics, they are distinguishable by their pathogenic potential to vertebrates (Yarita *et al.* 2010, Samerpitak *et al.* 2014). *Verruconis gallopava* is a neurotropic invader in birds and also occurs in humans (Samerpitak *et al.* 2014). *Verruconis calidifluminalis*, however, has low virulence in mice (Samerpitak *et al.* 2014). In addition, DNA sequence data can also readily distinguish these two species (Fig. 1).

***Verruconis gallopava*** (W.B. Cooke) Samerp. & de Hoog, Fungal Diversity 65: 117. 2013 [2014].

*Basionym:* *Diplorhynchium gallopavum* W.B. Cooke, Sabouraudia 3: 242. 1964.

*Synonyms:* *Dactylaria gallopava* (W.B. Cooke) G.C. Bhatt & W.B. Kendr., Canad. J. Bot. 46: 1257. 1968.

*Ochroconis gallopava* (W.B. Cooke) de Hoog, Fung. Path. Hum. Anim.: 181. 1983.

*Dactylaria constricta* var. *gallopava* (W.B. Cooke) Salkin & D.M. Dixon, Mycotaxon 29: 379. 1987.

*Scolecobasidium gallopavum* (W.B. Cooke) G.Y. Sun & Lu Hao, Mycol. Progr. 12(3): 492. 2012.

*Typus:* **Turkey**, isolated from the brain tissue of sick young *Bos taurus*, collection date and collector unknown (**holotype** CDC 45-492-62, culture ex-type CBS 437.64 = ATCC 16027 = CDC 45-492-62 = MUCL 6683 = IFM 52605) (not seen).

*Notes:* *Verruconis gallopava* is a widely distributed thermophile which was encountered in diverse types of hot environments, such as self-heated coal waste piles (Tansey & Brock 1973), hot springs (Tansey & Brock 1973, Weitzman *et al.* 1983, Yarita *et al.* 2007), warm effluents of a nuclear reaction station (Rippon *et al.* 1980), and broiler-house litter (Waldrip *et al.* 1974, Randall & Owen 1981). *Verruconis gallopava* is a neurotropic invader in birds, chicken, humans, trumpeters and cats (Evans 1971a, b, Tansey & Brock 1973, Weitzman *et al.* 1983, Karesh *et al.* 1987, Horr  & de Hoog 1999, Redman *et al.* 1999, Yarita *et al.* 2007, Samerpitak *et al.* 2014). For differences from *V. calidifluminalis* see comments above.

***Verruconis hainanensis*** Z.F. Yu & M. Qiao, MycoKeys 48: 47. 2019.

*Typus:* **China**, Hainan Province, Qixianling, 18°68'N, 109°69'E, 902 m alt., from leaves of an unidentified dicotyledonous plant submerged in a stream, 16 Jun. 2016, Z.F. Yu (**holotype** YMFT 1.04165; culture ex-type YMF 1.04165; **isotype** CGMCC 3.18974).

***Verruconis panacis*** T. Zhang & Y. Zhang, Int. J. Syst. Evol. Microbiol. 68: 2502. 2018.

*Typus:* **China**, Yunnan Province, Wen-shan district, from the root of a 3-yr-old *Panax notoginseng* (Araliaceae), Oct. 2015, T. Zhang (**holotype** SYPFH 8337, culture ex-type CBS 142802 = CGMCC 3.18302 = SYPF 8337).

*Notes:* *Verruconis panacis* was introduced by Zhang *et al.* (2018), having been collected from *Panax notoginseng* roots in China. Morphologically, *Verruconis panacis* is distinguishable from other *Verruconis* species by its four-celled conidia (Zhang *et al.* 2018). This species is sister to *V. verruculosa* / *terricola* (Fig. 1).

***Verruconis pseudotricladiata*** Z.F. Yu & M. Qiao, MycoKeys 48: 48. 2019.

*Typus:* **China**, Hainan Province, Diaoluo Mountain, 18°41'N, 109°41'E, 254 m alt., from leaves of an unidentified broad-leaf species submerged in a stream, 16 Jun. 2016, Z.F. Yu (**holotype** YMFT 1.04915; culture ex-type YMF 1.04915; **isotype** CGMCC 3.18939).

***Verruconis terricola*** (J. Ren *et al.*) Crous, M. Shen & Y. Zhang *ter*, **comb. nov.** MycoBank MB831671.

*Basionym:* *Scolecobasidium terricola* J. Ren *et al.*, Mycoscience 54: 421. 2013.

*Typus:* **China**, Hainan Province, Wuzhi Mountain, isolated from soil, Dec. 2009, Y.-L. Zhang (**holotype** HGUPd3009, culture ex-type CBS 131795 = HGUP3009).

*Notes:* *Scolecobasidium terricola* was originally isolated from soil in a tropical region of China (Ren *et al.* 2013). Morphologically, the sympodial, holoblastic conidiogenous cells, solitary, ellipsoidal, 1-septate conidia with a sterigma left as a tubular appendage on the conidiogenous cell and the conidial base of conidia point to *Scolecobasidium* / *Verruconis* (Ren *et al.* 2013). Phylogenetically, *Scolecobasidium terricola* nests in *Verruconis* (Fig. 1), to which is assigned.

***Verruconis verruculosa*** (R.Y. Roy *et al.*) Samerp. & de Hoog, Fungal Diversity 65: 120. 2013 [2014].

**Basionym:** *Scolecobasidium verruculosum* R.Y. Roy *et al.*, *Lloydia* 25: 164. 1962.

**Typus:** India, Varanasi, grassland soil, collection date and collector unknown (**holotype** in Indian Type Culture Collection, IARI New Delhi) (not seen).

**Notes:** *Verruconis verruculosa* is a soil-borne fungus, which was saprophytic in grassland soil in India (Roy *et al.* 1962, Samerpitak *et al.* 2014). Morphologically, *Verruconis verruculosa* is distinguishable from other species of *Verruconis* by its oblong conidia with rounded ends and prominent spines (Samerpitak *et al.* 2014). Based on the multigene phylogenetic analysis, *Verruconis verruculosa* formed a single sister lineage distinguishing it from other species of *Verruconis* (Fig. 1).

**Venturiaceae** E. Müll. & Arx ex M.E. Barr, *Mycologia* 71: 947. 1979.

Habitat saprophytic, endophytic or parasitic on leaves or stems of dicotyledons, rarely on monocotyledons. Sexual morph: *Ascomata* immersed, erumpent to superficial, scattered or gregarious, sometimes composed of a well-developed subiculum, globose, subglobose, with or without setae around papilla, ostiolate. *Hamathecium* of narrowly cellular pseudoparaphyses, mostly evanescent. *Asci* 8-spored, bitunicate, fissitunicate, usually obclavate to obpyriform, rarely cylindrical, mostly apedicellate. *Ascospores* yellowish, light greenish olivaceous to brown, or hyaline, 1-septate, symmetrical, asymmetrical or apiosporous. Asexual morph: *Mycelium* consisting of pale to medium brown, smooth to finely verruculose, branched hyphae. *Conidiophores* singly or in clusters, sometime even in sporodochia, simple or branched. *Conidiogenous cells* integrated, terminal or sometimes intercalary, proliferating sympodially or percurrently, sometimes with conspicuous annellations. *Conidia* aseptate or euseptate, pigmented, solitary or in chains.

**Type genus:** *Venturia* Sacc.

**Notes:** *Venturiaceae* was first invalidly introduced by Müller & von Arx (1950), and von Arx (1952) provided a systematic key to genera of *Venturiaceae*. The familial type of *Venturiaceae* is *Venturia* Sacc. Barr (1979) validated the family, included 12 genera within *Venturiaceae* and provided a first detailed description with important diagnostic characters. Furthermore, Barr (1989) provided a key to North American genera and species. Lumbsch & Huhndorf (2010) assigned 27 genera to *Venturiaceae*. *Venturiaceae sensu* Zhang *et al.* (2011) comprises eight genera, viz. *Acantharia*, *Apiosporina* (including *Dibotryon*), *Caproventuria*, *Coleroa*, *Pseudoparodiella*, *Metacoleroa*, *Tyrannosorus* and *Venturia* with another seven genera ambiguously included without molecular data. Hyde *et al.* (2013) assigned 15 genera (including an ambiguous genus *Spilodochium*) to *Venturiaceae*. Based on morphological, ecological and molecular data, *Caproventuria* is treated as a synonym of *Tyrannosorus* in this study.

**Acantharia** Theiss. & Syd., *Ann. Mycol.* 16: 15. 1918.

**Synonym:** *Zeuctomorpha* Sivan. *et al.*, In: Sivanesan, Bitunicate Ascomycetes and their Anamorphs: 572. 1984.

**Type species:** *Acantharia echinata* (Ellis & Everh.) Theiss. & Syd.

**Note:** Based on the morphological characteristics of the type species, e.g. its foliicolous habitat, superficial, setose ascomata, evanescent pseudoparaphyses, obclavate asci, and 1-septate,

brown, constricted ascospores, *Acantharia* was assigned to *Venturiaceae* (Zhang *et al.* 2011). Molecular proof, however, is still needed to confirm its placement in *Venturiaceae*.

**Apiosporina** Höhn., *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1.* 119: 439. 1910.

**Synonym:** *Dibotryon* Theiss. & Syd., *Ann. Mycol.* 13: 663. 1915.

**Type species:** *Apiosporina collinsii* (Schwein.) Höhn.

**Notes:** Based on the fusicladium-like asexual morph, morphological characteristics of the sexual morph, as well as the molecular phylogeny of *A. collinsii* and *A. morbosa*, *Apiosporina* was assigned to *Venturiaceae* (Zhang *et al.* 2011). Morphologically, the submedian ascospore septation of *Apiosporina* was the most striking characteristic of *Apiosporina*. The phylogenetic significance of ascospore septation (and position) still needs to be clarified.

**Apiosporina collinsii** (Schwein.) Höhn., *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1.* 119: 439. 1910.

**Basionym:** *Sphaeria collinsii* Schwein., *Trans. Amer. Philos. Soc., n.s.* 4: 211. 1832 [1834].

**Material examined:** Canada, Ontario, Thunder Bay, Lakehead, Univ., Campus, on *Amelanchier alnifolia* (Rosaceae), 23 May 2005, L.J. Hutchinson (culture CBS 118973 = CPC 12229–12231).

**Notes:** Phylogenetically, *Apiosporina collinsii* (represented by CBS 118973), the generic type of *Apiosporina*, clustered apart from *Apiosporina morbosa*, and basal to most other members of *Venturiaceae* (Figs 1, 2).

**Apiosporina morbosa** (Schwein.) Arx, *Acta Bot. Neerl.* 3: 86. 1954.

**Basionym:** *Sphaeria morbosa* Schwein., *Schriften Naturf. Ges. Leipzig.* 1: 40 [14 of repr.]. 1822.

**Notes:** *Apiosporina morbosa* is represented by strain “dimosp” from *Prunus* in USA in Fig. 1. Unfortunately, no ITS sequence is available for comparison to other *A. morbosa* ITS sequences on GenBank; the majority of which appears to be associated with *Cladosporium* (GenBank AF493982–AF493982, AY166451 and AY165751) or distantly with *Periconia* (GenBank MK575461). The generic status of *Apiosporina morbosa* cannot be confirmed until authentic isolates become available for further study.

**Coleroa** Rabenh., *Klotzschii Herb. Viv. Mycol., Ed. 1, Cent.* 15, no. 1456. 1850.

**Description and illustration:** Zhang *et al.* (2011).

**Type species:** *Coleroa chaetomium* (Kunze ex Fr.) Rabenh.

**Notes:** Based on the scattered, setose ascomata, deliquescent pseudoparaphyses, fusoid to obclavate asci and the 1-septate, constricted ascospores of *C. chaetomium*, *Coleroa* was assigned to *Venturiaceae* (Zhang *et al.* 2011). Two isolates, *C. circinans* and *C. robertiani*, nested in *Venturiaceae* in this study (Figs 1, 2). *Coleroa* spp. 1–3 were all collected in Europe, and previously named as *Venturia* spp. Phylogenetically, they all nest in a clade with *C. circinans* and *C. robertiani* (Figs 1, 2). They were thus treated as unnamed taxa within *Coleroa*. Both *C. circinans* and *C. robertiani*, however, were tentatively used to represent *Coleroa*. The phylogeny of *Coleroa* needs to be resolved once sequence data become available for the generic type.

**Coleroa circinans** (Fr.) G. Winter, *Rabenh. Krypt.-Fl., Ed. 2,* 1(2): 200. 1885.



*Basionym:* *Perisporium circinans* Fr., Syst. Mycol. 3: 252. 1829.

*Material examined:* France, *Geranium rotundifolium* (Geraniaceae), 26 Jun. 1961, C. Bachmann (ETH 2760, culture CBS 457.64).

*Note:* The species is sister to *C. robertiani* (Figs 1, 2).

***Coleroa robertiani*** (Fr.) E. Müll., Beitr. Kryptogamenfl. Schweiz. 11(2): 416. 1962.

*Basionym:* *Dothidea robertiani* Fr., Syst. mycol. 2(2): 564. 1823.

*Typus:* Switzerland, Oetliberg, Zürich-Witikon, on *Geranium robertianum* (Geraniaceae), 28 Sep. 1960, C. Bachmann (lectotype ETH 2757 designated here, MBT391368, epitype specimen designated here CBS 458.64, MBT391369, preserved as metabolically inactive culture, culture ex-epitype CBS 458.64).

*Note:* The species is sister to *C. circinans* (Figs 1, 2).

***Cylindrosympodioides*** Crous & M.J. Wingf., Persoonia 36: 336. 2016.

*Description and illustration:* Crous *et al.* (2016).

*Type species:* *Cylindrosympodioides brabeji* Crous & M.J. Wingf.

*Notes:* *Cylindrosympodioides* was first introduced based on *C. brabeji*, which shares a similar morphology with species of *Cylindrosympodium* in having solitary, septate, cylindrical to subacicular, hyaline conidia with truncate bases, somewhat darkened hila, and brown conidiogenous structures with sympodial proliferation (Crous *et al.* 2016). *Cylindrosympodioides* differs from *Cylindrosympodium* in that it has acicular conidia with slightly thickened hila, and a fusicladium-like synasexual morph, which has narrowly fusiform, 1-septate conidia and conidiophores reduced to conidiogenous cells. *Cylindrosympodioides brabeji* forms a distinct sister lineage basal in the Venturiaceae.

***Cylindrosympodioides brabeji*** Crous & M.J. Wingf., Persoonia 36: 335. 2016.

*Description and illustration:* Crous *et al.* (2016).

*Typus:* South Africa, Western Cape Province, Franschhoek, on leaves of *Brabejum stellatifolium* (Proteaceae), 17 Jan. 2015, P.W. Crous & M.J. Wingfield (holotype CBS H-22594, culture ex-type CBS 141285 = CPC 25934).

*Notes:* *Cylindrosympodioides* is a monotypic genus represented by *C. brabeji*, which is an endophyte (presumed saprobe) on leaves of *Brabejum stellatifolium* (Crous *et al.* 2016). Phylogenetically (Fig. 1), *Cylindrosympodioides brabeji* is basal in Venturiaceae, sibling to *Sympoventuriaceae* and *Cylindrosympodiaceae*. The genus can be distinguished from *Cylindrosympodium* acicular conidia with slightly thickened hila, and a fusicladium-like synasexual morph, as well as conidiophores that are reduced to conidiogenous cells (Crous *et al.* 2016).

***Fagicola*** Crous, M. Shen & Y. Zhang *ter*, *gen. nov.* MycoBank MB831517.

*Etymology:* Named after the host genus on which it occurs, *Fagus*; “-icola” means dweller, inhabiter.

*Mycelium* consisting of pale to medium brown, smooth to finely verruculose, branched hyphae. *Conidiophores* integrated, terminal on hyphae, aseptate or septate, mostly reduced to conidiogenous cells, also lateral, visible as small, protruding,

denticle-like loci. *Conidiogenous cells* subcylindrical, pale to medium brown, smooth to finely verruculose, tapering to several apical indistinct loci. *Ramoconidia* present. *Conidia* pale brown, smooth, guttulate, subcylindrical to narrowly ellipsoid, occurring in simple or branched chains, aseptate or septate, tapering towards subtruncate ends; *hila* mostly inconspicuous, *i.e.*, rarely thickened or darkened-refractive (adapted from Crous *et al.* 2007b).

*Type species:* *Fagicola fagi* (Crous & de Hoog) Crous, M. Shen & Y. Zhang *ter*

***Fagicola fagi*** (Crous & de Hoog) Crous, M. Shen & Y. Zhang *ter*, *comb. nov.* MycoBank MB831586. Fig. 12.

*Basionym:* *Fusicladium fagi* Crous & de Hoog, Stud. Mycol. 58: 209. 2007.

*Description and illustration:* Crous *et al.* (2007b).

*Typus:* Netherlands, Utrecht Province, Baarn, Maarshalksbosch, on decaying leaves of *Fagus sylvatica* (Fagaceae), 1 Oct. 1984, G.S. de Hoog (holotype CBS H-10366, culture ex-type CBS 621.84 = ATCC 200937).

*Notes:* *Fagicola* is proposed based on *Fagicola fagi* (as *Fusicladium fagi*), which is saprophytic on leaves of *Fagus sylvatica* collected in the Netherlands. A multigene phylogenetic analysis indicated that *Fagicola fagi* is sibling to other genera of Venturiaceae (Figs 1, 2).

***Fraxinicola*** Crous, M. Shen & Y. Zhang *ter*, *gen. nov.* MycoBank MB831518.

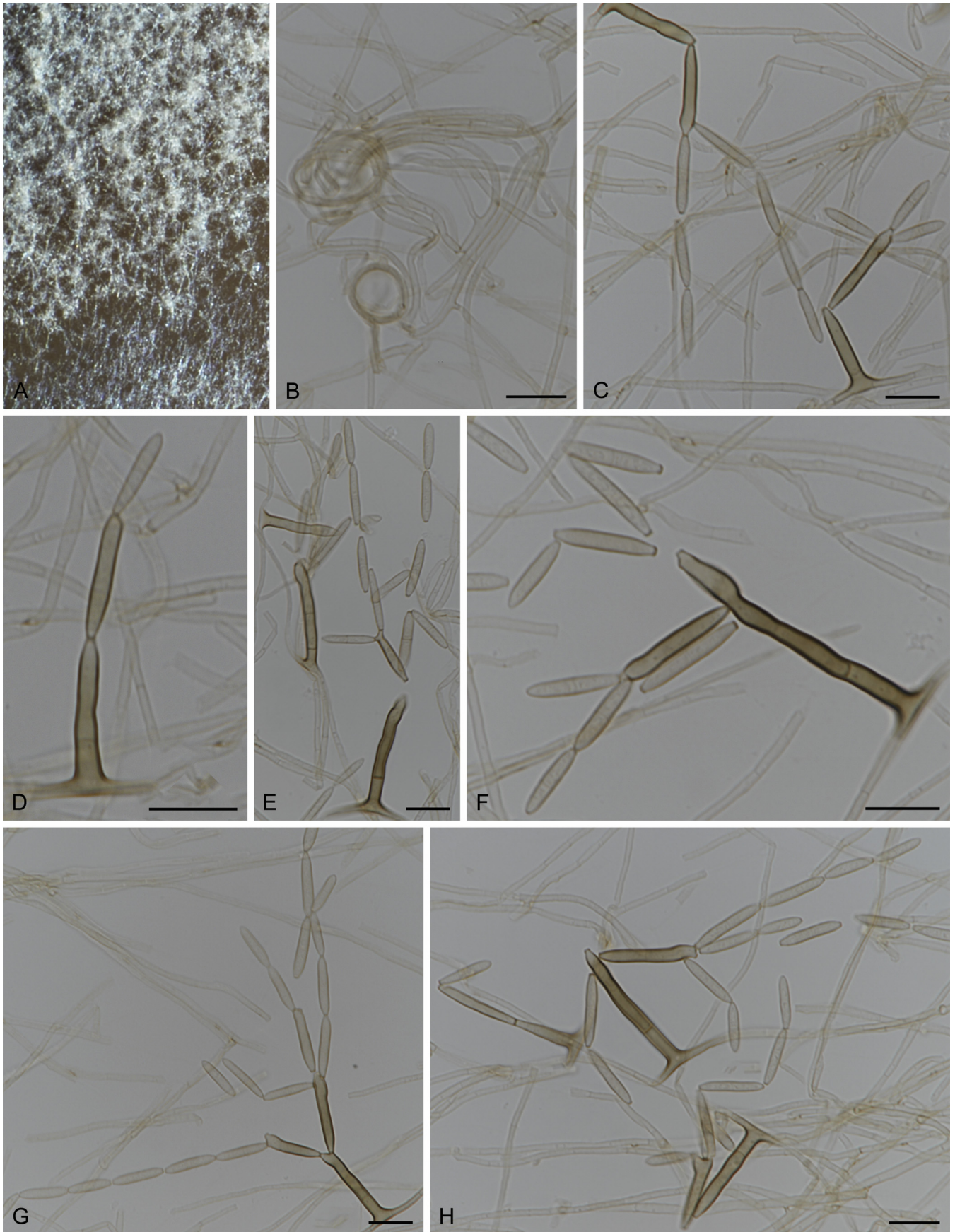
*Etymology:* Named after the host genus on which it mostly occurs, *Fraxinus*. “-icola” means dweller, inhabiter.

*In vivo:* *Ascomata* scattered over the entire leaf surface, immersed, globose to subglobose, pseudoparaphysate, ostiolate, papillate, with or without setae. *Peridium* thin, composed of pigmented cells of *textura angularis*. *Asci* bitunicate, oblong to obclavate, with a short pedicel. *Ascospores* uniseriate, partially overlapping to biseriate, especially at the base, ellipsoidal, with broadly rounded ends, olivaceous pale brown, 1-septate, slightly constricted at the septum, the upper cells often shorter and wider than the lower ones, smooth-walled. *Conidiophores* fusicladium-like, arising in clusters (sporodochia) from erumpent subcuticular to intraepidermal, few-celled stromata, or from terminal or lateral hyphae in culture, erect, unbranched, geniculate, septate, dark brown, smooth, walls thickened. *Sporodochia* interconnected by subcuticular to intraepidermal mycelium of melanised, partly swollen short cells and intercellular chlamydospores. *Conidiogenous cells* terminal, geniculate, proliferation sympodial, with a few to numerous truncate loci, somewhat refractive or darkened. *Conidia* solitary, smooth, lanceolate but apical tip rounded, 0–2-septate, pale medium brown, with a truncate base which is often somewhat thickened (adapted from Aderhold 1897, Crous *et al.* 2011, Ibrahim *et al.* 2016).

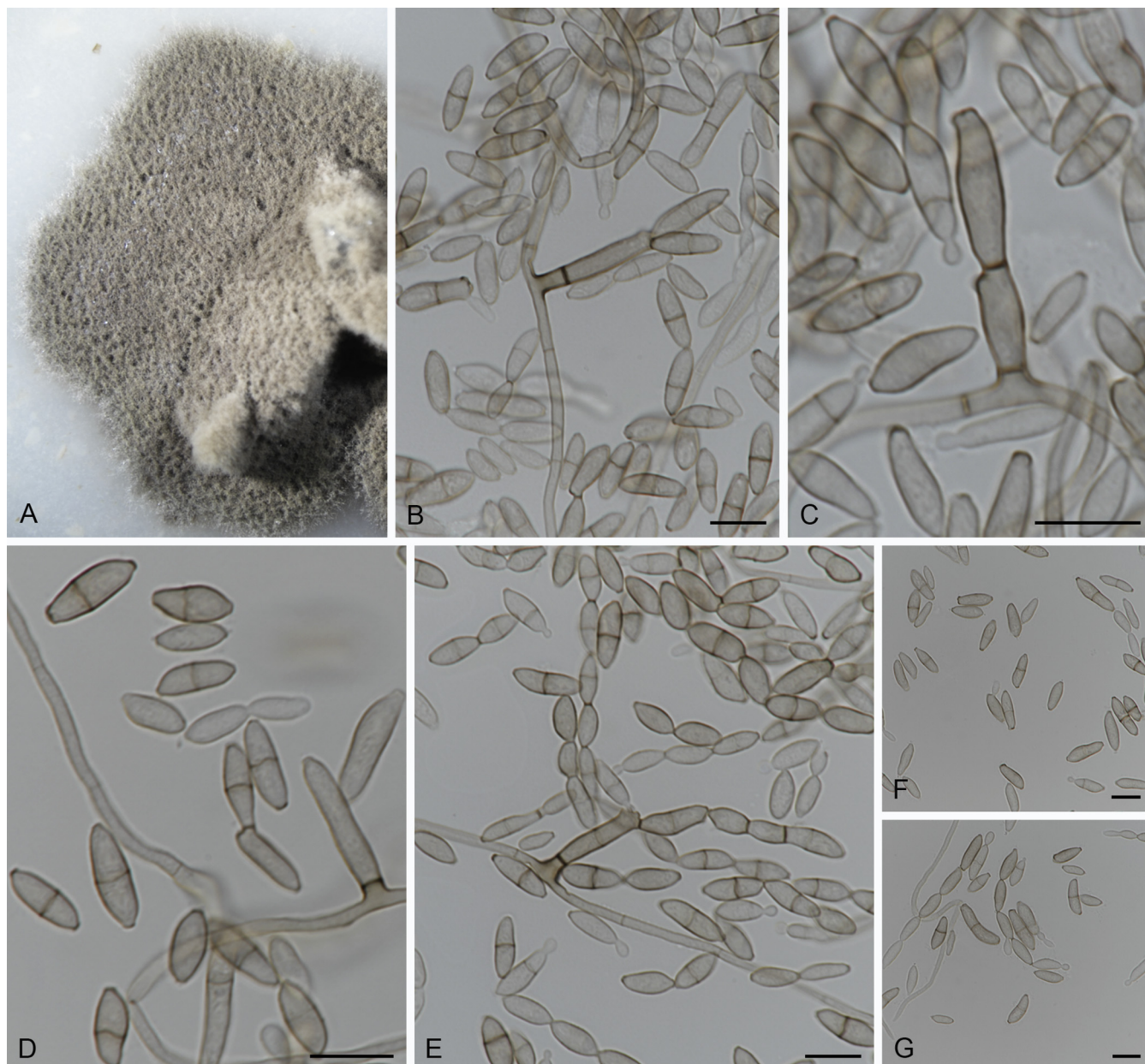
*Type species:* *Fraxinicola fraxini* (Aderh.) Crous, M. Shen & Y. Zhang *ter*

***Fraxinicola europaea*** Crous, M. Shen & Y. Zhang *ter*, *sp. nov.* MycoBank MB831523.

*Etymology:* Named after the continent where it was collected. Europe.



**Fig. 11.** *Pinaceicola pini* (culture ex-type CBS 463.82) asexual morph. **A.** Colony on OA. **B.** Hyphal coil. **C–H.** Symplodial conidiogenous loci and concatenated conidia arising from conidiogenous cells. Scale bars: B–H = 10 μm.



**Fig. 12.** *Fagicola fagi* (culture ex-type CBS 621.84) asexual morph. **A.** Colony on OA. **B–E.** Conidia in simple or branched chains arising from conidiogenous cells. **F, G.** Brown, aseptate or 1-septate conidia. Scale bars: B–G = 10  $\mu$ m.

Cultures sterile. *Fraxinicola europaea* differs from its closest phylogenetic neighbours, *F. fraxini*, *F. italica* and *F. orni* (Fig. 1) by unique fixed alleles in five loci based on alignments of the separate loci deposited in TreeBASE (S24573): *Fraxinicola europaea* (CBS 472.61) vs. *F. fraxini* (CBS 140930) by 34 bp in ITS (7%), 7 bp in LSU (1%), 95 bp in *rpb2* (12%), 59 bp in *tef1* (17%), 80 bp in *tub2* (21%); *F. europaea* (CBS 472.61) vs. *F. italica* (CBS 140918) by 34 bp in ITS (7%), 8 bp in LSU (1%), 94 bp in *rpb2* (12%); 60 bp in *tef1* (18%), 86 bp in *tub2* (22%); *F. europaea* (CBS 472.61) vs. *F. orni* (CBS 140920) by 35 bp in ITS (7%), 9 bp in LSU (1%), 98 bp in *rpb2* (13%), 62 bp in *tef1* (18%), 86 bp in *tub2* (22%).

**Culture characteristics:** Colonies spreading, erumpent, with aerial mycelium and regular and smooth margins on OA, grey to olivaceous brown (surface); reverse fuscous-black; on MEA grey to dark brown (surface); reverse fuscous-black; on SNA olivaceous (surface); reverse dark olivaceous. Colonies reaching 5 mm diam after 2 wk on OA at 25 °C in the dark.

**Typus:** Switzerland, Kt. Tessin, Gola di Lago, on *Betula pubescens* (*Betulaceae*), 8 Apr. 1959, E. Müller (**holotype** CBS-H 24308, culture ex-type CBS 472.61 = ETH 2839).

**Additional materials examined:** France, Hautes Alpes, Aiguilles, on dead leaf of *Populus tremula* (*Salicaceae*), 28 Jun. 1958, E. Müller (ETH 2831, culture CBS 477.61); Hautes Alpes, Monetier, on *P. tremula*, Jun. 1981, M. Morelet (culture CBS 689.85); Alpes Maritimes, Tende, on *Epilobium montanum* (*Onagraceae*), 24 Aug. 1953, E. Müller (culture CBS 377.53).

**Notes:** *Fraxinicola europaea* does not sporulate in culture, and thus lacks a morphological description. According to the multi-gene phylogenetic analyses, it forms a separate lineage distinguishing it from other species of *Fraxinicola* (Figs 1, 2).

***Fraxinicola fraxini*** (Aderh.) Crous, M. Shen & Y. Zhang **ter. comb. nov.** MycoBank MB831587. Fig. 13.

**Basionym:** *Venturia fraxini* Aderh., Hedwigia 36: 83. 1897.

**Synonyms:** *Fusicladium fraxini* Aderh., Hedwigia 36: 74, 83. 1897.

*Fusicladium proteae* Crous, Persoonia 27: 34. 2011.



**Fig. 13.** *Fraxinicola fraxini* (culture CBS 140930) asexual morph. **A.** Colony on OA. **B–F.** Sympodial conidiogenous cells producing conidia. **G–J.** Brown, 1–3-septate, tapering conidia. Scale bars: B–J = 10  $\mu$ m.

See Schubert *et al.* (2003) for additional synonyms.

*Typus*: Parasitic on leaves of *Fraxinus excelsior* (Oleaceae) (**lectotype** designated here Aderhold 1897, plate IV, fig. 6, MBT391370). **Switzerland**, Spiez, on leaf of *F. excelsior* as endophyte, 31 Aug. 2013, M. Schlegel (**epitype** designated here, specimen CBS 140930, MBT391371, as metabolically inactive culture, ex-epitype culture CBS 140930).

*Additional materials examined*: **Italy**, Premia, on leaf of *F. ornus* (Oleaceae) as endophyte, 31 Aug. 2013, M. Schlegel (culture CBS 140929 = VE 2). **South Africa**, Western Cape Province, Hermanus, Fernkloof Nature Reserve, on leaves of *Protea* sp. (Proteaceae), 5 May 2010, P.W. Crous (ex-type culture of *F. proteae* CBS 130599 = CPC 18282). **Switzerland**, Monte Caslano, on leaf litter of *F. excelsior* (Oleaceae), 5 Sep. 2013, M. Ibrahim (culture CBS 140935 = VE 12); Kt. Wallis, Brig, on *F. excelsior*, 10 Jul. 1953, E. Müller (culture CBS 374.55).

*Notes*: *Venturia fraxini*, the basionym of *Fraxinicola fraxini*, was reported as an endophyte of *Fraxinus excelsior* (Aderhold 1897, Ibrahim *et al.* 2016). Morphologically, *Fraxinicola fraxini* (conidia fusoid to obclavate, 12–28 × 4–6(–7) µm, (0–)1(–3)-septate), is comparable with *Fusicladium proteae* (conidia obpyriform, unequally 1-septate, (13–)17–22(–30) × 4(–5) µm, Schubert *et al.* 2003, Crous *et al.* 2011). Phylogenetically, the type isolate of *Fusicladium proteae* (CBS 130599) forms a conspecific clade together with isolates identified as *Fraxinicola fraxini* (Fig. 2). Thus, we assigned *Fusicladium proteae* to synonymy with *Fraxinicola fraxini*. *Fusicladium proteae* was reported as a causal agent on leaf spots on *Protea* sp. in South Africa (Crous *et al.* 2011). *Fraxinicola fraxini* is sister to *F. orni* / *italica* in Figs 1, 2.

***Fraxinicola italica*** Crous, M. Shen & Y. Zhang *ter*, **sp. nov.** MycoBank MB831524.

*Etymology*: Named after Italy, where this species was collected.

Cultures sterile. *Fraxinicola italica* (CBS 140918) differs from its closest phylogenetic neighbour *F. orni* (CBS 140920) (Fig. 1) by unique fixed alleles in five loci based on alignments of the separate loci deposited in TreeBASE (S24573), by 11 bp in ITS (2%), 3 bp in LSU (1%), 6 bp in *rpb2* (1%), 10 bp in *tef1* (2%), 9 bp in *tub2* (2%).

*Culture characteristics*: Colonies spreading, erumpent, with moderate aerial mycelium and regular, smooth margins on OA, dark brown (surface); reverse fuscous-black; on MEA dark brown (surface); reverse fuscous-black; on SNA dark brown (surface); reverse fuscous-black. Colonies reaching 12 mm diam after 2 wk on OA at 25 °C in the dark.

*Typus*: **Italy**, Lago di Ledro, on leaf of *Fraxinus ornus* (Oleaceae) as endophyte, 5 Sep. 2013, M. Ibrahim (**holotype** specimen and culture ex-type CBS 140918 preserved as metabolically inactive culture).

*Notes*: *Fraxinicola italica* does not sporulate in culture. The species is sister to *F. orni* (Figs 1, 2).

***Fraxinicola orni*** (M. Ibrahim *et al.*) Crous, M. Shen & Y. Zhang *ter*, **comb. nov.** MycoBank MB831588. Fig. 14.

*Basionym*: *Venturia orni* M. Ibrahim *et al.*, Mycol. Progr. 15 (29): 6. 2016.

*Description and illustration*: Ibrahim *et al.* (2016).

*Typus*: **Switzerland**, on leaf litter of *Fraxinus ornus* (Oleaceae), 4 May 2015, M. Schlegel (**holotype** ZT Myc 55333, culture ex-type CBS 140924 = VO 10).

*Additional materials examined*: **Italy**, Lago di Ledro, on leaf of *Fraxinus ornus* (Oleaceae) as endophyte, 5 Nov. 2013, M. Ibrahim (ZT Myc 55330, cultures CBS 140919 = VO 4; ZT Myc 55331, CBS 140920 = VO 5; CBS 140921 = VO 6). **Switzerland**, on leaf of *F. ornus* as endophyte, 13 Nov. 2013, M. Ibrahim (culture CBS 140922 = VO 8).

*Notes*: *Fraxinicola orni* is based on *Venturia orni*, which was described as saprobic on *Fraxinus ornus* (Ibrahim *et al.* 2016). Morphologically, *Venturia orni* can be distinguished from *V. fraxini* by the absence of setae (Aderhold 1897, Ibrahim *et al.* 2016). The multigene phylogenetic analyses indicated that *Fraxinicola orni* clustered in *Fraxinicola* and is sister to other species, viz., *F. italica*, *F. fraxini*, and *F. europaea* (Figs 1, 2).

***Gibbera*** Fr., Syst. Orb. Veg. 1: 110. 1825.

*Type species*: *Gibbera vaccinii* (Sowerby) Fr.

*Notes*: Due to the lack of molecular data for the generic type species, the phylogenetic status of *Gibbera* remains unresolved. Currently, molecular data is available for *G. conferta* (Figs 1, 2) and *G. rosae* (LSU GenBank JQ036234). However, a blast search using the *G. rosae* sequence shows it to be allied to *Cadophora* (data not shown).

***Gibbera kalmiae*** (Peck) M.E. Barr, Canad. J. Bot. 39: 315. 1961. Fig. 15.

*Basionym*: *Venturia kalmiae* Peck, Rep. (Annual) New York State Mus. Nat. Hist. 28: 82. 1876.

Ascomata epiphyllous, 43–71 µm diam, scattered or gregarious, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuously papillate ostiole, surrounded by setae. Setae dark brown, 28–65 × 5–7 µm, setae wall 1–2 µm thick, base swollen, up to 14 µm diam. *Peridium* 1-layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 4–6 × 6–12 µm, cell wall 0.5–1 µm thick. *Pseudoparaphyses* rare, 1.5–3 µm wide, hyaline, septate, persistent. *Asci* 36–50 × 6–8 µm (av. 41.8 × 7.5 µm, n = 20), numerous, 8-spored, bitunicate, fissitunicate, broadly cylindrical to somewhat obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 9–12.5 × 2.5–4 µm (av. 10.8 × 3.2 µm, n = 20), narrowly fusiform, hyaline when young, becoming pale brown when mature, overlapping to biseriate, 1-septate, the upper cells wider and shorter than the lower ones (length ratio: 5:7–10:11), smooth-walled. *Asexual morph* unknown.

*Typus*: **USA**, New York, Oswego City, on the leaves of *Kalmia glauca* (Ericaceae), Jul. 1874, C.H. Peck (**holotype** NYSf1621).

*Notes*: The scattered ascomata, numerous asci, hyaline to pale brown ascospores as well as the persistent pseudoparaphyses of *Venturia kalmiae* point to *Leptosphaeriaceae*. Barr (1961) reported *Venturia kalmiae* as having a thin hypostroma and assigned it to *Gibbera*. The generic type of *Gibbera*, *G. vaccinii*, lacks molecular data, and thus the taxonomic status remains unresolved. No sequence data is currently available for *G. kalmiae*.

***Helicoon*** Morgan (as “*Helicoön*”), J. Cincinnati Soc. Nat. Hist. 15: 49. 1892.

*Type species*: *Helicoon sessile* Morgan

*Notes*: There are currently two accessions listed under the name *H. sessile* on GenBank (accessions ITS: U72605 and SSU-ITS-LSU: KY659207). The former accession number is allied to *Sarocladium* whereas the latter accession number is allied to

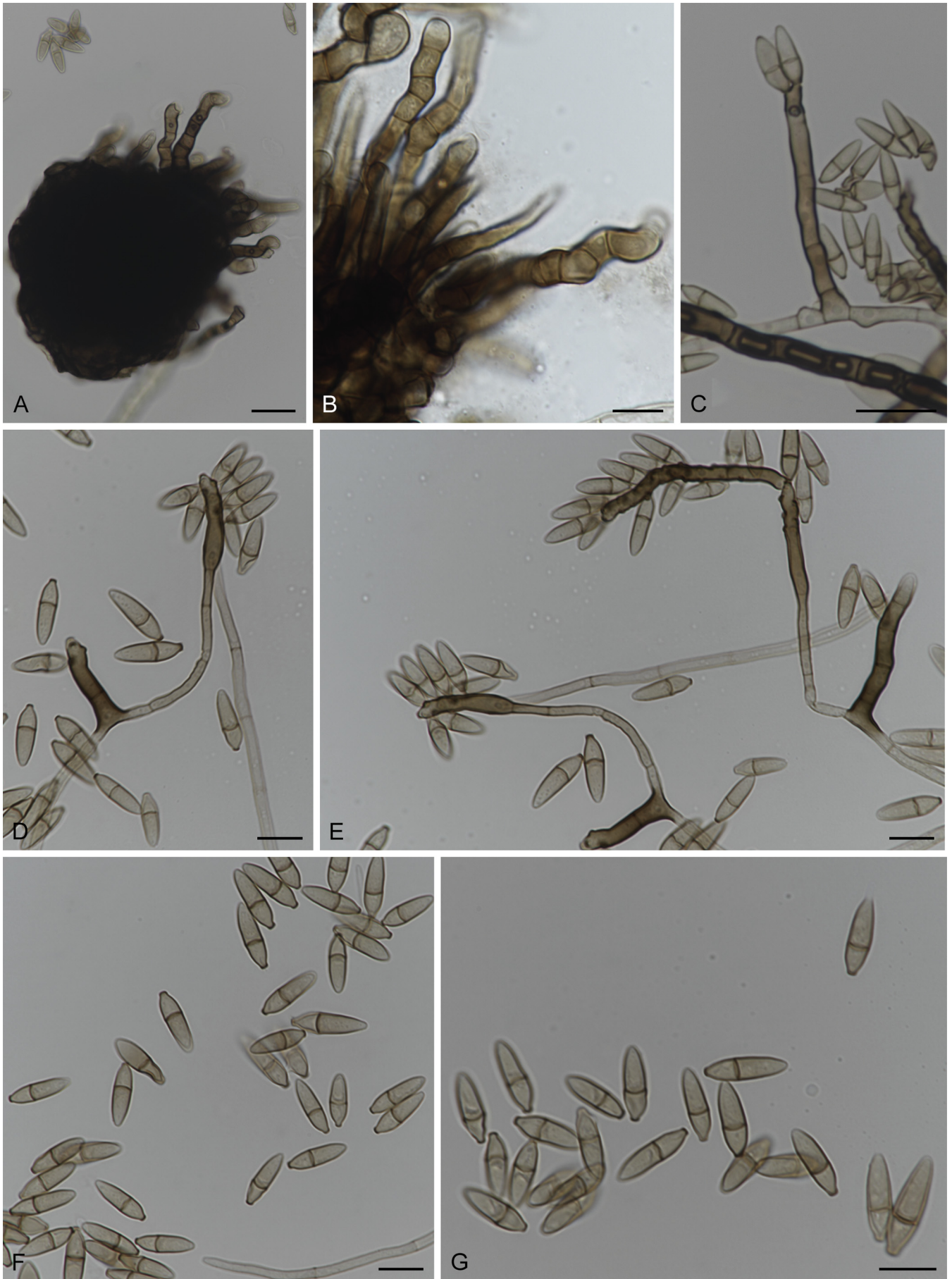
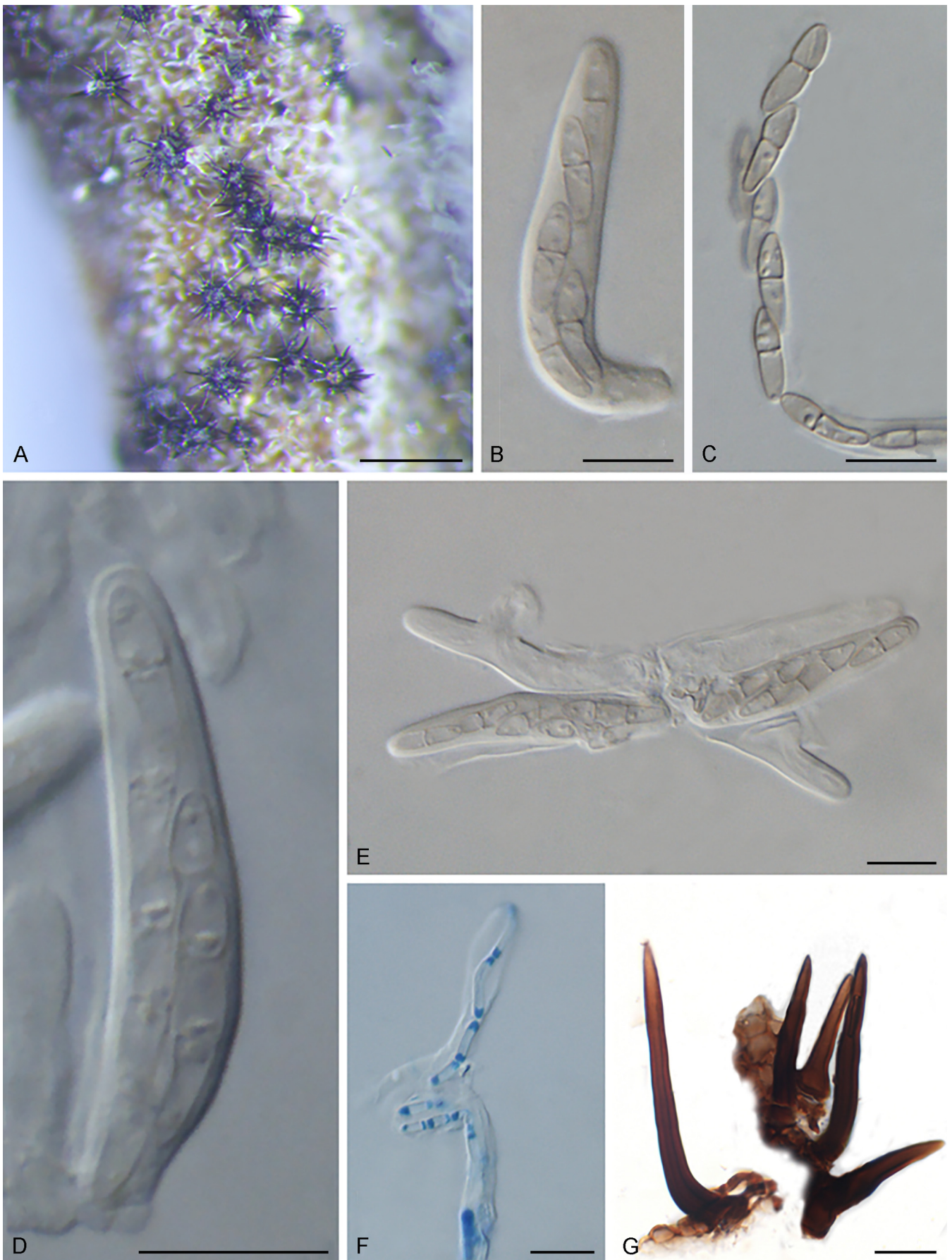


Fig. 14. *Fraxinicola omi* (culture CBS 140920) asexual morph. A, B. Sporodochia produced on OA. C–E. Sympodial conidiogenous cells producing conidia. F, G. Medium brown, 1-septate and asymmetrical conidia. Scale bars: A, C = 20  $\mu$ m; B, D–G = 10  $\mu$ m.



**Fig. 15.** *Gibbera kalmiae* (holotype NYSf1621) sexual morph. **A.** Ascomata scattered on the host surface. **B, D, E.** Clavate, asci. **C.** Released, pale brown, 1-septate ascospores. **F.** Evanescent, cellular pseudoparaphyses. **G.** Setae. Scale bars: A = 200  $\mu$ m; B–G = 10  $\mu$ m.

*Orbilina*. The phylogenetic status of this genus remains to be resolved.

***Helicoon myosuroides*** Voglmayr, Mycol. Res. 101: 337. 1997.

*Typus*: Austria, Upper Austria, Hausruckviertel, distr. Vöcklabruck, comm. Tiefgraben, wooded raised bog 'Wiehmoos' at Neuhäusl at the NW side of the Mondseeberg, 790 m s. m., 23 Oct. 1993, coll. H. Voglmayr (**holotype** WU, culture ex-type CBS 743.96).

*Notes*: Morphologically, *Helicoon* was introduced based on solitary, non-proliferating, barrel-shaped conidia borne on distinct conidiophores (Morgan 1892, Goos *et al.* 1986, Goh & Hyde 1996), and was regarded as synonym of *Orbilina*. *Helicoon myosuroides* was described from bark and leaves of *Betula* spp., but also from leaves of *Fagus sylvatica* in Austria, which is characterised by its percurrent, septate conidiophores and dark fuscous to blackish brown colonies (Goh & Hyde 1996), which point to *Venturiales*. Phylogenetically, *H. myosuroides* nests in the *Venturiaceae*, and is sibling to other genera, such as *Apiosporina*, *Tyrannosorus*, *Gibbera*, *Metacoleroa*, *Protoventuria*, *Fraxinicola*, *Coleroa* and *Venturia* (Figs 1, 2).

***Metacoleroa*** Petr., Ann. Mycol. 25: 332. 1927.

*Type species*: *Metacoleroa dickiei* (Berk. & Broome) Petr.

***Metacoleroa dickiei*** (Berk. & Broome) Petr. (as "*dieckiei*"), Ann. Mycol. 25: 332. 1927.

*Basionym*: *Sphaeria dickiei* Berk. & Broome, Ann. Mag. Nat. Hist., ser. 2(9): 317. 1852.

*Notes*: *Metacoleroa* is a monotypic genus based on *M. dickiei*. *Metacoleroa* was assigned to *Venturiaceae* based on superficial ascomata and ascospores with a median or submedian septum (Zhang *et al.* 2011). The identification of isolate "medipc" from *Linnaea borealis* in Oregon, USA (Winton *et al.* 2007) used in our phylogenetic analyses (Figs 1, 2) remains unconfirmed.

***Pseudoparodiella*** F. Stevens, Illinois Biol. Monogr. 11(2): 166. 1927.

*Type species*: *Pseudoparodiella vernoniae* F. Stevens.

***Pseudoparodiella vernoniae*** F. Stevens, Illinois Biol. Monogr. 11(2): 166. 1927.

*Synonym*: *Spilodochium vernoniae* Syd., Ann. Mycol. 25(1/2): 158. 1927.

*Typus*: Costa Rica, Peralta, on leaves of *Vernonia canescens* (Asteraceae), 12 Jul. 1923, F.L. Stevens 352 (**holotype** K(M) 154549).

*Notes*: *Pseudoparodiella* is a monotypic genus, based on *P. vernoniae* (Stevens 1927). *Pseudoparodiella* was assigned to *Venturiaceae* due to its small-sized ascomata produced on leaves of dicotyledons, rare pseudoparaphyses, obclavate asci, and 1-septate, olivaceous brown ascospores (Zhang *et al.* 2011). *Spilodochium vernoniae* is the asexual morph of *P. vernoniae* (Sivanesan 1986). No molecular data is available for *P. vernoniae*, and its phylogenetic status remains undetermined.

***Tyrannosorus*** Unter. & Malloch, Mycol. Res. 99: 910. 1995.

*Synonyms*: *Caproventuria* U. Braun, Monogr. *Cercosporiella*, *Ramularia* Allied Genera (Phytopath. Hyphom.) 2: 396. 1998.

*Pseudocladosporium* U. Braun, Monogr. *Cercosporiella*, *Ramularia* Allied Genera (Phytopath. Hyphom.) 2: 392. 1998.

*Type species*: *Tyrannosorus pinicola* (Petrini & P.J. Fisher) Unter. & Malloch

*Notes*: *Tyrannosorus* was introduced based on its saprophytic lifestyle, immersed to erumpent ascomata, lacking a subcuticular stroma, which agrees with the diagnostic characteristics of *Caproventuria* (Untereiner & Straus 1995, Zhang *et al.* 2011). Phylogenetically, *Caproventuria* nests in the well-supported *Tyrannosorus* clade (data not shown). The genus *Tyrannosorus* is older than *Caproventuria*, and has priority.

***Tyrannosorus hanlinianus*** (U. Braun & Feiler) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831589.

*Basionym*: *Capronia hanliniana* U. Braun & Feiler, Microbiol. Res. 150: 90. 1995.

*Synonyms*: *Venturia hanliniana* (U. Braun & Feiler) Unter., Mycologia 89: 129. 1997.

*Caproventuria hanliniana* (U. Braun & Feiler) U. Braun, Monogr. *Cercosporiella*, *Ramularia* Allied Genera (Phytopath. Hyphom.) 2: 396. 1998.

*Cladophialophora brevicatenata* U. Braun & Feiler, Microbiol. Res. 150: 84. 1995.

*Pseudocladosporium brevicatenatum* (U. Braun & Feiler) U. Braun, Monogr. *Cercosporiella*, *Ramularia* Allied Genera (Phytopath. Hyphom.) 2: 393. 1998.

*Fusicladium brevicatenatum* (U. Braun & Feiler) Crous *et al.*, Stud. Mycol. 58: 212. 2007.

*Typus*: Germany, Mecklenburg, Bornhof, 1994, U. Feiler (**holotype** pseudothecia formed in pure culture (strain 7623), dried culture on SNA (HAL 1579 F) (not seen).

*Notes*: The congeneric status of *Caproventuria hanliniana* and *C. hystrioides* (current name *Tyrannosorus hystrioides*) could be confirmed based on their similarity in morphology and DNA sequence data (data not shown).

***Tyrannosorus hystrioides*** (Dugan *et al.*) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831590. Fig. 16.

*Basionym*: *Capronia hystrioides* Dugan *et al.*, Mycologia 87: 713. 1995.

*Synonym*: *Venturia hystrioides* (Dugan *et al.*) Crous & U. Braun, Stud. Mycol. 58: 212. 2007.

*Description and illustration*: (Dugan *et al.* 1995, Crous *et al.* 2007b, this study).

*Typus*: USA, Washington, Wenatchee, isolated from cherry fruit, 7 Jul. 1992, F.M. Dugan & R.G. Roberts (**holotype** ST10-7, permanent slide WSP 69609, culture ex-type CBS 117727, ATCC 96019).

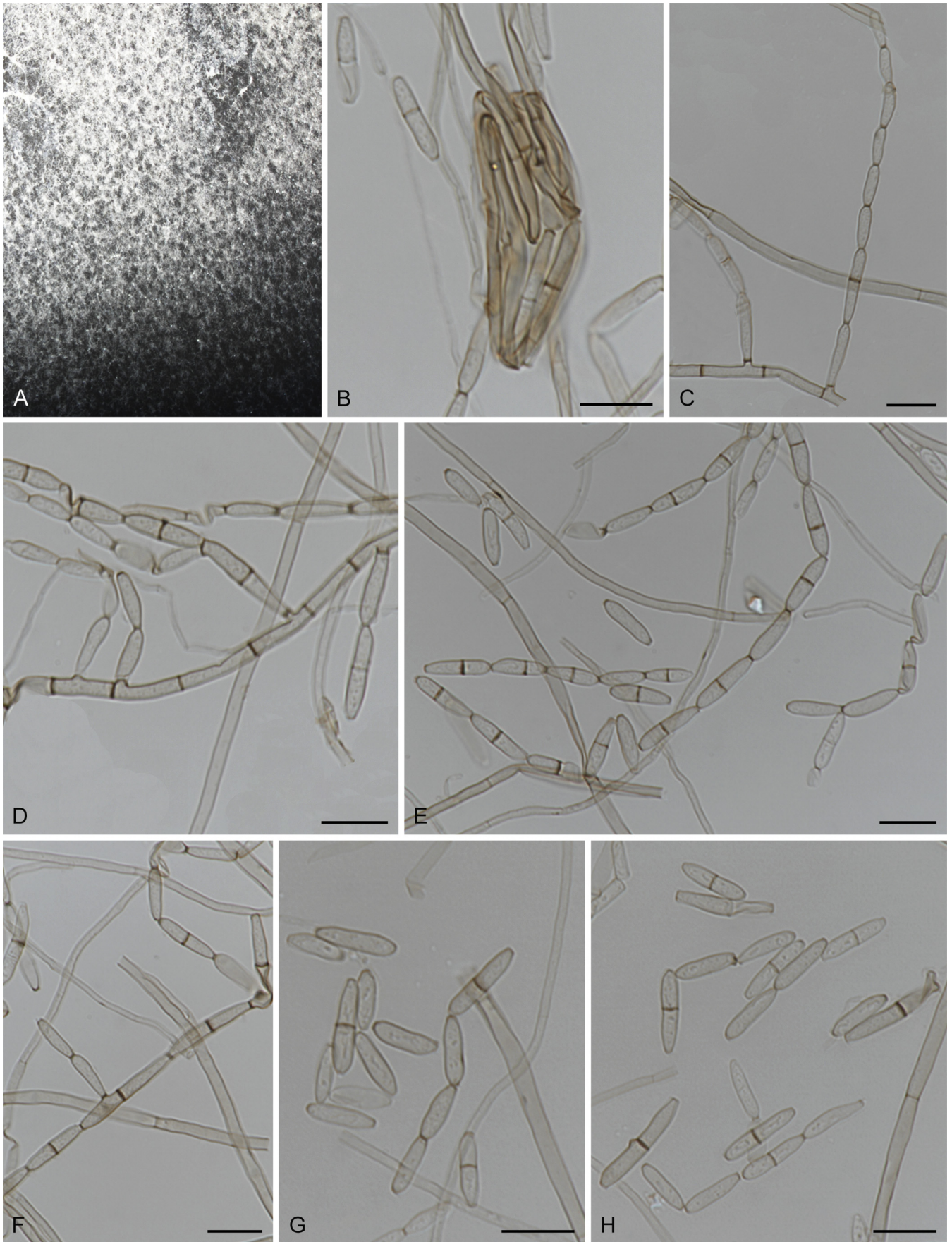
*Note*: This species is sister to *T. lichenicola* / *pinicola* (Figs 1, 2).

***Tyrannosorus lichenicola*** Crous, M. Shen & Y. Zhang ter, **sp. nov.** MycoBank MB831525. Fig. 17.

*Etymology*: The epithet refers to the lichen, *Letharia* (*Parmeliaceae*), the host from which the fungus was collected.

*In vitro* on OA: *Mycelium* branched or unbranched, 2–3 µm wide, septate, not constricted or rarely constricted at septa, hyaline to pale brown, verrucose or smooth, straight or flexuous, walls unthickened, and not darkened, frequently with hyphal coils. *Conidiophores* arising from hyphae, often as short lateral conical prolongations of hyphae, reduced to conidiogenous cells.





**Fig. 16.** *Tyrannosorus hystrioides* (culture ex-type CBS 117727) asexual morph. **A.** Colony on OA. **B.** Hyphal coil. **C–F.** Concatenated conidia arising from conidiogenous cells. **G, H.** Aseptate or 1-septate conidia. Scale bars: B–H = 10 µm.

*Conidiogenous cells* erect or geniculate-sinuous,  $8\text{--}20.5 \times 2.5\text{--}4 \mu\text{m}$ , monoblastic or polyblastic, pale brown to brown, subcylindrical; loci truncate,  $1.5\text{--}2 \mu\text{m}$  wide, usually not thickened, somewhat darkened. *Ramoconidia*  $14\text{--}31.5 \times 2.5\text{--}6.5 \mu\text{m}$ , 0–1-septate, often not constricted at the septum, pale brown, with a truncate base, cylindrical, subcylindrical, occasionally broadly fusiform, usually with several denticle-like apical loci. *Conidia* catenate, mostly formed in unbranched chains, straight or slightly curved, cylindrical, subcylindrical, oblong, occasionally broadly fusiform,  $11.5\text{--}23 \times 3\text{--}4 \mu\text{m}$ , subhyaline to pale brown, 0–1-septate, septum median, usually constricted at the septum, smooth, walls slightly thickened, but not darkened-refractive, tapering towards both ends; hila truncate,  $1\text{--}2 \mu\text{m}$  wide, sometimes slightly thickened and darkened.

*Culture characteristics:* Colonies spreading, somewhat erumpent, with sparse aerial mycelium and regular margins on OA, white-grey (surface), margins fuscous-black; reverse fuscous-

black; on MEA greyish (surface), margins fuscous-black; reverse fuscous-black; on SNA olivaceous (surface); reverse dark olivaceous. Colonies reaching 28 mm diam after 2 wk on OA at  $25^\circ\text{C}$  in the dark; colonies fertile.

*Typus:* USA, on *Letharia* sp. (*Parmeliaceae*), 27 May 2013, A. Smith (**holotype** CBS H-23600, culture ex-type CBS 144018 = CPC 25106).

*Notes:* *Tyrannosorus lichenicola* was isolated from a *Letharia* sp. Morphologically, the monoblastic conidiogenous cells, catenate conidia, and the slow-growing, olivaceous colonies point to *Venturiaceae*. In particular, the occasional microcyclic conidia of *Tyrannosorus lichenicola* differs from other reported members of *Venturiaceae*. Phylogenetically, *Tyrannosorus lichenicola* nests in the *Tyrannosorus* clade, closely related to *T. pinicola* (Figs 1, 2).

*Tyrannosorus pinicola* (Petri & P.J. Fisher) Unter. & Malloch, Mycol. Res. 99: 910. 1995. Fig. 18.

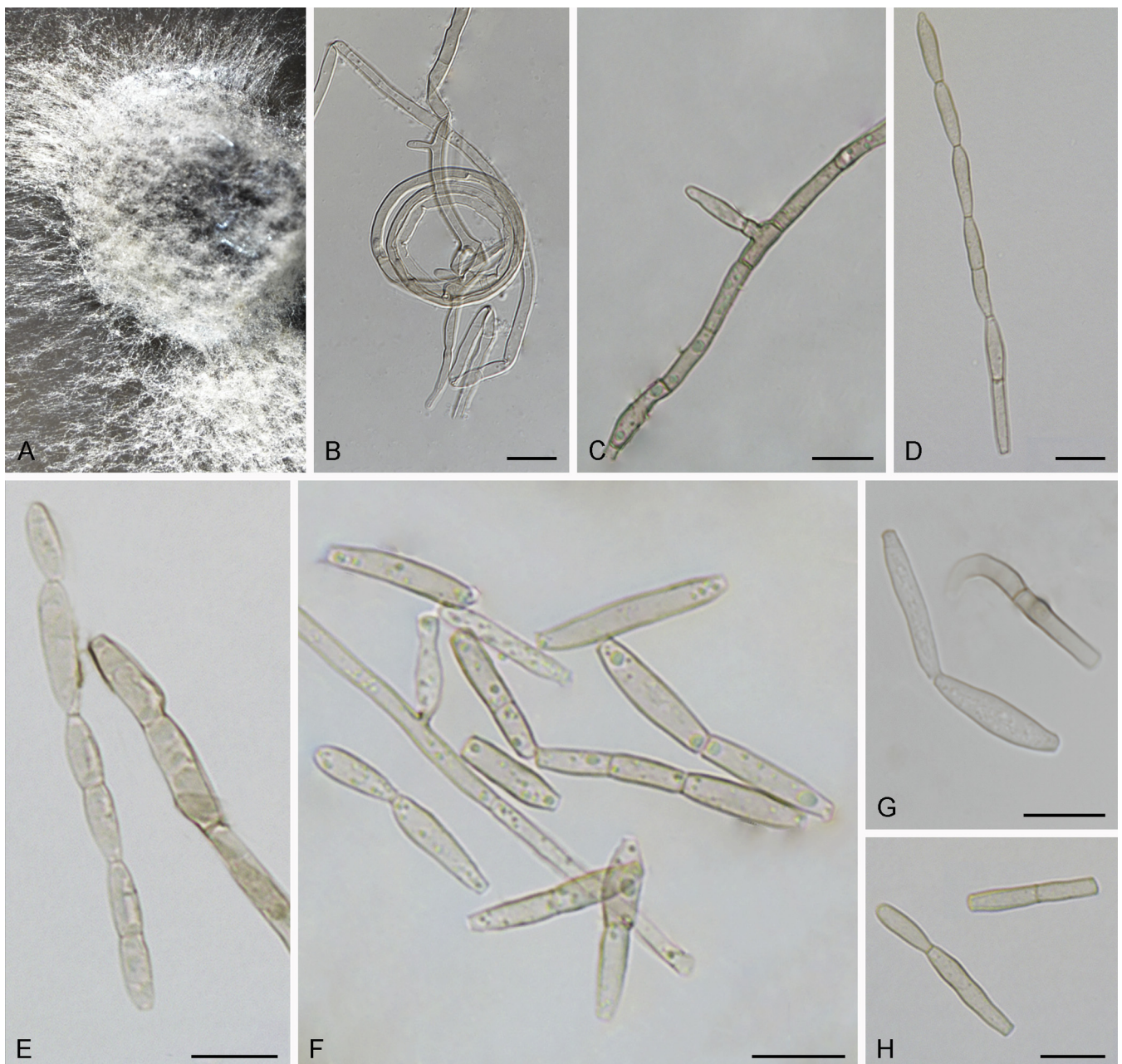
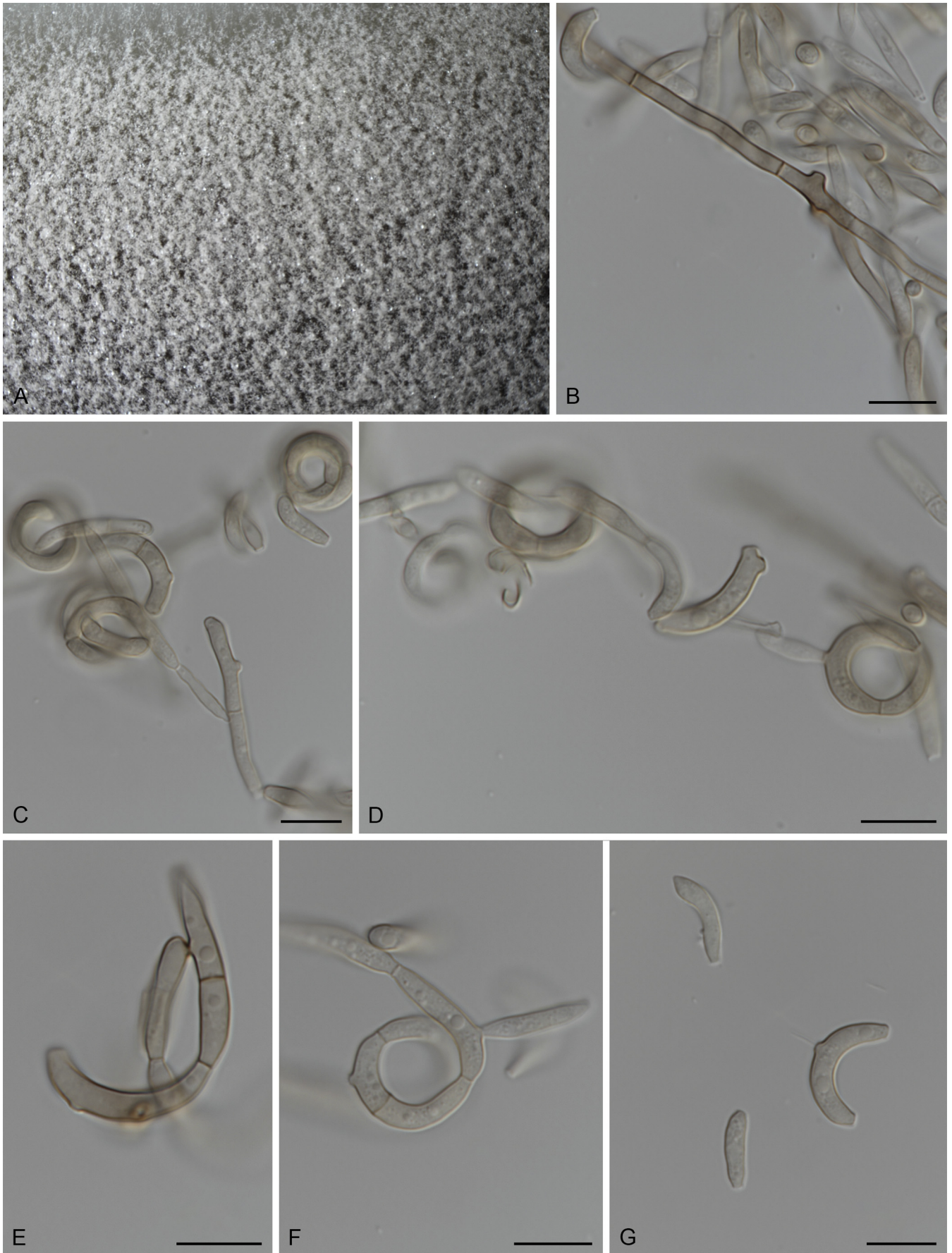


Fig. 17. *Tyrannosorus lichenicola* (culture ex-type CBS 144018) asexual morph. A. Colony on OA. B. Hyphal coil. C. Conidium arising from conidiogenous locus. D–H. Aseptate or 1-septate conidia in chains. Scale bars: B–H =  $10 \mu\text{m}$ .



**Fig. 18.** *Tyrannosorus pinicola* (culture ex-type CBS 124.88) asexual morph. **A.** Colony on OA. **B.** Conidiogenous loci on hypha. **C–F.** Conidia in chains forming three-dimensional helix. **G.** Straight or curved conidia. Scale bars: B–G = 10  $\mu$ m.

*Basionym:* *Capronia pinicola* Petrini & P.J. Fisher, Trans. Brit. Mycol. Soc. 88: 68. 1987.

*Synonym:* *Helicodendron pinicola* E. Müll. et al., ex Voglmayr & P.J. Fisher, Mycol. Res. 101: 1124. 1997.

*Typus:* **Pakistan**, on wood of *Pinus* sp. (*Pinaceae*), O. Petrini (**holotype** IMI 308599, culture ex-type CBS 124.88).

*Note:* This species is sister to *T. lichenicola* (Figs 1, 2).

***Tyrannosorus pini-sylvestris*** Crous & R.K. Schumach., *sp. nov.* MycoBank MB831526. Fig. 19.

*Etymology:* The epithet refers to *Pinus sylvestris*, the host species from which this fungus was isolated.

*Mycelium* consisting of pale brown, smooth, septate, branched, 2–2.5 µm wide hyphae. *Conidiophores* 0–2-septate, mostly reduced to conidiogenous cells on creeping hyphae, lateral or terminal, subcylindrical, erect, 5–20 × 2–3 µm. *Conidiogenous cells* integrated, 5–10 × 2–3 µm, sympodial, loci truncate, 0.5–1 µm wide, mostly somewhat darkened. *Ramoconidia* occurring. *Conidia* in penicillate heads of branched chains, subcylindrical, pale brown, smooth, guttulate, 0–1-septate, (7–) 9–11(–13) × 2(–3) µm; *loci* truncate, somewhat darkened, 0.5 µm diam.

*Culture characteristics:* Colonies spreading, erumpent, with moderate aerial mycelium and smooth, lobate margins. On MEA and PDA grey olivaceous (surface); reverse iron-grey; on OA iron-grey (surface). Colonies reaching 15 mm diam after 2 wk at 25 °C; colonies fertile.

*Typus:* **Germany**, Berlin, on needles of *Pinus sylvestris* (*Pinaceae*), 5 Feb. 2016, R.K. Schumacher (**holotype** CBS H-23839, cultures ex-type CBS 143393 = CPC 30464, CPC 30461).

*Notes:* The sympodial conidiogenous cells of *T. pini-sylvestris* agree with *Venturiaceae*. *Tyrannosorus pini-sylvestris* can be distinguished from *T. hystrioides* by its penicillate heads formed by conidia occurring in branched chains. Phylogenetically, *T. pini-sylvestris* nests in the *Tyrannosorus* clade, and is basal to other species of *Tyrannosorus*, such as *T. hystrioides*, *T. lichenicola* and *T. pinicola* (Figs 1, 2).

***Venturia*** Sacc., Syll. Fung. 1: 586. 1882.

*Synonyms:* *Spilocaea* Fr., Novit. fl. svec. 5(cont.): 79. 1819.

*Cycloconium* Castagne, Cat. Pl. Mars.: 220. 1845.

*Fusicladium* Bonord., Handb. Mykol.: 80. 1851.

*Napicladium* Thüm., Hedwigia 14: 4. 1875.

*Basiascum* Cavara [as '*Basiaschum*'], Atti Ist. bot. R. Univ. Pavia, 2 Sér. 1: 433. 1888.

*Pollaccia* E. Bald. & Cif., Atti Ist. Bot. 'Giovanni Briosi', ser. 4, 10: 71. 1937.

Mostly parasitic on leaves, fruits or twigs, causing leaf spots, scab diseases, necroses or deformations. Sexual morph: *Ascomata* erumpent, semi-erumpent or superficial, rarely immersed, scattered or gregarious, often with papillate ostiole, mostly with setae (except species with immersed ascomata). *Paraphyses* narrowly cellular, hyaline, mostly evanescent in mature ascomata. *Asci* 8-spored, bitunicate, broadly cylindrical to obclavate, usually lacking a pedicel. *Ascospores* pale olivaceous brown to olivaceous brown, 1-septate, usually asymmetrical. Asexual morph: Colonies punctiform, scattered, caespitose or dendritic, olivaceous, olivaceous brown, dingy grey to blackish. Stromata lacking to well-developed, pseudostromatic, composed of rounded to isodiametric swollen hyphal cells, pigmented, wall often somewhat thickened. *Mycelium* consisting of unbranched or sparingly branched, septate, not constricted at septa, subhyaline, pale brown to brown, smooth hyphae. *Conidiophores* solitary or sparsely gregarious, arising from internal or external hyphae or stromata, conidiophores often reduced to conidiogenous cells or composed of several cells, erect, cylindrical, pyriform, subclavate, narrowly obclavate, slightly to distinctly geniculate-sinuuous, unbranched or occasionally branched, pale olivaceous to dark brown, tips sometimes paler, smooth to somewhat verruculose, sometimes only as short lateral conical prolongations of hyphae, occasionally irregular in shape. *Conidiogenous cells* integrated, terminal or intercalary or conidiophores reduced to conidiogenous cells, monoblastic to polyblastic, proliferation percurrent or sympodial; conidiogenous loci terminal or lateral, sometimes denticle-like, apex truncate to slightly convex, wall unthickened or almost so, sometimes slightly darkened-refractive. *Conidia* solitary or catenate, sometimes in simple or branched chains, ellipsoid, obovoid, fusiform, obclavate to subcylindrical, straight to slightly curved, septate or aseptate, subhyaline, pale to dark brown, but mostly olivaceous, sometimes constricted at the septa, smooth to verruculose, ends pointed or rounded to truncate, hila thickened or not, occasionally darkened-refractive.

*Type species:* *Venturia inaequalis* (Cooke) G. Winter



**Fig. 19.** *Tyrannosorus pini-sylvestris* (culture ex-type CBS 143393) asexual morph. **A.** Colony on OA. **B–E.** Conidia in penicillate-like chains. Scale bars: B applies to B, C, E = 10 µm; G = 10 µm.

Notes: *Venturia* was first described by De Notaris (1844) to accommodate *V. rosae* and *V. dianthi* with no type designated. Subsequently, Cesati & De Notaris (1863) described a further two species, *V. dickiei* and *V. eres*. Saccardo (1882) emended the description of *Venturia*, excluding both *V. rosae* and *V. dianthi*, while accepting *V. dickiei* and *V. eres*. *Venturia* Sacc. was widely accepted, and was neotypified with *V. inaequalis* (Korf 1956, Sivanesan 1977).

*Venturia* includes economically important plant pathogens, such as apple scab caused by *V. inaequalis* and pear scab caused by *V. pyrina* (Sivanesan 1977). In the monograph by Sivanesan (1977), herbarium specimens of 65 species were studied including type materials of 31 species. Sivanesan (1977) recognised 52 species and transferred five species to other genera, i.e., *V. caulicola* and *V. himalayensis* to *Coleroa*, *V. enteleae* and *V. rhois* to *Mycosphaerella* and *V. microspora* to *Niesslia*. Barr (1968) studied specimens of 35 venturiaceous species from North America, of which 12 species were based on type materials.

Morphologically, the circumscription of *Venturia* s. str. has been summarised as follows: 1) ascomata, erumpent, semi-erumpent, or superficial, rarely immersed, scattered or gregarious, often with papillate ostiole, mostly with setae; 2) hamothecium narrowly cellular, hyaline, usually evanescent in mature ascomata; 3) asci 8-spored, bitunicate, broadly cylindrical to obclavate, usually lacking a pedicel; 4) ascospores pale greenish olivaceous to dark brown, 1-septate, usually asymmetrical (Zhang et al. 2016a, b). Based on the circumscription above, type specimens of six species of *Venturia*, *V. centaureae*, *V. chrysanthemii*, *V. corni*, *V. helvetica*, *V. muelleri* and *V. rhamnii* were revised, redescribed and illustrated, and *V. corni* was excluded from *Venturia* (Zhang et al. 2016a, b). Fungarium specimens of 59 species of *Venturia* are described and illustrated in the present study, with 22 species being excluded from *Venturia* (see below). The asexual morphs of *Venturia* have been assigned to *Fusicladium*, *Spilocaea* or *Pollaccia*, while the names in *Venturia* are more widely known than those in *Fusicladium*, *Spilocaea* or *Pollaccia*. Thus, *Venturia* was recommended for protection over *Fusicladium* and *Pollaccia* (Rossmann et al. 2015).

***Venturia acerina*** Plakidas ex M.E. Barr, Canad. J. Bot. 46: 814. 1968. Fig. 20.

Synonyms: *Venturia acerina* Plakidas, Mycologia 34: 34. 1942. *Nom. inval.*, Art. 39.1 (Shenzhen).

*Cladosporium humile* Davis, Trans. Wisconsin Acad. Sci. 19(2): 702. 1919.

*Fusicladium humile* (Davis) K. Schub. & U. Braun, I.M.I. Descript. Fungi Bact. 152, No. 1520. 2002.

Ascomata hypophyllous, 50–120 µm diam, scattered, solitary or gregarious, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuous papillate ostiole, surrounded by the setae. Setae dark brown, 37–52 × 4–5 µm, 0–2-septate, setae wall 1–1.5 µm thick, up to 6–7 µm wide at the base. Peridium 7–14 µm wide, 1–2 layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 8–9 × 5–7 µm, cell wall 0.8–1 µm thick. Pseudoparaphyses rare, 2–3 µm wide, hyaline, septate, evanescent when mature. Asci 46–76 × 8–12 µm (av. 59.4 × 9.9 µm, n = 20), 8-spored, bitunicate, fissitunicate, obclavate, pedicel lacking, with an inconspicuous ocular chamber. Ascospores 9–17 × 3–6 µm

(av. 13.8 × 4.5 µm, n = 14), oblong, ellipsoid, yellow or pale brown, uniseriate at the top and bi- to triseriate at the base, 1-septate, constricted at the septum, the upper cells shorter and wider than the lower ones (length ratio: 3:5–1:1), smooth-walled. Asexual morph: see Schubert et al. (2003: 57–58, fig. 26).

Typus: USA, New York, Tompkins Co., Ithaca, on overwintered leaves of *Acer rubrum* (Aceraceae), 16 May 1941, A.G. Plakidas (holotype CUP-029477).

Notes: The asexual morph of *V. acerina* is *F. humile*, which causes leaf spot of maple in the USA, and overwinters with ascospores and conidia (Sivanesan 1977). *Venturia aceris*, another venturiaceous species occurring on *Acer* sp., is distinguishable from *V. acerina* by the absence of setae as well as the lower positioned ascospore septum.

***Venturia aesculi*** (Syd.) Sivan., Biblioth. Mycol. 59: 31. 1977. Fig. 21.

Basionym: *Spilosticta aesculi* Syd., Ann. Mycol. 27: 118. 1929.

Ascomata hypophyllous, (44–)58–118 µm diam, gregarious or scattered, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuous papillate ostiole. Setae not observed. Peridium 4–6.5 µm wide, 1-layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 5–13 × 6–15 µm, cell wall 0.5–2 µm thick, thickened towards the ostiole. Pseudoparaphyses not observed. Asci 28–40 × 7–8 µm (av. 33.1 × 7.6 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical, each with an inconspicuous ocular chamber. Ascospores 8–9.5 × 3–4(–4.5) µm (av. 8.7 × 3.5 µm, n = 20), fusiform to broadly fusiform, olivaceous brown, overlapping to biseriate near the base, 1-septate, slightly constricted at the septum, the upper cells somewhat shorter than the lower ones (length ratio: 4:5–1:1), smooth to slightly verruculose. Asexual morph unknown.

Typus: Germany, on overwintered leaves of *Aesculus hippocastanum* (Hippocastanaceae), 18 May 1924, P. Vogel (isotype K(M) 189168). Syd., Mycoth. Germ. 2339, lectotype S-F6679 designated here, MBT391372, isolectotypes, e.g., BPI 613455, CUP, K(M) 189168, PDD 42226, PH 44201, WIS-F-83314.

***Venturia alaskensis*** M.E. Barr, Canad. J. Bot. 46: 821. 1968. Fig. 22.

Ascomata 80–100 × 100–120 µm, initially immersed, becoming erumpent to semi-immersed, gregarious or scattered, globose or subglobose, wall black, with a conspicuous papillate ostiole, surrounded by setae. Setae dark brown, 46–103 × 5–7 µm, aseptate, setae wall 1 µm thick, wider at the base. Peridium 7–14 µm wide, 1-layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 7–11 × 6–9 µm, cell wall 0.8–1 µm thick. Pseudoparaphyses rare, 2–3 µm wide, hyaline, septate, evanescent when mature. Asci 50–75 × 13–29 µm (av. 63.2 × 16.2 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly obclavate to broadly fusiform, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. Ascospores 15–23 × 7–9 µm (av. 20.6 × 7.9 µm, n = 20), ellipsoid, pale brown, overlapping to biseriate, especially at the base, 1-septate, constricted at the septum, the upper cells wider than the lower ones (length ratio: 5:4–8:3), smooth-walled. Asexual morph unknown.

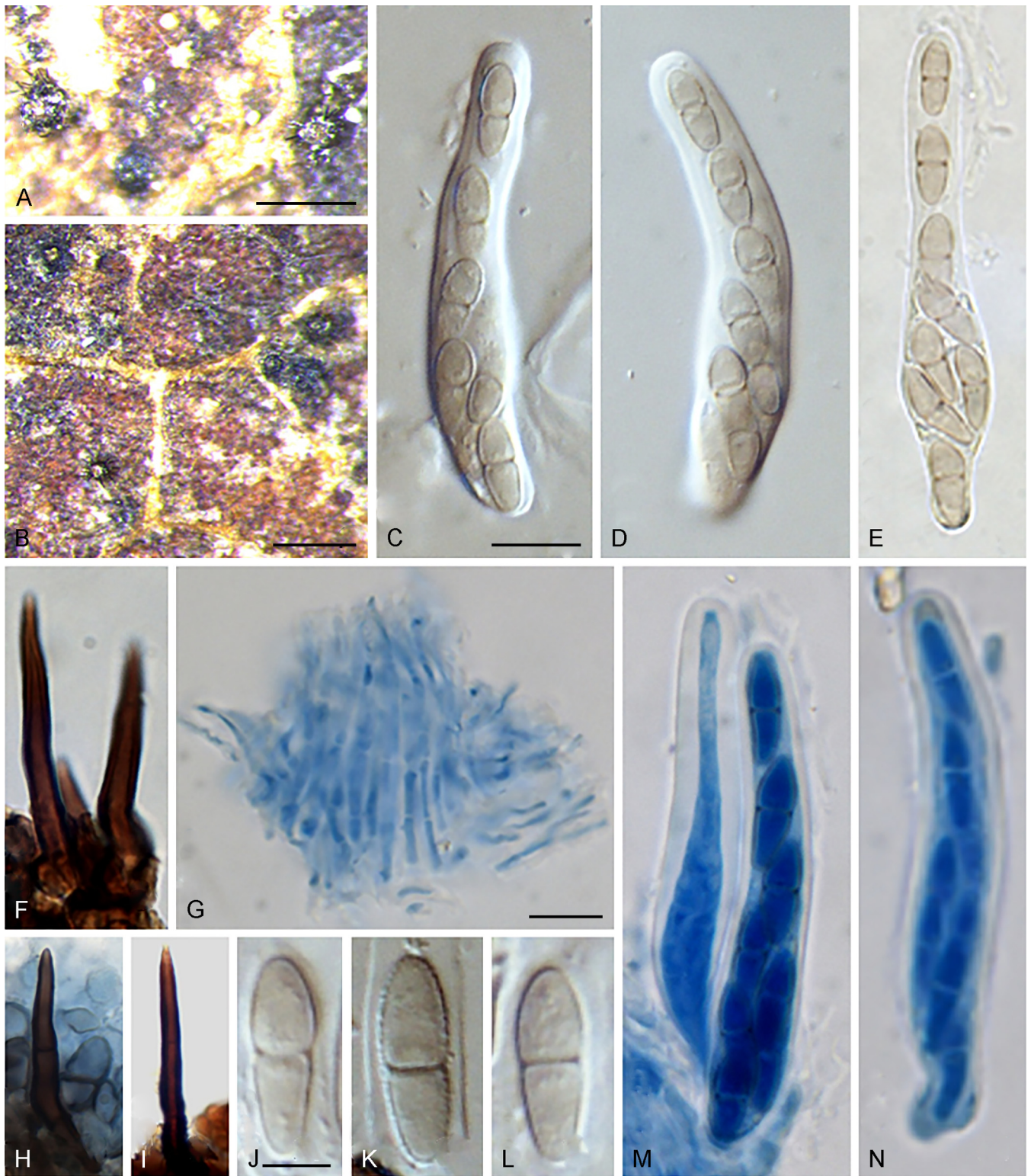


Fig. 20. *Venturia acerina* (holotype CUP 029477) sexual morph. A, B. Ascomata scattered on the host surface. C–E, M, N. Cylindrical asci. F, H, I. Setae. G. Evanescent pseudoparaphyses. J–L. Ascospores. Scale bars: A, B = 200  $\mu$ m; C applies to C–F, M, N = 10  $\mu$ m; G applies to G–I = 10  $\mu$ m; J applies to J–L = 5  $\mu$ m.

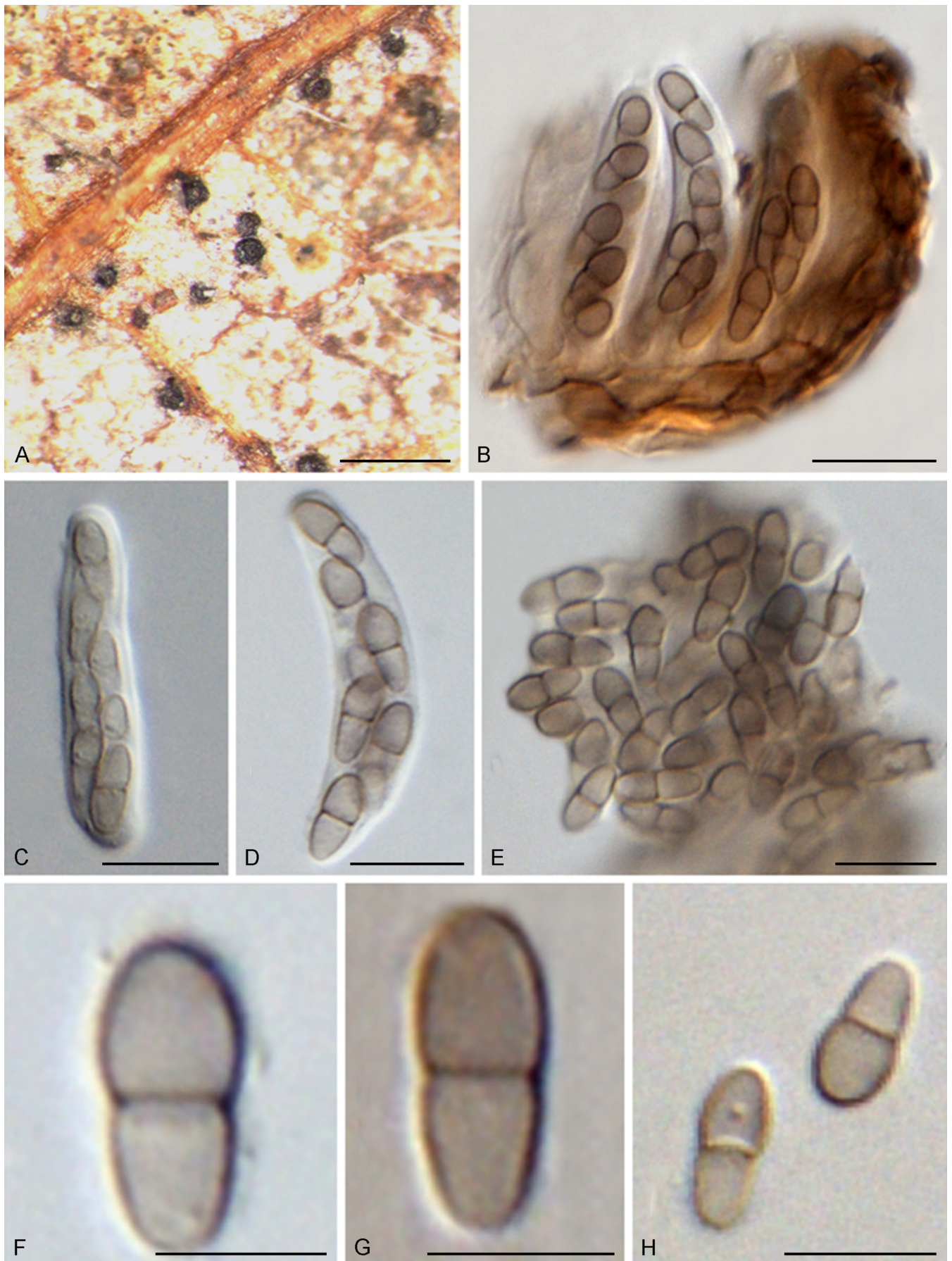
**Typus:** USA, Alaska, Yukon-Koyukuk. Porcupine Dome, about 12 miles from Miller House, alt. 1466 m (4810 ft.), on overwintered leaves of *Geum sericeum* (Rosaceae), 12 Jul. 1937, E.H. Scamman (holotype NY 00914426, isotype NY 00914427).

**Notes:** Morphologically, *Venturia alaskensis* is most comparable with *V. atriseda*, while the wider ascospores of *V. alaskensis* (7–9  $\mu$ m) are distinguishable from *V. atriseda* [5–6(–7.5)  $\mu$ m] (Barr 1968, see page 36). Although the stromatic network of

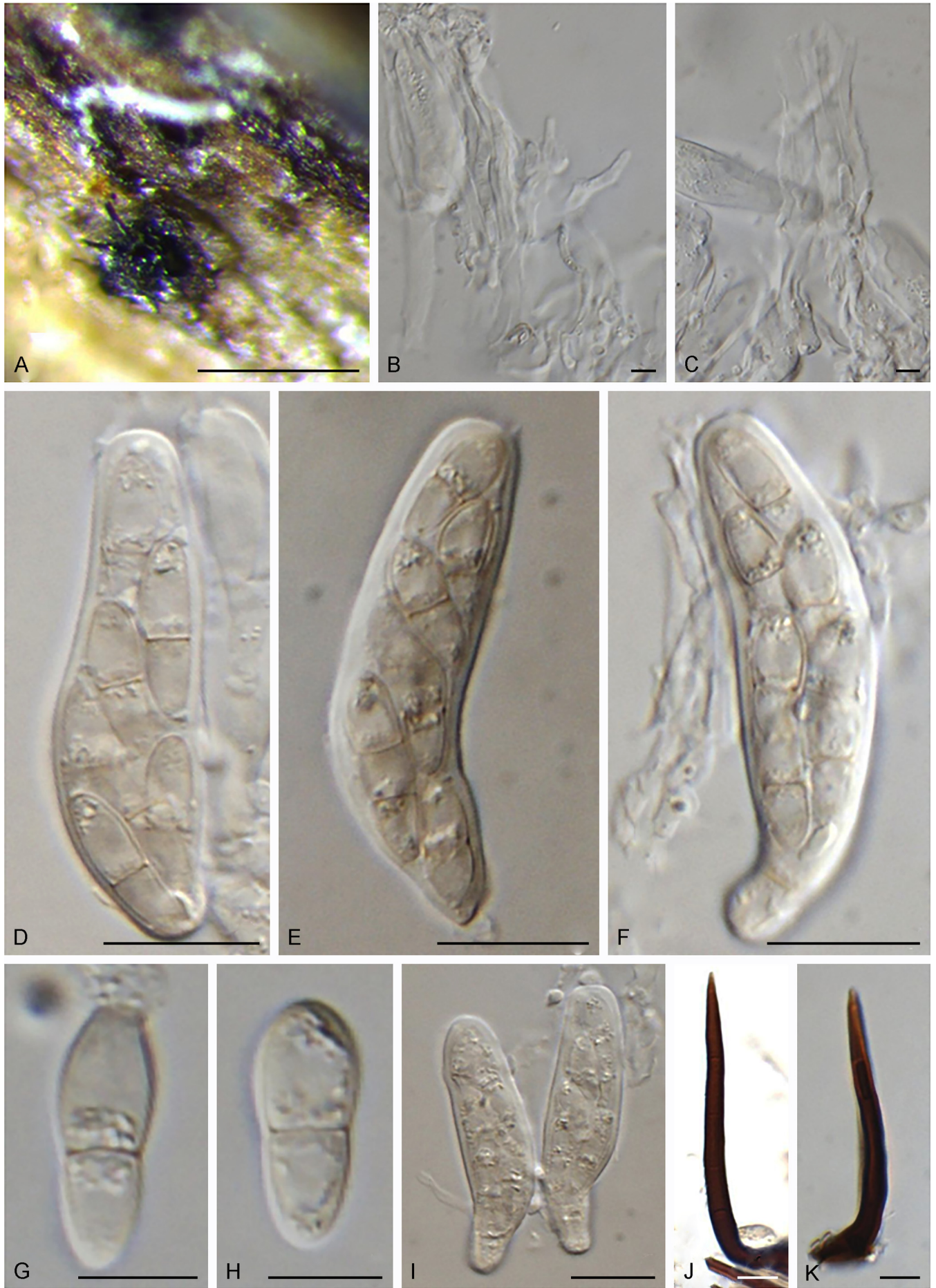
*V. asteromorpha* is comparable with *V. alaskensis*, the ascospores of *V. asteromorpha* are smaller with a beaked apex as well as its ascomata lacking setae, which differs from *V. alaskensis* (Barr 1968).

***Venturia albae*** Crous, M. Shen & Y. Zhang ter, *sp. nov.* MycoBank MB831527. Figs 23, 24.

**Etymology:** The epithet refers to epithet of *Salix alba*, the host from which the species was first reported.

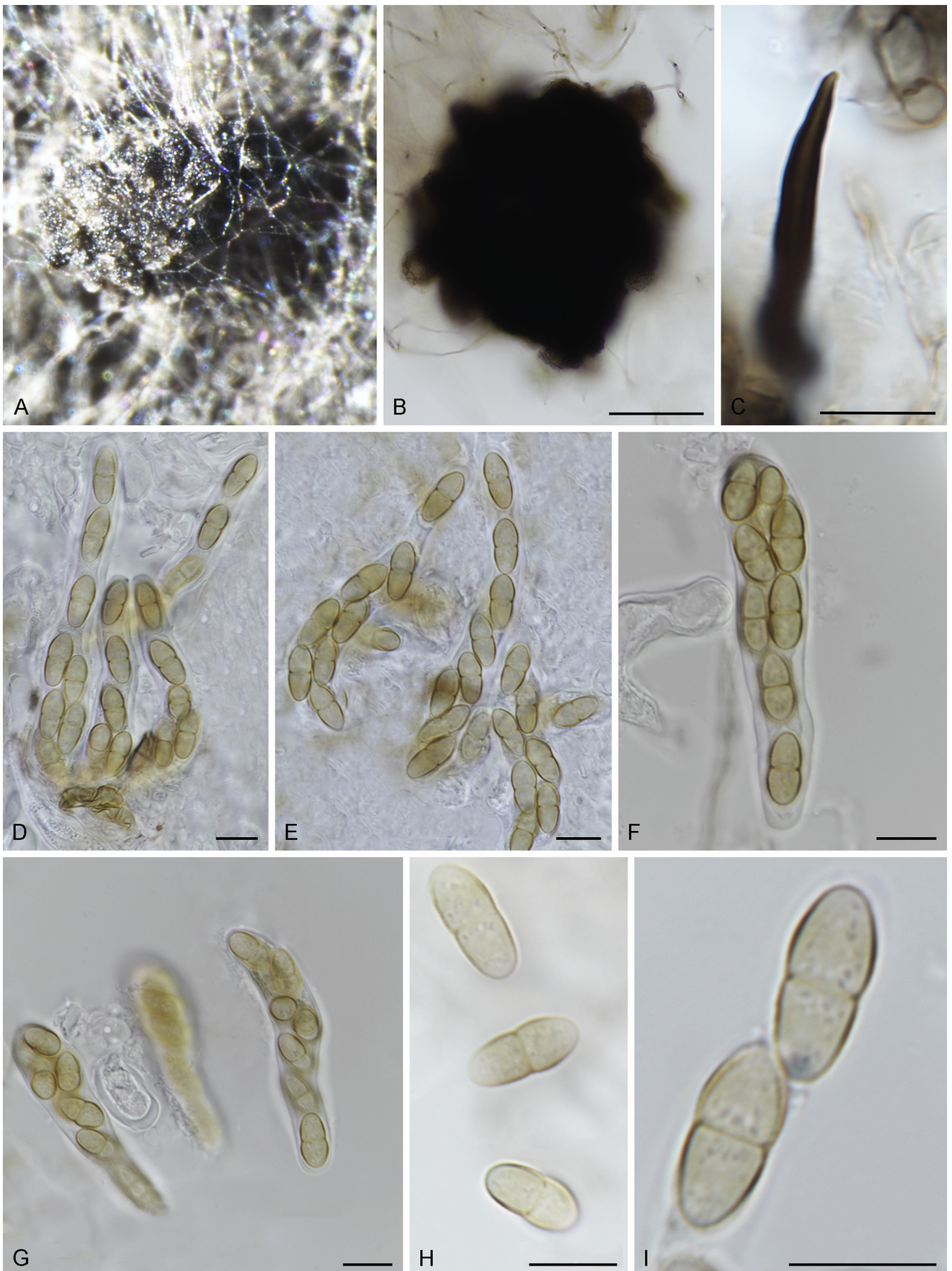


**Fig. 21.** *Venturia aesculi* (isotype K(M) 189168) sexual morph. **A.** Ascomata on the host surface. **B.** Section of an ascoma (showing the asci). **C, D.** Broadly cylindrical asci. **E–H.** Released, olivaceous brown ascospores. Scale bars: A = 300  $\mu\text{m}$ ; B–E, H = 10  $\mu\text{m}$ ; F, G = 5  $\mu\text{m}$ .



**Fig. 22.** *Venturia alaskensis* (type NY 00914426) sexual morph. **A.** Ascmata scattered on the host surface. **B, C.** Evanescent pseudoparaphyses. **D–F, I.** Subcylindrical asci. **G, H.** Released, pale brown, 1-septate ascospores. **J, K.** Dark brown setae. Scale bars: A = 200  $\mu\text{m}$ ; B–C = 5  $\mu\text{m}$ ; D–F, I = 20  $\mu\text{m}$ ; G, H, J, K = 10  $\mu\text{m}$ .

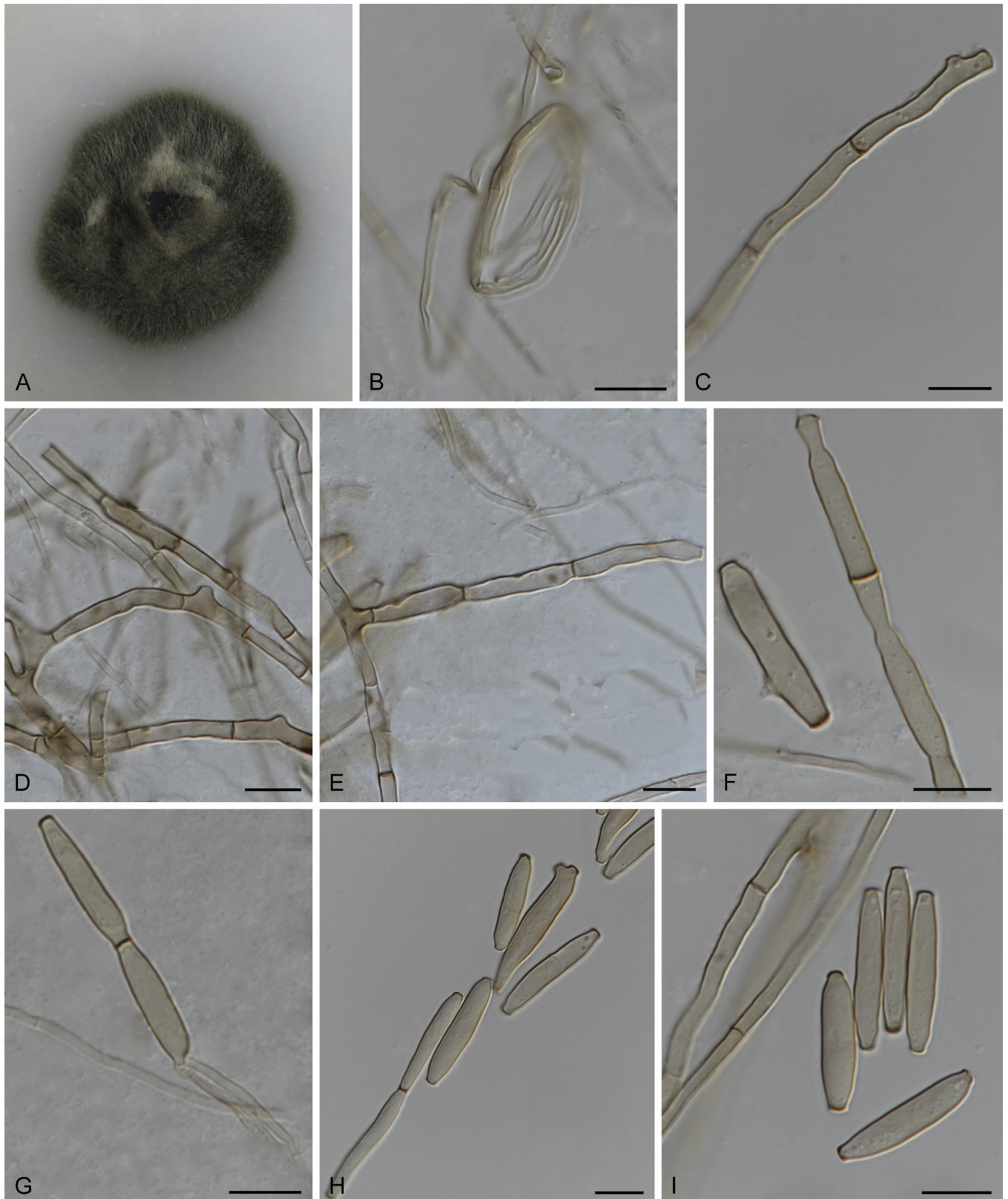




**Fig. 23.** *Venturia albae* (culture ex-type CBS 471.61) sexual morph. **A, B.** Ascomata on OA. **C.** Dark brown seta. **D–G.** Cylindrical, narrowly cylindrical or obclavate asci. **H, I.** Released, yellowish to brown ascospores. Scale bars: B = 100  $\mu$ m; C–I = 10  $\mu$ m.

*In vitro* on OA: Sexual morph: *Ascomata* initially immersed, becoming erumpent to semi-immersed, gregarious or scattered, black, 198–404  $\mu\text{m}$  diam, subglobose to globose, with a conspicuous papillate ostiole, surrounded by dark brown setae; setae aseptate, 26.5–27.5  $\times$  3–3.5  $\mu\text{m}$ , up to 4  $\mu\text{m}$  wide at the base, wall black. *Peridium* 1-layered, composed of 2–4 rows of thin-walled, dark brown pigmented cells of *textura angularis*, cells

4.5–8  $\times$  6.5–9.5  $\mu\text{m}$ . *Pseudoparaphyses* evanescent when mature, hyaline. *Asci* 43–87.5  $\times$  8.5–14  $\mu\text{m}$  (av. 64  $\times$  11  $\mu\text{m}$ ,  $n = 15$ ), 8-spored, bitunicate, fissitunicate, broadly cylindrical, to obclavate, pedicel lacking, with an inconspicuous ocular chamber. *Ascospores* 10.5–14  $\times$  3.5–5.5  $\mu\text{m}$  (av. 12.5  $\times$  5  $\mu\text{m}$ ,  $n = 30$ ), ellipsoid to broadly fusiform, 1-septate, constricted at the septum, yellowish to brown, obliquely uniseriate or partially



**Fig. 24.** *Venturia albae* (culture ex-type CBS 471.61) asexual morph. **A.** Colony on OA. **B.** Hyphal coil. **C, D.** Conidiophores with conidiogenous loci. **E.** Conidiogenous cell giving rise to conidia. **F, G.** Conidia in chains. **H, I.** Ramoconidium and conidia. Scale bars: B–I = 10  $\mu\text{m}$ .

overlapping to biseriate, especially at the base, rounded at the both ends, the upper cells longer and wider than the lower ones (length ratio: 1:1–5:4), smooth-walled. Asexual morph: *Mycelium* unbranched or sparingly branched, 2.5–4.5 µm wide, septate, pale brown, smooth or occasionally verrucose, walls not thickened and darkened, frequently with hyphal coils. *Conidiophores* laterally or terminally arising from hypha, conidiophores reduced to conidiogenous cells, sometimes only as short lateral conical prolongations of hyphae. *Conidiogenous cells* erect, 12.5–29 × 2.5–4.5 µm, monoblastic or rarely sympodial, brown to medium brown, smooth, walls unthickened, cylindrical or subcylindrical, with a single conidiogenous locus; *conidiogenous loci* truncate, 2–3 µm wide, mostly unthickened, not darkened. *Ramoconidia* present, 21.5–27.5 × 4.5–6 µm, aseptate, occasionally 1-septate, not constricted at the septa, brown to medium brown, truncate at the ends, subcylindrical or broadly cylindrical, with 1–3 denticle-like apical loci, rarely thickened or slightly darkened. *Conidia* catenate, formed in unbranched or loosely branched chains, straight, narrowly cylindrical, 19.5–24.5 × 3.5–6 µm, mostly aseptate, rarely 1-septate, septum median, not constricted at the septa, pale brown to brown, smooth, walls not thickened, tapering towards the ends; *hila* truncate, 1.5–2 µm wide, slightly thickened, and somewhat darkened-refractive.

**Culture characteristics:** Colonies spreading, somewhat erumpent, with moderate to sparse aerial mycelium and regular margin on OA, uneven, greyish sepia (surface); reverse fuscous-black; on MEA spreading, smooth, greyish green (surface), margins pale grey to whitish; on SNA spreading, smooth, greyish sepia (surface). Colonies reaching 13 mm diam after 3 wk at 25 °C in the dark.

**Typus:** **Liechtenstein**, BERN, on *Salix alba* (*Salicaceae*), 22 May 1959, E. Müller (**holotype** CBS H-23603, culture ex-type CBS 471.61).

**Additional material examined:** **Liechtenstein**, Schneckeneule, on *Salix alba* (*Salicaceae*), 13 May 1958, J. Nüesch (ETH 2821, culture CBS 468.61).

**Notes:** CBS 468.61 and CBS 471.61 were collected by J. Nüesch and E. Müller from Liechtenstein in 1958 and 1959 respectively, and were identified as *Venturia chlorospora* based on the shape and dimensions of their ascospores (Barr 1968). Ascospores of *Venturia chlorospora* were reported as 20–25 × 5–8 (Barr 1968), which is much larger than CBS 468.61 and CBS 471.61 (10.5–14 × 3.5–5.5 µm). In addition, the ascospore septum of *V. chlorospora* is in or near the upper third, while the ascospores of CBS 468.61 and CBS 471.61 have a median septum. Phylogenetically, CBS 468.61 and CBS 471.61 are sibling to other species of *Venturia*, and closely related to *V. fuliginosa* and *V. chlorospora* (Figs 1, 2). Thus, a new species, *V. albae*, is introduced to accommodate CBS 468.61 and CBS 471.61.

***Venturia antherici*** Hollós, Ann. Hist.-Nat. Mus. Natl. Hung. 8: 9. 1910. Fig. 25.

**Synonyms:** *Venturia allii* Ade & Rehm, Hedwigia 64: 292. 1923. *Spilosticta adeana* Petr., Kryptogamenfl. Forsch. Bayer. Bot. Ges. Erforsch Heim. Flora 2: 173. 1931.

**Ascomata** epiphyllous, 70–170 µm diam, gregarious or solitary, initially immersed, becoming erumpent or subsuperficial, globose, wall black, with a conspicuous papillate ostiole, surrounded by setae. *Setae* dark brown, up to 200 µm long, 5–7 µm

wide, septate, base wider, up to 11 µm diam. *Peridium* 11–16 µm wide, 1-layered, composed of several rows of pigmented cells of *textura angularis*, cells 8–12 µm wide, cell wall 0.5–1 µm thick, the inner wall thinner than the outer one. *Pseudoparaphyses* 2–3 µm wide, hyaline, septate. *Asci* 64–93 × 12–16 µm (av. 76.8 × 14 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical, with a short, knob-like pedicel or pedicel lacking, with an inconspicuous ocular chamber. *Ascospores* 16.5–24 × 5–6.5 µm (av. 19.1 × 5.8 µm, n = 20), broadly cylindrical to clavate, pale olivaceous brown, overlapping to biseriate, with a submedian septum, constricted at the septum, the upper cells longer than the lower ones (length ratio: 5:4–2:1), smooth-walled. **Asexual morph** unknown.

**Additional materials examined:** **Switzerland**, on the leaves of *Allium victorialis* (*Liliaceae*), 20 Jul. 1955, E. Müller (NY); on the leaves of *Polygonatum officinale* (*Liliaceae*), 23 May 1954, E. Müller (NY).

**Notes:** Ascospore septa of *V. antherici* are mostly submedian (Müller 1958, Barr 1968). *Venturia antherici* was reported as a common species associated with some genera of *Liliaceae* in Europe, such as *Allium*, *Polygonatum*, *Lloydia* and *Anthericum* (Barr 1968).

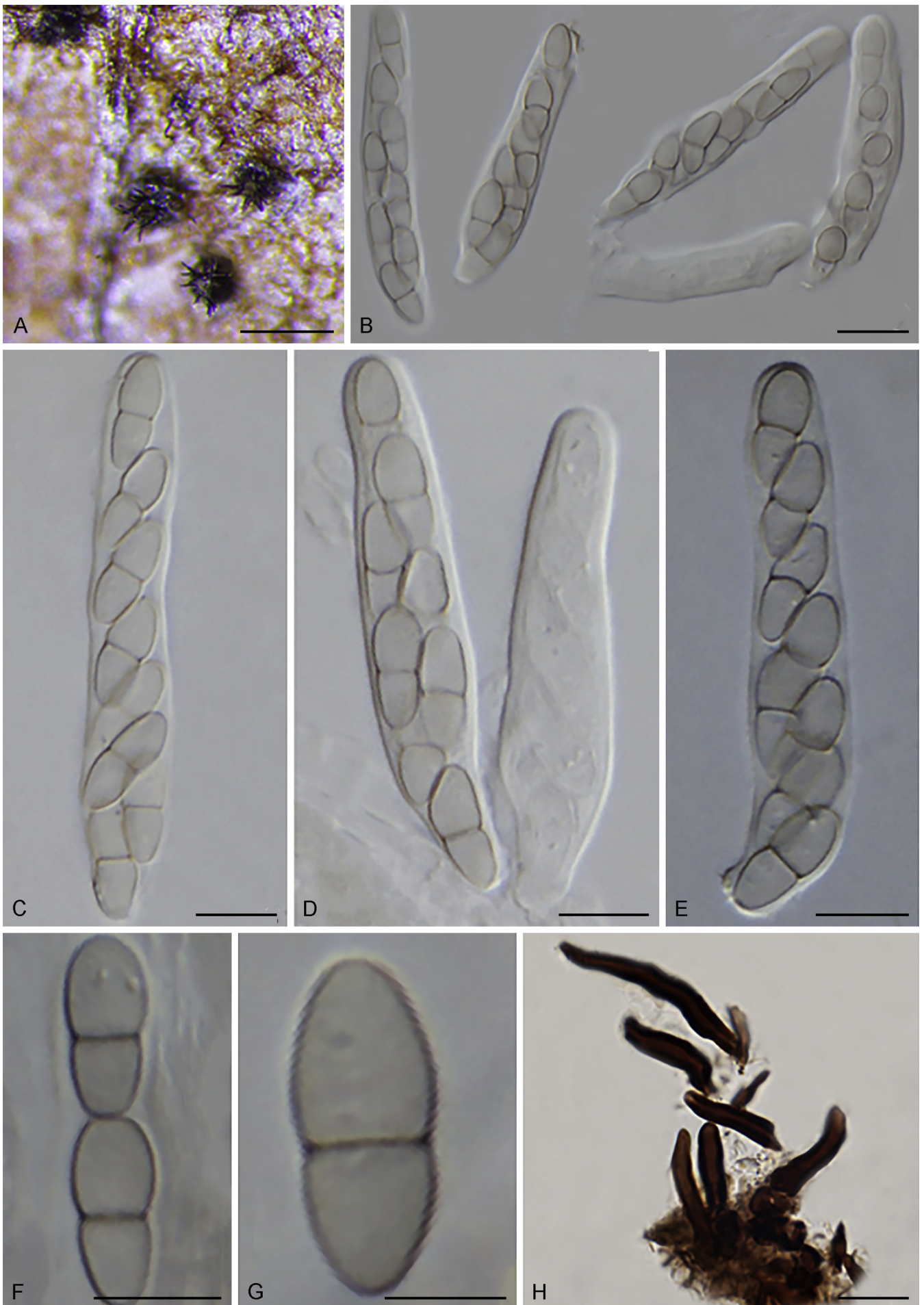
***Venturia asperata*** Samuels & Sivan., New Zealand J. Bot. 13: 646. 1975. Figs 26, 27.

**Synonym:** *Fusicladium asperatum* K. Schub. & U. Braun, Schlechtendalia 9: 18. 2003.

**Ascomata** amphigenous, 70–130 µm diam, solitary, scattered or in small groups of 2 to 3, initially immersed, becoming erumpent or subsuperficial, globose, wall black, with a conspicuous papillate ostiole, surrounded by setae. *Setae* dark brown, 18–45 × 4–6.5 µm, septate, setae wall 0.5–2 µm thick. *Peridium* 10–14 µm wide, 1-layered, composed of 3 rows of pigmented cells of *textura angularis*, cells 7–10 µm wide, cell wall 0.8–1.5 µm thick. *Pseudoparaphyses* rare, hyaline, evanescent when mature. *Asci* 47–61 × (8.5–)10–11 µm (av. 54.3 × 10.4 µm, n = 20), 8-spored, bitunicate, fissitunicate, narrowly obclavate to broadly cylindrical, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 11.5–15 × 4–6 µm (av. 12.9 × 5.3 µm, n = 20), ellipsoid, yellow to pale brown, uniseriate at the apex and biseriate at the base, 1-septate, mostly submedian, constricted at the septum, the upper cells somewhat longer than the lower ones (length ratio: 1:1–7:5), smooth-walled. **Asexual morph:** *Mycelium* 2–3 µm wide, branched or rarely branched, septate, not constricted at septa, subhyaline to pale brown, smooth, wall unthickened or slightly thickened. *Conidiophores* laterally arising from hyphae, erect, straight or somewhat flexuous, sometimes geniculate, unbranched, (6–)12–75 × (2.5–)3–4.5 µm, septate or aseptate, pale to medium brown, smooth, wall slightly thickened, sometimes only as short lateral conical hyphae, occasionally irregular in shape. *Conidiogenous cells* integrated, terminal, or conidiophores reduced to conidiogenous cells, 6–29 µm long, sometimes geniculate, proliferation sympodial, with several denticle-like loci, broadly truncate, 1.5–2(–2.5) µm wide, unthickened, somewhat darkened-refractive. *Ramoconidia* present, 20–28 × 5 µm, 0–1-septate, medium brown, broadly truncate base, with several loci at the apex, 3–4 µm wide. *Conidia* catenate, formed in unbranched or loosely branched chains, straight or slightly curved, cells sometimes irregularly swollen, 13–35 × 3.5–5.5(–6) µm, subcylindrical, fusiform, occasionally obpyriform, 0–3-septate, occasionally slightly



**Fig. 25.** *Venturia antherici* (NY) sexual morph. **A.** Ascomata on the host surface. **B, F.** Broadly cylindrical asci. **C, E.** Released, broadly cylindrical, pale brown ascospores. **D.** Dark brown setae. Scale bars: A = 200 μm; B, D, F = 20 μm; C, E = 10 μm.



**Fig. 26.** *Venturia asperata* (holotype PDD 31846) sexual morph. **A.** Ascomata scattered on the host surface. **B–E.** Broadly cylindrical to somewhat obclavate asci. **F, G.** Ellipsoid, pale brown ascospores. **H.** Dark brown setae. Scale bars: A = 200 µm; B–F, H = 10 µm; G = 5 µm.

constricted at the septum, few very large conidia with 5 septa, up to 75 µm long, 4.5–6 µm wide, subhyaline to pale brown, smooth, wall slightly thickened, slightly attenuated towards apex and base; *hila* broadly truncate, 1–2 µm wide, not or only slightly thickened, slightly darkened-refractive; microcyclic conidiogenesis present.

**Typus:** New Zealand, Auckland Prov., Waitemut Co., Oratia, P.D.D Research Orchard, on leaves of *Malus sylvestris* (*Rosaceae*), Aug. 1973, P.J. Brook, G.J. Samuels & M.A. Manning (**holotype** PDD 32263, **isotypes** IMI 186580, NY 00914428; **holotype** of *Fusicladium asperatum* PDD 31846).

**Notes:** Both *V. asperata* and *V. inaequalis* occur on *Malus* spp. Morphologically, the upper cells of ascospores of *V. asperata* are longer than the lower cells, distinguishing it from the shorter upper cells of ascospores of *V. inaequalis*. Furthermore, their asexual morphs differ in the sometimes concatenated conidia of *V. asperata* (vs. the not concatenated conidia of *V. inaequalis*), as does the position of the septum in their ascospores.

**Venturia atriseda** Rehm, Hedwigia 21(6): 84. 1882. Fig. 28.

**Synonyms:** *Eriosphaeria atriseda* (Rehm) Rehm, in Jaap, Ann. Mycol. 5: 253. 1907. *Nom. illeg.*, Art. 53.1, *non E. atriseda* (Feltgen) Sacc. & D. Sacc., 1905.

*Spilosticta atriseda* (Rehm) Petr., Ann. Mycol. 25: 209. 1927.

**Ascomata** occur on stems of *Gentiana lutea*, 80–166 × 60–120 µm diam, scattered or solitary, initially immersed, becoming erumpent, globose to conical, wall black, with a conspicuously papillate ostiole, surrounded by setae. Setae dark brown, 34–93 × 4–8 µm, septate, wall 1.5–2 µm thick. **Peridium** 11–14 µm wide, 1-layered, composed of 2–3 rows of pigmented cells of *textura angularis*, cells 4–4.5 µm wide, cell wall 0.5–1.2 µm thick, gradually thickened towards the ostiole. **Pseudoparaphyses** 2–3 µm wide, hyaline, filiform. **Asci** 42–74 × 14–21 µm (av. 55.8 × 16.8 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical to broadly obclavate, with a short, knob-like pedicel or pedicel lacking, with an inconspicuous ocular chamber. **Ascospores** 18–22 × 5–6(–7.5) µm (av. 19.5 × 5.7 µm, n = 20), fusiform to narrowly fusiform, pale brown to brown, obliquely uniseriate to biseriate at the top, triseriate near the base, 1-septate, apiosporous, with one septum at or nearly a third from the base, constricted or not at the septum, the upper cells longer and wider than the lower ones (length ratio: 11.9–25:14), smooth-walled. **Asexual morph** unknown.

**Typus:** Germany, Bavaria, Benediktenwand, Hausstatt Mountain, on dried stems of *Gentiana lutea* (*Gentianaceae*), Jul. 1881, Arnold (**lectotype** K(M) 189232 designated here, MBT391373).

**Additional material examined:** Switzerland, Kt. St. Gallen, Speergebiet, on *Gentiana punctata* (*Gentianaceae*), E. Müller, 2 Jul. 1953 (culture CBS 371.55).

**Notes:** Isolate CBS 371.55 was sterile, and its identity could not be confirmed. This isolate forms a distinct lineage in the *Venturia* clade (Fig. 2).

**Venturia australiana** Crous, M. Shen & Y. Zhang ter, *sp. nov.* MycoBank MB831537. Fig. 29.

**Etymology:** The epithet refers to Australia, the country where the species was collected.

**Sexual morph** unknown. *In vitro* on OA: **Mycelium** branched or sparingly unbranched, 2–3 µm wide, septate, not constricted

at septa, hyaline to pale brown, smooth, straight to somewhat flexuous, walls not thickened and darkened. **Conidiophores** arising from wider and darker hyphae, erect or geniculate-sinuous, unbranched, 17.5–55 × 4–7.5 µm, sometimes up to 155.5 µm long, septate, not constricted at the septa, medium to dark brown, smooth, walls somewhat thickened or darkened, cylindrical or subcylindrical. **Conidiogenous cells** integrated, terminal or conidiophores reduced to conidiogenous cells, cylindrical or subcylindrical, erect or sometimes geniculate, medium to dark brown, often becoming hyaline towards the apex, (6.5–)13–39.5 × 4.5–8 µm, proliferating sympodially or monoblastic, with a single or more conidiogenous loci, loci narrowly truncate, 1–3.5 µm wide, thickened and somewhat darkened. **Ramoconidia** present, 12–20 × 4–6.5 µm, 0(–1)-septate, occasionally constricted at the septa, pale to medium brown, sometimes dark brown, subcylindrical, broadly fusiform, or somewhat irregular, with 1–3 denticle-like apical loci. **Conidia** catenate, usually formed in branched chains, straight or occasionally slightly curved, cylindrical, subcylindrical, fusiform, broadly fusiform or somewhat irregular, 12–21 × 4–5.5 µm, pale to medium brown, smooth, mostly aseptate, rarely 1–2-septate, septum median, rarely constricted, tapered towards the ends, truncate at the base; *hila* 1–2 µm wide, slightly thickened, and somewhat darkened; conidia often germinating.

**Culture characteristics:** Colonies spreading, somewhat erumpent, with moderate to sparse aerial mycelium and smooth margins on OA; fuscous-black (surface); reverse fuscous-black; on SNA olivaceous (surface); reverse olivaceous. Colonies reaching 21 mm diam on OA after 2 wk at 25 °C in the dark; colonies fertile.

**Typus:** Australia, Victoria, Berwick, on leaf spot of *Convolvulus cneorum* (*Convolvulaceae*), 23 Jun. 2010 (**holotype** CBS H-23595, culture ex-type CBS 128286 = VPRI 41762).

**Notes:** Isolate CBS 128286 was originally identified as *Fusicladium convolvularum*, while the conidial dimensions are smaller than those of *F. convolvularum* (Schubert et al. 2003). Although *F. convolvularum* (as *V. convolvularum*) clusters sister to CBS 128286 (Figs 1, 2; ITS identity 96 %, LSU identity 99 %, *tub2* identity 93 %), the two species are distinct.

**Venturia bistortae** (Syd.) Sivan., Biblioth. Mycol. 59: 42. 1977. Fig. 30.

**Basionym:** *Spilosticta bistortae* Syd., Ann. Mycol. 21: 172. 1923.

**Ascomata** forming subcircular brown to black spots on leaf surfaces, 60–120 µm diam, solitary or rarely gregarious, initially immersed, becoming erumpent, globose or subglobose; wall black, with a conspicuous papillate ostiole, surrounded by setae. Setae dark brown, up to 60 µm long, base 2–3 µm wide. **Peridium** 10 µm wide, 1-layered, composed of 2–3 rows of pigmented cells of *textura angularis*, cells 8–10 µm wide, cell wall 0.8–1 µm thick, thicker near the apex. **Pseudoparaphyses** rare, evanescent when mature. **Asci** 38–60 × 12–19 µm (av. 52 × 15.9 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. **Ascospores** 15–19 × 5–7 µm (av. 17 × 5.6 µm, n = 20), broadly clavate, pale brown, overlapping to biseriate near the base, 1-septate, slightly constricted at the septum, the upper cells shorter and wider than



**Fig. 27.** *Venturia asperata* (holotype PDD 31846) asexual morph. **A.** Colony growing on OA. **B–H.** Conidiophores reduced to conidiogenous cells. **I, J.** Fusiform conidia. **K.** Subcylindrical ramoconidium. **L.** Germinating conidia. Scale bars: B–L = 5 µm.

the lower ones (length ratio: 3:5–1:1), smooth-walled. *Asexual morph*: unknown.

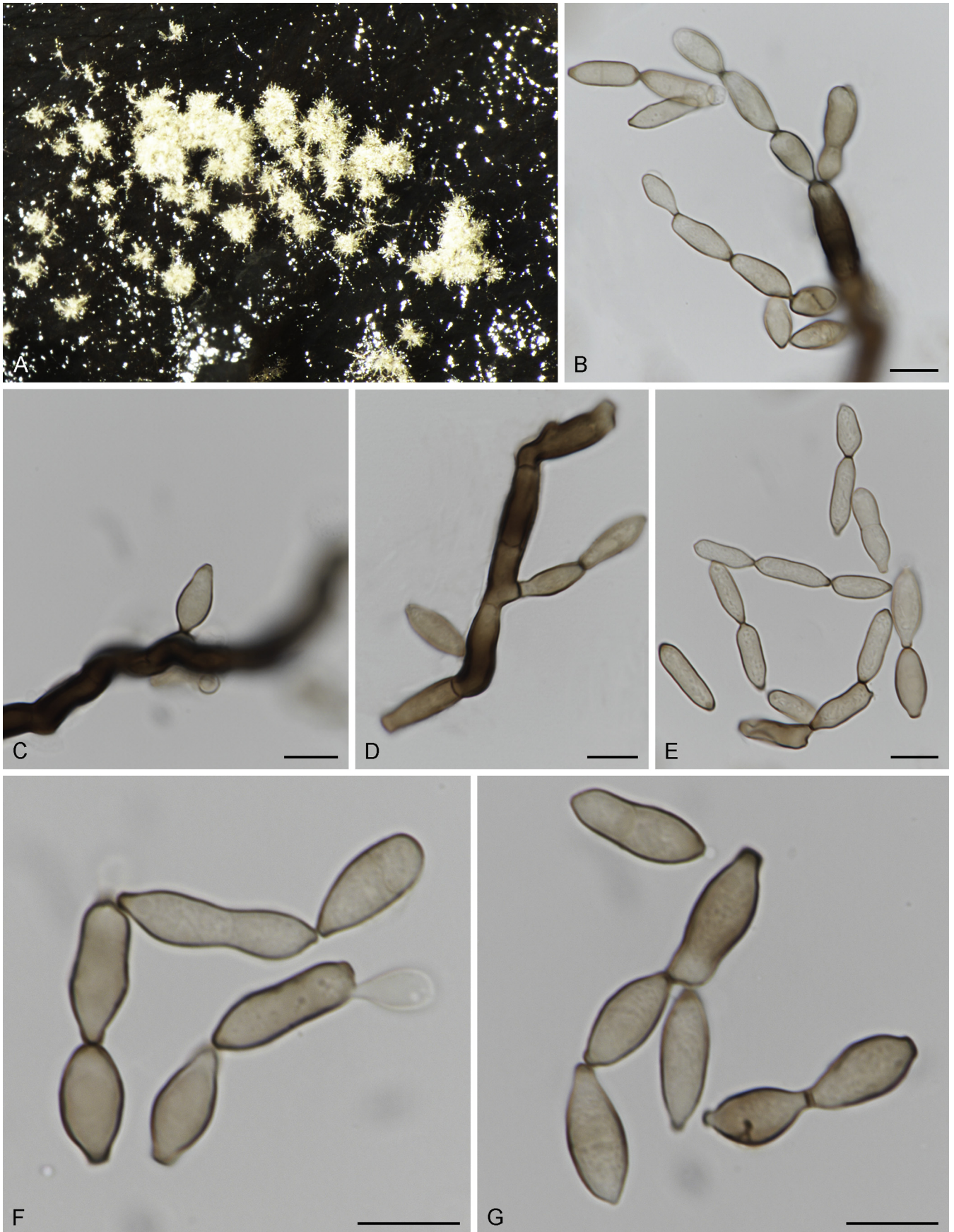
*Typus*: **Germany**, Westphalia, Ginsberger Heide, on leaves of *Polygonum bistorta* (*Polygonaceae*), 26 Jun. 1921, A. Ludwig

(**lectotype** S-F6682 designated here, MBT391374, **isolectotypes** Syd., Mycoth. Germ. 1911, e.g., BPI 613462, CUP, PDD 42615, PH 44202).

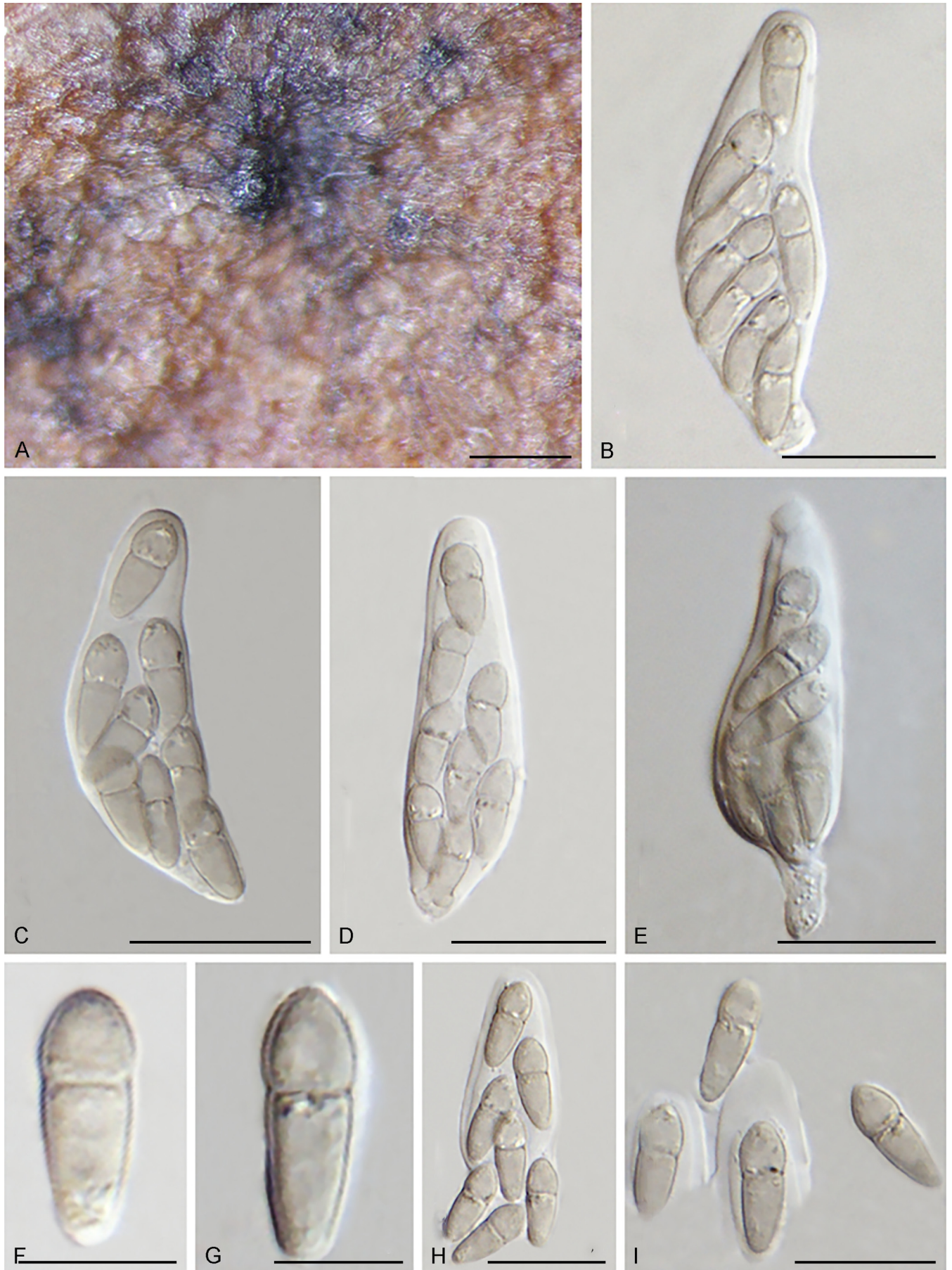


**Fig. 28.** *Venturia atriseda* (isotype K(M) 189232) sexual morph. **A.** Ascomata scattered on the host surface. **B.** Dark brown setae. **C–E, H.** Broadly cylindrical to somewhat obclavate asci. **F, G.** Released, fusiform, pale brown ascospores. Scale bars: A = 200  $\mu$ m; B, F, G = 10  $\mu$ m; C–E, H = 20  $\mu$ m.





**Fig. 29.** *Venturia australiana* (culture ex-type CBS 128286) asexual morph. **A.** Colony on OA. **B–D.** Conidiogenous cells giving rise to conidia. **E–G.** Ramoconidia and conidia in chains. Scale bars: B–G = 10 μm.



**Fig. 30.** *Venturia bistortae* (isotype K(M) 189233) sexual morph. **A.** Ascomata scattered on the host surface. **B–E.** Broadly obclavate asci. **F–I.** Released, pale brown ascospores. Scale bars: A = 200  $\mu$ m; B–E = 20  $\mu$ m; F–I = 10  $\mu$ m.

Notes: Although this taxon conforms to *Venturia* in general morphology, the subcircular leaf spots, and pale brown ascospores of *V. bistortae* disagree with *Venturia* s. str. Its phylogenetic position remains to be resolved.

***Venturia caesia*** Crous, M. Shen & Y. Zhang ter, *sp. nov.* MycoBank MB831538.

*Etymology*: The epithet refers to the host species from which this fungus was collected, *Salix caesia*.

Cultures sterile. *Venturia caesia* (CBS 466.61) differs from its closest phylogenetic neighbour *V. minuta* (CBS 479.61; Fig. 2) by unique fixed alleles in two loci based on alignments of the separate loci deposited in TreeBASE (S24582), by 13 bp in *tef1* (4 %) and 14 bp in *tub2* (3 %).

*Culture characteristics*: Colonies spreading, erumpent, with aerial mycelium and regular, smooth margins on OA, brown to dark olivaceous brown (surface); reverse fuscous-black; on MEA grey to olivaceous brown (surface); reverse fuscous-black; on SNA olivaceous brown (surface); reverse dark olivaceous brown. Colonies reaching 26 mm diam after 2 wk on OA at 25 °C in the dark.

*Typus*: **Switzerland**, on *Salix caesia* (*Salicaceae*), 2 Jul. 1959, J. Nüesch (**holotype** CBS 466.61, preserved as metabolically inactive culture, culture ex-type CBS 466.61).

Notes: CBS 466.61 was isolated from *Salix caesia* by E. Müller, and named *Venturia chlorospora*. According to the multigene phylogenetic analysis (Fig. 2), CBS 466.61 forms a separate lineage distinguishing it from closely related species (i.e., *V. minuta*, *V. helvetica* and *V. chinensis*) as well as isolates of *V. chlorospora*. Thus, a new name, *V. caesia*, is proposed here. *Venturia caesia* is sister to *V. chinensis* in Fig. 1.

***Venturia canadensis*** M.E. Barr, *Canad. J. Bot.* 46: 818. 1968. Fig. 31.

*Ascomata* 80–125 µm diam, solitary, initially immersed, becoming erumpent, to nearly superficial, globose to subglobose, black, with a conspicuously papillate ostiole, surrounded by setae. *Setae* dark brown, 30–100 × 4–7 µm, base up to 10 µm wide. *Peridium* 6–8 µm wide, 1-layered, composed of two rows of pale brown thick-walled cells of *textura angularis*, cells 4–6 µm wide, cell wall 0.8–1 µm thick, thickened along the apex. *Pseudoparaphyses* rare, evanescent when mature. *Asci* 41–60 × 11–13 µm (av. 49.6 × 12.4 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical to somewhat obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 14–16(–19) × 5–6 µm (av. 15.5 × 5.4 µm, n = 20), fusiform, broadly fusiform, pale brown, bi- to triseriate near the base, 1-septate, with one septum in the lower half, constricted or not at the septum, the upper cells wider than the lower ones (length ratio: 8:7–11:8), smooth-walled. *Asexual morph* unknown.

*Typus*: **Canada**, Quebec, Gaspé Prov. Park, Mont Albert, on leaves and stalks of *Rumex acetosella* (*Polygonaceae*), 10 Jul. 1957, H.E. & M.E. Bigelow (**holotype** NY 00914436, **isotype** NY 00914437).

Note: *Venturia caulicola* is another venturiaceous species occurring on *Rumex* sp., which was assigned to *Coleroa* based on its superficial ascomata (as *Coleroa caulicola*, Sivanesan 1977).

***Venturia carpophila*** E.E. Fisher, *Trans. Brit. Mycol. Soc.* 44: 339. 1961. *Nom. cons. prop.* (Rossman et al. 2018). Fig. 32.

*Synonyms*: *Cladosporium carpophilum* Thüm., *Oesterr. Bot. Z.* 27: 12. 1877.

*Fusicladium carpophilum* (Thüm.) Oudem., *Verh. Kon. Akad. Wetensch., Tweede Sect.*: 388. 1900.

*Fusicladium pruni* Ducomet, *Thèse Fac. Sci. Paris*: 137. 1907.

*Fusicladium amygdali* Ducomet, *Ann. École Natl. Agric. Rennes* 4: 11. 1911.

*Megacladosporium carpophilum* (Thüm.) Vienn.-Bourg., *Les Champignons Parasites Pl. Cult.* 1: 489. 1949.

*Fusicladosporium carpophilum* (Thüm.) Partr. & Morgan-Jones, *Mycotaxon* 85: 362. 2003.

*Ascomata* 100–160 µm diam, scattered or solitary, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuously papillate ostiole, surrounded by dark brown setae or setae not observed. *Peridium* 15–20 µm wide, 1-layered, composed of 2–3 rows of pale brown thick-walled cells of *textura angularis*, cells 4–11 µm wide, cell wall 1–1.2 µm thick. *Pseudoparaphyses* septate, hyaline, evanescent when mature. *Asci* 47–68 × 9–11 µm (av. 57.5 × 10.4 µm, n = 20), 8-spored (rarely 4-spored), bitunicate, fissitunicate, clavate, broadly cylindrical, with a short, knob-like pedicel, with an inconspicuous ocular chamber. *Ascospores* 12–16 × 4–6 µm (av. 13.9 × 5.1 µm, n = 20), clavate, pale brown, biseriate, rarely uniseriate, 1-septate, constricted at the septum, the upper cells much wider than the lower ones, smooth-walled. *Asexual morph*, see Schubert et al. (2003: 27–30, figs 7 and 8).

*Typus*: **Australia**, Victoria, on dead leaves of *Prunus armeniaca* (*Rosaceae*), 29 Aug. 1955, E.E. Fisher (**holotype** VPRI No. 984, **isotypes** K(M) 189234, PDD 32688, VPRI No. 983).

Notes: The diagnostic characteristics of *Venturia carpophila* are its asymmetrical ascospores (the upper cells much wider than the lower ones), and conspicuous constriction at the septum. *Venturia carpophila* causes freckle disease of apricots, plum and almonds and scab of peaches (Sivanesan 1977).

***Venturia cassandrae*** Peck, *Rep. (Annual) New York State Mus. Nat. Hist.* 38: 104. 1885. Fig. 33.

*Synonym*: *Gibbera cassandrae* (Peck) M.E. Barr, *Canad. J. Bot.* 39: 313. 1961.

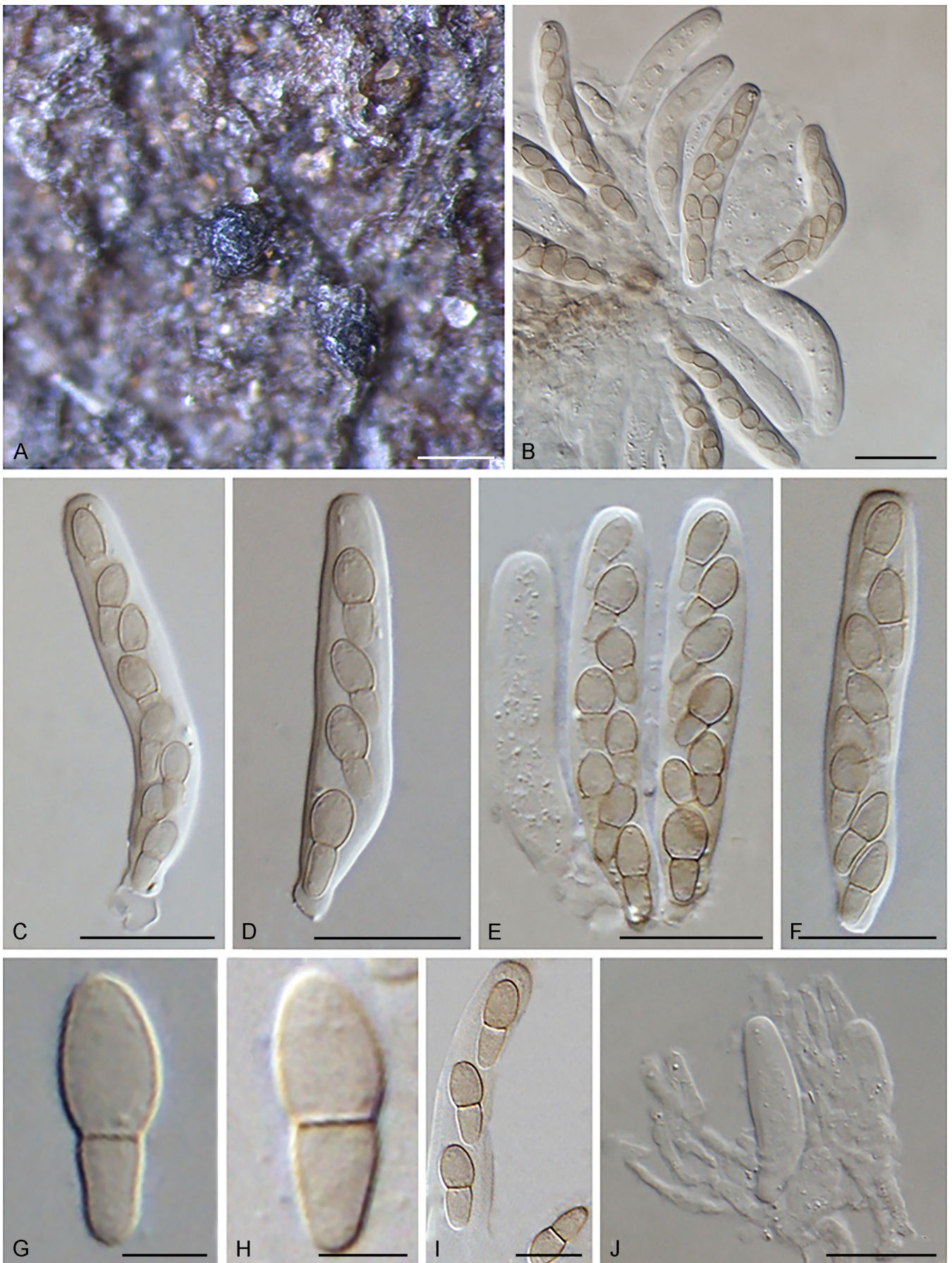
*Ascomata* scattered on the grey brown spots, 50–90 µm diam, globose to conical, wall black, with a conspicuous papillate ostiole, erumpent to nearly superficial, surrounded by setae. *Setae* dark brown, 43–75 × 5–7 µm, wall 1–2 µm thick, base swollen, up to 10–12 µm, septate. *Peridium* 1-layered, composed of two rows of pigmented cells of *textura angularis*, cells 4–8 µm wide, cell wall 1–1.5 µm thick. *Pseudoparaphyses* 2–4 µm wide, hyaline, septate, evanescent when mature. *Asci* 57–65 × 20–25 µm (av. 60.6 × 22.7 µm, n = 20), 8-spored, bitunicate, fissitunicate, oblong, pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 21–22(–24) × 7–10 µm (av. 21.5 × 8.6 µm, n = 20), fusiform to broadly fusiform, pale brown, with rounded or somewhat tapered ends, triseriate especially in the middle of the ascus, 1-septate, slightly constricted at the septum, the upper cell sometimes shorter and wider than the lower one (length ratio: 9:13–1:1), smooth-walled. *Asexual morph* unknown.



Fig. 31. *Venturia canadensis* (type NY 00914436) sexual morph. A, B. Ascomata scattered on the host surface. C. Evanescent pseudoparaphyses. D–I. Broadly cylindrical to somewhat obclavate asci. J. Released, fusiform, pale brown ascospores. K, L. Dark brown setae. Scale bars: A, B = 200  $\mu$ m; C–L = 10  $\mu$ m.

*Typus*: USA, New York, Fulton County, Caroga, on the leaves of *Chamaedaphne calyculata* (*Ericaceae*), Jul. 1884, C.H. Peck (*holotype* NYSf672).

*Notes*: Barr (1961) assigned *V. cassandrae* to *Gibbera* as *G. cassandrae* based on the erumpent ascomata and thin hypostroma. Morphologically, the nearly superficial,



**Fig. 32.** *Venturia carpophila* (isotype K(M) 189234 and PDD 32688) sexual morph. **A.** Ascomata scattered on the host surface. **B–F.** Clavate or cylindrical asci. **G–I.** Clavate, pale brown ascospores. **J.** Evanescent pseudoparaphyses. Scale bars: A = 200  $\mu\text{m}$ ; B–F, J = 20  $\mu\text{m}$ ; G–I = 10  $\mu\text{m}$ .

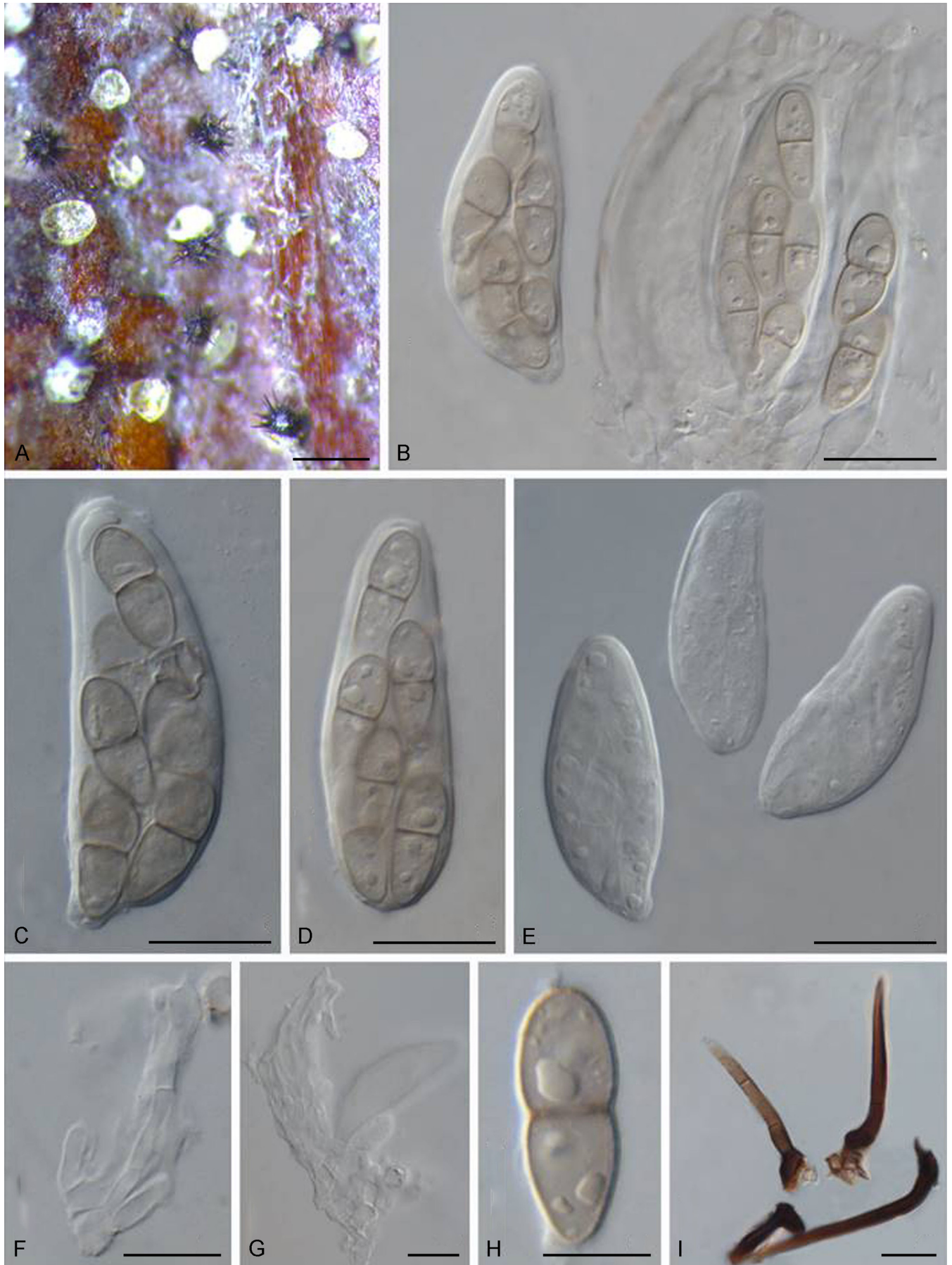


Fig. 33. *Venturia cassandrae* (holotype NYSf672) sexual morph. A. Ascomata scattered on the host surface. B–E. Broadly obclavate asci. F, G. Evanescent pseudoparaphyses. H. Released, pale brown ascospores. I. Setae. Scale bars: A = 200  $\mu\text{m}$ ; B–E, I = 20  $\mu\text{m}$ ; F–H = 10  $\mu\text{m}$ .

scattered ascomata with setae; narrowly cellular, hyaline, evanescent pseudoparaphyses; 8-spored, bitunicate, broadly obclavate asci lacking pedicels, as well as pale olivaceous, 1-septate ascospores of *V. cassandrae* fit *Venturia* s. str. very well. Thus, the name *V. cassandrae* is retained here.

***Venturia catenospora*** (Butin) Rossman & Crous, IMA Fungus 6: 520. 2015.

*Basionym:* *Pollaccia catenospora* Butin, Mycol. Res. 96: 658. 1992.

*Synonym:* *Fusicladium catenosporum* (Butin) Ritschel & U. Braun, Schlechtendalia 9: 30. 2003.

*Description and illustration:* Schubert et al. (2003: 30–31, fig. 9).

*Typus:* **Germany**, Berlin, Eberswalde-Finow, on the leaf spot of *Salix triandra* (*Salicaceae*), 7 Aug. 1990, H. Butin (**holotype** IMI 349857, culture ex-type CBS 447.91).

*Additional materials examined:* **China**, Heilongjiang Province, on *Salix* sp. (*Salicaceae*), 22 Aug. 2014, Y. Zhang & Y. Zhou (culture CGMCC 3.18369 = BJFCC 140822-1). **Switzerland**, on *S. caprea* (*Salicaceae*), 10 Jun. 1958, J. Nüesch (culture CBS 469.61).

*Note:* The species is sister to *V. chinensis* / *caesia* (Fig. 1) and to *V. viennotii* (Fig. 2).

***Venturia cephalariae*** (Auersw.) Kalchbr. & Cooke, Grevillea 9(no. 49): 31. 1880. Fig. 34.

*Basionym:* *Sphaerella cephalariae* Auersw., in Gonnermann & Rabenhorst, Mycol. Eur. 5–6: 14. 1869.

*Synonyms:* *Laestadia cephalariae* (Auersw.) Sacc., Syll. Fung. 1: 425. 1882.

*Carlia cephalariae* (Auersw.) Kuntze, Revis. Gen. Pl. 2: 846. 1891.

*Guignardia cephalariae* (Auersw.) F. Stevens, Trans. Illinois State Acad. Sci. 10: 184. 1917.

*Ascomata* hypophyllous, associated with leaf spots, 70–130 µm diam, gregarious or scattered, initially immersed, becoming erumpent, globose, wall black, with a conspicuously papillate ostiole, surrounded by setae. *Setae* dark brown, 27–43 × 5–8 µm, base swollen, base up to 10 µm wide, wall 1–2 µm thick, septate. *Peridium* 7–20 µm wide, 1-layered, composed of 2–3 rows of brown pigmented cells of *textura angularis*, cells 5–12 µm wide. *Pseudoparaphyses* 2–4 µm wide, swollen at the apex, septate, hyaline, evanescent when mature. *Asci* 55–74 × 13–17 µm, 8-spored, bitunicate, fissitunicate, broadly cylindrical to somewhat obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 14–19(–24) × 5–7 µm (av. 16.4 × 6 µm, n = 20), ellipsoid, pale brown, bi- to triseriate, 1-septate, apiosporous, with the septum in the lower third of ascospores, slightly constricted at the septum, the upper cells wider and longer than the lower ones [length ratio: 21:11–3:1(–19:5)], smooth-walled. *Asexual morph* unknown.

*Material examined:* **South Africa**, Cape Province, on leaves of *Cephalaria attenuata* (*Calyceraceae*), P. MacOwan 1338 (ex herb. M.C. Cooke, K(M) 189236).

*Note:* Colonies of *V. cephalariae* produced a sexual morph in malt agar media (Sivanesan 1977).

***Venturia cerasi*** Aderh., Landw. Jahrb. 29: 541. 1900. Fig. 35.

*Synonym:* *Fusicladium cerasi* (Rabenh.) Erikss., Meddeland. Kongl. Lantbruksakad. Exp.-fält 1: 73. 1885.

*Sexual morph:* see Sivanesan (1977: 51). *In vitro* on OA: *Mycelium* unbranched or only sparingly branched, 1.5–2.5 µm wide, septate, not constricted at septa, hyaline to pale brown, smooth, flexuous or straight, walls not thickened or almost so. *Conidiophores* solitary, arising laterally from hyphae, erect, straight to somewhat flexuous, sometimes geniculate, unbranched, 30.5–69.5 × 3–5 µm, aseptate or septate, pale brown or pale medium brown, sometimes paler towards the apex, smooth, walls somewhat thickened, sometimes only as short lateral conical prolongations of hyphae, subcylindrical. *Conidiogenous cells* integrated, terminal or conidiophores reduced to conidiogenous cells, sometimes geniculate, 17–24 × 3–4 µm, proliferating sympodially, pale brown or pale medium brown, with several conidiogenous loci, crowded at the apex, loci denticulate, 0.5–1.5 µm wide, not thickened or sometimes slightly darkened-refractive. *Ramoconidia* present, 12–22 × 3–6 µm, (0)–1-septate, not constricted at the septa, pale to medium brown, oval or broadly cylindrical, with a truncate base, usually with two loci. *Conidia* catenate, formed in unbranched or loosely branched chains, straight to rarely curved, narrowly or broadly fusiform, subcylindrical or ellipsoid, 11.5–24.5 × 2.5–5 µm, 0–1(–2)-septate, not constricted at the septa, pale brown, smooth, walls slightly thickened, attenuated towards apex and base; *hila* truncate, 0.5–1.5 µm wide, not thickened or only slightly thickened, somewhat darkened-refractive.

*Culture characteristics:* Colonies spreading, somewhat erumpent, with moderately sparse aerial mycelium and regular margins on OA, uneven, greyish (surface), margins greyish sepia; reverse fuscous-black. Colonies reaching 44 mm diam after 1.5 wk at 25 °C in the dark; colonies fertile.

*Typus:* **Germany**, Borussia, on fruits of *Prunus cerasus* (*Rosaceae*) (**lectotype** designated in Schubert et al. 2003: 33: Braun (l.c.: Pl. 1, B, 1–2); Aschersleben, on *Prunus cerasus*, 17 Sep. 1954, H. Schweizer (**epitype** specimen designated here CBS 444.54, MBT391375, preserved as metabolically inactive culture, ex-epitype culture CBS 444.54).

*Additional materials examined:* **Switzerland**, Zollikon, Kt. Zürich, on *Prunus mirabelle* (*Rosaceae*), 10 Aug. 1961, E. Müller (ETH 4568, culture CBS 497.62). **USA**, California, on the fruit of *Prunus amygdalus* (*Rosaceae*) (specimen CBS H-23596, culture CBS 160.55 = ATCC 12062 = MUCL 10087).

*Notes:* The ITS sequence identity among CBS 160.55, CBS 497.62 (sterile) and CBS 444.54 are 99 %, thus they are conspecific. None of the isolates, however, are ex-type. Morphologically, CBS 160.55 is most comparable with CBS 444.54 in its conidial size (11.5–24.5 × 2.5–5 vs. 20–24 × 3.5–4.5) and sympodially proliferating conidiogenous cells, which agree with the description of the asexual morph of *V. cerasi* (*Fusicladium cerasi*) provided by Schubert et al. (2003). Thus, we apply the name *V. cerasi* to this clade (Fig. 2).

***Venturia chamaemori*** (P. Karst.) Arx, Acta Bot. Neerl. 6: 340. 1957. Fig. 36.

*Basionym:* *Sphaerella chamaemori* P. Karst., Fungi Fenn. Exs., Fasc. 9: no. 899. 1869.

*Synonym:* *Mycosphaerella chamaemori* (P. Karst.) Lindau, in Engler & Prantl, Nat. Pflanzenf. Teil 1, 1(1): 424. 1897.

*Ascomata* amphigenous, 100–160 × 90–120 µm diam, scattered, solitary, initially immersed, becoming erumpent, globose to conical, wall black, with a conspicuously papillate ostiole,

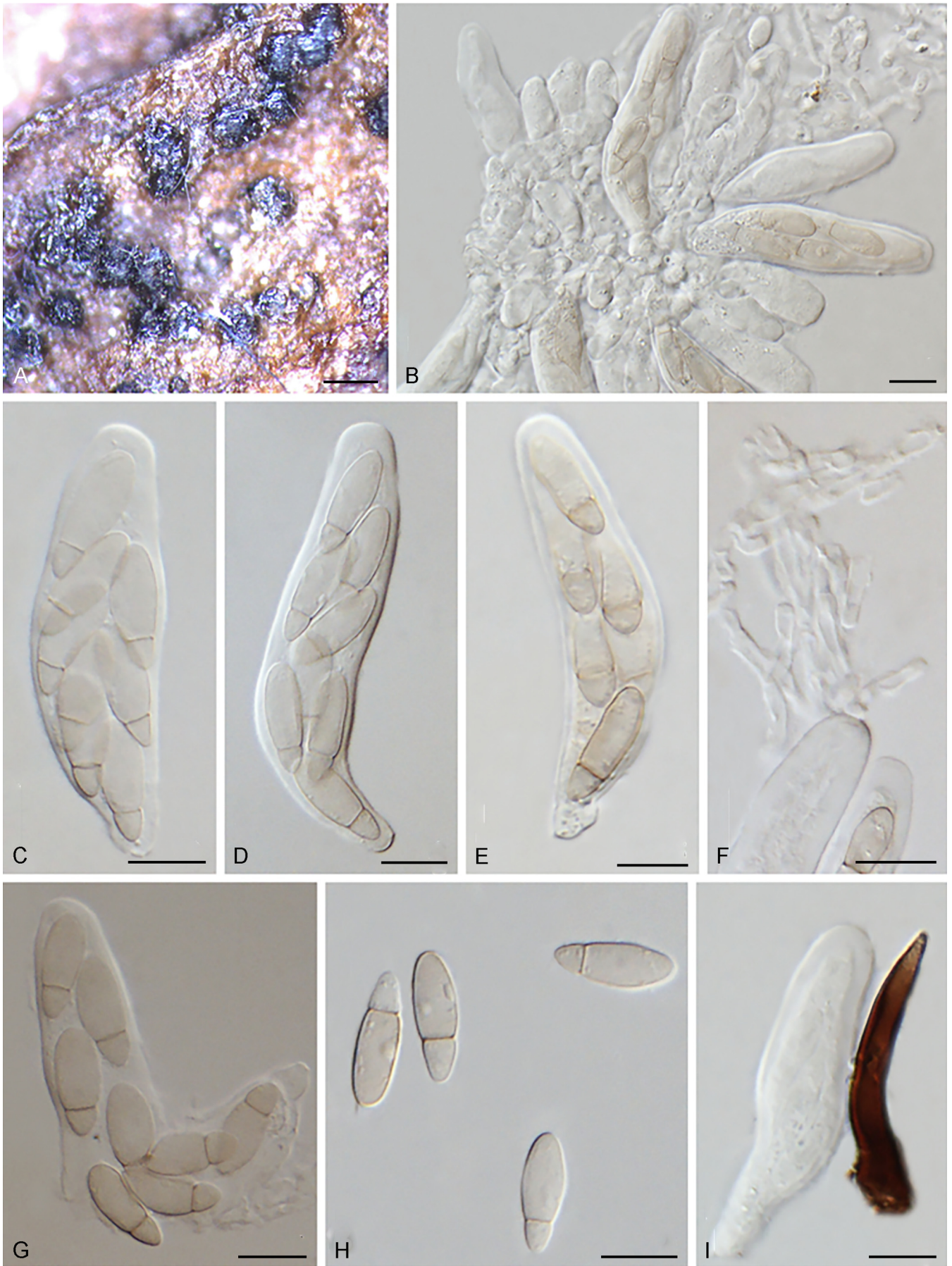


Fig. 34. *Venturia cephalariae* (type K(M) 189236) sexual morph. A. Ascomata scattered on the host surface. B–E. Broadly cylindrical asci. F. Evanescent pseudoparaphyses. G, H. Released, pale brown, 1-septate, apiosporous ascospores. I. Dark brown setae. Scale bars: A = 200  $\mu$ m; B–I = 10  $\mu$ m.



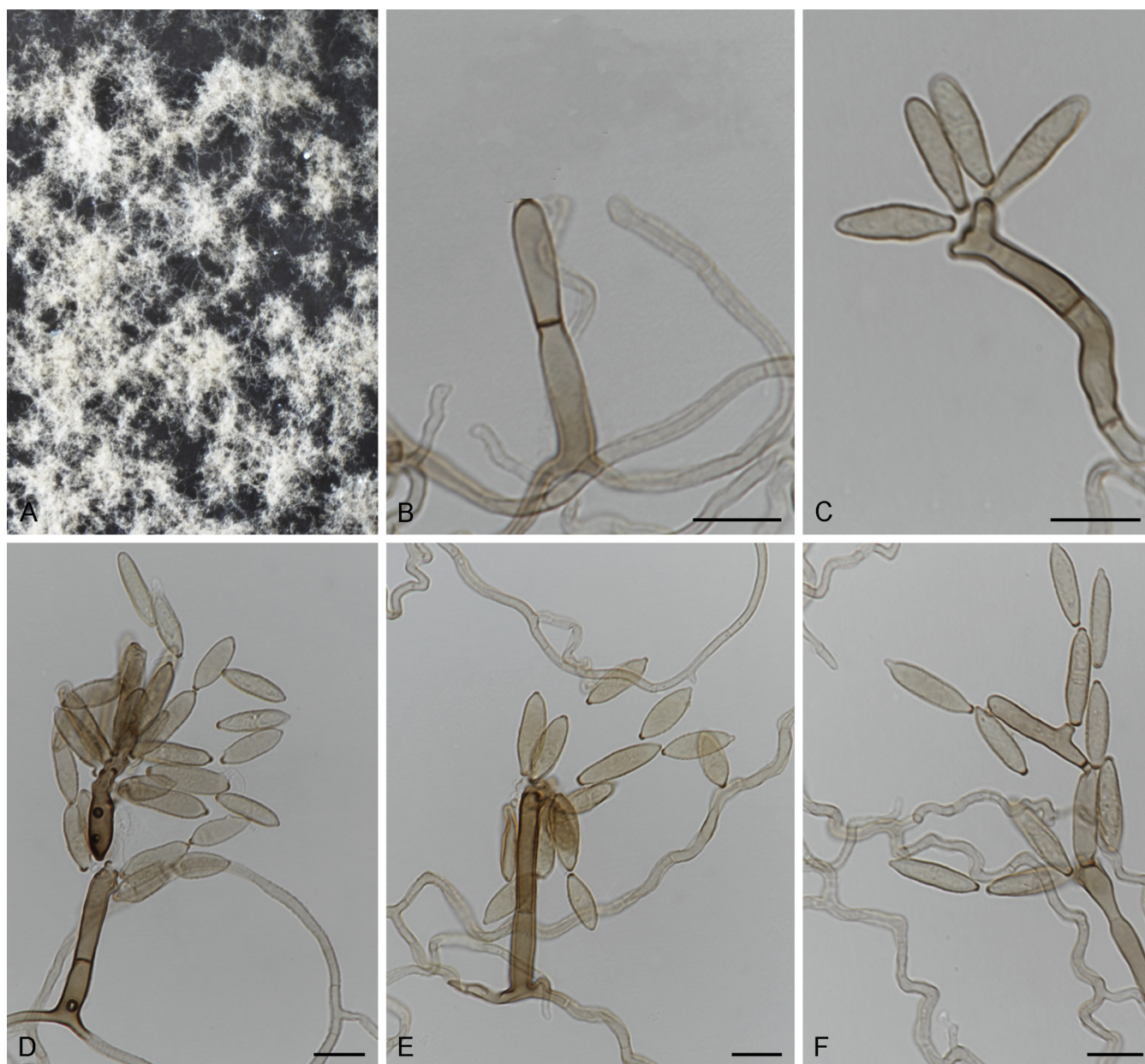


Fig. 35. *Venturia cerasi* (CBS 160.55) asexual morph. A. Colony on OA. B–F. Conidiogenous cells giving rise to conidia. Scale bars: B–F = 10  $\mu$ m.

surrounded by dark brown setae. Setae 40–86  $\times$  4–8  $\mu$ m, base swollen, up to 14  $\mu$ m diam, setae wall 1–1.5  $\mu$ m thick, septate. Peridium 13–19  $\mu$ m wide, 1-layered, composed of three rows of brown pigmented cells of *textura angularis*, cells 4–9  $\mu$ m diam. Pseudoparaphyses 2–4  $\mu$ m wide, septate, hyaline. Asci 50–80  $\times$  10–26  $\mu$ m, 8-spored, bitunicate, fissitunicate, cylindrical, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. Ascospores 11–15  $\times$  4–7  $\mu$ m (av. 12.7  $\times$  5.3  $\mu$ m,  $n = 20$ ), ellipsoid, olivaceous, obliquely uniseriate and partially overlapping to biseriate, medianly 1-septate, slightly constricted at the septum, the upper cells sometimes longer and wider than the lower ones (length ratio: 1:1–7:6), smooth-walled. Asexual morph unknown.

**Typus:** Finland, Etelä-Häme, Mustalia, on leaves of *Rubus chamaemorus* (Rosaceae), P.A. Karsten [Fungi Fenn. Exs. no. 899, **syntypes** H 6052060, K(M) 189238].

**Note:** The specimen is depauperate, and information about asci refers to von Arx (1957) and Sivanesan (1977).

***Venturia chinensis*** Y. Zhang ter & J.Q. Zhang, Saudi J. Biol. Sci. 23: 594. 2015 [2016].

**Description and illustration:** Zhang *et al.* (2016a, b).

**Typus:** China, Heilongjiang province, Yichun, Wuyiling district, Wuyiling forestry station, on leaves of *Lonicera praeflorens* (Caprifoliaceae), 26 Aug. 2014, Y. Zhang & Y. Zhou (**holotype** HAMS 246485, culture ex-type CBS 142240 = CGMCC 3.17685 = BJFC 140826-17).

**Note:** The species is sister to *V. caesia* (Fig. 1) and to *V. helvetica* / *caesia* / *minuta* (Fig. 2).

***Venturia chlorospora*** (Ces.) P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 189. 1873. Fig. 37.

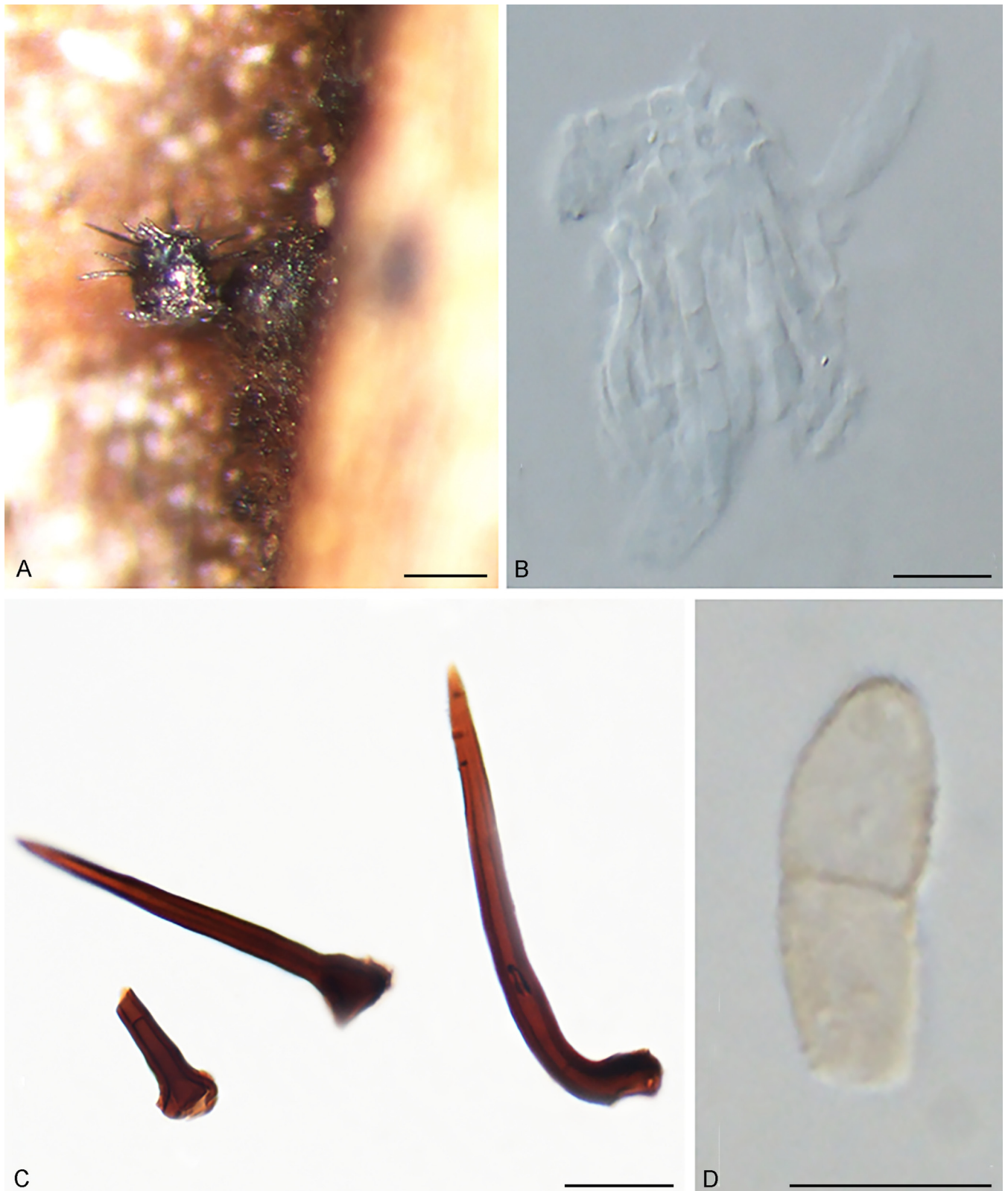
**Basionym:** *Sphaeria chlorospora* Ces., Erb. Critt. Ital., Ser. 1, Fasc. 2: no. 296, 1859 [Ces., in Rabenh., Fungi Eur. Exs. (Klotzschii Herb. Viv. Mycol. Continuatio, Ed. Nova, Ser. Sec.), Cent. 1: no. 48, 1859; Bot. Zeitung 17: 296, 1859; Flora 42: 434, 1859].

*Synonyms:* *Endostigme chlorospora* (Ces.) Syd., Ann. Mycol. 21(3/4): 173. 1923.

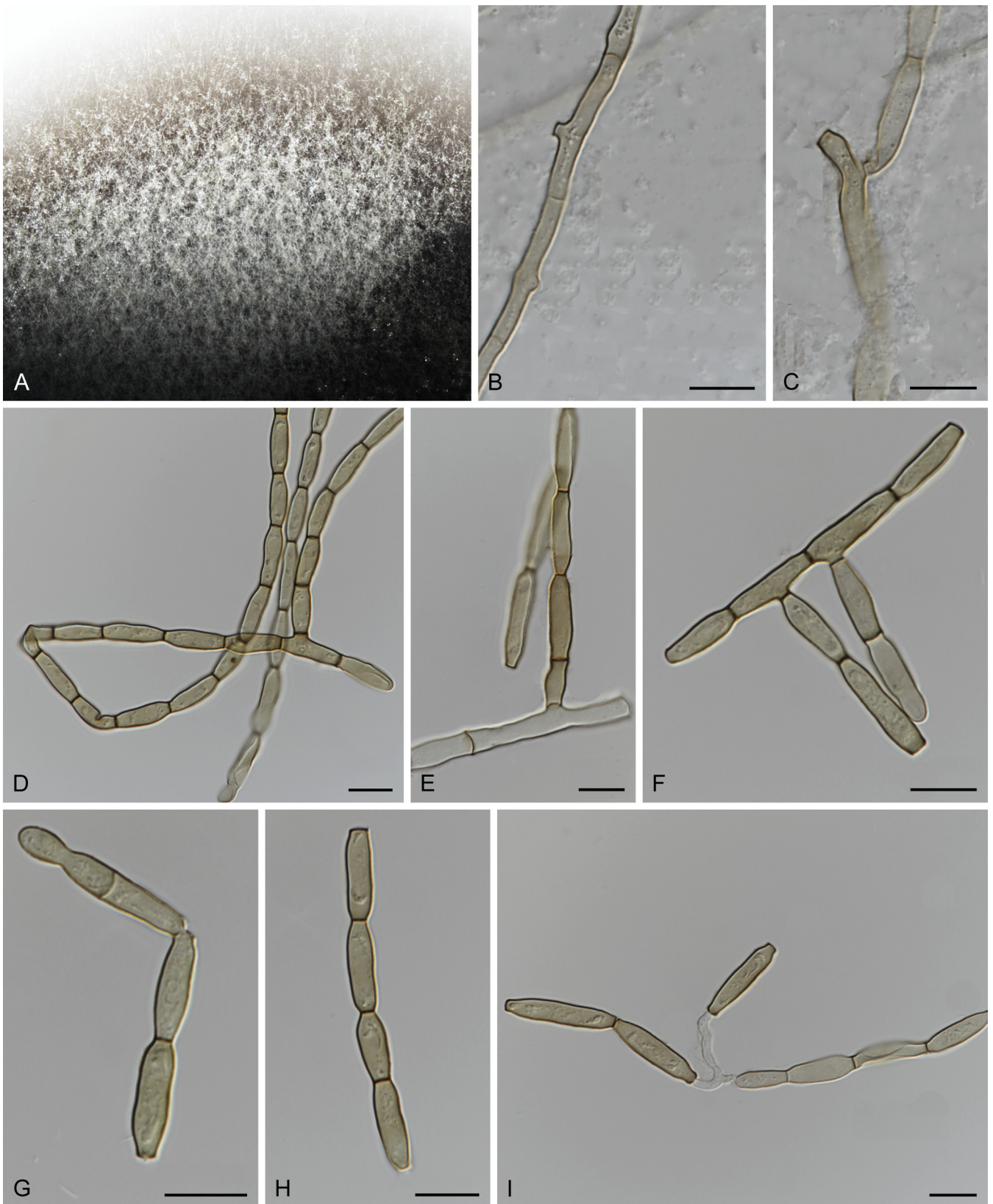
*Venturia chlorospora* var. *canescens* P. Karst., Bidrag Kännedom Finlands Natur. Folk 23: 190. 1873.

*Venturia chlorospora* var. *salicis-vitellinae* Sacc., Syll. Fung. 1: 587. 1882.

*Sexual morph:* see Nüesch (1960: 342–344). *In vitro* on OA: *Mycelium* branched, 1.5–3.5  $\mu\text{m}$  wide, hyaline to pale brown, smooth or verrucose, straight or somewhat flexuous, septate, often not constricted at the septa, walls not darkened or thickened, with hyphal coils. *Conidiophores* arising as short branches from subhyaline to pale brown hyphae, reduced to conidiogenous cells. *Conidiogenous cells*



**Fig. 36.** *Venturia chamaemori* (isotype K(M) 189238) sexual morph. **A.** Ascomata scattered on the host surface. **B.** Evanescent pseudoparaphyses. **C.** Dark brown setae. **D.** Pale brown ascospores. Scale bars: A = 100  $\mu\text{m}$ ; B, D = 10  $\mu\text{m}$ ; C = 20  $\mu\text{m}$ .



**Fig. 37.** *Venturia chlorospora* (culture CBS 467.61) asexual morph. **A.** Colony on OA. **B, C.** Hypha with conidiogenous loci. **D.** Long, branched conidial chains. **E, F.** Conidiophores giving rise to concatenate conidia. **G, H.** Ramoconidium and conidia in chains. **I.** Germinating conidia. Scale bars: B–I = 10  $\mu$ m.

terminal or intercalary, erect, 10–20  $\times$  3–7  $\mu$ m, monoblastic, pale brown to brown, walls not thickened nor darkened, subcylindrical, with single loci, 1.5–3.5  $\mu$ m wide, not thickened nor darkened-refractive. *Ramoconidia* present, 13–36.5  $\times$  2.5–6.5  $\mu$ m, aseptate, sometimes 1-septate, usually not constricted at septa, pale brown to brown, truncate at the both ends, occasionally rounded towards the

apex, cylindrical to subcylindrical, smooth or somewhat verrucose, straight or flexuous, with one to two denticle-like loci; loci broadly truncate, 1.5–2.5  $\mu$ m wide, slightly thickened or somewhat darkened. *Conidia* catenate, mostly formed in long, branched chains, cylindrical to subcylindrical, 11–29  $\times$  3–7  $\mu$ m, (0–)1-septate, constricted at the septa, brown, verrucose to smooth, straight or occasionally

geniculate, walls slightly thickened and darkened, truncate at both ends, sometimes rounded towards the apex; *hila* truncate, 1.5–3 µm wide, slightly thickened and somewhat darkened.

**Culture characteristics:** Colonies spreading, somewhat erumpent, with moderate sparse aerial mycelium and regular margins on OA, uneven, greyish sepia (surface); reverse fuscous-black; on MEA spreading, smooth, greyish green (surface), margins pale grey to whitish; on SNA spreading, smooth, greyish sepia (surface); reverse fuscous-black. Colonies reaching 32 mm diam on OA after 3 wk at 25 °C in the dark; colonies fertile.

**Typus:** **Italy**, Vercellis, on *Salix (triandra, alba)* (*Salixaceae*), 1858, V. de Cesati [Erb. Critt. Ital. 296 and Rabenh., Fungi Eur. Exs. 48, **syntypes**, e.g. B, CUP, HAL, S].

**Additional materials examined:** **France**, Aiguilles, Val Queyras, Hautes Alpes, on *Salix daphnoides* (*Salixaceae*), 25 Jun. 1958, J. Nüesch (ETH 2828, culture CBS 470.61). **Switzerland**, La Punt, Kt. Graubünden, on *S. daphnoides*, 2 Jul. 1959, J. Nüesch (CBS H-23602, culture CBS 467.61, ETH 2504).

**Notes:** CBS 467.61 and CBS 470.61 were collected by Nüesch in Europe in 1958 and 1959 respectively. The conidia of CBS 467.61 agree morphologically with *V. chlorospora* (20–25 × 5–8 µm) (Nüesch 1960, Sivanesan 1977). This species is sister to *V. fuliginosa* (Fig. 2). The nomenclature of *Sphaeria chlorospora* has recently been discussed in detail by Braun & Bensch (2019: 3), including copy of the label of the original description and illustration in Rabenh., Fungi. Eur. Exs. 48.

**Venturia convolvularum** (Ondřej) Rossman & Crous, IMA Fungus 6: 520. 2015.

**Basionym:** *Fusicladium convolvularum* Ondřej, Česká Mykol. 25: 171. 1971.

**Description and illustration:** Schubert et al. (2003), Crous et al. (2007b).

**Typus:** **Czech Republic**, Libina, kraj pole pod nadrazim (okr. Sumperk), on *Convolvulus arvensis* (*Convolvulaceae*), 7 Sep. 1970, Ondřej (**holotype** BRA) (not seen). **New Zealand**, on the leaves of *C. arvensis*, 7 Nov. 2000, C.F. Hill (**epitype** CBS H-19911 designated in Crous et al. (2007b), culture ex-epitype CBS 112706 = CPC 3884 = LYN 136 = IMI 383037).

**Note:** The species is sister to *V. australiana* (Figs 1, 2).

**Venturia crataegi** Aderh., Ber. Deutsch. Bot. Ges. 20: 200. 1902. Figs 38, 39.

**Synonyms:** *Fusicladium crataegi* Aderh., Ber. Deutsch. Bot. Ges. 20: 200. 1902.

*Endostigme crataegi* (Aderh.) Syd., Ann. Mycol. 21(3/4): 173. 1923.

*Megacladosporium crataegi* (Aderh.) Vienn.-Bourg., Les Champignons Parasites Pl. Cult. 1: 539. 1949.

**Ascomata** amphigenous, 80–140 µm diam, scattered, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuously papillate ostiole, surrounded by setae. *Setae* dark brown, 32–56 × 4–5 µm, setae wall 1–1.5 µm thick. *Peridium* 9–14 µm wide, 1-layered, composed of 1–3 rows of brown pigmented cells of *textura angularis*, cells 5–10 × 4–10 µm, cell wall 0.5–1.2 µm thick. *Pseudoparaphyses* numerous, filamentous, hyaline, evanescent when mature. *Asci*

45–55 × 8–11 µm, 8-spored, bitunicate, fissitunicate, broadly cylindrical, with a short, knob-like pedicel, each with an inconspicuous ocular chamber. *Ascospores* 10–15 × 4–6 µm (av. 12.8 × 5.2 µm, n = 20), colourless to pale brown, fusiform, with narrowly to broadly rounded ends, biseriate, 1-septate, slightly constricted at the septum, the upper cells mostly shorter and wider than the lower ones (length ratio: 4:7–3:4), smooth-walled.

**In vitro on OA:** *Mycelium* unbranched, 1.5–3 µm wide, septate, not constricted at septa, subhyaline, smooth, straight, walls neither thickened nor darkened. *Conidiophores* laterally arising from hyphae, erect, sometimes geniculate, unbranched, up to 135 µm long, (0–)7-septate, medium to dark brown, smooth, subcylindrical. *Conidiogenous cells* integrated, terminal, erect, 14.5–58.5(–98) × 2–3.5 µm, medium to dark brown, sometimes becoming hyaline towards the apex, proliferating sympodially, with several truncate loci, 1–1.5 µm wide, slightly thickened and darkened. *Conidia* solitary, straight, narrowly fusiform, 15–24.5 × 3–5 µm, often medianly 1-septate, sometimes 2-septate, not or slightly constricted at the septum, mostly widest in the middle or lower third, pale brown to brown, smooth, becoming tapered to both ends, walls not thickened, inconspicuous to somewhat darkened; *hila* truncate, 1–1.5 µm wide, slightly thickened or darkened, but not refractive.

**Culture characteristics:** Colonies spreading, somewhat erumpent, with sparse aerial mycelium and regular margins on OA, uneven, greyish (surface), margins dark brown; reverse fuscous-black. Colonies reaching 16 mm diam after 2 wk at 25 °C in the dark; colonies fertile.

**Typus** (*Fusicladium crataegi*): **Germany**, Thuringia, Steiger, on *Crataegus laevigata* (*Rosaceae*) (*C. oxyacantha* auct.), 15 Mar. 1902, H. Diedicke [Syd., Mycoth. Germ. 45] (HBG, **lectotype**, designated in Schubert et al. 2003: 37). **Isolectotypes:** B, BPI 423805, ILL 6195, IND-F-3788, JE, LE, MICH 15608, PH 5573, S-F-45734, WIS-F70209.

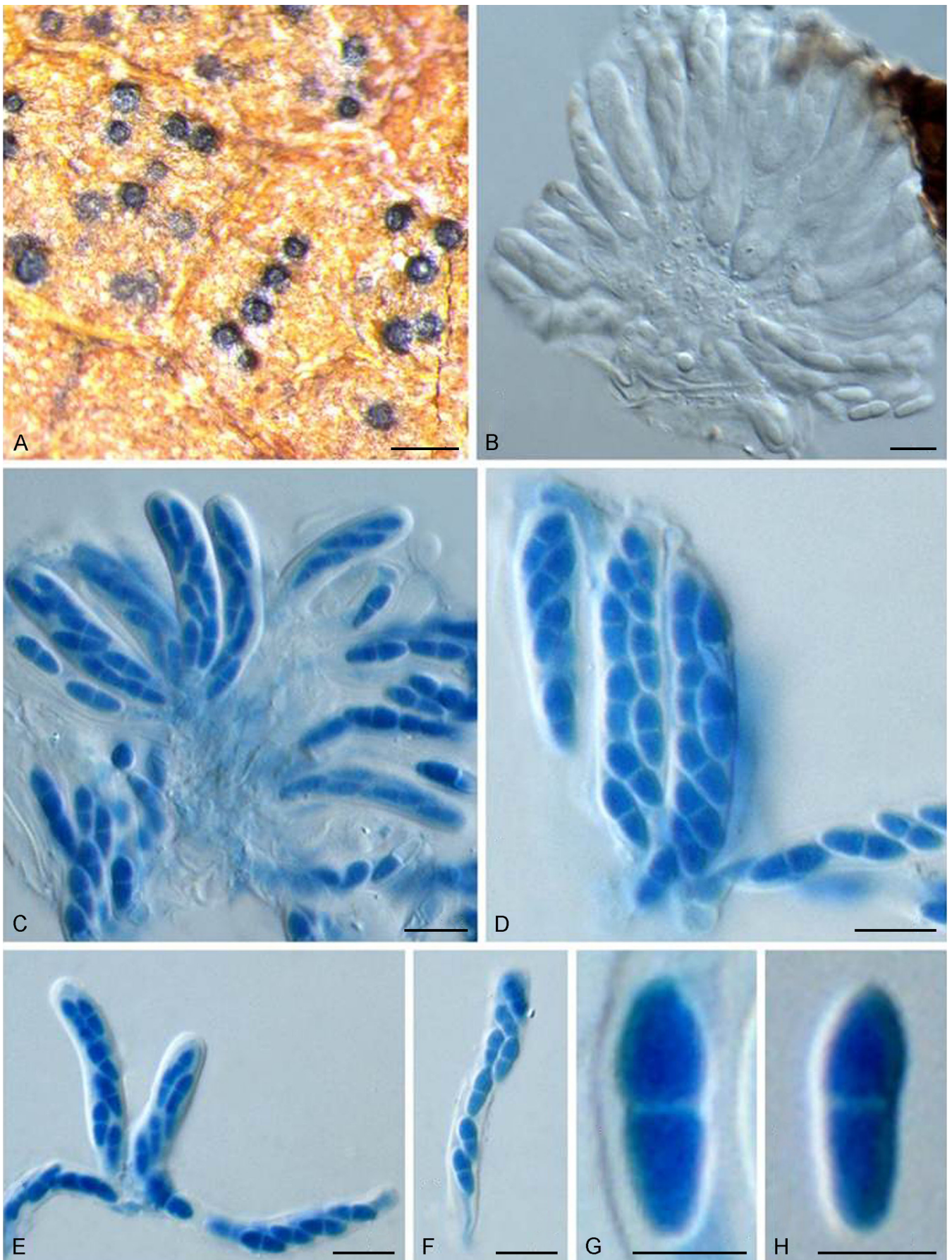
**Additional materials examined:** **Germany**, Müncheberg, on *Sorbus aucuparia* (*Rosaceae*) (CBS H-23599, culture CBS 367.35); on *Crataegus* sp. (*Rosaceae*) (cultures CBS 368.35, CBS 369.35).

**Notes:** CBS 367.35 and CBS 368.35 / CBS 369.35 were from different host genera, but all from members of *Rosaceae* collected in Germany. Morphologically, all of these isolates agree with the description of *V. crataegi* provided by Schubert et al. (2003). Thus, we identify the clade as *V. crataegi*. This species is sister to *V. orbiculata* (Fig. 2).

**Venturia curviseta** Peck, Rep. (Annual) New York State Mus. Nat. Hist. 35: 145. 1884 [1882]. Fig. 40.

**Synonym:** *Antennularia curviseta* (Peck) M.E. Barr, Canad. J. Bot. 46: 848. 1968.

**Ascomata** hypophyllous, 50–100 µm diam, 60–93 µm high, gregarious or scattered, becoming superficial, globose to subglobose, wall black, with a conspicuous papillate ostiole, surrounded by long setae. *Setae* dark brown, 120–160 × 4–6 µm, setae wall 1–2 µm, base swollen, up to 7–9 µm diam, aseptate. *Peridium* 8–14 µm wide, 1-layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 5–10 × 4–9 µm, cell wall 0.5–1 µm thick. *Pseudoparaphyses* 2–3 µm wide, hyaline, septate, evanescent when mature. *Asci* 40–65 × 9–13 µm (av. 52.5 × 10.7 µm, n = 20), 8-spored, bitunicate, fissitunicate, clavate, with a short, knob-like pedicel, each with an inconspicuous ocular chamber. *Ascospores* 11–15 × 4–5 µm (av.



**Fig. 38.** *Venturia crataegi* (MICH 15147) sexual morph. **A.** Ascomata scattered on the host surface. **B, C.** Squash mounts with a large number of asci (C in cotton blue). **D–F.** Cylindrical asci (in cotton blue). **G, H.** Released, colourless to pale brown ascospores (in cotton blue). Scale bars: A = 100  $\mu$ m; B–F = 10  $\mu$ m; G, H = 5  $\mu$ m.

12.9 × 4.3 μm, n = 20), cylindrical to oblong, pale olivaceous brown, with narrowly rounded ends, overlapping to biseriate at the base, 1-septate, the upper cells somewhat shorter than the lower ones (length ratio: 5:7–1:1), smooth-walled. Asexual morph unknown.

*Typus*: USA, New York, Albany, on fallen leaves of *Nemopanthes mucronata* (Aquifoliaceae), Jun. 1881, C.H. Peck (**holotype** NYSf 925).

*Notes*: *Venturia curviseta* was assigned to *Antennularia* based on its long, reflexed setae surrounding the apex of ascostromata, and ascospores being close to medianly septate (Barr 1968). The small-sized ascostromata with setae, evanescent pseudoparaphyses, pale olivaceous brown, 1-septate ascospores agree with *Venturia* s. str.

***Venturia ditricha*** (Fr.) P. Karst., Bidr. Känn. Finl. Nat. Folk 23: 188. 1873. Fig. 41.

*Basionym*: *Sphaeria ditricha* Fr., Syst. Mycol. 2(2): 515. 1823.

*Synonyms*: *Exosporium ditrichum* (Fr.) Link, Sp. Pl., Ed. 4, 6: 123. 1825.

*Vermicularia ditricha* (Fr.) Schwein. [as 'ditricham'], Trans. Amer. Philos. Soc., n.s. 4: 228. 1832.

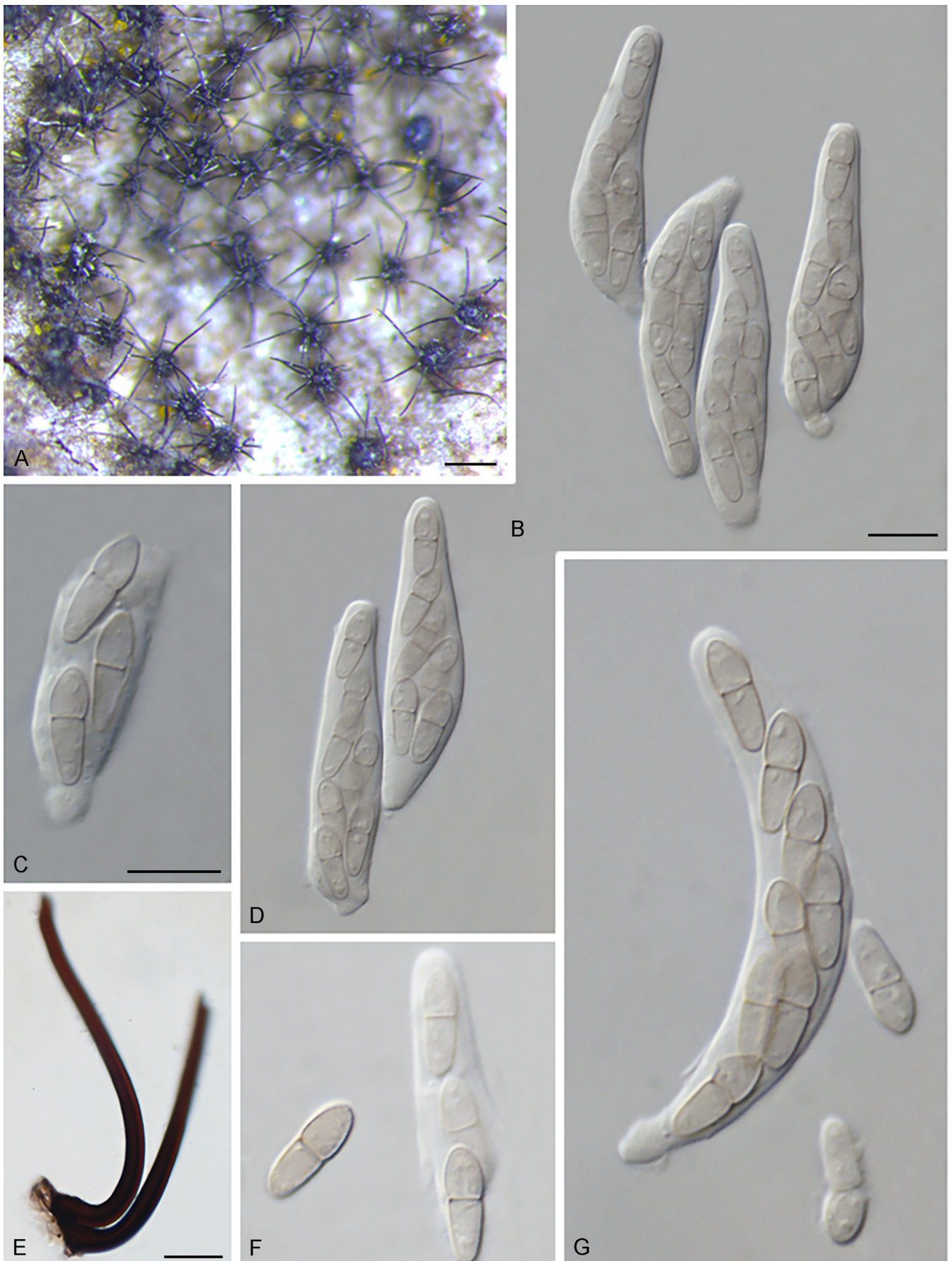
*Sphaerella ditricha* (Fr.) Auersw., Rabenh., Fungi Eur. Exs. (Klotzschii Herb. Viv. Mycol. Continuatio, Ed. Nova, Ser. Sec.), Cent. 10: no. 943, 1866 [Bot. Zeitung 24: 300, 1866; Hedwigia 5: 191, 1866].

*Fusicladium betulae* Aderh., Centralbl. Bakteriol., 2. Abth., 2: 57. 1896.

*In vitro* on OA: Sexual morph: *Ascomata* solitary, scattered, initially immersed or slightly erumpent, becoming superficial, dark black, globose, wall black, the ascostromata covered with setae. *Setae* dark brown, 4–4.5 × 62–76 μm, aseptate, wall black. *Asci* not observed. Asexual morph: *Mycelium* branched or unbranched, 2–3.5 μm wide, septate, not constricted at septa, hyaline to pale brown, smooth, straight, walls thickened or darkened. *Conidiophores* laterally or terminally arising from darker hyphae, erect or geniculate-sinuous, sometimes branched, subcylindrical, 40–60.5(–72.5) × 3.5–5 μm, mainly aseptate or 1-septate, not constricted at septa, medium brown, smooth, walls somewhat thickened and slightly darkened-refractive. *Conidiogenous cells* terminal, integrated,



**Fig. 39.** *Venturia crataegi* (culture CBS 367.35) asexual morph. **A.** Colonies on OA. **B, C.** Conidiophores giving rise to conidia. **D.** Conidiogenous cells with sympodial proliferation. **E–G.** Germinating conidia. Scale bars: B–G = 10 μm.



**Fig. 40.** *Venturia curviseta* (holotype NYSf 925) sexual morph. **A.** Ascoma scattered on the host surface. **B, D, G.** Broadly clavate to somewhat obclavate asci. **C, F.** Pale brown ascospores. **E.** Dark brown setae. Scale bars: A = 100  $\mu$ m; B applies to B, D = 10  $\mu$ m; C applies to C, F, G = 10  $\mu$ m; E = 10  $\mu$ m.

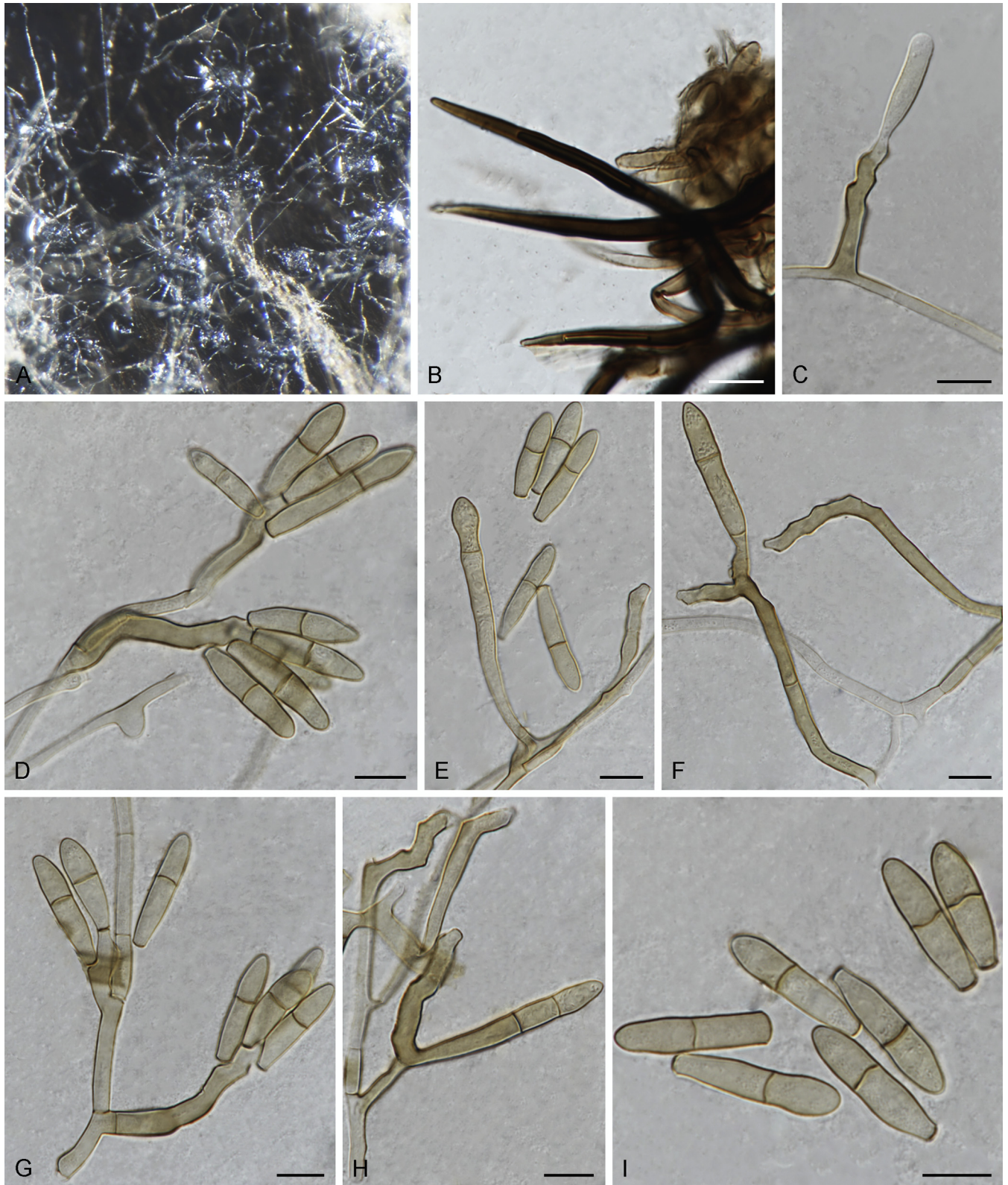


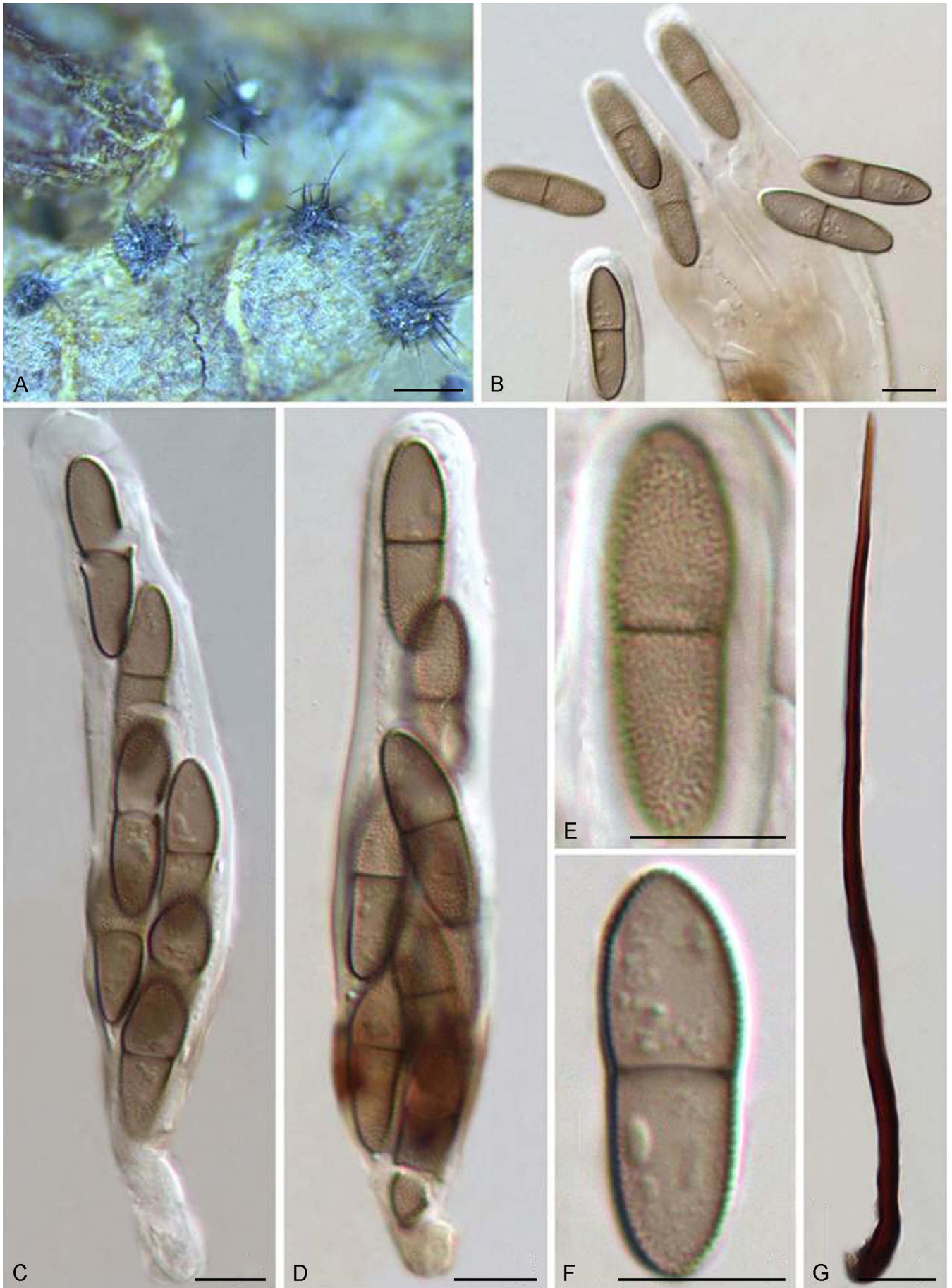
Fig. 41. *Venturia ditricha* (culture CBS 115426) sexual / asexual morph. A. Ascomata scattered on OA. B. Dark brown setae on ascoma. C–H. Symphyllal conidiogenous cells giving rise to conidia. I. Fusiform to subcylindrical conidia. Scale bars: B–I = 10  $\mu$ m.

geniculate or sometimes erect, subcylindrical, 25.5–46.5  $\times$  4–4.5  $\mu$ m, polyblastic, proliferating sympodially, brown to medium brown, with several loci, mostly truncate, 2–2.5  $\mu$ m wide, not thickened, inconspicuous to somewhat darkened, but not refractive. *Conidia* solitary, mostly straight to rarely curved, fusiform, subcylindrical, 19–29.5  $\times$  4.5–6.5  $\mu$ m, mainly 1-septate, septum median or somewhat in the upper half, rarely 2(–3)-septate, often not constricted at septa,

yellowish to brown, smooth, becoming rounded towards the apex, truncate at the base, *hila* flattened, 1.5–3  $\mu$ m wide, slightly thickened and somewhat darkened.

*Culture characteristics:* Colonies spreading, somewhat erumpent, with moderate sparse aerial mycelium and regular margins on OA, greyish (surface), margins olivaceous; reverse fuscous-dark. Colonies reaching 12 mm diam after 2 mo at 25  $^{\circ}$ C in the dark, colonies fertile.





**Fig. 42.** *Venturia elegantula* (type NY 00914439) sexual morph. **A.** Globose ascomata scattered on the host surface. **B, E, F.** Released, ellipsoid, olivaceous or brown ascospores. **C, D.** Somewhat obclavate asci with short pedicels. **G.** Long, dark brown seta. Scale bars: A = 200  $\mu$ m; B–G = 10  $\mu$ m.

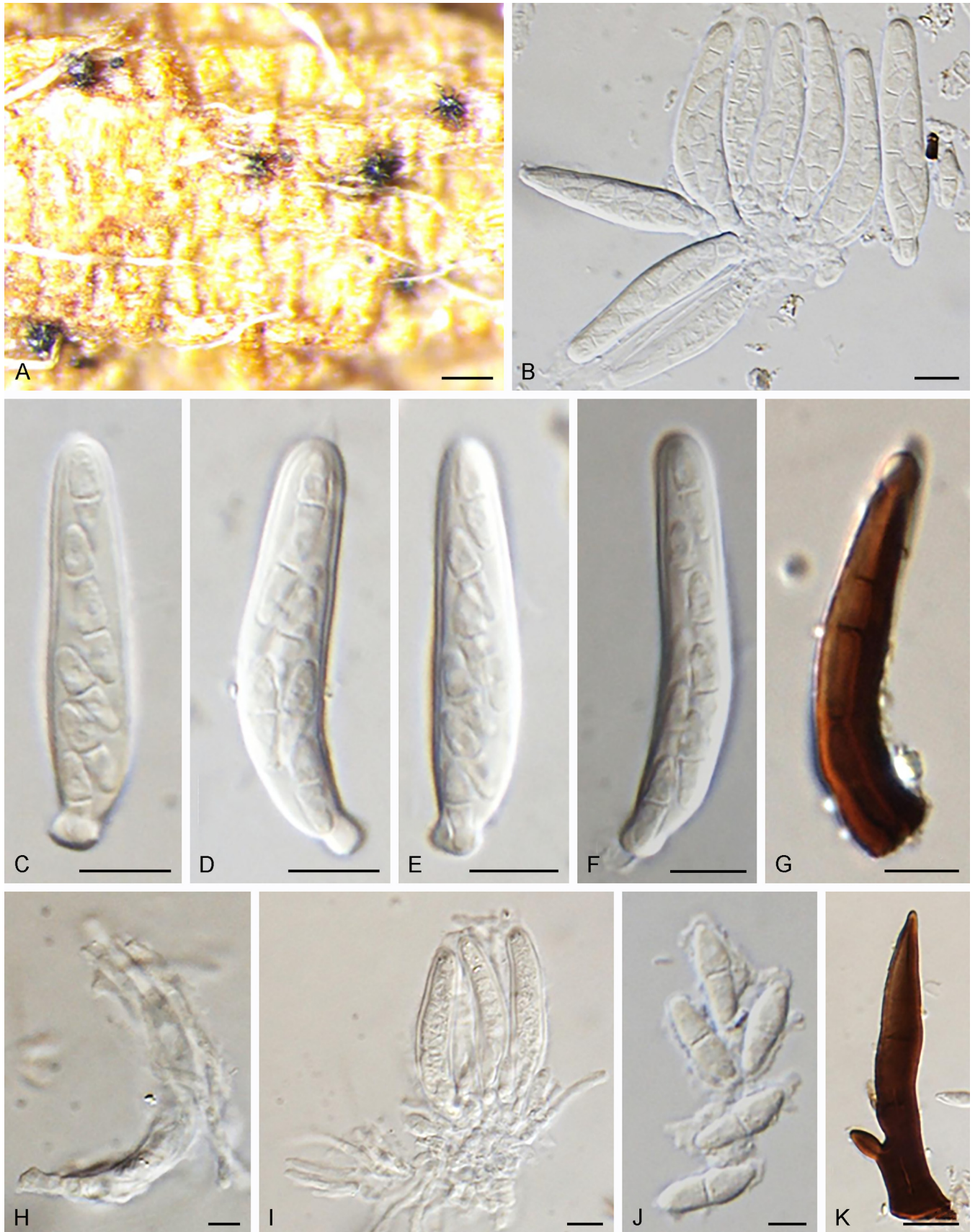


Fig. 43. *Venturia fagi* (holotype NY 00914440) sexual morph. **A**. Ascomata scattered on the host surface. **B–F**. Broadly cylindrical to subcylindrical asci with short, knob-like pedicels. **G, K**. Dark brown setae. **H, I**. Evanescent pseudoparaphyses and immature asci. **J**. Colourless ascospores. Scale bars: A = 100  $\mu$ m; B–G, K = 10  $\mu$ m; H–J = 5  $\mu$ m.

**Typus:** Sweden, on deciduous leaves of *Betula* (*Betulaceae*) [Fries, *Scleromyc. Suec.* 54, syntypes, e.g., B, UPS].

**Additional materials examined:** Finland, Kevo, on *Betula pubescens* var. *tortuosa* (*Betulaceae*), 1 Aug. 1992, M. Helander (dry culture CBS H-23625, cultures CBS

115426, CBS 118894). Italy, on *Populus tremula* (*Salixaceae*), collection date and collector unknown, isol. O. Servazzi (culture CBS 257.38).

**Notes:** *Fusicladium betulae* is the asexual morph of *V. ditricha*. CBS 115426 was morphologically comparable with the

description provided by Sivanesan (1977). Schubert *et al.* (2003: 20–22, fig. 3) provided a detailed description of the asexual morph *in vivo* and neotypified the name *F. betulae*. This species is sister to *V. peltigericola* (Fig. 2).

***Venturia elegantula*** Rehm, Hedwigia 24(6): 241. 1885. Fig. 42. *Synonym:* *Gibbera elegantula* (Rehm) Petr., Sydowia 1: 200. 1947.

*Ascomata* epiphyllous, 100–184 µm diam, scattered, initially immersed, becoming erumpent, globose, wall black, with a conspicuously papillate ostiole, surrounded by tapered setae. *Setae* dark brown, up to 200 µm long, 4–5 µm wide, aseptate. *Pseudoparaphyses* not observed. *Asci* 96–116 × 18–22 µm (av. 107.6 × 20.3 µm, n = 20), 8-spored, bitunicate, fissitunicate, clavate, with a short, knob-like pedicel, each with an inconspicuous ocular chamber. *Ascospores* 22–26 × 7–8 µm (av. 24.1 × 7.8 µm, n = 20), ellipsoid, olivaceous brown, overlapping to biseriate, 1-septate, the upper cells shorter and wider than the lower ones (length ratio: 11:13–1:1), wall verruculose. *Asexual morph* unknown.

*Typus:* **Italy**, Tyrol, Gampen Hofe, Sulden, Ortler, on rotting leaves of *Vaccinium myrtillus* (*Ericaceae*), Jul. 1884, Rehm [Rehm, *Ascomyc.* 841, *syntypes*, e.g., B, S-F11555, 11556, also NY 914439 and PH 44546].

***Venturia fagi*** M.E. Barr, *Canad. J. Bot.* 46: 816. 1968. Fig. 43.

*Ascomata* hypophyllous, 40–110 µm diam, scattered, initially immersed, becoming erumpent, globose, wall black, with a conspicuously papillate ostiole, surrounded by setae. *Setae* dark brown, 40–56 × 6–8 µm, setae wall 1–2 µm thick, swollen at the base, base up to 11 µm wide, septate. *Peridium* 1-layered, composed of 2 rows of pigmented cells of *textura angularis*, cells 6–9 × 5–6 µm, cell wall 1–1.5 µm thick. *Pseudoparaphyses* rare, 2–2.5 µm wide, hyphal, hyaline, septate, evanescent when mature. *Asci* 39–50 × 8–12 µm (av. 46.2 × 9.6 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical to sub-cylindrical, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 11–13(–15) × 3–4 µm (av. 12.2 × 3.8 µm, n = 20), ellipsoid, hyaline, biseriate, 1-septate, constricted at the septum, the upper cells often shorter and broader than the lower ones (length ratio: 5.6–1:1), smooth-walled. *Asexual morph* unknown.

*Typus:* **USA**, Maine, near Baxter State Park, Abol Field, on overwintered leaves of *Fagus grandifolia* (*Fagaceae*), 18 Jul. 1962, M.E. Barr & H.E. Bigelow (**holotype** NY 00914440, **isotype** NY 00914441).

*Notes:* Barr (1968) described the ascospores of *Venturia fagi* as green, olivaceous or brown. No mature ascomata were observed in this study, and the ascospores were mostly hyaline.

***Venturia finlandica*** Crous, M. Shen & Y. Zhang *ter*, **sp. nov.** MycoBank MB831539.

*Etymology:* The epithet refers to Finland, the country where these isolates were collected.

Cultures sterile. *Venturia finlandica* (CBS 115442) differs from its closest phylogenetic neighbour *V. minuta* (CBS 479.61) (Fig. 2) by unique fixed alleles in four loci based on alignments of the separate loci deposited in TreeBASE (S24582), by 23 bp in ITS (5%), 7 bp in LSU (1%), 40 bp in *tef1* (8%), 31 bp in *tub* (14%).

*Culture characteristics:* Colonies spreading, erumpent, with aerial mycelium and regular and smooth margins on OA, dark olivaceous brown (surface); reverse dark olivaceous brown to fuscous-black; on MEA dark brown (surface); reverse fuscous-black; on SNA olivaceous brown (surface); reverse dark olivaceous brown. Colonies reaching 29 mm diam after 2 wk on OA at 25 °C in the dark.

*Typus:* **Finland**, on *Betula pubescens* var. *pumila* (*Betulaceae*), collection date unknown, M. Helander (**holotype** CBS H-23733, culture ex-type CBS 115442 = CPC 3864).

*Additional material examined:* **Finland**, on *Betula pubescens* var. *pumila* (*Betulaceae*), 1 Jul. 1993, M. Helander (culture CBS 112703 = CPC 3865).

*Notes:* *Venturia finlandica* was collected from *Betula pubescens* var. *pumila*. According to multigene phylogenetic analysis, it forms a separate single clade distinguishing it from closely related species (Fig. 2). *Venturia ditricha* (CBS 115426), another *Venturia* species known from *Betula*, differs from *V. finlandica* (CBS 115442) by unique fixed alleles in four loci based on alignments of the separate loci deposited in TreeBASE (S24582), by 19 bp in ITS (4%), 4 bp in LSU (1%), 38 bp in *tef1* (8%), 17 bp in *tub* (10%).

***Venturia frangulae*** Krieger, *Ann. Mycol.* 7(6): 542. 1909. Fig. 44.

*Ascomata* hypophyllous, 43–85 µm diam, gregarious, scattered or solitary, initially immersed, becoming erumpent, globose, wall black, with a conspicuously papillate ostiole, surrounded by setae. *Setae* dark brown, 24–50 × 4–7 µm, setae wall 1–1.5 µm thick, swollen at the base, base up to 14 µm wide, septate. *Peridium* 9–12 µm wide, 1-layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 4–13 × 3–12 µm, cell wall 0.5–1 µm thick. *Pseudoparaphyses* rare, evanescent when mature. *Asci* 30–46(–62) × 8–12 µm (av. 38.5 × 9.8 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly clavate to obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 10.5–13.5 × 4–6 µm (av. 12.2 × 5.1 µm, n = 20), fusiform to broadly fusiform, pale brown, biseriate, 1-septate, with the septum in the upper half, slightly constricted at the septum, with a narrowly rounded to somewhat pointed ends, the upper cells shorter and wider than the lower ones (length ratio: 6.7–1:1), smooth-walled. *Asexual morph* unknown.

*Typus:* **Germany**, Königstein, on fallen leaves of *Frangula alnus* (*Rhamnaceae*), 14 Apr. 1898, W. Krieger (Krieger, *Fungi Saxon.* Exs. 2068, *syntypes* MICH 15149, K(M) 189239).

***Venturia fuliginosa*** Y. Zhang *ter* & J.Q. Zhang, *Mycosphere* 7: 1295. 2016.

*Description and illustration:* Shen *et al.* (2016).

*Typus:* **China**, Heilongjiang Province, Yichun City, Fenglin Nature Reserve, on leaves of *Salix capitata* (*Salicaceae*), 27 Aug. 2014, Y. Zhang & Y.P. Zhou (**holotype** HMAS 247007, culture ex-type CGMCC 3.18370 = CBS 142241 = BJFCCC 140827-14).

*Note:* The species is sister to *V. albae* (Fig. 1) and *V. chlorospora* (Fig. 2).

***Venturia gaultheriae*** Ellis & Everh., *J. Mycol.* 1: 153, 1885. Fig. 45.

*Synonym:* *Gibbera gaultheriae* (Ellis & Everh.) M.E. Barr, *Canad. J. Bot.* 46: 841, 1968.

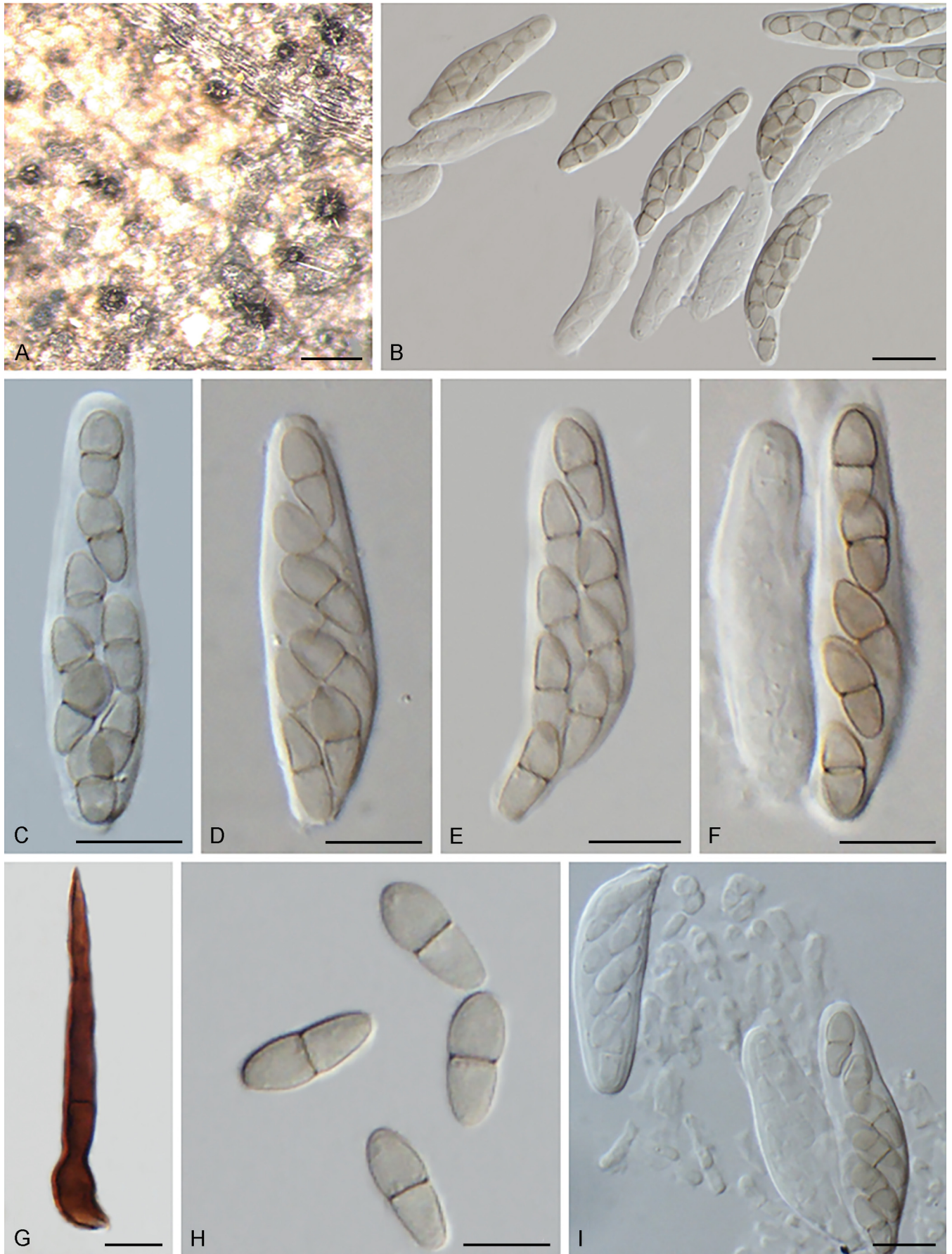
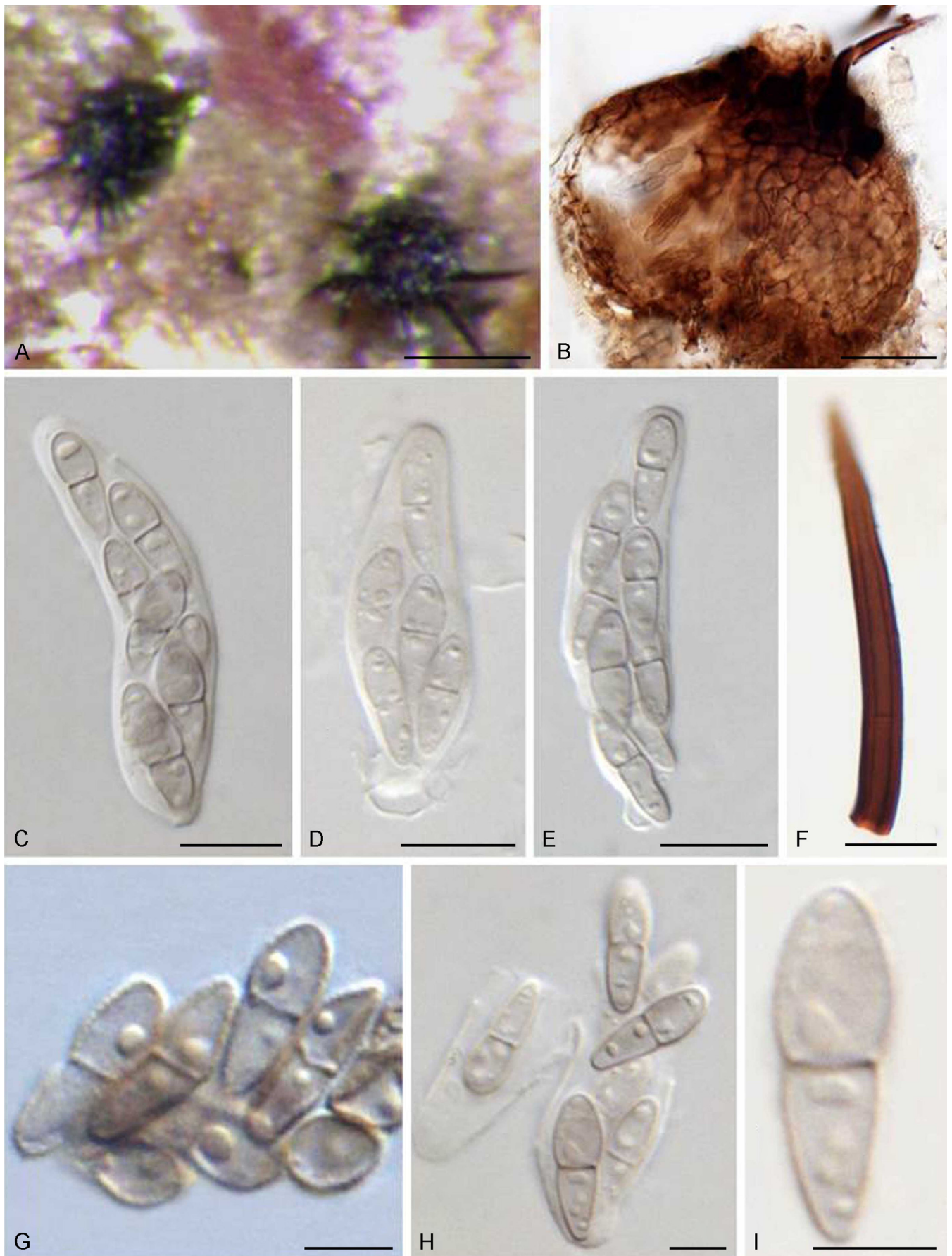


Fig. 44. *Venturia frangulae* (syntype MICH 15149) sexual morph. A. Ascomata scattered on the host surface. B–F. Asci and immature asci. G. Dark brown seta. H. Released, pale brown ascospores. I. Evanescent pseudoparaphyses and with mature and immature asci. Scale bars: A = 200  $\mu$ m; B = 20  $\mu$ m; C–I = 10  $\mu$ m.



**Fig. 45.** *Gibbera gaultheriae* (isotype MICH 15150) sexual morph. **A.** Ascomata scattered on the host surface. **B.** Section of an ascoma. **C–E.** Pale brown, broadly cylindrical to somewhat obclavate asci. **F.** Brown seta. **G–I.** Released, fusiform, pale brown ascospores. Scale bars: A = 100  $\mu$ m; B = 20  $\mu$ m; C–F = 10  $\mu$ m; G–I = 5  $\mu$ m.

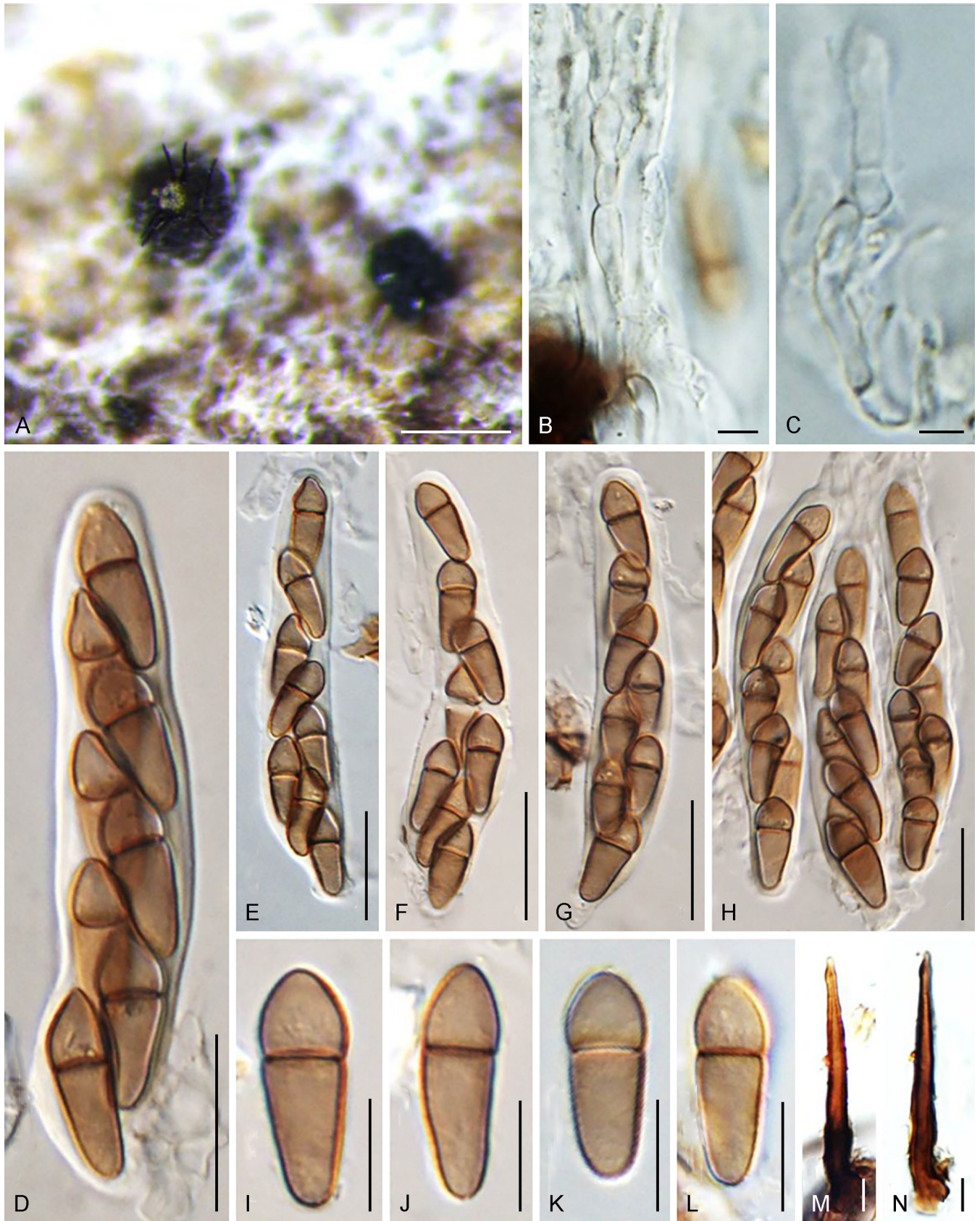


Fig. 46. *Venturia inaequalis* (NY 00914442) sexual morph. A. Ascomata scattered on the host surface. B, C. Evanescent pseudoparaphyses. D–H. Broadly cylindrical to somewhat obclavate asci. I–L. Olivaceous brown, asymmetrical ascospores. M, N. Dark brown setae. Scale bars: A = 200  $\mu$ m; B–N = 10  $\mu$ m.

*Protoventuria gaultheriae* (Ellis & Everh.) M.E. Barr, Sydowia 41: 37, 1989.

*Ascomata* epiphyllous, 40–80  $\mu$ m diam, scattered or solitary, becoming superficial, globose, wall black, with a conspicuously papillate ostiole, surrounded by setae. *Setae* dark brown,

20–50  $\times$  5–6  $\mu$ m, setae wall 1–1.5  $\mu$ m thick, base swollen, up to 7–8  $\mu$ m thick, septate. *Peridium* 7–11  $\mu$ m wide, 1-layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 5–10  $\times$  3–9  $\mu$ m, cell wall 0.5–1  $\mu$ m thick. *Pseudoparaphyses* not observed. *Asci* 31–45  $\times$  9–11  $\mu$ m (av. 57.6  $\times$  14.8  $\mu$ m, n = 10), 8-spored, bitunicate, fissitunicate,

broadly clavate or broadly obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. Ascospores 12–14 × 4–4.5 µm (av. 18.6 × 6.6 µm, n = 10), fusiform, pale brown, overlapping to biseriate, especially at the base, 1-septate, slightly constricted at the septum, with narrowly to broadly rounded ends, the upper cells often shorter and wider than the lower ones (length ratio: 3:4–1:1), smooth-walled. *Asexual morph* unknown.

*Typus*: **USA**, New Jersey, Gloucester, on leaves of *Gaultheria procumbens* (*Ericaceae*), Jul. 1884, Ellis & Everhart (**holotype** NY 00938215 (not seen), **isotype** MICH 15150).

**Venturia helvetica** Nüesch, *Phytopathol. Z.* 39: 346. 1960.

*Description and illustration*: Zhang *et al.* (2016a, b).

*Typus*: **Switzerland**, Kt. Graubünden, on decaying leaves of *Salix helvetica* (*Salicaceae*), Jul. 1959 (**holotype** Reinkultur Stamm ETH Nr. 2571).

*Additional materials examined*: **Switzerland** Kt. Graubünden, Albulapasshöhe, on *Salix helvetica* (*Salicaceae*), 2 Jul. 1959, J. Nüesch (ETH 2571, IMI 163990, culture CBS 474.61); Val Tuors, on *S. helvetica*, 1 Jul. 1959, J. Nüesch (ETH 2587, culture CBS 475.61).

*Note*: The species is sister to *V. caesia* / *minuta* (Fig. 2).

**Venturia inaequalis** (Cooke) G. Winter, *Mycoth. Univ.*, Cent. 3: no. 261. 1875. Figs 46, 47.

*Basionym*: *Sphaerella inaequalis* Cooke, *J. Bot. (London)* 4: 248. 1866. *Nom. cons. prop.* (Rossman *et al.* 2018).

*Synonyms*: *Endostigme inaequalis* (Cooke) Syd., *Ann. Mycol.* 21(3/4): 171. 1923.

*Spilosticta inaequalis* (Cooke) Petr., *Ann. Mycol.* 38(2/4): 193. 1940.

*Didymosphaeria inaequalis* (Cooke) Niessl, *Fungi Eur. Exsicc.*: no. 2663. 1881.

*Spilocaea pomi* Fr., *Novit. Fl. Svec.* 5 (cont.): 79. 1819 (*Nom. sanct.*, Fr., *Syst. mycol.* 3: 504. 1832).

*Fusicladium pomi* (Fr.) Lind, *Dan. Fung.*: 521. 1913.

*Sphaeria cinerascens* Fuckel, *Fungi Rhen. Exs.*, Fasc. 9: no. 824, 1863. *Nom. illeg.*, Art. 53.1, *non* Schwein., 1832.

*Cladosporium dendriticum* Wallr., *Fl. Crypt. Germ.* 2: 169. 1833. *Fusicladium dendriticum* (Wallr.) Fuckel, *Jahrb. Nassauischen Vereins Naturk.* 23–24: 357. 1870.

*Passalora dendritica* (Wallr.) Sacc., *Michelia* 1(no. 2): 265. 1878.

*Sphaeria cinerascens* Fuckel, *Fungi Rhen. Exs.*, Fasc. 9: no. 824. 1863. *Nom. illeg.*, Art. 53.1.

*Sphaerella cinerascens* Rabenh. (as "(Fuckel) Rabenh."), *Fungi Eur. Exs.* (Klotzschii Herb. Viv. Mycol. Continuatio, Ed. Nova, Ser. Sec.), Cent. 9: no. 845, 1865 [Bot. Zeitung 23: 288, 1865].

*Mycosphaerella cinerascens* (Rabenh.) Vestergr., *Bot. Not.*: 267. 1897.

*Venturia inaequalis* var. *cinerascens* (Rabenh.) Aderh., *Hedwigia* 36(2): 82. 1897.

*Endostigme cinerascens* (Rabenh.) Jørst., *Nytt Mag. Naturvidensk* 84: 252. 1945.

*Spilosticta cinerascens* (Rabenh.) Petr., *Sydowia* 1(4–6): 197. 1947.

*Fusicladium dendriticum* var. *opuli* Thüm., *Fungi Austr.*, Cent. 11, no. 1091 (1873). *Nom. inval.*, Art. 38.1(a) (Shenzhen).

*Napicladium soraueri* Thüm., *Mycoth. Univ.*, Cent. I, no. 91. 1875.

*Fusicladium dendriticum* var. *soraueri* (Thüm.) Sacc., *Syll. Fung.* 4: 346. 1886.

*Fusicladium pyrorum* var. *amelanchieris* Sacc., *Syll. Fung.* 4: 346. 1886.

*Fusicladium dendriticum* f. *microsperma* Roum., *Fungi Sel. Exs.*, Cent. 61, no. 5592. 1891.

*Fusicladium dendriticum* var. *eribotryae* Scalia, *Boll. Accad. Gioenia Sci. Nat. Catania* 70: 5. 1901.

*Leaf spots* amphigenous, subcircular to somewhat irregular, initially pale olivaceous brown, later black-grey, with pale brown halo, 5–10 mm diam. *Ascomata* amphigenous, 120–225 µm diam, scattered, initially immersed, becoming erumpent, globose, wall black, with papillate ostiole, with or without setae. *Setae* dark brown, 28–65 × 5–7 µm, setae wall 1–2 µm thick, base swollen, up to 14 µm wide. *Peridium* 10–18 µm wide, 1-layered, composed of 3–4 rows of pigmented cells of *textura angularis*, cells 5–10 µm wide, cell wall 0.5–1.5 µm thick. *Pseudoparaphyses* 2–4 µm wide, septate, hyaline, evanescent when mature. *Asci* 56–79 × 11–15 µm (av. 63.4 × 12.3 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 11.5–16 × 5–7 µm (av. 14.2 × 6.2 µm, n = 20), fusiform to broadly clavate, olivaceous brown, uniseriate to partially overlapping at the top, biseriate near the base, 1-septate, with septum in the upper third, the upper cell tapers toward the apex, the lower cell with a broadly to narrowly rounded base, the upper cells shorter than the lower cells (length ratio: 3:5–7:8), smooth-walled. *Asexual morph*: *Mycelium* amphigenous, gregarious, olivaceous brown to black, mostly subcircular. *Stromata* variable in size, pale olivaceous to brown, angular or circular, composed of thin-walled parenchyma cell, cells 4–7 µm diam. *Conidiophores* reduced to conidiogenous cells. *Conidiogenous cells* solitary or sparsely gregarious, arising from stromata or hyphae, straight or flexuous, unbranched, 16–35 × 5–6 µm, 0(–1)-septate, pale to medium brown, verruculose, wall slightly thickened, base swollen. *Conidia* solitary, subpyriform to obclavate, 18–29 × 6–8 µm, pale brown to brown, 0(–1)-septate, not constricted at the septum, becoming tapered towards the apex, base truncate, 4–5 µm wide, slightly refractive, not darkened.

*Typus*: **UK**, England, Surrey, Shere, on *Sorbus aria* (*Rosaceae*), Apr. 1866, Herb. Cooke (**lectotype** of *Sphaerella inaequalis* K(M) 237177, designated by Rossman *et al.* 2018; **isolectotypes** of *Sphaerella inaequalis* BPI 798917, K(M) Nos. 237173, 237174, 237175, 237176 & 237178). **Sweden**, *Malus domestica* (*Rosaceae*) (**epitype** specimen designated here as metabolically inactive culture, CBS 120627, MBT391376, culture ex-epitype CBS 120627).

*Additional materials examined*: **China**, Jilin, Yushu, on leaves of *Malus* sp. (*Rosaceae*), 27 Jul. 2015, D. Ma (culture CGMCC 3.18372 = BJFCC 150727-1).

**South Africa**, on *Malus domestica* (*Rosaceae*), collection date and collector unknown (cultures CBS 120625 = SA 14, CBS 120627 = SU 05 AL GAL3).

**Switzerland**, on leaves of *Cotoneaster integerrima* (*Rosaceae*), 11 Jun. 1953, collector unknown (**type** of *Venturia inaequalis* f. sp. *cotoneasteris* ZT 57113).

**Czech Republic**, Brünn, falling leaves of *Sorbus torminalis* (*Rosaceae*), June of unknown year, Niessl (**isotypes** of *Sphaerella inaequalis* NY 00914442, NY 00914443, NY 00914444).

*Note*: The species is sister to *V. orbiculata* and *V. pyrina* (Fig. 1) and to *V. oleaginea* (Fig. 2).

**Venturia loniceræ** Sacc., *Syll. Fung.* 1: 589. 1882.

*Synonym*: *Sphaeria loniceræ* Fuckel, *Jahrb. Nassauischen Vereins Naturk.* 23–24: 111. 1870. *Nom. illeg.*, Art. 53.1, *non*



Fig. 47. *Venturia inaequalis* (CGMCC 3.18372) asexual morph. A, B. Leaf spots caused by *Venturia inaequalis* (from herbarium specimen). C. Conidiophores. D–F. Annellidic conidiogenous cells giving rise to conidia. G, H. Released subpyriform conidia. Scale bars: C, G, H = 20 µm; D–F = 10 µm.



Sowderby 1803. *Nom. illeg.*, Art. 53.1, *non Sphaeria loniceræ* Sowderby 1803.

*Description and illustration:* Sivanesan (1977).

*Typus:* **Germany**, Hessen, Oestrich, on *Lonicera xylosteum* (Caprifoliaceae) [Fuckel, Fungi Rhen. Exs. 1688, syntypes, e.g., B, BPI 613122, HAL, S-F90852, 908554) (not seen).

*Material examined:* **Switzerland**, Kt. Wallis, Grächen, on *Lonicera coerulea* (Caprifoliaceae), 1 Jun. 1953, E. Müller (IMI 163997, culture CBS 445.54).

*Notes:* Isolate CBS 445.54 proved to be sterile in culture. This species is sister to *V. polygoni-vivipari* (Fig. 2).

**Venturia maculans** Peck, Rep. (Annual) New York State Mus. Nat. Hist. 28: 81. 1876 [1875]. Fig. 48.

*Ascomata* hypophyllous, 86–145 µm diam, scattered or solitary, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuous papillate ostiole, surrounded by setae. Setae dark brown, 54–90 × 5–6 µm, setae wall 1–1.5 µm thick, 0(–1)-septate, base swollen, up to 9 µm wide. *Peridium* 15–28 µm thick, 1-layered, composed of 2–3 rows of pigmented cells of *textura angularis*, cells 6–13 × 5–10 µm, cell wall 1–1.2 µm thick. *Pseudoparaphyses* rare, 2–3 µm wide, septate, hyaline, evanescent when mature. *Asci* 43–62 × 11–16 µm (av. 54.1 × 12.8 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical to obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 12–16 × 4–6.5 µm (av. 14.2 × 5.4 µm, n = 20), fusiform, olivaceous brown, overlapping to biseriate near the base, 1-septate, deeply constricted at the septum, the upper cells longer and wider than the lower ones (length ratio: 13:11–9:5), smooth-walled. *Asexual morph* unknown.

*Typus:* **USA**, New York, Albany, Karner, on fallen leaves of *Betula populifolia* (Betulaceae), Jun. 1870?, C.H. Peck (**holotype** NYSf1816).

**Venturia maculiformis** (Desm.) G. Winter [as “*maculaeformis*”], Rabenh. Krypt. -Fl., Ed. 2, 1(2): 435. 1885. Fig. 49.

*Basionym:* *Dothidea maculiformis* Desm. [as “*maculaeformis*”], Ann. Sci. Nat., Bot. 3, 8: 176. 1847.

*Synonyms:* *Stigmatea maculiformis* (Desm.) Fr., Summa Veg. Scand. 2: 421. 1849. *Nom. illeg.*, Art. 53.1.

*Spilosticta maculiformis* (Desm.) Petr. [as “*maculaeformis*”], Hedwigia 65: 241. 1925.

*Sphaeria microspila* Berk. & Broome, Ann. Mag. Nat. Hist., ser. 3, 7: 455. 1861.

*Laestadia epilobiana* Sacc., Syll. Fung. 1: 429. 1882.

*Ascomata* hypophyllous, 60–150 µm diam, solitary, scattered or in small groups of 2–3, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuous papillate ostiole. Setae not observed. *Peridium* 8–12 µm thick, 1-layered, composed of (1–)2–3 rows of pigmented cells of *textura angularis*, cells 4–8 µm wide, cell wall 0.8–1.5 µm thick. *Pseudoparaphyses* rare, evanescent when mature. *Asci* 30–50 × 9–12 µm (av. 48.5 × 10.5 µm, n = 20), 8-spored, bitunicate, fissitunicate, oblong to somewhat obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 9–14 × 3–5 µm (av. 12.8 × 3.8 µm, n = 20), pale olivaceous brown, overlapping to biseriate near the base, oblong to fusiform, with broadly to

narrowly rounded ends, 1-septate, slightly constricted at the septum, the upper cells somewhat longer and wider than the lower ones, smooth-walled. *Asexual morph* unknown.

*Typus:* **France**, on autumn leaves of *Epilobium montanum* (Onagraceae) (not seen).

*Material examined:* **UK**, England, Surrey, on ?*Epilobium montanum* (Onagraceae), 13 Jul. 2003, B.M. Spooner (HMAS 243785).

*Notes:* *Venturia maculiformis* is morphologically comparable with *V. muelleri*, *V. rumicis* and *V. rhamnii*, which have semi-immersed ascomata lacking setae, and ascospores with a septum in the lower half. The small-sized ascomata (40–60 µm) of *V. muelleri* (Zhang et al. 2016a, b), however, are distinguishable from the other three species. The asci and ascospores of *V. rumicis* are longer and wider than *V. maculiformis*, and asci of *V. rhamnii* are also longer than those of *V. maculiformis* (Zhang et al. 2016a, b).

**Venturia mandshurica** M. Morelet [as “*mandshurica*”], Ann. Soc. Sci. Nat. Archéol. Toulon Var. 45(3): 219. 1993.

*Synonyms:* *Pollaccia mandshurica* M. Morelet, Ann. Soc. Sci. Nat. Archéol. Toulon Var. 45: 218. 1993.

*Fusicladium mandshuricum* (M. Morelet) Ritschel & U. Braun, Schlechtendalia 9: 62. 2003.

*Description and illustration:* Schubert et al. (2003).

*Typus:* **China**, Liaoning, on leaves and branches of *Populus simonii* × *Populus nigra* (Salicaceae), 17 Jun. 1992, M. Morelet (**holotype**, Laboratoire de Pathologie Forestière de Nancy, PC (PFN 1466)) (not seen); on *P. simonii*, 20 Apr. 1993 (**epitype** CBS H-19912, designated in Crous et al. 2007b, culture ex-epitype CBS 112235 = CPC 3639 = MPFN 307) (examined).

*Note:* The species is sister to *V. populina* (Figs 1, 2).

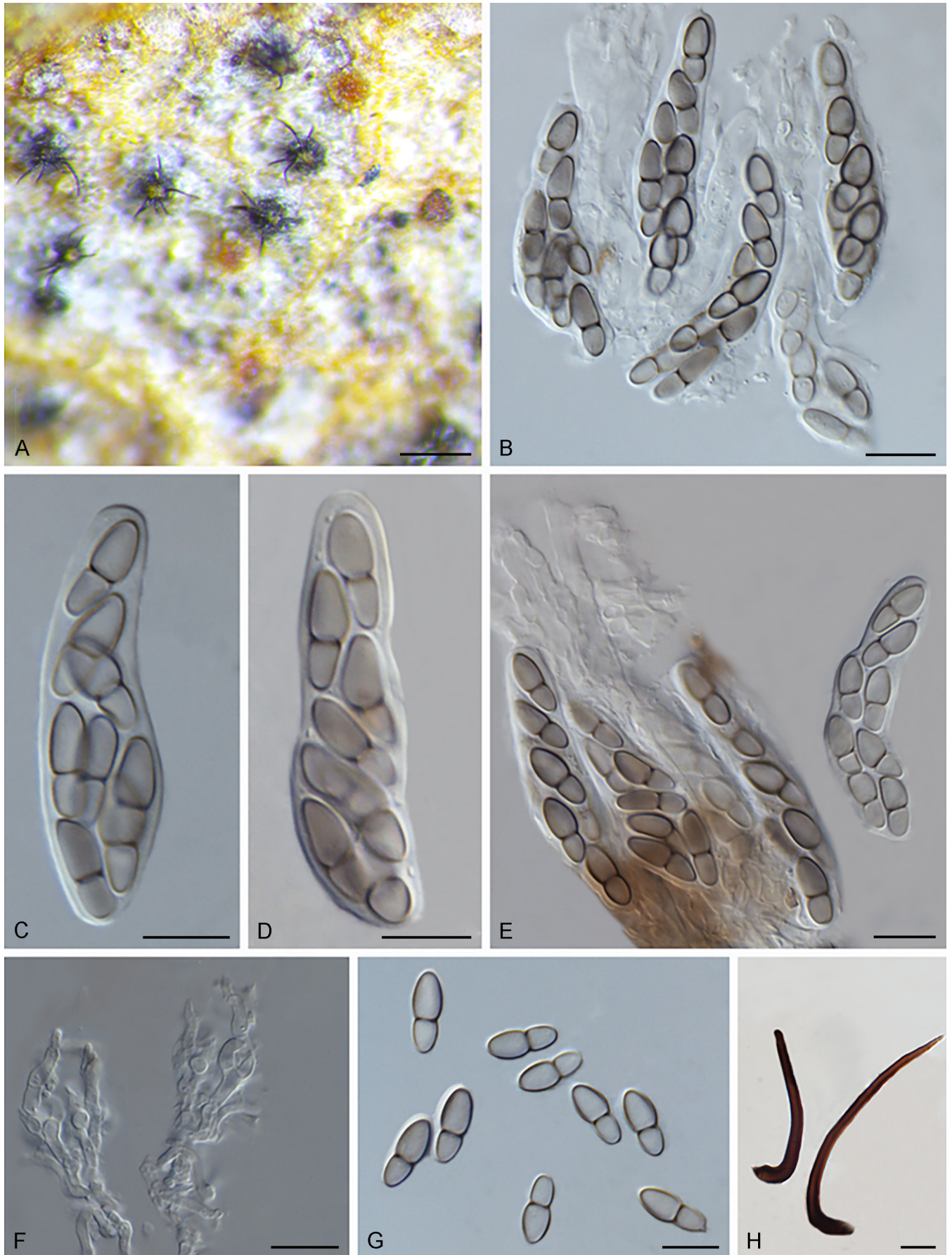
**Venturia martianoffiana** (Thüm.) Y. Zhang ter & J.Q. Zhang, Stud. Mycol. 86: 205. 2017. Figs 50, 51.

*Basionym:* *Cladosporium martianoffianum* Thüm., Bull. Soc. Imp. Naturalistes Moscou 55: 74. 1880.

*Synonyms:* *Fusicladium martianoffianum* (Thüm.) K. Schub. & U. Braun, I.M.I. Descript. Fungi Bact. 152 (nos 1511–1520): [10]. 2002.

*Fusicladium martianoffianum* var. *sinensis* M. Morelet, Bull. Mens. Soc. Linn. Lyon 75: 179. 2006.

*Sexual morph:* Unknown. *Asexual morph:* Leaf spots amphigenous, subcircular to angular, 1–9 mm wide, often confluent, diffuse, numerous, dark brown to black, with an irregular margin. *Colonies* amphigenous, caespitose, olivaceous dark brown to blackish. *Mycelium* mainly subcuticular. *Stromata* variable in size, composed of pale olivaceous to brown, angular to rounded, thick-walled, pseudoparenchymatous cells, 4–8 µm diam. *Conidiophores* solitary or loosely fasciculate, arising from stromata or from hyphae, erect, straight, sometimes flexuous at the apex, unbranched or apically branched, 17–30 × 5–7 µm, 0–1-septate, pale to medium brown, smooth, with somewhat thickened walls. *Conidiogenous cells* integrated, terminal or intercalary, or conidiophores reduced to conidiogenous cells, 14–27 × 4.5–6 µm, with a single or several denticle-like conidiogenous loci, proliferation sympodial, loci unthickened, not or only somewhat darkened-refractive, 1.5–2.5 µm wide. *Conidia* in simple or branched chains, 15–31 × 4.5–6 µm,



**Fig. 48.** *Venturia maculans* (holotype NYSf1816) sexual morph. **A.** Ascomata scattered on the host surface. **B–E.** Broadly subcylindrical to obclavate asci. **F.** Evanescent pseudoparaphyses. **G.** Released, brown ascospores. **H.** Dark brown setae. Scale bars: A = 200  $\mu$ m; B–H = 10  $\mu$ m.



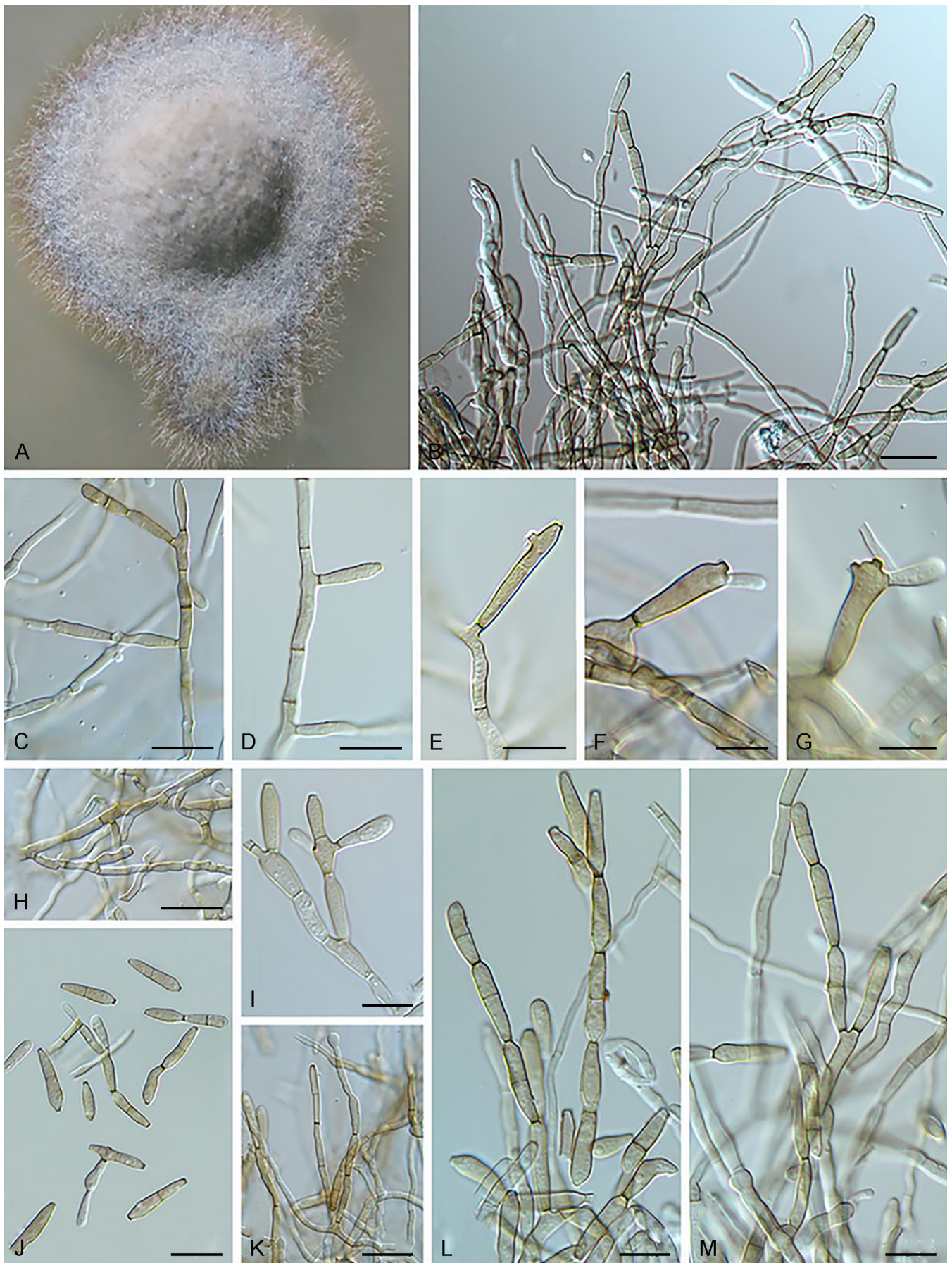
Fig. 49. *Venturia maculiformis* (HMAS 243785) sexual morph. A. Ascomata scattered on the host surface. B–I. Oblong to obclavate asci. J–O. Released, pale brown to olivaceous brown, 1-septate ascospores. Scale bars: A = 200  $\mu$ m; B–I = 20  $\mu$ m; J–O = 10  $\mu$ m.

pyriform, ellipsoid, subcylindrical, fusiform, pale brown, 0–1(–3)-septate, smooth, attenuated towards apex and base, apex mostly truncate, occasionally rounded or pointed, base truncate; *hila* 1.5–3  $\mu$ m wide, not thickened, but somewhat darkened-refractive. *In culture on MEA*: *Mycelium* unbranched

or only sparingly branched, 2–5  $\mu$ m wide, septate, not constricted at septa, subhyaline to pale brown, smooth, walls unthickened or almost so. *Conidiophores* laterally arising from hyphae, erect, straight to somewhat flexuous, sometimes geniculate, unbranched, 21–65  $\times$  4–6  $\mu$ m, aseptate or



**Fig. 50.** *Venturia martianoffiana* (BJFU 150828-1) asexual morph. **A, B.** Leaf spots caused by *V. martianoffiana* (from herbarium specimen). **C–F, H.** Sympodial conidiophores and conidiogenous cells. **G.** Fusiform, non-septate or 1-septate conidia. **I.** Conidia in chains. Scale bars: C–I = 10 μm.



**Fig. 51.** *Venturia martianoffiana* (culture CGMCC 3.18375) asexual morph. **A.** Colony growing on MEA. **B.** Hyphae and conidial chains. **C–G.** Conidiophores with conidiogenous loci. **H.** Geniculate-sinuous hyphae. **I, L, M.** Conidiophore with branching conidial chains. **J.** Ramoconidia and conidia. **K.** Conidiophores reduced to conidiogenous cells. Scale bars: B–E, H, J, K = 20  $\mu$ m; F, G, I, L, M = 10  $\mu$ m.

septate, pale or medium brown, smooth, walls somewhat thickened, sometimes only as short lateral conical prolongations of hyphae, occasionally irregular in shape. *Conidiogenous cells* integrated, terminal or conidiophores reduced to conidiogenous cells, sometimes geniculate, 21–36 µm long, proliferation sympodial, with 1–4 denticle-like loci, broadly truncate, 1.5–2(–2.5) µm wide, unthickened, somewhat refractive or darkened. *Ramoconidia* present, 18–26 × 4–5 µm, 0–2-septate, pale to medium brown, with a broadly truncate base, 3–4 µm wide, usually with 2–3 denticle-like apical loci. *Conidia* catenate, formed in unbranched or loosely branched chains, straight to sometimes curved, cells sometimes irregularly swollen, fusiform, subcylindrical, sometimes obpyriform, 17–29 × 4–6 µm, pale to medium brown, smooth, 0(–2)-septate, walls slightly thickened, sometimes attenuated towards apex and base; *hila* broadly truncate, 2–2.2 µm wide, not or only slightly thickened, somewhat darkened-refractive; microcyclic conidogenesis present.

**Culture characteristics:** Colonies erumpent, spreading, with abundant aerial mycelium and feathery to smooth margins on PDA; grey olivaceous (surface), reverse dark olivaceous. Colonies reaching 14 mm diam after 1 mo at 25 °C in the dark; colonies fertile.

**Typus:** **Russia**, Sibiria, Minussinsk, near river Jenissei, on living leaves of *Populus laurifolia* (*Salicaceae*), Aug. 1879, N. Martianoff (M: **lectotype** designated in Schubert et al. 2003: 64; **isoelectotypes**, Thüm., Mycoth. Univ. 2067, BPI 427257, 427258, HAL, ILL 77739) (not seen).

**Materials examined:** **China**, Shanxi, Yangling, on leaves of *Populus* sp. (*Salicaceae*), 4 Nov. 2015, Y.F. Zhang (culture CGMCC 3.18377 = BJFC 150904-1); Liaoning, Dengta city, Wan Bao Qiao, Bridge Street Road Village, on leaves of *Populus* sp., 27 Aug. 2014, Y.F. Zhang (BJFU 150828-1, culture CGMCC 3.18375 = BJFC 150828-1).

**Note:** This species is sister to *V. phaeosepta* (Fig. 2).

**Venturia minuta** M.E. Barr, Canad. J. Bot. 46: 815. 1968.

**Replaced synonym:** *Venturia microspora* Nüesch, Phytopathol. Z. 39: 347. 1960. *Nom. illeg.*, Art. 53.1, *non Venturia microspora* Speg. 1887.

**Description and illustration:** Barr (1968).

**Typus:** **Switzerland**, Aareue bei Rubigen, on decaying leaves of *Salix nigricans* (*Salicaceae*), Kt. Bern, 30 May 1959, collector unknown (**holotype** ETH Nr. M 523, culture ex-type ETH 523 = IMI 163991 = CBS 478.61).

**Additional material examined:** **Switzerland**, on *Salix cinerea* (*Salicaceae*), 20 May 1959, J. Nüesch (culture ETH 525 = CBS 479.61).

**Notes:** *Venturia minuta* was introduced to replace the illegitimate *V. microspora*. Unfortunately, both isolates representing *V. minuta* (CBS 478.61, CBS 479.61) proved to be sterile in culture. *Venturia minuta* is sibling to *V. caesia* (Fig. 2).

**Venturia nashicola** S. Tanaka & S. Yamam., Ann. Phytopathol. Soc. Japan 29: 136. 1964.

**Synonym:** *Fusicladium nashicola* K. Schub. & U. Braun, Schlechtendalia 9: 65. 2003.

**Description and illustration:** Schubert et al. (2003), Tanaka & Yamamoto (1964).

**Typus (of *Fusicladium nashicola*):** **Japan**, Tsukuba, Ibaraki, Orchard of the National Institute of Agro-Environmental Sciences, on leaves of *Pyrus pyrifolia* (*Rosaceae*), 18 Aug. 2000, H. Ishii (**holotype** HAL 1749 F).

**Additional materials examined:** **Japan**, on *Pyrus serotina* var. *culta* (*Rosaceae*), collection date and collector unknown (cultures CBS 793.84, CBS 794.84).

**Notes:** Unfortunately, both isolates (CBS 793.84, CBS 794.84) proved to be sterile in culture. This species is sister to *V. pyrina* (Fig. 2).

**Venturia oleaginea** (Castagne) Rossmann & Crous, IMA Fungus 6: 520. 2015. Fig. 52.

**Basionym:** *Cycloconium oleagineum* Castagne, [as “*oleaginum*”], Cat. Pl. Marseille: 220. 1845.

**Synonyms:** *Spilocaea oleaginea* (Castagne) S. Hughes, Canad. J. Bot. 31: 564. 1953.

*Fusicladium oleagineum* (Castagne) Ritschel & U. Braun, Schlechtendalia 9: 70. 2003.

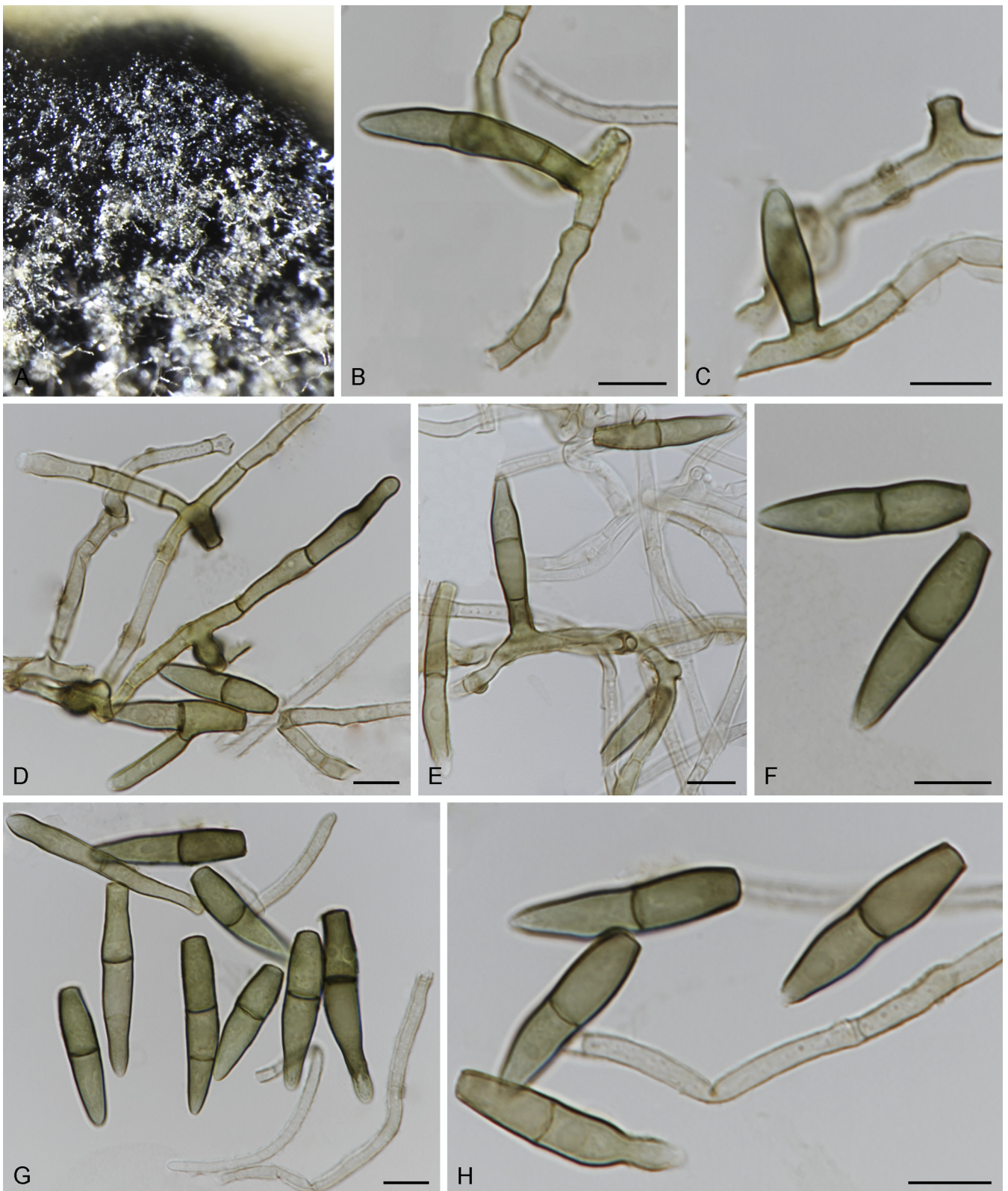
**Sexual morph:** unknown. *In vitro* on OA: *Mycelium* unbranched or only sparingly branched, 2–3.5 µm wide, septate, not constricted at septa, subhyaline or pale brown, smooth or occasionally verrucose, straight, walls somewhat thickened or darkened. *Conidiophores* reduced to conidiogenous cells, sometimes only as short lateral conical prolongations of hyphae. *Conidiogenous cells* arising terminally or laterally from darker hyphal cells, subcylindrical, straight, 19–35.5 × 3–4.5 µm, monoblastic, medium to dark brown, walls somewhat thickened and darkened, often with 1–2 conidiogenous loci, broadly truncate, 2–3.5 µm wide, somewhat thickened and darkened. *Conidia* solitary, straight or occasionally slightly curved, subcylindrical, fusiform, 24.5–44 × 6–8 µm, 1-septate, septum median or somewhat in the lower half, sometimes 2-septate, not constricted or rarely constricted at the septa, medium to dark brown, dark olivaceous, smooth, walls slightly thickened and darkened, becoming attenuated and hyaline towards the apex, broadly truncate at the base; *hila* 3.5–5.5 µm wide, somewhat thickened and darkened. Description and illustration *in vivo*, see Schubert et al. (2003: 70, 71, fig. 35).

**Culture characteristics:** Colonies spreading, smooth, somewhat erumpent, with moderate to sparse aerial mycelium and margins irregular on OA, uneven, dark brown to fuscous-black (surface), margins greyish white; reverse fuscous-black. Colonies reaching 12 mm diam after 2 mo at 25 °C in the dark; colonies fertile.

**Typus:** **France**, Marseille, on leaves of *Olea europaea* (*Oleaceae*), Castagne (**lectotype** STR, designated by Schubert et al. 2003: 70; **isoelectotypes** M and IMI 69757, slide).

**Additional materials examined:** **Morocco**, on *Olea europaea* (*Oleaceae*), collection date and collector unknown (culture CBS 120629). **New Zealand**, Parkhurst, Northland, on *O. europaea*, Jun. 2003, C.F. Hill (culture CBS 113427). **Portugal**, unknown substratum, 1982, Branquinho d'Oliveira (dried culture CBS H-23606, culture CBS 113539 = UPSC 1329).

**Notes:** Isolate CBS 113539 was collected from Portugal on an unknown host, but is morphologically comparable with *Fusicladium oleagineum* (as *Venturia oleaginea*) according to Schubert et al. (2003). In addition, CBS 113427 (New Zealand) and CBS 120629 (Morocco) are both from *Olea europaea*, which is the same host as in the original description of *V. oleaginea* from France. This species is sister to *V. inaequalis* (Fig. 2).



**Fig. 52.** *Venturia oleaginea* (culture CBS 113539) asexual morph. **A.** Colony on OA. **B, C, E.** Conidiogenous cells giving rise to conidia. **D.** Hypha with conidiogenous loci and conidia. **F–H.** Released conidia. Scale bars: B–H = 10  $\mu$ m.

***Venturia orbicula*** (Schwein.) Cooke & Peck, Rep. (Annual) New York State Mus. Nat. Hist. 25: 105. 1873. [1872]. **Fig. 53.**

**Basionym:** *Sphaeria orbicula* Schwein., Trans. Amer. Philos. Soc., n.s. 4: 224. 1832. [1834].

**Ascomata** hypophyllous, 42–70  $\mu$ m diam, gregarious or scattered on circular spots, superficial, globose to subglobose, wall black, with a conspicuous papillate ostiole, surrounded by setae.

**Setae** dark brown, 38–69  $\times$  5–7  $\mu$ m, wall 1–1.5  $\mu$ m wide at the base, septate. **Peridium** 1-layered, composed of one row of pigmented cells of *textura angularis*, cells 5–12  $\times$  4–8  $\mu$ m, cell wall 1  $\mu$ m thick. **Pseudoparaphyses** 2–4  $\mu$ m wide, septate, hyaline. **Asci** 33–45  $\times$  10–12  $\mu$ m (av. 38.2  $\times$  10.6  $\mu$ m, n = 10), 8-spored, bitunicate, fissitunicate, broadly cylindrical to somewhat obclavate, with a short, knob-like pedicel or pedicel lacking, each



Fig. 53. *Venturia orbicula* (lectotype NYSf 2176) sexual morph. A. Ascomata scattered on the host surface. B, D–F. Oblong to somewhat obclavate asci. C. Evanescent pseudoparaphyses. G, H. Released, fusiform, 1-septate ascospores. I. Dark brown setae. Scale bars: A = 200 μm; B–I = 10 μm.





**Fig. 54.** *Venturia peltigericola* (culture CBS 370.35) asexual morph. **A.** Colony on OA. **B–D.** Symphytoid conidiogenous loci. **E.** Conidiogenous cell giving rise to conidia. **F.** Conidia in chain. **G–I.** Conidia and germinating conidia. Scale bars: B–E, G–I = 10  $\mu\text{m}$ ; F = 20  $\mu\text{m}$ .

with an inconspicuous ocular chamber. *Ascospores* 11–13  $\times$  4–6  $\mu\text{m}$  (av. 11.8  $\times$  5  $\mu\text{m}$ ,  $n = 20$ ), fusiform to narrowly fusiform, pale olivaceous brown to brown, obliquely overlapping to biserial near the base, 1-septate, constricted at the septum, the upper cells shorter and wider than the lower ones (length ratio: 6:5–1:2), smooth-walled. *Asexual morph* unknown.

*Typus:* USA, Rensselaer, Lake Sander, on the fallen leaves of *Quercus montana* (as *Quercus monticola*, *Fagaceae*), Jun. of unknown year, C.H. Peck (**lectotype** NYS-F- 002176).

*Venturia orbiculata* (Desm.) U. Braun, *Schlechtendalia* 36: 66 (2019).

Synonyms: *Cladosporium orbiculatum* Desm., Ann. Sci. Nat., Bot., Sér. 3, 11: 275, 1849.

*Fusicladium orbiculatum* (Desm.) Thüm., Fungi Austr., Cent. VIII, no. 774.1873.

*Passalora dendritica* var. *orbiculata* (Desm.) Berk., in Sacc., Mycoth. Ven., Cent. XII, no. 1246. 1876 [Michelia 1: 265, 1878].

*Fusicladium dendriticum* var. *orbiculatum* (Desm.) Sacc., Syll. Fung. 4: 345, 1886.

Misapplied name: *Venturia aucupariae* (Plowr.) Rostr. [as "(Lasch)"], Plantepatologi: 466, 1902.

**Materials examined:** Germany, Müncheberg, on *Sorbus aucuparia* var. *moravica* (Rosaceae), collection date and collector unknown, isol. Jul. 1935, M. Schmidt (cultures CBS 365.35, CBS 366.35).

**Notes:** Isolates CBS 365.35 and CBS 366.35 were sterile. The species is sister to *V. pyrina* (Fig. 1) and to *V. crataegi* (Fig. 2).

***Venturia peltigericola*** (Crous & Diederich) Crous, M. Shen & Y. Zhang ter, **comb. nov.** MycoBank MB831592. Fig. 54.

**Basionym:** *Fusicladium peltigericola* Crous & Diederich, Per-sonia 25: 129. 2010.

**In vitro** on OA: Mycelium mostly branched, 2–3.5 µm wide, septate, unstricted at septa, pale brown to brown, smooth, walls unthickened, sometimes hyphal cells swollen. *Conidiophores* laterally arising from hyphae, solitary, erect, straight to geniculous-sinuuous, subcylindrical, 23–75 × 3.5–5 µm, unbranched, 1–3-septate, unstricted at septa, brown to medium brown, smooth, walls somewhat thickened but not darkened-refractive. *Conidiogenous cells* terminal, integrated, geniculate-sinuuous or straight, subcylindrical, 14–45.5 × 2.5–4 µm, polyblastic, proliferating sympodially, brown to medium brown, smooth; *conidiogenous loci* flattened, 2.5–3 µm wide, inconspicuous to somewhat darkened, but not refractive, not appearing thickened. *Ramoconidia* present, subcylindrical, 18.5–21.5 × 4.5–5 µm, medianly 1-euseptate, relatively thick-walled, medium brown, finely verruculose, basal hilum flattened, somewhat darkened, 2–2.5 µm wide, with one to several sympodial, apical loci; frequently with a lateral branch up to 20 µm long, 3–4 µm wide. *Conidia* catenate, proliferating in sympodially to form short chains of conidia, straight or slightly curved, subcylindrical, 16.5–24.5 × 4–5.5 µm, (0–)1-euseptate, septum mostly in the upper third of the conidium, rarely 2-septate, medium brown to brown, smooth, finely verruculose, apex obtusely rounded or flattened; hila flattened, 1.5–3.5 µm wide, somewhat darkened, but not thickened.

**Culture characteristics:** Colonies spreading, smooth, somewhat erumpent, with aerial mycelium and regular margins on OA, fuscous-black (surface); reverse fuscous-black. Colonies reaching 25 mm diam on OA after 2 wk at 25 °C in the dark; colonies fertile.

**Typus:** Luxembourg, on *Peltigera rufescens* (Peltigeraceae), May 2008, P. Diederich (**holotype** CBS-H 20487, culture ex-type CBS 128206 = CPC 15252).

**Additional materials examined:** Germany, Müncheberg, on *Betula verrucosa* (Betulaceae), Jul. 1935, M. Schmidt (cultures CBS 370.35, CBS 371.35).

**Notes:** Isolates CBS 370.35 and CBS 371.35 are in the same clade (Fig. 2) as the ex-type isolate of *Fusicladium peltigericola* (CBS 128206, Crous et al. 2010), but occur on different hosts. These isolates, however, appear to represent a morphologically distinct species as *F. peltigericola* has larger conidia. Additional loci will have to be sequenced to resolve this issue. *Venturia*

*peltigericola* is sister to *V. ditricha* (Fig. 2) and not sister to a specific species in Fig. 1.

***Venturia phaeosepta*** Y. Zhang ter & J.Q. Zhang, Stud. Mycol. 86: 205. 2017.

**Description and illustration:** Marin-Felix et al. (2017).

**Typus:** China, Henan province, Puyang City Academy Experimental Farm, on leaves of *Populus × euramericana* (Salicaceae) cv. 74/76 (sect. Aigeiros), 20 May 2015, W. He (**holotype** HMAS 246998, culture ex-type CGMCC3.18368); Y.F. Zhang, 20 Jun. 2015 (**paratype**, HMAS 246999, CGMCC3.18371); 6 Aug. 2015 (**paratype**, HMAS 247000, CGMCC3.18373); 7 Aug. 2015 (**paratype**, HMAS 247002, CGMCC3.18374); 8 Aug. 2015 (**paratype**, HMAS 247001, CGMCC3.18375); Shanxi, Yangling, on leaves of *Populus* sp. (sects. Aigeiros), 4 Sep. 2015, Y.F. Zhang (**paratype**, HMAS 247004, CGMCC3.18378); *ibid.* (**paratype**, HMAS 247005, CGMCC3.18379).

**Note:** *Venturia phaeosepta* is sibling to *V. martianoffiana* (Fig. 2).

***Venturia polygoni-vivipari*** Arx, Sydowia 4: 391. 1950.

**Description and illustration:** von Arx (1950).

**Typus:** Switzerland, Kt. Valais, Val de Bagnes, Corbassieres, on leaves of *Polygonum viviparum* (Polygonaceae), 19 Jul. 1948, H. Kobel (ETH) (not seen).

**Material examined:** Norway, on *Polygonum viviparum* (Polygonaceae), 12 Aug. 1988, K. & L. Holm (culture CBS 114207 = UPSC 2754).

**Notes:** Unfortunately, isolate CBS 114207 was sterile. The species is related to *V. viennotii* (Fig. 1) and *V. loniceræ* (Fig. 2).

***Venturia populina*** (Vuill.) Fabric., Jahresber. Neuerungen Pflanzenkrankh. 5: 282. 1902.

**Basionym:** *Didymosphaeria populina* Vuill., in: Duchartre, Compt. Rend. Hebd. Séances Acad. Sci. 108: 634. 1889.

**Synonyms:** *Fusicladium radiosum* [(Lib.) Lind] var. *balsamiferae* Davis, Trans. Wisconsin Acad. Sci. 20: 402. 1922.

*Pollaccia elegans* Servazzi, Boll. Lab. Sperim. Osserv. Fitopatol. 15(3–4): 64. 1939.

*Pollaccia balsamiferae* (Davis) M. Morelet, Bull. Soc. Sci. Nat. Archéol. Toulon Var 4: 3. 1972.

*Fusicladium elegans* (Servazzi) Ritschel & U. Braun, Schlechtendalia 9: 43. 2003.

**Description and illustration:** Sivanesan (1977); Schubert et al. (2003).

**Typus:** France, Loir-et-Cher, Montdoubleau, on young branches of *Populus* (Salicaceae), Apr. 1889, Prillieux s.n. (**lectotype**, PC) (not seen).

**Materials examined:** Italy, on *Populus canadensis* (Salicaceae), collection date and collector unknown, isol. O. Servazzi (culture CBS 256.38 = IMI 163996); on *Populus* sp., collection date and collector unknown, isol. R. Ciferri (culture CBS 316.58).

**Notes:** Unfortunately, isolates CBS 256.38 and CBS 316.58 proved to be sterile. The species is sister to *V. mandshurica* (Figs 1, 2).

***Venturia pyrina*** Aderh., Landw. Jahrb. 25: 875. 1896. *Nom. cons. prop.* (Rossman et al. 2018). Fig. 55.

**Synonyms:** *Helminthosporium pyrurum* Lib. (p.p.), Pl. Crypt. Arduenna, Fasc. 2, 188. 1832.

*Arthrinium pyrinum* Wallr., Fl. Crypt. Germ. 2: 163. 1833.

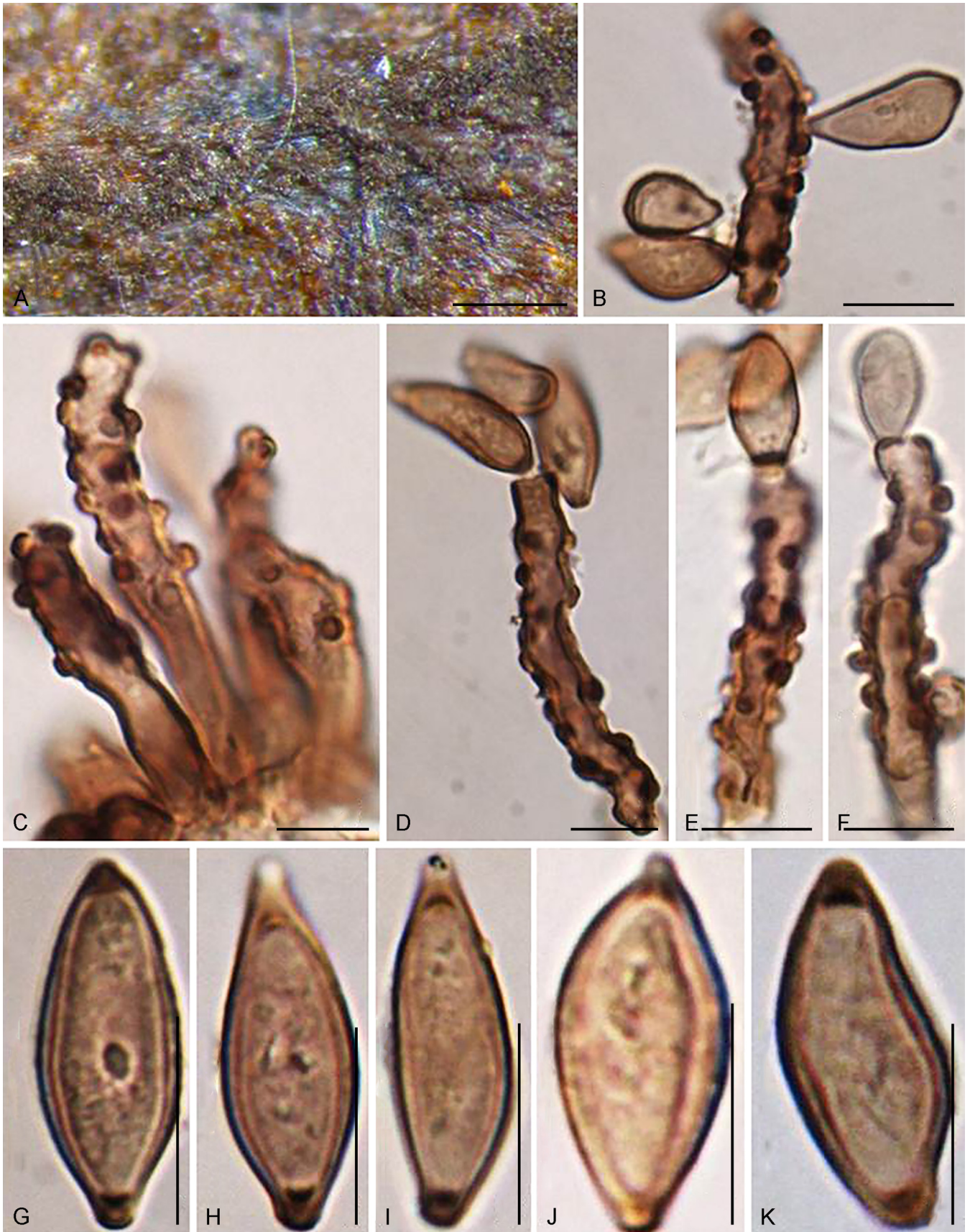


Fig. 55. *Venturia pyrina* (HMAS 03905) asexual morph. A. Dense fascicle of conidiophores on the host surface. B–F. Solitary or fasciculate conidiophores with sympodial conidiogenous loci. G–K. Fusiform to broadly fusiform conidia. Scale bars: A = 200 µm; B–F = 20 µm; G–K = 5 µm.

*Fusidium pyrinum* Corda, Icon. Fung. 1: 3. 1837.  
*Fusicladium virescens* Bonord., Handb. Mykol.: 80. 1851.  
*Fusicladium fuscescens* Rabenh., Bot. Zeitung (Berlin) 15: 430.  
 1857.

*Cladosporium polymorphum* Peyl, Lotos 15: 18. 1865.  
*Passalora pomi* G.H. Otth, Mitth. Naturf. Ges. Bern 1868: 66.  
 1868.

*Cercospora porriga* Speg., Anales Mus. Nac. Buenos Aires. II. 3: 341. 1899.

*Acrotheca dearnessiana* Sacc., Ann. Mycol. 10: 314. 1912.

*Endostigme pyrina* (Aderh.) Syd., Ann. Mycol. 21: 173. 1923.

Colonies amphigenous, dark brown to olivaceous brown. *Stroma* well developed on fruit, leaves, rarely on young twigs and buds, sometimes composed of only a few cells. *Conidiophores* erect, solitary or fasciculate unbranched, usually short, up to 90  $\mu\text{m}$  long, 5–7  $\mu\text{m}$  wide, dark brown to olivaceous brown, mostly

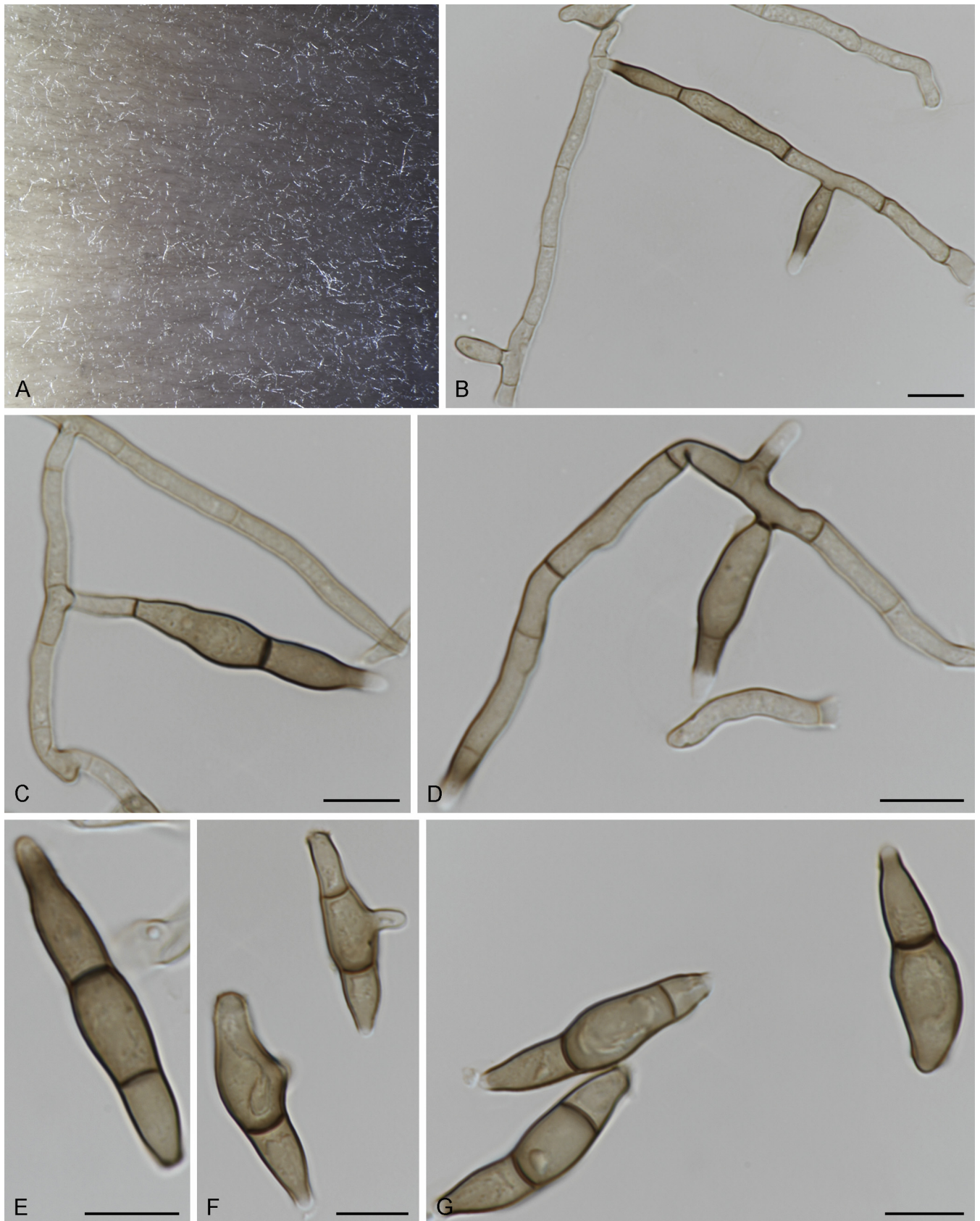


Fig. 56. *Venturia quebecensis* (ex-type culture CBS 695.85) asexual morph. A. Colony on OA. B–D. Conidiogenous cells giving rise to conidia. E–G. Conidia or germinating conidia. Scale bars: B–G = 10  $\mu\text{m}$ .

aseptate. *Conidiogenous cells* integrated, terminal, proliferation sympodially, with several conspicuous loci. *Conidia* solitary, 16–24.5 × 6–9 µm, broadly fusiform, sometimes irregular, pale to olivaceous brown, smooth, wrinkled or verruculose, 0(–1)-septate, not constricted at the septum, pointed at the apex, truncate at the base; *hila* narrowly truncate, somewhat thickened and darkened. Description in vivo and illustration, see Schubert *et al.* (2003: 82–85, fig. 41).

*Typus: lectotype* [icon in] Landw. Jahrb. 25: 878, t. 31, fig. 1–11. 1896 (designated in Rossman *et al.* 2018).

*Materials examined:* **Brazil**, on *Pyrus communis* (Rosaceae), collection date and collector unknown (culture CBS 120825 = BR 04 PC S2.2). **China**, on leaves of *Pyrus* sp., Aug. 1942, F. Dai (HMAS 03923); *idem.*, 1 Sep. 1942, F. Dai (HMAS 03905); Shandong, Wendeng, on leaves of *Pyrus* sp., 4 Aug. 2014, J. Zhang & Y. Liu (culture BJFCC 140804-2). **Germany**, unknown host, Jul. 1935, M. Schmidt (culture CBS 379.35). **New Zealand**, on *P. communis*, 20 Apr. 2008, C.F. Hill (culture CBS 123189 = CPC 15384).

*Notes:* The species is sister to *V. orbiculata* (Fig. 1) and to *V. nashicola* (Fig. 2). *Fusicladium virescens*, the type species of *Fusicladium*, was reported on apple leaves (or on pear leaves., see Schubert *et al.* 2003: 3–4), and was reduced to a synonym of *F. pyrorum* based on morphological features of the conidiophores given in the original description (Bonorden 1851, Saccardo 1897, Lindau 1907).

***Venturia quebecensis*** Crous, M. Shen & Y. Zhang *ter. sp. nov.* MycoBank MB831540. Fig. 56.

*Etymology:* The epithet refers to Quebec, the province where this isolate was collected.

*Sexual morph* unknown. *In vitro* on OA: *Mycelium* branched or unbranched, pale to medium brown, 2.5–3.5 µm wide, septate, not constricted at septa, smooth or occasionally verrucose, straight, wall not thickened. *Conidiophores* laterally or terminally arising from hyphae, reduced to conidiogenous cells. *Conidiogenous cells* integrated, terminal, erect or geniculate-sinuuous, 6–24 × 3–6 µm, antenna- or hyphopodium-like, phialidic, collarette sometimes present, pale to medium brown, subcylindrical, smooth, walls somewhat thickened, with a single locus, 2.5–4 µm wide, slightly thickened or darkened, sometimes only as short lateral conical prolongations of hyphae. *Conidia* solitary, straight or slightly curved, fusiform, sometimes obpyriform, 25–38.5 × 5.5–8 µm, 1–2(–3)-septate, usually constricted at the septa, medium to dark brown, smooth, walls somewhat thickened or darkened, often widest in the middle or just below, becoming tapered and hyaline towards the apex, attenuated or rounded towards the base; *hila* truncate, 2–3.5 µm wide, somewhat thickened and darkened.

*Culture characteristics:* Colonies spreading, somewhat erumpent, smooth, with sparse aerial mycelium and regular margins on OA, uneven, greyish sepia (surface), becoming paler towards margins; reverse fuscous-black. Colonies reaching 65 mm diam after 6.5 wk at 25 °C in the dark; colonies fertile.

*Typus:* **Canada**, Quebec, Portneuf, on the spotted leaf of *Populus tremuloides* (Salicaceae), 18 Jun. 1979, M. Morelet (**holotype** CBS H-23604, culture ex-type CBS 695.85).

*Notes:* Isolate CBS 695.85 was collected on *Populus tremuloides* in Quebec by M. Morelet, and was identified as *Venturia tremulae*. However, the 2-septate conidia of CBS 695.85 are distinct from those of *V. tremulae* (Schubert *et al.* 2003). Phylogenetically, this

isolate also does not cluster with strains of *V. tremulae* and therefore a novel species is introduced to accommodate it (Figs 1, 2).

***Venturia rumicis*** (Desm.) G. Winter, Rabenh. Krypt.-Fl., Ed. 2, 1(2): 435. 1885. Fig. 57.

*Basionym:* *Sphaeria rumicis* Desm., Ann. Sci. Nat., Bot. ser. 2, 19: 361. 1843.

*Synonyms:* *Sphaerella rumicis* (Desm.) Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 103. 1870.

*Stigmatea rumicis* (Desm.) J. Schröt., Kryptogamenfl. Schlesien 3.2: 332. 1894.

*Ascospora rumicis* (Desm.) Kuntze, Rev. Gen. Plant 3: 444. 1898.

*Spilosticta rumicis* (Desm.) Syd., Ann. Mycol. 21: 171. 1923.

*Mycosphaerella rumicis* (Desm.) Grove, J. Bot. (London) 71: 253. 1933.

*Mycosphaerella rumicis* f. *caulicola* Grove, J. Bot. (London) 71: 253. 1933.

*Mycosphaerella stromatoidea* Dearn., Mycologia 18: 245. 1926.

*Ascomata* epiphyllous, 60–170 µm diam, gregarious or scattered, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuous papillate ostiole. *Setae* not observed. *Peridium* 10–25 µm wide, 1-layered, composed of 2–3 rows of pigmented cells of *textura angularis*, cells 8–9 × 4–8 µm, cell wall 0.8–1.2 µm thick. *Pseudoparaphyses* 2–4 µm wide, rare, evanescent when mature, septate, hyaline. *Asci* 39–67 × 13–19 µm (av. 53.6 × 15.8 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical to somewhat obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 14–19 × 5.5–7 µm (av. 16.1 × 6.5 µm, n = 20), fusiform, hyaline to pale olivaceous brown, obliquely uni- or triseriate near the base, 1-septate, constricted at the septum, the upper cells wider and longer than the lower ones (length ratio: 9:8–3:2), smooth-walled. *Asexual morph* unknown.

*Typus:* **France**, on overwintered leaves of *Rumex* sp. (Polygonaceae), J.B.H.J. Desmazières (? **type** K(M) 189242).

*Additional material examined:* **USA**, California, on overwintered leaves of *Rumex occidentalis* (Polygonaceae), 26 May 1930, L. Bonar (HMAS 49551).

*Notes:* Although both *Venturia rumicis* and *V. canadensis* occur on *Rumex* spp., the immersed ascomata and larger-sized ascospores of *V. rumicis* are distinguishable from those of *V. canadensis*. Neither of these species are currently known from molecular data.

***Venturia saliciperda*** J. Nüesch, Phytopathol. Z. 39: 349. 1960.

*Synonyms:* *Septogloeum saliciperdum* Allesch. & Tubeuf, Fungi Bavar. Exsicc.: no. 485. 1895.

*Fusicladium saliciperdum* (Allesch. & Tubeuf) Lind, Ann. Mycol. 3: 430. 1905.

*Pollaccia saliciperda* (Allesch. & Tubeuf) Arx, Tijdschr. Plantenziekten 63: 233. 1957.

*Description and illustration:* Nüesch (1960) and Schubert *et al.* (2003).

*Typus:* **Switzerland**, Katzenssee bei Zürich, Kt. Zürich, *Salix cordata* (Salicaceae), 24 Sep. 1958, collector unknown (**holotype** ETH Nr. 2836, culture ex-type CBS 480.61 = ETH 2836).

*Additional materials examined:* **France**, on *Populus tremula* (Salicaceae), 1 Sep. 1977, collector unknown (culture CBS 112625 = CPC 3638 = MPFN 349 = STE-U 3638). **Switzerland**, on *Salix elegantissima* (Salicaceae), collection date and

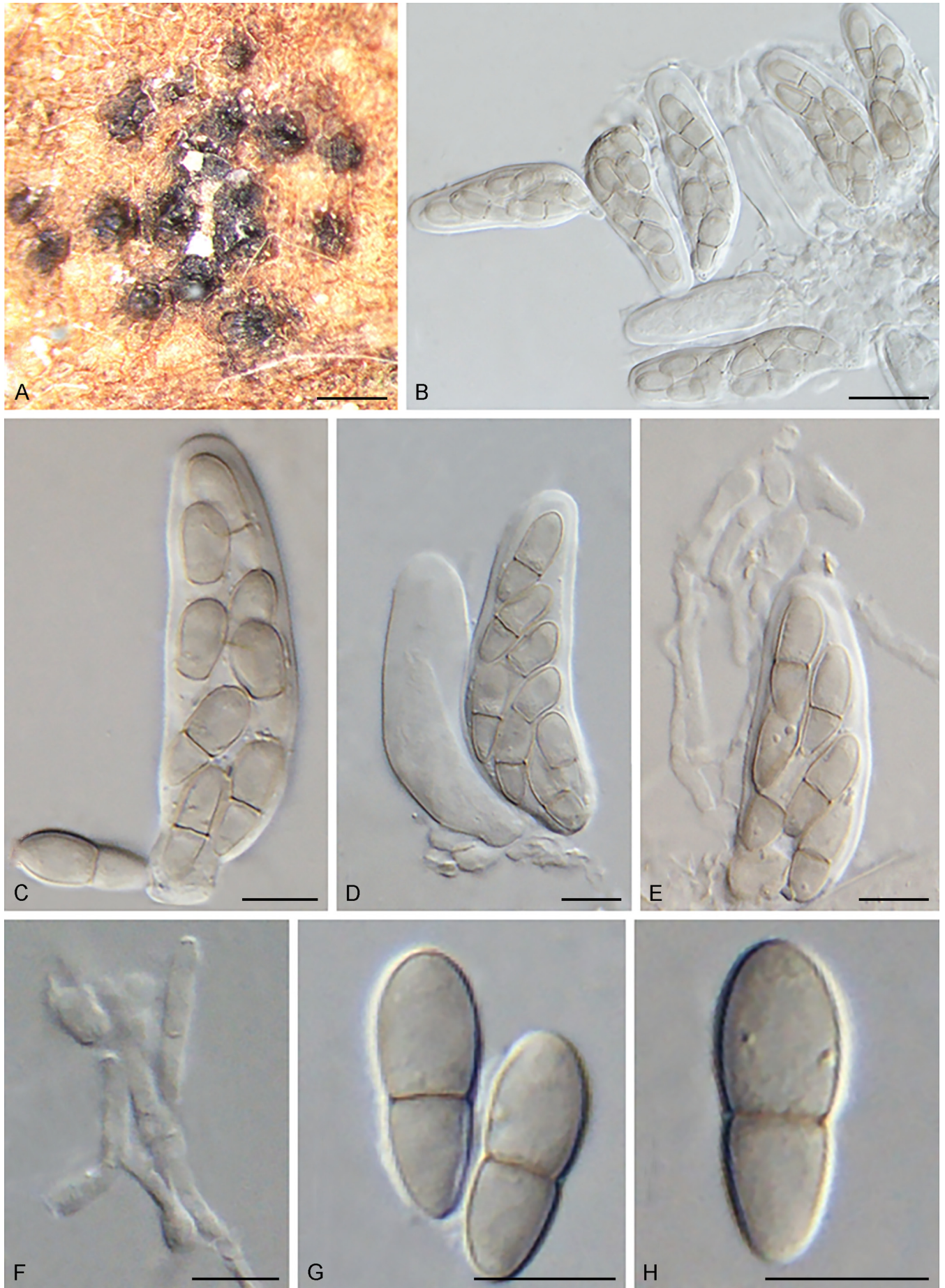


Fig. 57. *Venturia rumicis* (? type K(M) 189242) sexual morph. A. Ascomata scattered on the host surface. B–D. Broadly clavate to somewhat obclavate asci. E. Obclavate ascus and evanescent pseudoparaphyses. F. Evanescent pseudoparaphyses. G, H. Released, pale brown 1-septate ascospores. Scale bars: A = 200  $\mu$ m; B–H = 10  $\mu$ m.



**Fig. 58.** *Venturia syringae* (isotype MICH 139624) sexual morph. **A.** Ascomata scattered on the host surface. **B.** Section of an ascoma. **C–E.** Cylindrical to somewhat obclavate asci. **F, G.** Evanescent pseudoparaphyses. **H, I.** Released, olivaceous brown ascospores. Scale bars: A = 200  $\mu$ m; B–G = 10  $\mu$ m; H–I = 5  $\mu$ m.

collector unknown, isol. E. Müller, 24 Sep. 1958 (culture CBS 481.61 = ETH 2837).

**Notes:** Unfortunately, these isolates proved to be sterile in culture. *Venturia saliciperda* is sister to *V. tremulae* (Figs 1, 2). *Venturia saliciperda* is exclusively associated with *Salix* spp., while *V. tremulae* associates with *Populus* spp.

***Venturia syringae*** (Syd.) M.E. Barr, *Canad. J. Bot.* 46: 815. 1968. Fig. 58.

**Basionym:** *Phaeosphaerella syringae* Syd., *Ann. Mycol.* 21(1–2): 145. 1923.

**Synonyms:** *Spilosticta syringae* (Syd.) Petr., *Hedwigia* 65: 241. 1925.

***Fusicladium diedickeanum*** U. Braun, *Nova Hedwigia* 55(1–2): 211. 1992.

**Sexual morph in vitro:** *Ascomata* 65–90 µm diam, hypophyllous, solitary, gregarious or scattered, initially immersed, becoming erumpent, globose to subglobose, wall black, with conspicuous papillate ostiole. *Setae* not observed. *Peridium* 5–10 µm wide, 1-layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 6–14 × 5–11 µm, cell wall 0.5–1.2 µm thick. *Pseudoparaphyses* 2–4 µm wide, rare, evanescent when mature, septate, hyaline. *Asci* 40–55 × 10–12 µm (av. 48.8 × 10.6 µm, n = 20), 8-spored, bitunicate, fissitunicate, cylindrical, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 9–12.5 × 4–6 µm (av. 10.6 × 4.5 µm, n = 20), oblong to broadly clavate, olivaceous brown, obliquely uniseriate to biseriate near the base, 1-septate, slightly constricted at the septum, the upper cells shorter and wider than the lower ones (length ratio: 2:3–1:1), smooth-walled. **Asexual morph in vivo:** see Schubert et al. (2003: 40, 41, fig. 16).

**Typus:** Germany, Leutenthal, near Kleinbrennbach, Hopfenberg at Buttelstedt, on the rotting leaves of *Syringa vulgaris* (Oleaceae), May 1921 (syntype MICH 139624). **Topotype** material (from 1923/24): Syd., *Mycoth. Germ.* 2116, e.g., B, BPI 618036, 618038, MICH 139623, PH 315989, WIS-F75798.

***Venturia tomentosae*** R. Menon, *Phytopathol. Z.* 27: 132. 1956. Fig. 59.

*Ascomata* hypophyllous, 100–215 µm diam, scattered, solitary, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuously papillate ostiole, sparsely surrounded by setae. *Setae* dark brown, 28–85 × 5–7 µm, setae wall 1–2 µm thick, aseptate. *Peridium* 20–28 µm wide, 1-layered, composed of (3–)4–5 rows of pigmented cells of *textura angularis*, cells 6–14 × 5–15 µm, cell wall 1–1.5 µm thick. *Pseudoparaphyses* rare, 2–4 µm wide, evanescent when mature, septate, hyaline. *Asci* 90–139 × 7–15 µm (av. 112.7 × 11.8 µm, n = 20), 8-spored, bitunicate, fissitunicate, cylindrical, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 15–20 × 7–8 µm (av. 18.2 × 7.5 µm, n = 20), ellipsoid to somewhat clavate, olivaceous brown, obliquely uniseriate, 1-septate, slightly constricted at the septum, the upper cells shorter and wider than the lower ones (length ratio: 1:2–7:8), smooth-walled. **Asexual morph** unknown.

**Typus:** Switzerland, on leaves of *Cotoneaster tomentosa* (Rosaceae), 28 Sep. 1937, A. Volkart (holotype ZT 57089).

***Venturia radiosa*** (Lib.) Ferd. & C.A. Jørg., *Skovtraeernes Sygdomme* 1: 125. 1938.

**Basionym:** *Oidium radiosum* Lib., *Pl. Crypt. Ard. Fasc.* 3, no. 285. 1834.

**Synonyms:** *Venturia tremulae* Aderh., *Hedwigia* 36: 81. 1897.

***Fusicladium radiosum*** (Lib.) Lind, *Ann. Mycol.* 3: 430. 1905.

***Pollaccia radiosa*** (Lib.) E. Bald. & Cif., in E. Bald., *Atti Ist. Bot. "Giovanni Briosi"* 10: 61. 1937.

***Venturia tremulae* var. *populi-albae*** M. Morelet, *Cryptog. Mycol.* 6: 112. 1985.

***Venturia tremulae* var. *grandidentatae*** M. Morelet, *Cryptog. Mycol.* 6: 113. 1985.

**Description and illustration:** Schubert et al. (2003).

**Typus:** Belgium, Belgian Ardennes, on *Populus tremula* (Salicaceae), 1834, Libert (lectotype BR, selected by Morelet 1985; **isoelectotypes:** Lib., *Pl. crypt. ard.*, Fasc. 3, 285) (not seen).

**Materials examined:** France, on spotted leaf of *Populus alba* (Salicaceae) (culture CBS 694.85); on spotted leaf of *P. tremula* (cultures CBS 692.85, CBS 693.85).

**Notes:** Unfortunately, these isolates proved to be sterile. The species is sister to *V. saliciperda* (Figs 1, 2).

***Venturia viennotii*** M. Morelet, *Trav. Dédicés à Georges Viennot-Bourgin* (Paris): 261. 1977.

**Synonym:** *Venturia viennotii* var. *levispora* M. Morelet, *Cryptog. Mycol.* 6: 107. 1985.

**Description and illustration:** Morelet (1985).

**Typus:** France, Velaine-sous-Amance (Meurthe-et-Moselle), on *Populus tremula* (Salicaceae), Jun. 1972, M. Morelet (holotype PFN 813).

**Additional materials examined:** France, on dead leaves of *Populus tremula* (Salicaceae), collection date and collector unknown, isol. M. Morelet, May 1979 (cultures CBS 690.85, CBS 691.85).

**Notes:** Unfortunately, these isolates proved to be sterile but they were deposited by the original author of the species and collected from the same host and region as the holotype and could therefore be regarded as authentic for the species. The species is related to *V. polygoni-vivipari* (Fig. 1) and *V. catenospora* (Fig. 2).

## SPECIES EXCLUDED FROM VENTURIALES

***Acanthostigma saccardioides*** (Ellis & G. Martin) Sacc., *Syll. Fung.* 9: 854. 1891. Fig. 60.

**Basionym:** *Venturia saccardioides* Ellis & G. Martin, *Amer. Naturalist* 18: 60. 1884.

*Ascomata* hypophyllous, 130–190 µm diam, scattered, becoming superficial, globose to subglobose, with setae. *Setae* brown, up to 100 µm long, 4–5 µm wide, setae wall 0.5–1 µm thick, septate. *Pseudoparaphyses* rare, 2–3.5 µm wide, hyaline, septate, branched. *Asci* 38–56 × 9–11 µm (av. 45.1 × 9.4 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical to clavate, with a short, knob-like pedicel, each with an inconspicuous ocular chamber. *Ascospores* 12–15 × 3–4 µm (av. 13.8 × 3.7 µm, n = 20), obclavate, hyaline, obliquely biseriate, 3-septate, slightly constricted at the median septum, smooth-walled.

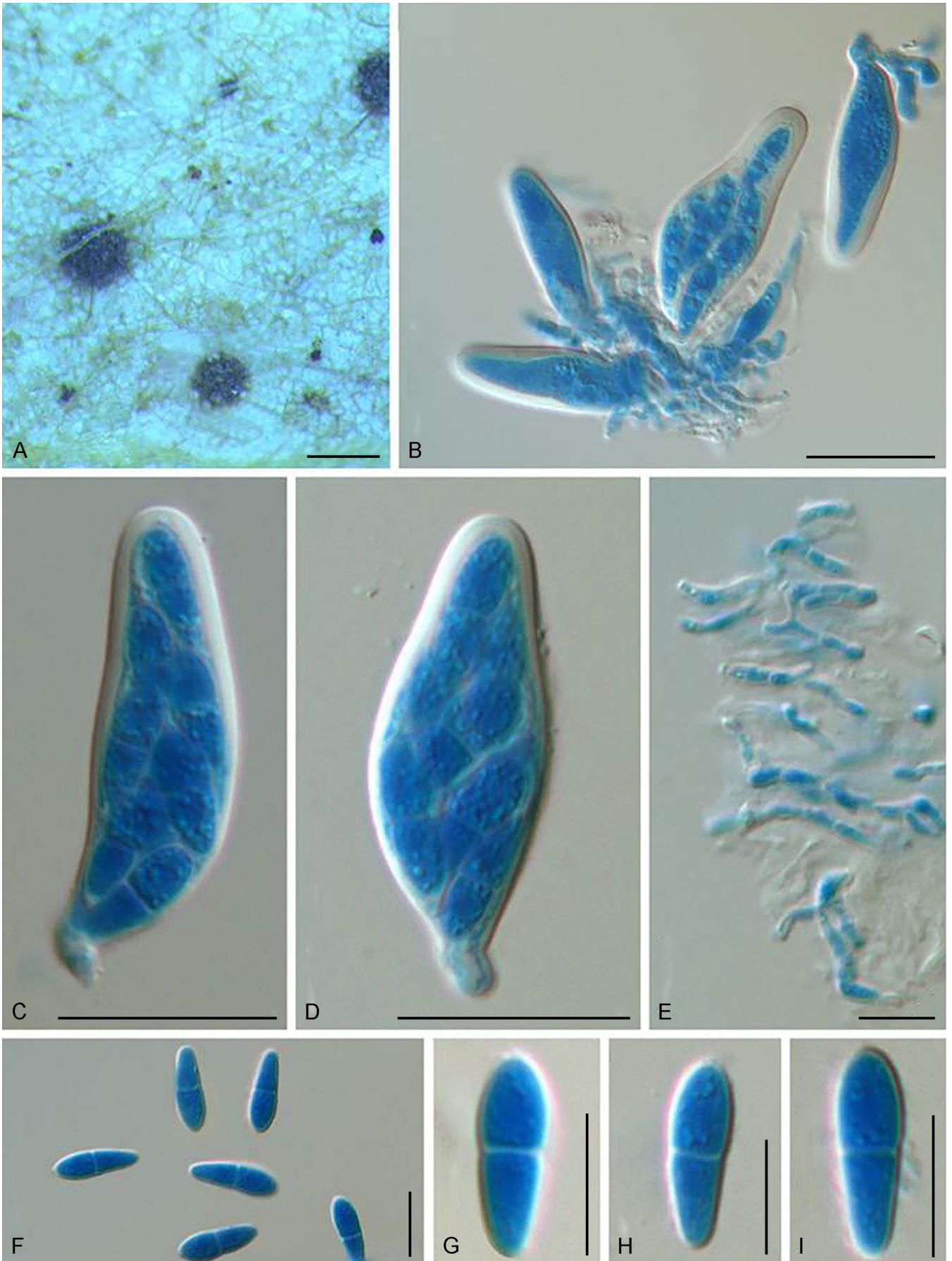




**Fig. 59.** *Venturia tomentosae* (holotype ZT 57089) sexual morph. **A.** Ascostromata scattered on the host surface. **B.** Section of an ascostroma. **C, D.** Cylindrical asci with short pedicels. **E, G.** Released, medium brown, asymmetrical ascospores. **F.** Evanescent pseudoparaphyses. **H.** Dark brown setae. Scale bars: A = 200  $\mu$ m; B–H = 10  $\mu$ m.



**Fig. 60.** *Acanthostigma saccardioides* (holotype NY 00938225) sexual morph. **A.** Ascostromata scattered on the host surface. **B, D.** Immature asci in evanescent pseudo-paraphyses. **C, E.** Cylindrical to broadly obclavate asci. **F, I.** Released ascospores with one to three septa. **G.** Evanescent pseudoparaphyses. **H.** Dark brown setae. Scale bars: A = 200  $\mu$ m; B–I = 10  $\mu$ m.



**Fig. 61.** *Chaetothyria applanata* (type NY 00938204) sexual morph. **A.** Ascomata scattered on the host surface. **B–D.** Broadly obclavate asci. **E.** Evanescent pseudo-paraphyses. **F–I.** Released, hyaline ascospores with one septum. Scale bars: A = 200 μm; B–D = 20 μm; E–I = 10 μm.

*Typus*: **USA**, Florida, Clay Co., Green Cove Springs, on underside of leaf of *Magnolia glauca* (*Magnoliaceae*), Mar. 1883, G. Martin (**holotype** NY 00938226, **isotype** NY 00938225).

*Notes*: The larger-sized ascomata, and hyaline, 3-septate ascospores of *Venturia saccardioides* are distinguishable from *Venturia s. str.*

***Chaetothyria applanata*** (Ellis & G. Martin) M.E. Barr, Mycotaxon 46: 73. 1993. Fig. 61.

*Basionym*: *Venturia applanata* Ellis & G. Martin, Amer. Naturalist 18: 69. 1884.

*Ascomata* hypophyllous, 115–220 µm diam, scattered or solitary, superficial, globose to subglobose, dark brown at the apex, hyaline at the base, with setae. *Setae* dark brown, up to 100 µm long, 3.5–5.5 µm wide. *Pseudoparaphyses* 2–3 µm wide, narrowly cellular, septate, hyaline. *Asci* 31–45 × 11–16 µm (av. 38.5 × 13.1 µm, n = 20), 8-spored, bitunicate, fissitunicate, obclavate, each with an inconspicuous ocular chamber. *Ascospores* 12–15 × 4–5 µm (av. 13.6 × 4.6 µm, n = 20), overlapping to triseriate, especially near the base, broadly clavate, hyaline, 1-septate, the upper cells shorter and wider than the lower ones (length ratio: 5.5:7–1:1), smooth-walled.

*Typus*: **USA**, Florida, on underside of living leaves of *Magnolia glauca* (*Magnoliaceae*), Mar. 1883, G. Martin s.n. (**holotype** NY 00938204).

*Notes*: The hyaline, clavate ascospores and persistent pseudoparaphyses of *Venturia applanata* differ from *Venturia s. str.*

***Chaetothyria asterinoides*** (Ellis & G. Martin) M.E. Barr, Mycotaxon 29: 504. 1987. Fig. 62.

*Basionym*: *Venturia asterinoides* Ellis & G. Martin, in Ellis, N. Amer. Pyren.: 138. 1892.

*Sexual morph*: *Ascomata* superficial, 100–140 µm diam, gregarious, subglobose, wall black, with a conspicuous papillate ostiole, surrounded by slender setae. *Setae* dark brown, up to 130 µm long, 4–4.5 µm wide, wall 0.5–1.2 µm thick. *Peridium* thin, composed of brown pigmented cells of *textura angularis*. *Pseudoparaphyses* 1.5–2 µm wide, numerous, septate, hyaline, branched. *Asci* 36–47 × 13–18 µm (av. 43.6 × 15.7 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 16–18.5 × 4.5–5.5 µm (av. 17.2 × 5.1 µm, n = 20), obliquely uni- to triseriate near the base, broadly clavate, hyaline, 1-septate, the upper cells shorter and wider than the lower ones (length ratio: 7:10–1:1), smooth-walled. *Asexual morph*: unknown.

*Typus*: **USA**, Florida, on leaves of *Quercus laurifolia* (*Fagaceae*), Mar. 1883, G.W. Martin s.n. (**holotype** NY 00938205).

*Notes*: The hyaline and clavate ascospores and persistent pseudoparaphyses of *Venturia asterinoides* differ from *Venturia s. str.* Barr (1987) suggested that *Venturia asterinoides* is morphologically comparable to *Chaetothyria applanata*, although they differ in their hosts and dimensions of asci and ascospores.

***Dimeriella sacchari*** (Breda de Haan) Hansf. ex E.V. Abbott, Sugar Cane Dis. World, II: 43. 1964. Fig. 63.

*sionym*: *Coleroa sacchari* Breda de Haan, Meded. Proefstat. Suikerriet W.-Java Kagok-Tegal. 33: 22. 1892.

*Synonym*: *Venturia sacchari* (Breda de Haan) Sacc., Syll. Fung. 11: 306. 1895.

*Ascomata* epiphyllous, 30–60 µm diam, scattered or solitary, becoming superficial, globose to subglobose, with a conspicuously papillate ostiole. *Peridium* thin, 1-layered, composed of 2–3 rows of pigmented cells of *textura angularis*, cells 6–8 µm wide, cell wall 0.8–1.2 µm thick. *Pseudoparaphyses* rare, evanescent when mature. *Asci* 31–45 × 7–12 µm (av. 38.6 × 10 µm, n = 20), 8-spored, bitunicate, fissitunicate, ellipsoid, with a short, knob-like pedicel, each with an inconspicuous ocular chamber. *Ascospores* 11–15 × 4–6 µm (av. 12.8 × 5.2 µm, n = 20), ellipsoid, subhyaline, bi- to triseriate, 1-septate, constricted at the septum, with broadly rounded ends, the upper cells shorter and wider than the lower ones, smooth-walled. *Asexual morph*: unknown.

*Material examined*: **China**, Taipei, Ilan County, on the leaves of *Saccharum officinarum* (*Poaceae*), 28 Nov. 1925, K. Sawada (HMAS 11669).

*Note*: The ellipsoid asci and hyaline ascospores of *Venturia sacchari* differ from *Venturia s. str.*

***Johansonia formosa*** (Ellis & G.W. Martin) M.E. Barr, Mycotaxon 46: 65. 1993. Fig. 64.

*Basionym*: *Venturia formosa* Ellis & G.W. Martin, in Ellis, N. Amer. Pyren.: 139. 1892.

*Ascomata* hypophyllous, 115–260 µm diam, scattered or solitary, becoming superficial, discoid, wall black, surrounded by slight setae. *Setae* dark brown, septate, 150–180 × 6 µm, setae wall 0.5–1 µm thick, base swollen, up to 11 µm. *Pseudoparaphyses* rare, 3 µm wide, hyaline, septate. *Asci* 50–69 × 23–33 µm (av. 63.1 × 29.8 µm, n = 10), 8-spored, bitunicate, fissitunicate, ellipsoid, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 23–29 × 10.5–13 µm (av. 26.0 × 11.5 µm, n = 10), ellipsoid to somewhat clavate, pale brown, bi- or triseriate, 1-septate, slightly constricted at the septum, base narrowly rounded to tapered, the upper cells shorter and wider than the lower ones (length ratio: 21:25–1:1), smooth-walled. *Asexual morph*: unknown.

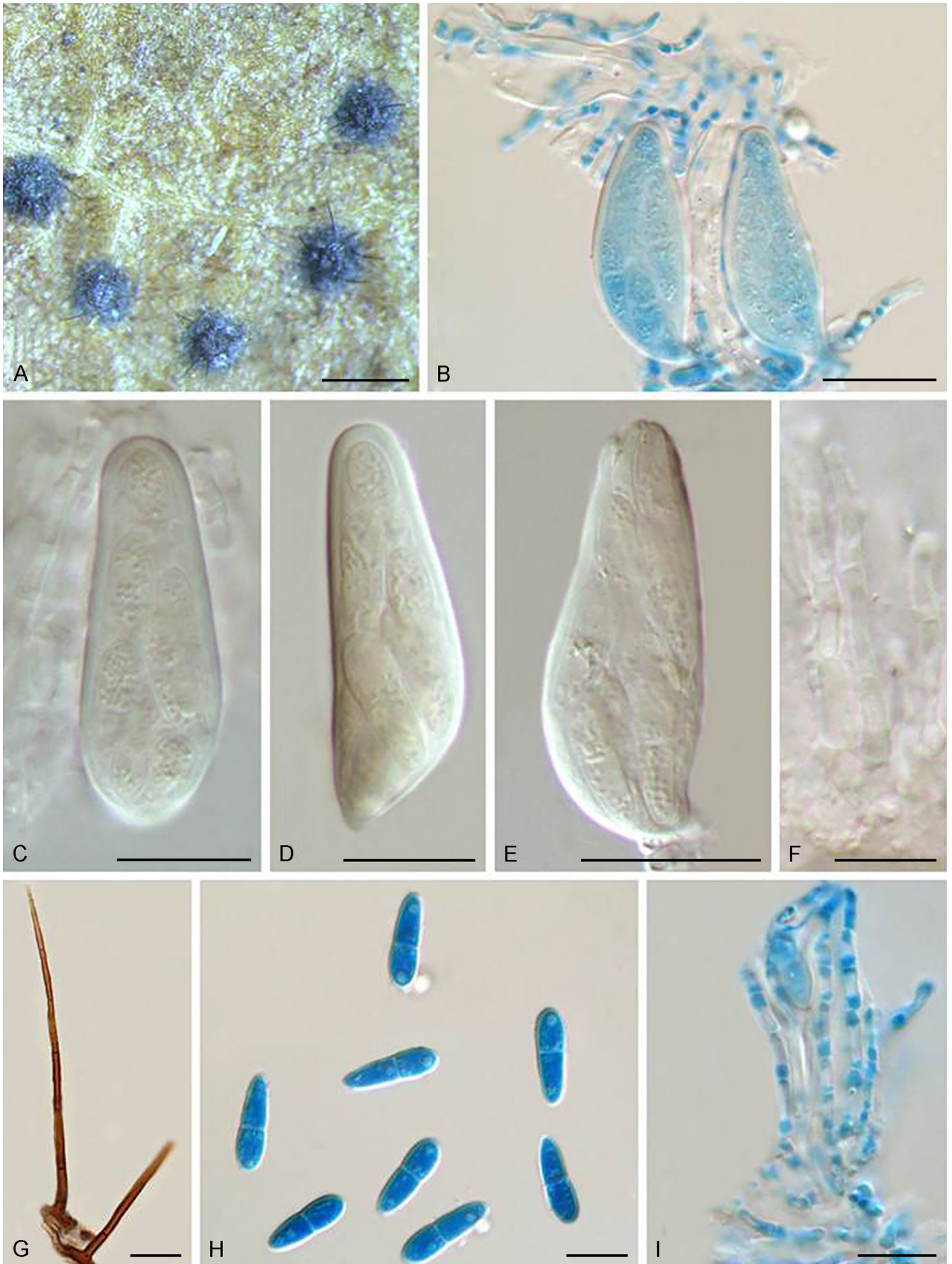
*Typus*: **USA**, Florida, clay companies, Green Bay Spa, on the leaves of *Olea americana* (*Oleaceae*), 15 Apr. 1885, G. Martin s.n. (**holotype** NY 00938214).

*Note*: The larger-sized ascomata and ellipsoid asci differ from *Venturia s. str.*

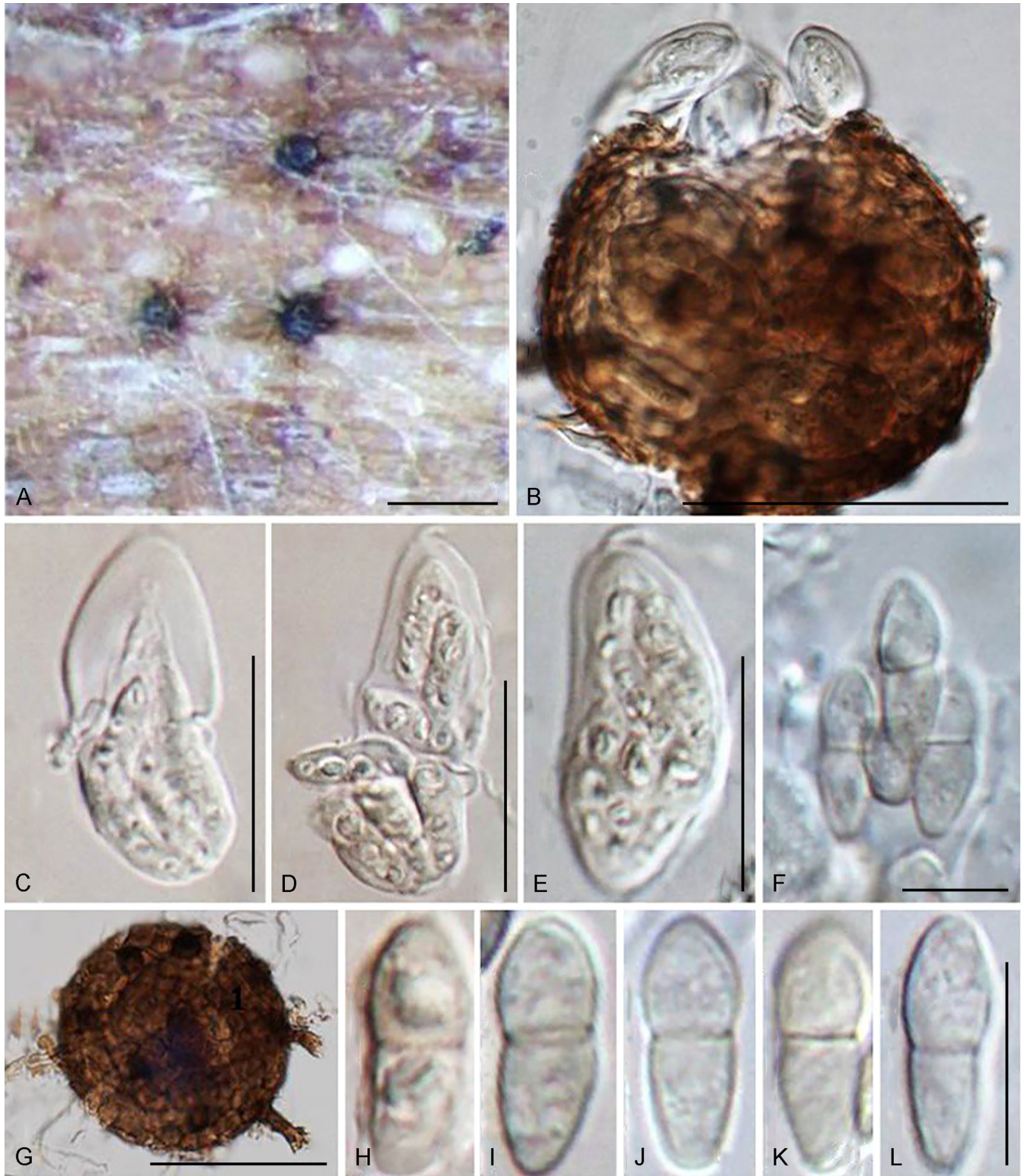
***Nematostoma occidentale*** (Ellis & Everh.) M.E. Barr, Mycol. Res. 46: 860. 1968. Fig. 65.

*Basionym*: *Venturia occidentalis* Ellis & Everh., J. Mycol. 2: 43. 1886.

*Ascomata* hypophyllous, 120–284 µm diam, scattered or solitary, becoming erumpent or superficial, globose to subglobose, wall black, with a conspicuously papillate ostiole, surrounded by setae. *Setae* dark brown, up to 300 µm long, 5–7.5 µm wide, setae wall 2–3 µm thick, base swollen, septate. *Pseudoparaphyses* 1.5–2.5 µm wide, hyaline, septate, branched. *Asci* 70–90 × 9–11 µm (av.



**Fig. 62.** *Chaetothyria asterinoides* (holotype NY 00938205) sexual morph. **A.** Ascomata scattered on the host surface. **B–E.** Broadly cylindrical to somewhat obclavate asci. **F, I.** Evanescent pseudoparaphyses. **G.** Dark brown setae. **H.** Hyaline, 1-septate ascospores. Scale bars: A = 200  $\mu$ m; B–E, G = 20  $\mu$ m; F, H, I = 10  $\mu$ m.



**Fig. 63.** *Dimeriella sacchari* (HMAS 11669) sexual morph. **A.** Ascomata scattered on the host surface. **B.** Ascoma and asci. **C–E.** Ellipsoid, subhyaline asci. **F, H–L.** Fusiform, 1-septate ascospores. **G.** Globose ascoma. Scale bars: A = 100  $\mu\text{m}$ ; C–E = 20  $\mu\text{m}$ ; B, G = 50  $\mu\text{m}$ ; F = 10  $\mu\text{m}$ ; L applies to H–L = 10  $\mu\text{m}$ .

78.7  $\times$  10.2  $\mu\text{m}$ ,  $n = 10$ ), 8-spored, bitunicate, fissitunicate, cylindrical or clavate, with a short pedicel, each with an inconspicuous ocular chamber. *Ascospores* 20–27  $\times$  4–6  $\mu\text{m}$  (av. 22.6  $\times$  4.6  $\mu\text{m}$ ,  $n = 20$ ), narrowly cylindrical to fusiform, pale brown, overlapping to biseriate near the top, 3-septate, constricted at the median septum, smooth-walled. *Asexual morph*: unknown.

*Typus*: **USA**, Illinois, Urbana, on leaves of *Cirsium discolor* (*Compositae*), 23 Oct. 1885, C.A. Hart 6597 (**syntype** NY 00938217); *idem.*, 3 Nov. 1885, C.A. Hart 6607 (**syntype** NY 00938218).

*Note*: The 3-septate and cylindrical ascospores of *Nematostoma occidentale* differ from *Venturia s. str.*



**Fig. 64.** *Johansonia formosa* (holotype NY 00938214) sexual morph. **A.** Ascomata scattered on the host surface. **B, C.** Broadly clavate asci. **D.** Pale brown ascospores. **E.** Dark brown seta. Scale bars: A = 200  $\mu$ m; B–E = 20  $\mu$ m.

***Niesslia erysiphoides*** (Ellis & Everh.) M.E. Barr [as “*erysiphoides*”], Mycotaxon 46: 50. 1993. Fig. 66.

*Basionym:* *Venturia erysiphoides* Ellis & Everh., J. Mycol. 3: 128. 1887.

*Ascomata* on stems or leaf sheaths, up to 100  $\mu$ m diam, in small groups, becoming superficial, globose, collapsing into a cup-shape when dry, wall black, with a conspicuous ostiole, covered with setae. *Setae* dark brown, 40–70  $\times$  5–7  $\mu$ m, wall 2  $\mu$ m thick, aseptate. *Pseudoparaphyses* not observed. *Asci* 34–49  $\times$  6–8  $\mu$ m (av. 41.5  $\times$  7  $\mu$ m, n = 20), 8-spored, oblong, without pedicel. *Ascospores* 16–20  $\times$  2.5–3  $\mu$ m (av.

18.1  $\times$  2.8  $\mu$ m, n = 20), narrowly fusiform, hyaline, bi- to triseriate, 1-septate, with a median septum. *Asexual morph:* unknown.

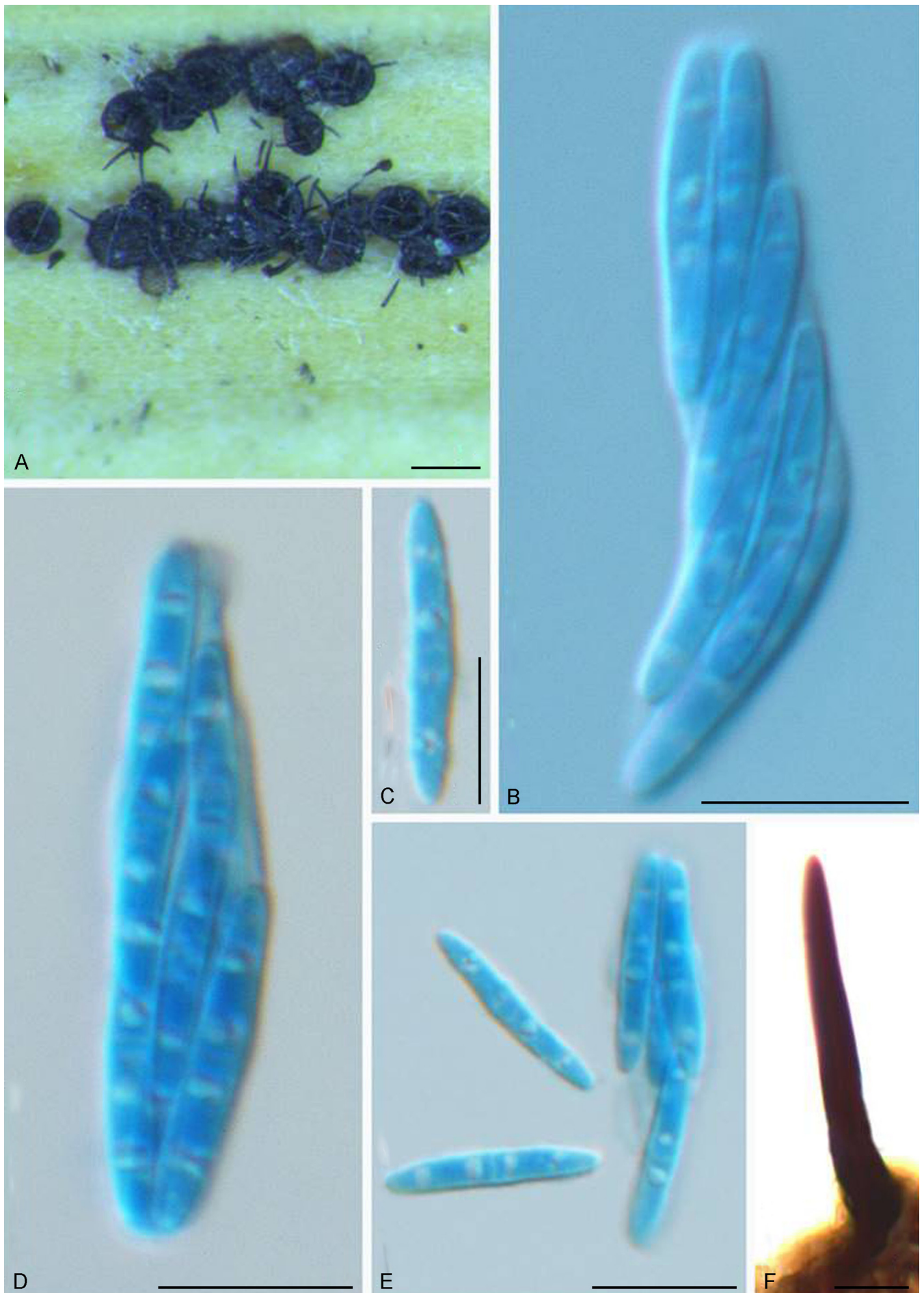
*Typus:* **USA**, Louisiana, on stems or leaf sheaths of *Panicum curtisii* (Poaceae), 24 Feb. 1887, A.B. Langlois 1023 (**holotype** NY 00938213, **isotype** NY 00938212).

*Notes:* The slender, hyaline and symmetrical ascospores and the absence of pseudoparaphyses of *Niesslia erysiphoides* differs from *Venturia* s. str. The ascospores of *N. erysiphoides* are larger than other species of *Niesslia* reported in South America (Barr 1993).



**Fig. 65.** *Nematostoma occidentale* (lectotype NYSf 2176) sexual morph. **A.** Ascomata scattered on the host surface. **B–D.** Clavate asci. **E.** Pale brown, 3-septate ascospores. **F.** Evanescent pseudoparaphyses. **G.** Dark brown setae. Scale bars: A = 200  $\mu$ m; B–G = 10  $\mu$ m.





**Fig. 66.** *Niesslia erysiphoides* (holotype NY 00938212) sexual morph. **A.** Gregarious ascomata on the host surface. **B, D.** Subcylindrical to somewhat obclavate asci (in cotton blue). **C, E.** Hyaline, narrowly fusiform ascospores (in cotton blue). **F.** Dark brown seta. Scale bars: A = 100 µm; B–F = 10 µm.



**Fig. 67.** *Niesslia iridicola* (holotype NY 00914445) sexual morph. **A.** Ascomata scattered on the host surface. **B, C.** Broadly obclavate asci. **D.** Evanescent pseudoparaphyses. **E.** Dark brown setae. **F.** Immature asci and hyaline, 1-septate ascospores. Scale bars: A = 200  $\mu\text{m}$ ; B–F = 10  $\mu\text{m}$ .

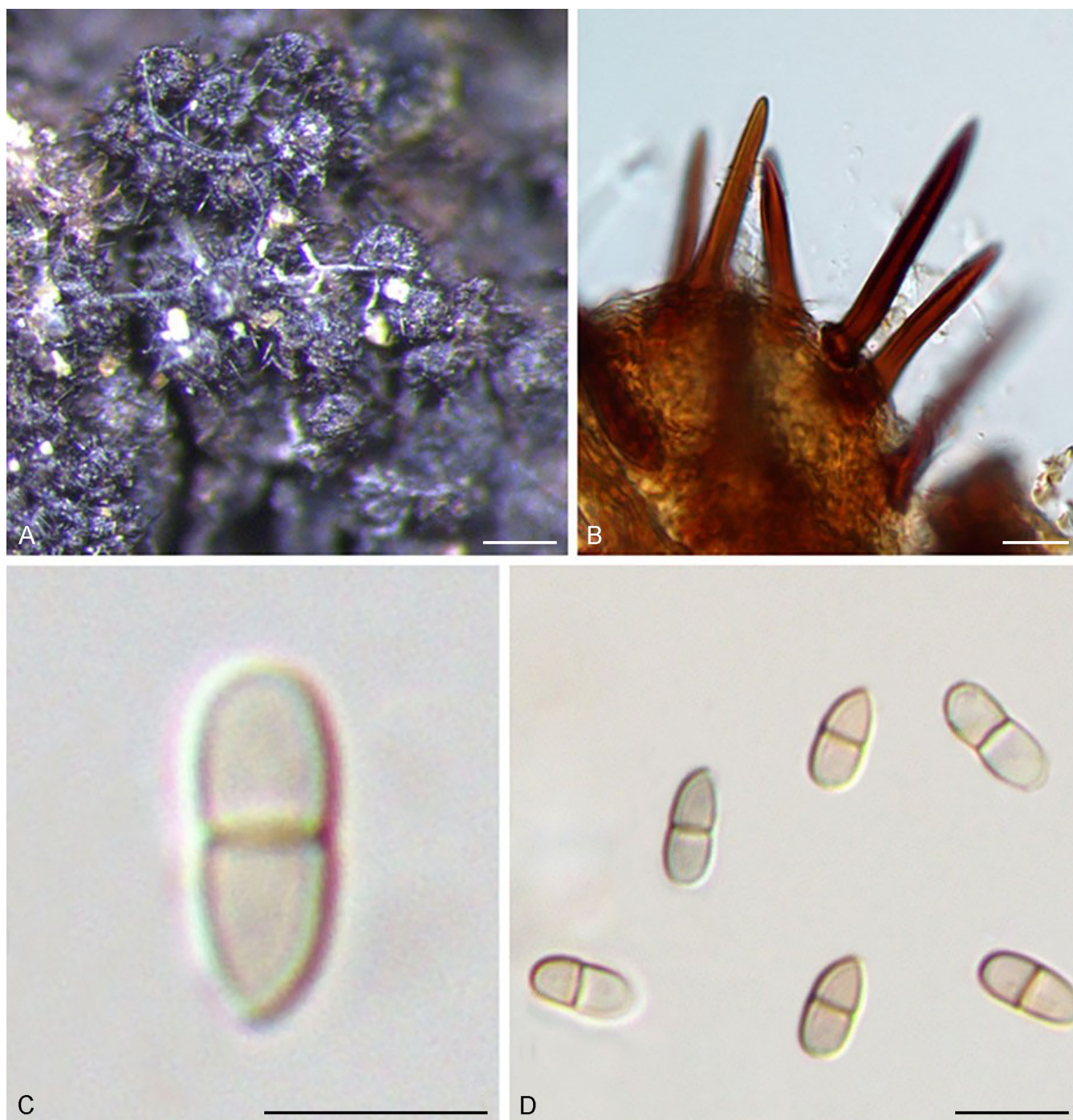


Fig. 68. *Niesslia parasitica* (holotype NY 00938219) sexual morph. **A.** Gregarious ascomata on the host surface. **B.** Dark brown setae on the surface of ascoma. **C, D.** Released, pale brown ascospores. Scale bars: A = 100  $\mu$ m; B–D = 10  $\mu$ m.

***Niesslia iridicola*** (M.E. Barr) Crous, M. Shen & Y. Zhang *ter, comb. nov.* MycoBank MB831595. Fig. 67.

*Basionym:* *Venturia iridicola* M.E. Barr, *Sydowia* 41: 27. 1989.

*Ascomata* on leaves or stems, 70–85  $\times$  71–100  $\mu$ m diam, solitary, scattered or in small groups of 2–3, initially immersed, becoming erumpent, globose to subglobose, wall black, apex erumpent, with the ostiole surrounded by setae. *Setae* dark brown, 30–44  $\times$  4–6  $\mu$ m, 0–1-septate, swollen at the base, up to 9  $\mu$ m wide. *Peridium* 1-layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 4–7  $\times$  5–10  $\mu$ m, cell wall 1  $\mu$ m thick. *Pseudoparaphyses* 2–3  $\mu$ m wide, hyaline, septate, branched, persistent. *Asci* 42–50(–67)  $\times$  10–13  $\mu$ m (av. 47.9  $\times$  11.9  $\mu$ m, n = 20), 8-spored, broadly cylindrical to

obclavate, each with an inconspicuous ocular chamber. *Ascospores* 15–18  $\times$  4–5  $\mu$ m (av. 16.9  $\times$  4.7  $\mu$ m, n = 20), narrowly fusiform, hyaline, obliquely overlapping to biseriate, 1-septate, the upper cells wider than the lower ones, smooth-walled. *Asexual morph:* unknown.

*Typus:* **Canada**, Newfoundland and Labrador, Blanc Sablon, on leaves and stems of *Iris* sp. (*Iridaceae*), 19 Jul. 1957, R.T. Wilce 158 (**holotype** NY 00914445).

*Notes:* The hyaline, symmetric ascospores, persistent pseudoparaphyses as well as its monocotyledon host disagrees with *Venturia* s. str. The ascomata of *V. iridicola* are tiny, superficial, dark brown and covered with shiny, typical

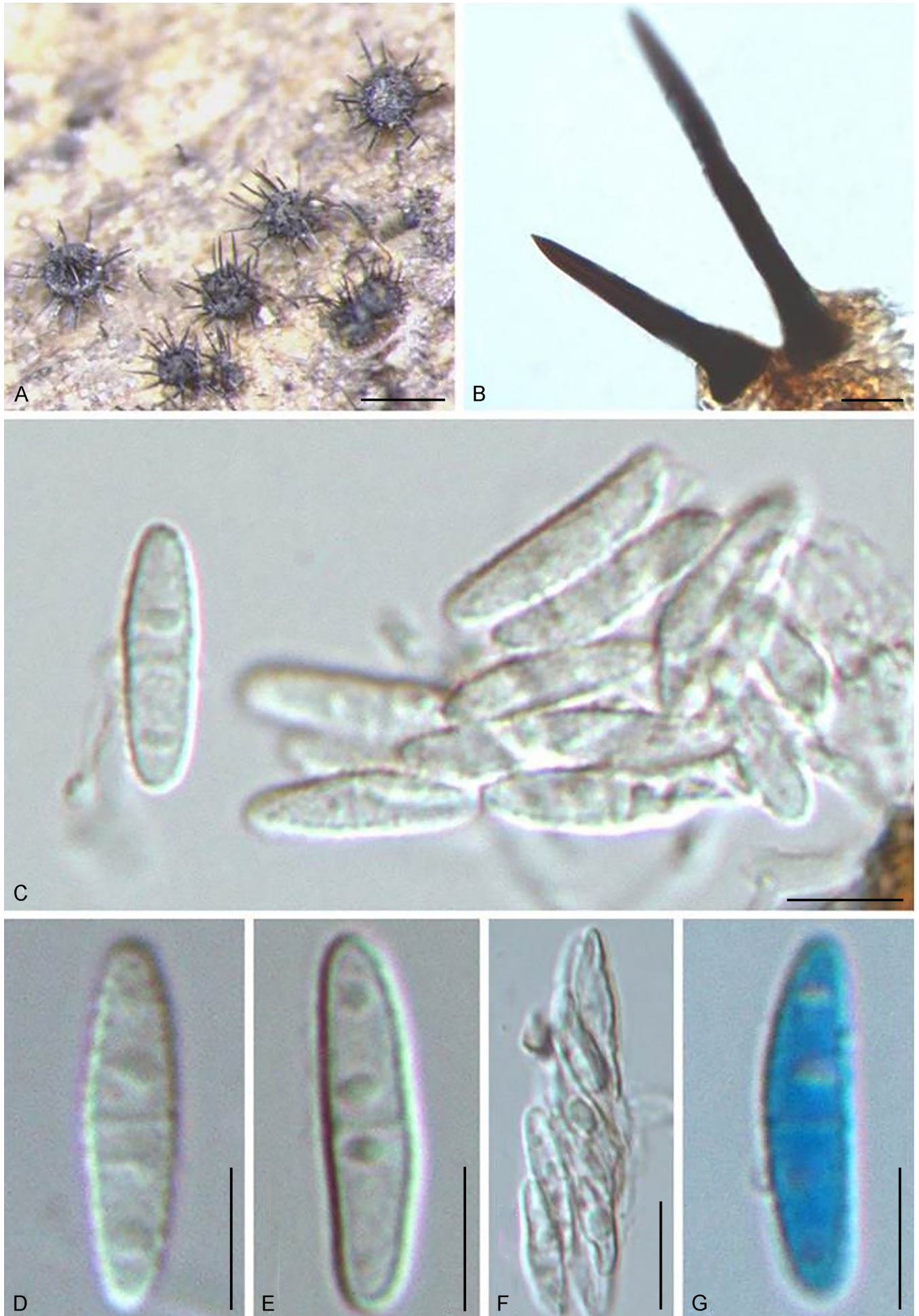


Fig. 69. *Niesslia sabalicola* (holotype NY 00938225) sexual morph. A. Ascomata scattered on the host surface. B. Dark brown setae. C–G. Released, hyaline, 1-septate ascospores (G in cotton blue). Scale bars: A = 200  $\mu$ m; B–G = 10  $\mu$ m.

spines, tending to collapse into a cup-like shape when mature and dry. The asci are broadly cylindrical to obclavate and ascospores are narrowly fusiform, hyaline, 1-septate. All these characteristics point to *Niesslia* (Gams *et al.* 2019).

***Niesslia parasitica*** (Ellis & Everh.) Crous, M. Shen & Y. Zhang *ter*, **comb. nov.** MycoBank MB831594. Fig. 68.

*Basionym:* *Venturia parasitica* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 42: 233. 1890.

*Ascomata* on bark surface, 90–100 µm diam, gregarious, globose to subglobose, with an ostiole, surrounded with setae. *Setae* dark brown, 30–44 × 4–5 µm, setae wall 1–1.5 µm thick, aseptate, base swollen. *Pseudoparaphyses* not observed. *Asci* 30 × 5 µm (Ellis & Everhart 1890), 8-spored, oblong to cylindrical. *Ascospores* 6–8 × 2–3 µm (av. 7.3 × 2.7 µm, n = 20), fusiform to broadly fusiform, pale brown, 1-septate, constricted at median septum. *Asexual morph:* unknown.

*Typus:* USA, Louisiana, near San Martinsville, on the bark of *Magnolia* sp. (*Magnoliaceae*), 21 Jan. 1889, A.B. Langlois 1781 (**holotype** NY 00938219).

*Notes:* The gregarious ascomata and the absence of pseudoparaphyses disagree with *Venturia* s. str. Because of the poor quality of the specimen, no asci were observed, the description of which was taken from Ellis & Everhart (1890). The tiny, superficial, dark brown ascomata covered with shiny and typical spines, that tend to collapse into a cup-like shape when dry point to *Niesslia* (Gams *et al.* 2019). Gams *et al.* (2019) treated *Venturia parasitica* as synonym of *Niesslia pulchriseta*, while the broader ascospores with constricted septa of *Venturia parasitica* are readily distinguished from those of *Niesslia pulchriseta*.

***Niesslia sabalicola*** (Ellis & Everh.) W. Gams, Mycol. Progr. 18(1-2): 62. 2019. Fig. 69.

*Basionym:* *Venturia sabalicola* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 42: 233. 1890.

*Ascomata* epiphyllous, 125–141 µm diam, scattered or subgregarious, erumpent to superficial, globose to subglobose, collapsing into a cup-like shape when dry, surrounded with setae. *Setae* dark brown, 50–90 × 6–8 µm, aseptate. *Pseudoparaphyses* not observed. *Asci* 38–56 × 9–11 µm (av. 45.1 × 9.4 µm, n = 20), 8-spored, oblong to broadly clavate. *Ascospores* 10–15 × 2.5–3 µm (av. 12.6 × 2.9 µm, n = 20), narrowly fusiform, hyaline, 1-septate, with a median septum, slightly constricted or not at the septum, smooth-walled. *Asexual morph* unknown.

*Typus:* USA, Louisiana, Bayou Chene, on dead leaves of *Sabal palmetto* (*Arecaceae*), 25 Oct. 1888, A.B. Langlois 1546 (**holotype** NY 00938203).

*Notes:* The symmetrical, 1-septate, hyaline ascospores, and absence of pseudoparaphyses of *V. sabalicola* disagree with *Venturia* s. str. The tiny, superficial, dark brown ascomata covered with shiny spines, and the ascomata that tend to collapse into a cup-like shape when dry, as well as the oblong to broadly clavate asci and narrowly fusiform, hyaline, 1-septate ascospores are reminiscent of *Niesslia* (Gams *et al.* 2019). Because of the poor quality of the specimen, most information was adapted from Ellis & Everhart (1890).

***Niesslia vaccinii*** (Ellis & Everh.) Crous, M. Shen & Y. Zhang *ter*, **comb. nov.** MycoBank MB831593. Fig. 70.

*Basionym:* *Venturia vaccinii* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 46: 325. 1894.

*Ascomata* hypophyllous, 60–115 µm diam, solitary, scattered, rarely in small groups, erumpent to superficial, globose to subglobose, collapse into a cup-like shape when dry, wall black, surrounded with setae. *Setae* dark brown, 37–65 × 5–7 µm, setae wall 1–2 µm thick, base swollen, aseptate. *Pseudoparaphyses* not observed. *Asci* 30–37 × 6–7 µm (av. 34.1 × 6.3 µm, n = 20), 8-spored, fusiform. *Ascospores* 10–12.7 × 2–2.5 µm (av. 11.3 × 2.1 µm, n = 20), narrowly fusiform, hyaline, bi- to triseriate, 1-septate, symmetrical, slightly constricted at the septum, smooth-walled. *Asexual morph* unknown.

*Typus:* USA, Washington, Seattle, on dead leaves of *Vaccinium ovatum* (*Ericaceae*), 16 Dec. 1893, C.V. Piper No. 225 (**holotype** NY 00938227).

*Notes:* The tiny, superficial, dark brown ascomata covered with shiny spines, which tend to collapse into a cup-like shape when dry, as well as the fusiform asci and hyaline, 1-septate, symmetric narrowly fusiform ascospores point to *Niesslia* (Gams *et al.* 2019). Gams *et al.* (2019) assigned *Venturia vaccinii* to synonymy with *Niesslia exilis*. However, the larger-sized asci and ascospores of *Venturia vaccinii* could be readily distinguished from those of *Niesslia exilis* (30–37 × 6–7 µm vs. 40–50 × 4–5 µm and 10–12.7 × 2–2.5 µm vs. (6–) 7–8.5(–11) × 1.5–2.0 µm).

***Phomatosporopsis sphaerelloidea*** (Höhn.) Petr., Ann. Mycol. 25: 249. 1927. Fig. 71.

*Basionym:* *Venturia sphaerelloidea* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Na. Cl., Abt. 1. 118: 1203. 1909.

*Ascomata* hypophyllous, 60–130 µm diam, solitary or scattered, becoming semi-immersed, globose to subglobose, wall black, with a conspicuously papillate ostiole. *Setae* not observed. *Peridium* thin, 1-layered, composed of 1–2 rows of pigmented cells of *textura angularis*, cells 5–12 × 5–11 µm, cell wall 1 µm thick. *Pseudoparaphyses* rare, 2–3 µm wide, hyaline, septate. *Asci* 30–36 × 8–10 µm (av. 32.8 × 9 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly clavate or somewhat obclavate. *Ascospores* 8–12 × 3–5 µm (av. 10.4 × 3.2 µm, n = 20), fusiform, hyaline, obliquely biserial, 1-septate, with a median septum, slightly constricted at the septum, the upper cells longer and wider than the lower ones (length ratio: 1:1–3:2), smooth-walled. *Asexual morph* unknown.

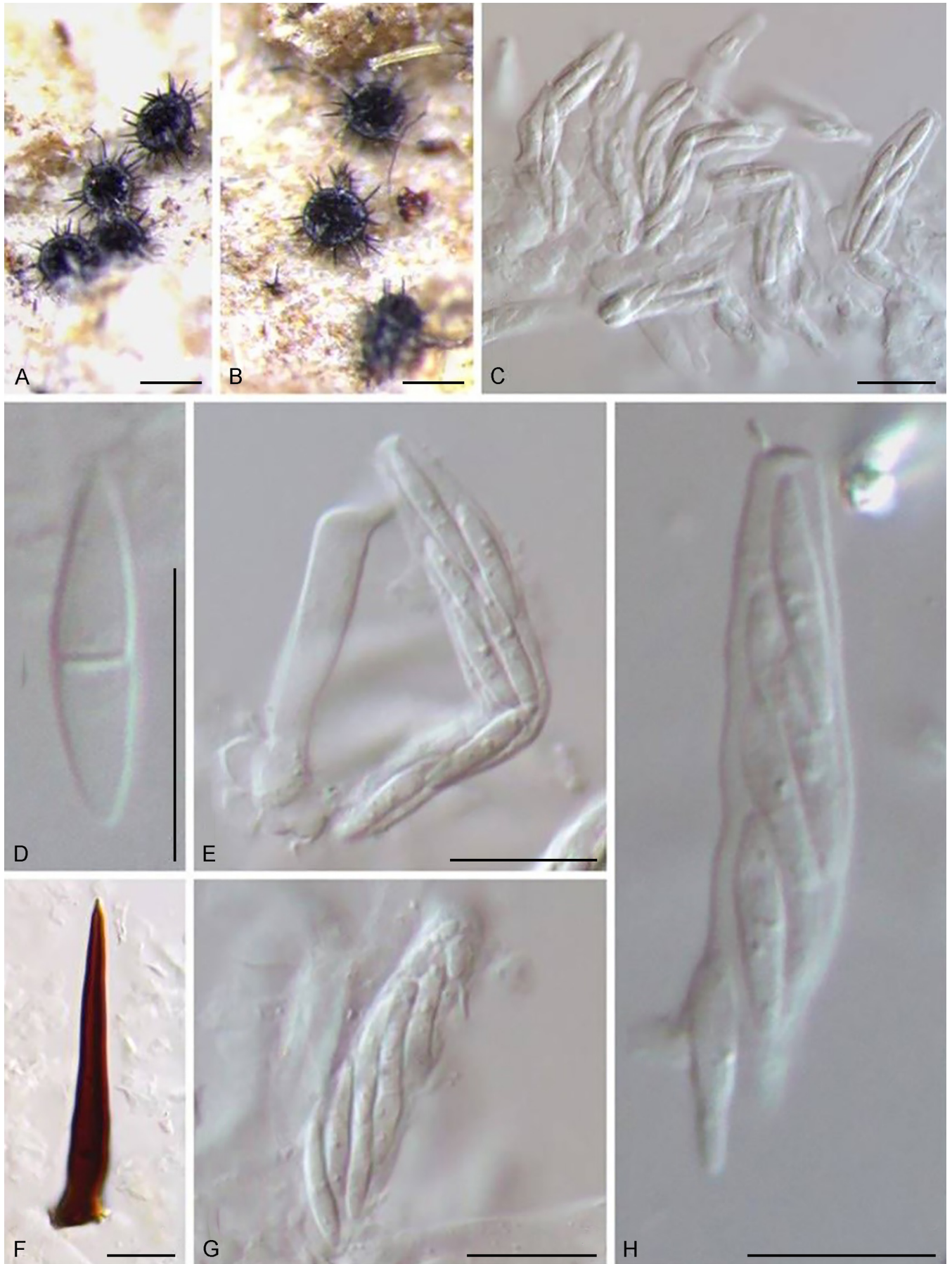
*Typus:* Austria, Niederösterreich, on branches of *Impatiens nolitangere* (*Balsaminaceae*), 12 Jul. 1908, P. Strasser (**holotype** W 0553).

*Notes:* The ascomata lack setae and the ascospores are hyaline, which differ from *Venturia* s. str., and are reminiscent of *Mycosphaerellaceae*.

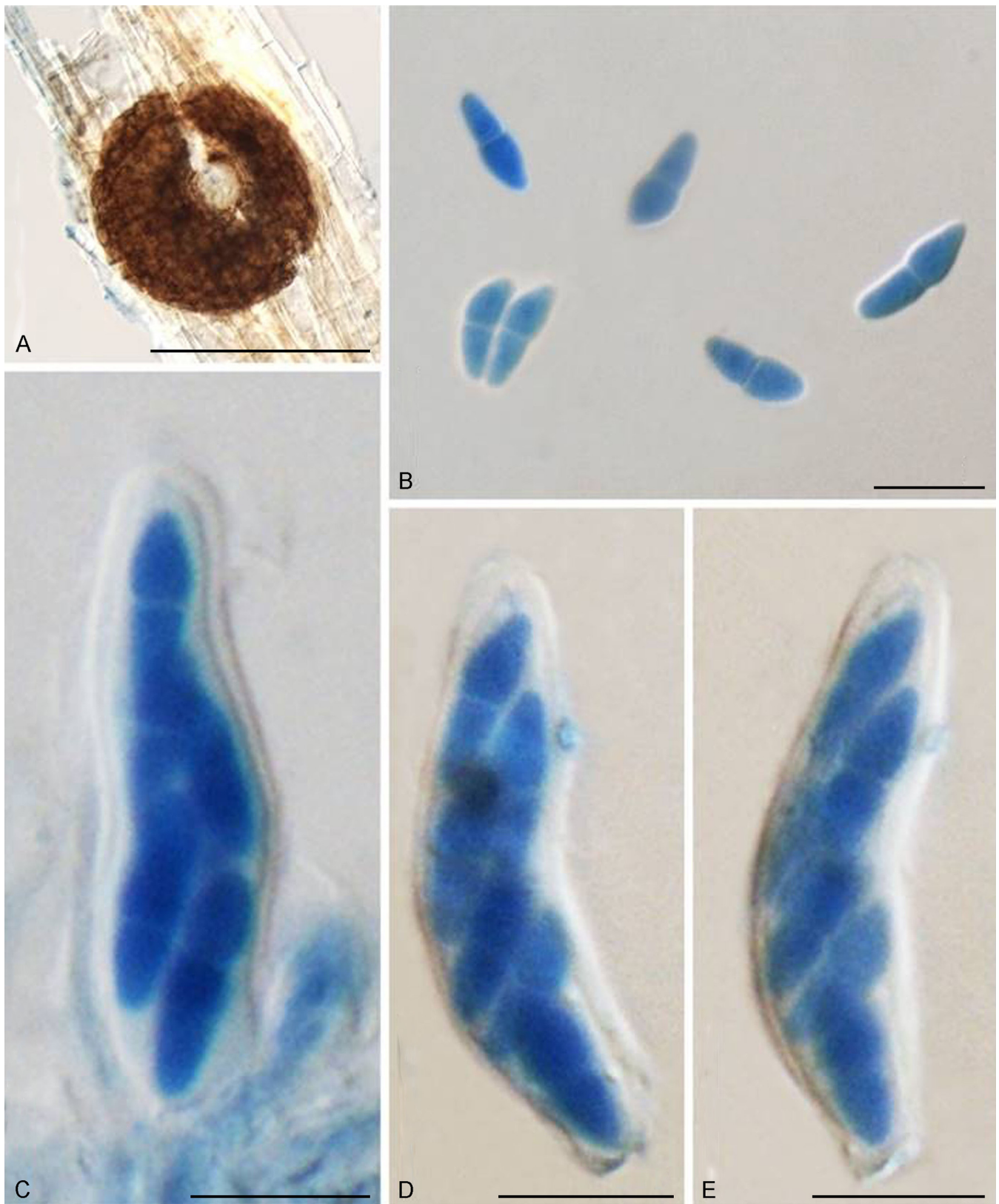
***Pyrenobotrys compacta*** (Peck) B. Erikss., Svensk Bot. Tidskr. 68: 224. 1974. Fig. 72.

*Basionym:* *Venturia compacta* Peck, Annual Rep. New York St. Mus. Nat. Hist. 25: 106. 1873 [1872].

*Ascomata* hypophyllous, 143–200 µm diam, gregarious, superficial, globose to subglobose, wall black, with short, spiny, dark brown setae, setae 19–35 × 6–7 µm, wall 1–2.5 µm



**Fig. 70.** *Niesslia vaccinii* (holotype NY 00938227) sexual morph. **A, B.** Ascomata scattered on the host surface. **C, E, G, H.** Lanceolate asci. **D.** Hyaline, fusiform ascospore. **F.** Dark brown seta. Scale bars: **A, B** = 200  $\mu$ m; **C–H** = 10  $\mu$ m.



**Fig. 71.** *Phomatosporopsis sphaerelloidea* (type W 0553) sexual morph. **A.** Ascus on host surface. **B.** Released, hyaline, 1-septate ascospores (in cotton blue). **C–E.** Broadly clavate to somewhat obclavate asci (in cotton blue). Scale bars: A = 100 µm; B–E = 10 µm.

thick. *Peridium* 50 µm wide, 1-layered, composed of several rows of pigmented cells of *textura angularis*. *Pseudoparaphyses* 2–4 µm wide, hyaline, septate. *Asci* 59–66 × 10–11 µm (av. 62.6 × 8.8 µm, n = 10), 8-spored,

bitunicate, fissitunicate, cylindrical to clavate, each with an inconspicuous ocular chamber. *Ascospores* 14–20 × 4–6 µm (av. 16.5 × 5.3 µm, n = 20), broadly cylindrical, hyaline to pale brown, with broadly rounded ends, overlapping to biseriate





near the base, 1-septate, with the septum in the upper third, slightly constricted at the septum, the upper cells shorter and wider than the lower ones (length ratio: 1:3–2:3), smooth-walled. *Asexual morph* unknown.

*Typus:* **USA**, New York, Rensselaer, Sandlake, on fallen leaves of *Vaccinium macrocarpum* (*Ericaceae*), Jun. 1871, C.H. Peck (**holotype** NYSf 826).

*Note:* The large-sized, gregarious ascomata, cylindrical asci and broadly cylindrical ascospores disagree with *Venturia s. str.*

***Venturia clintonii*** Peck, Annual Rep. New York St. Mus. Nat. Hist. 28: 82. 1876. Fig. 73.

*Ascomata* hypophyllous, 100–170 µm diam, scattered, or solitary, erumpent to nearly superficial, globose to subglobose, wall black, with a conspicuous papillate ostiole, surrounded by setae. *Setae* dark brown, 60–115 × 6–7 µm, wall 1–1.5 µm thick, base swollen, up to 8–12 µm, septate. *Peridium* 10–23 µm wide, 1-layered, composed of 2–3 rows of pigmented cells of *textura angularis*, cells 7–113 × 6–11 µm, cell wall 0.5–1 µm thick. *Pseudoparaphyses* rare, evanescent when mature. *Asci* 68–87 × 6–8 µm (av. 75.9 × 6.9 µm, n = 20), 8-spored, bitunicate, fissitunicate, narrowly cylindrical, with a short, furcate pedicel, each with an inconspicuous ocular chamber. *Ascospores* 10–11 × 4–5 µm (av. 10.4 × 4.8 µm, n = 20), broadly clavate, olivaceous brown, with narrowly rounded ends, obliquely uniseriate, 1-septate, apiosporous, septum in the lower third, the upper cells much longer and wider than the lower ones (length ratio: 7:4–8:3), smooth-walled.

*Typus:* **USA**, New York, Lake Erie, on fallen leaves of *Cornus circinata* (*Cornaceae*), May 1874, G.W. Clinton (**holotype** NYSf794).

*Note:* The numerous, cylindrical asci of *Venturia clintonii* have furcate pedicels, which disagree with *Venturia s. str.* Its phylogenetic position remains unclear (no molecular data).

***Venturia musae*** Sawada, Special Publ. Coll. Agric., Natl. Taiwan Univ. 8: 73. 1959. *Nom. inval.*, Art. 39.1 (Shenzhen). Fig. 74.

*Leaf spots* 2–8 mm diam, scattered, diamond, grey or sometimes pale grey in the medium, margin dark brown. *Ascomata* 35–40 µm diam, 28–41 µm high, scattered or solitary, initially immersed to erumpent, becoming superficial, globose to subglobose, wall black, with a conspicuously papillate ostiole, ostiole 10–12 µm diam, surrounded with setae. *Setae* dark brown, up to 20 µm long, setae wall 1 µm thick, 1(–2)-septate. *Peridium* 1-layered, composed of (1–)2–3 rows of pigmented cells of *textura angularis*, cells 4–6 µm wide, cell wall 0.8–1 µm thick. *Pseudoparaphyses* not observed. *Asci* 13–19 × 7–8 µm (av. 15.6 × 7.4), 8-spored, bitunicate, fissitunicate, obovoid, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 8–10 × 3–3.5 µm (av. 9.4 × 3.4), ellipsoid, hyaline to pale brown, irregularly triseriate or more, medianly 1-septate. *Asexual morph* unknown.

*Typus:* **China**, Taipei Wooden Gate, on the leaves of *Musa cavendishii* (*Musaceae*), 25 Apr. 1916, Saburo Fuji (**type** PPMH).

*Note:* The small ascomata, symmetrical ascospores and the complete absence of pseudoparaphyses of *V. musae* disagree with *Venturia s. str.*

***Venturia nebulosa*** Ellis & Everh., J. Mycol. 8: 66. 1902. Fig. 75.

*Ascomata* epiphyllous, 70–115 µm diam, gregarious or solitary, becoming superficial, subglobose, wall black, with a conspicuously papillate ostiole, surrounded with setae. *Setae* dark brown, 30–40 × 4–5 µm, setae wall 1–1.2 µm thick, base swollen, septate. *Peridium* 1-layered, composed of one row of pigmented cells of *textura angularis*, cells 4–8 µm diam, cell wall 1 µm thick. *Pseudoparaphyses* 1.5–3 µm wide, hyaline, branched, septate, persistent. *Asci* 30–50 × 13–15 µm (av. 39.5 × 14.2 µm, n = 10), 8-spored, bitunicate, fissitunicate, narrowly oblong, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. *Ascospores* 15–18 × 5–6 µm (av. 16.2 × 5.7 µm, n = 20), fusiform to narrowly fusiform, hyaline, overlapping to triseriate, constricted at the median septum, the upper cells wider than the lower ones, smooth-walled. *Asexual morph* unknown.

*Typus:* **USA**, Alabama, on overwintered leaves of *Eragrostis* sp. (*Gramineae*), Nov. 1901, G.W. Carver 613 (**holotype** NY 00938216).

*Note:* The narrowly oblong asci, persistent pseudoparaphyses and the hyaline ascospores of *Venturia nebulosa* disagree with *Venturia s. str.*, while point to *Lasioslemma*. Its taxonomic status cannot be determined yet.

***Venturia pezizoidea*** Sacc. & Ellis, *Michelia* 2: 567. 1882. Fig. 76.

*Ascomata* hypophyllous, 60–115 µm diam, solitary or scattered, erumpent to superficial, globose to subglobose, covered with setae. *Setae* dark brown, 34–75 × 4–7 µm, setae wall 1–1.2 µm thick, base swollen, aseptate. *Peridium* thin, composed of pale to brown cells of *textura angularis*. *Pseudoparaphyses* not observed. *Asci* 32–35 × 7–8 µm (av. 32.5 × 7.3 µm, n = 20), 8-spored, broadly cylindrical to clavate. *Ascospores* 8–10 × 1.5–2 µm (av. 9.3 × 1.7 µm, n = 20), subcylindrical, hyaline, obliquely uniseriate, aseptate. *Asexual morph* unknown.

*Typus:* **USA**, New Jersey, Newfield, on fallen leaves of *Andromeda racemosa* (*Ericaceae*) (**syntypes** NY 00938220, 00938221, 00938222, 00938223, 00938224; MICH 15151).

*Note:* The hyaline, aseptate ascospores of *Venturia pezizoidea* are readily distinguishable from *Venturia s. str.* Its taxonomic status cannot be determined yet.

***Venturia pruni*** M.E. Barr, *Canad. J. Bot.* 46: 816. 1968. Fig. 77.

*Ascomata* epiphyllous, 55–75 µm diam, gregarious, scattered, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuously papillate ostiole. *Setae* not observed. *Peridium* 4–6 µm wide, 1-layered, composed of pigmented cells of *textura angularis*, cells up to 6 µm wide, cell wall

**Fig. 72.** *Pyrenobotrys compacta* (holotype NYSf 826) sexual morph. **A, B.** Gregarious ascomata on the host surface. **C.** Section of an ascoma. **D.** Squash mount with a large number of asci. **E.** Released, hyaline to pale brown, asymmetrical ascospores. **F.** Evanescent pseudoparaphyses (in cotton blue). **G.** Dark brown setae. Scale bars: B = 200 µm; C = 50 µm; D–G = 10 µm.

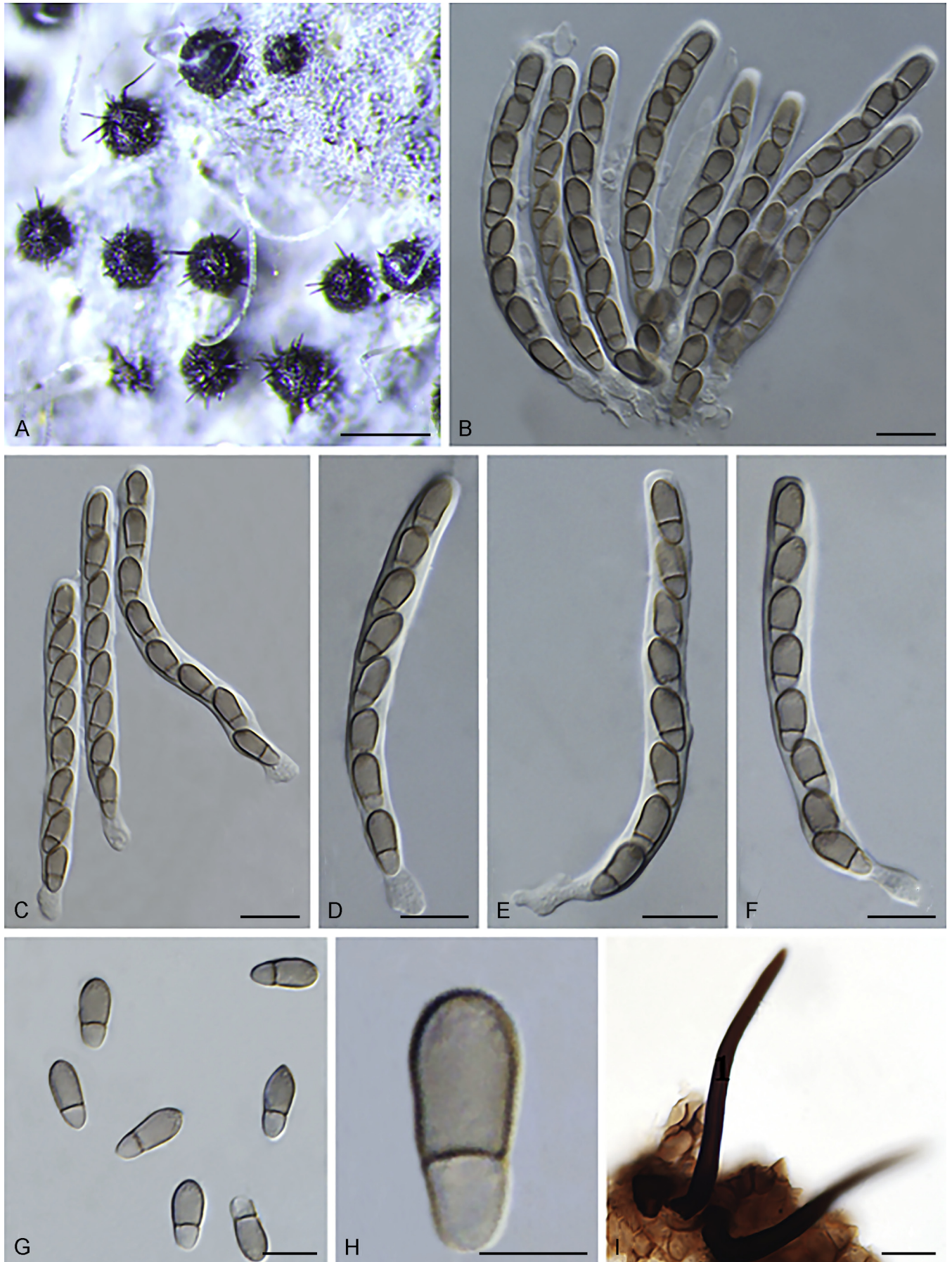


Fig. 73. *Venturia clintonii* (holotype NYSf794) sexual morph. A. Ascomata scattered on the host surface. B–F. Narrowly cylindrical asci with short pedicels. G, H. Olivaceous brown, asymmetrical ascospores. I. Dark brown setae. Scale bars: A = 200  $\mu$ m; B–I = 10  $\mu$ m.

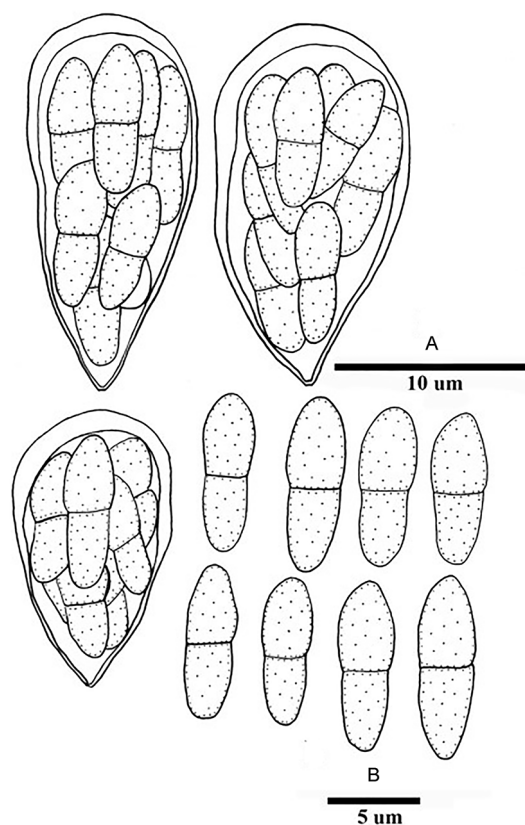


Fig. 74. *Venturia musae* (based on the type PPMH) sexual morph. A. Obovoid asci. B. Hyaline to pale brown ascospores. Scale bars: A = 10 µm; B = 5 µm.

0.8–1.2 µm thick. *Pseudoparaphyses* not observed. Asci 25–41 × 7–9 µm (av. 32 × 8.2 µm, n = 20), 8-spored, bitunicate, fissitunicate, broadly cylindrical, broadly clavate or somewhat obclavate, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. Ascospores 10.5–12 × 3–4 µm (av. 11.3 × 3.4 µm, n = 20), fusiform to narrowly fusiform, olivaceous brown, obliquely uniseriate to biseriate near the base, 1-septate, with a slightly constricted median septum, the upper cells somewhat shorter than the lower ones (length ratio: 5:6–1:1), smooth-walled. *Asexual morph* unknown. *Asexual morph* unknown.

*Typus*: **Canada**, Quebec, on leaves of *Prunus pennsylvanica* (*Rosaceae*), 6 Jul. 1957, M.E. Barr & H.E. Bigelow (**holotype** NY 00914448, **isotype** NY 00914449).

*Note*: The gregarious, immersed ascomata as well as the absence of pseudoparaphyses of *V. pruni* disagree with *Venturia* s. str.

***Venturia pulchella*** Cooke & Peck, in Peck, Annual Rep. New York St. Mus. Nat. Hist. 25: 106. 1873 [1872]. Fig. 78.

*Synonym*: *Gibbera pulchella* (Cooke & Peck) Petr., Sydowia 1: 200. 1947.

*Ascomata* epiphyllous, 100–180 µm diam, 100–140 µm high, gregarious, scattered or solitary, superficial, globose to subglobose, wall black, rough, covered with setae. Setae dark brown, 31–61 × 6–9 µm, base swollen, up to 10–15 µm, setae wall 1.2–1.8 µm. *Peridium* 18–24 µm wide, thicker near the apex

(38–45 µm wide), 2-layered, outer wall composed of thickened cells of *textura angularis*, cells 6–13 µm diam, cell wall 1–3 µm thick; inner wall composed of thin-walled *textura angularis*. *Pseudoparaphyses* dense, 2–4 µm wide, hyaline, septate, constricted at the septum, apex swollen. Asci 60–93 × 8–13 µm (av. 76.5 × 10 µm, n = 20), 8-spored, bitunicate, fissitunicate, cylindrical to somewhat obclavate. Ascospores 11–14 × 4–5 µm (av. 13 × 6 µm, n = 20), ellipsoid, pale brown, obliquely uniseriate or partly overlapping to biseriate near the base, 1-septate, slightly constricted at the septum, with broadly rounded ends, the upper cells shorter than the lower ones (length ratio: 9:17–3:4), smooth-walled. *Asexual morph* unknown.

*Typus*: **USA**, New York, Albany, Center, C.H. Peck (**isotype** NYSf2478).

*Additional materials examined*: **Canada**, Lake Ontario, on leaves of *Chamaedaphne calyculata* (*Ericaceae*), 3 Jul. 1935, J.W. Groves (HMAS 03160). **USA**, New Hampshire, on leaves of *C. calyculata*, 18 May 1908, W.G. Farlow (HMAS 43696).

*Note*: The superficial ascomata, dense paraphysoids with swollen pigmented tips that are closely agglutinated, forming a heavy epithecium above the asci, point to *Patellariaceae* (*Patellariales*).

***Venturia rhois*** Sawada, Special Publ. Coll. Agric., Natl. Taiwan Univ. 8: 73. 1959. *Nom. inval.*, Art. 39.1 (Shenzhen). Fig. 79.

*Ascomata* amphigenous, 60–80 µm diam, solitary or scattered, initially immersed, becoming erumpent, globose to subglobose, wall black, with a conspicuous papillate ostiole. Setae not observed. *Peridium* 1-layered, composed of (1–)2–3 rows of pigmented cells of *textura angularis*, cells 8–12 µm diam, cell wall 0.8–1.5 µm thick. *Pseudoparaphyses* not observed. Asci 29–66 × 7–10 µm (av. 42.2 × 8.4 µm, n = 20), 8-spored, bitunicate, fissitunicate, cylindrical, with a short, knob-like pedicel or pedicel lacking, each with an inconspicuous ocular chamber. Ascospores 11–17 × 2.5–4 µm (av. 13.5 × 2.8 µm, n = 20), cylindrical, hyaline, obliquely uniseriate or partly overlapping to biseriate, 1-septate, with narrowly rounded ends, the upper cells slightly wider than the lower ones, smooth-walled. *Asexual morph* unknown.

*Typus*: **China**, Taichung City, on overwintered leaves of *Rhus javanicus* (*Anacardiaceae*), 23 Aug. 1944, K. Sawada (**holotype** HMAS 11670).

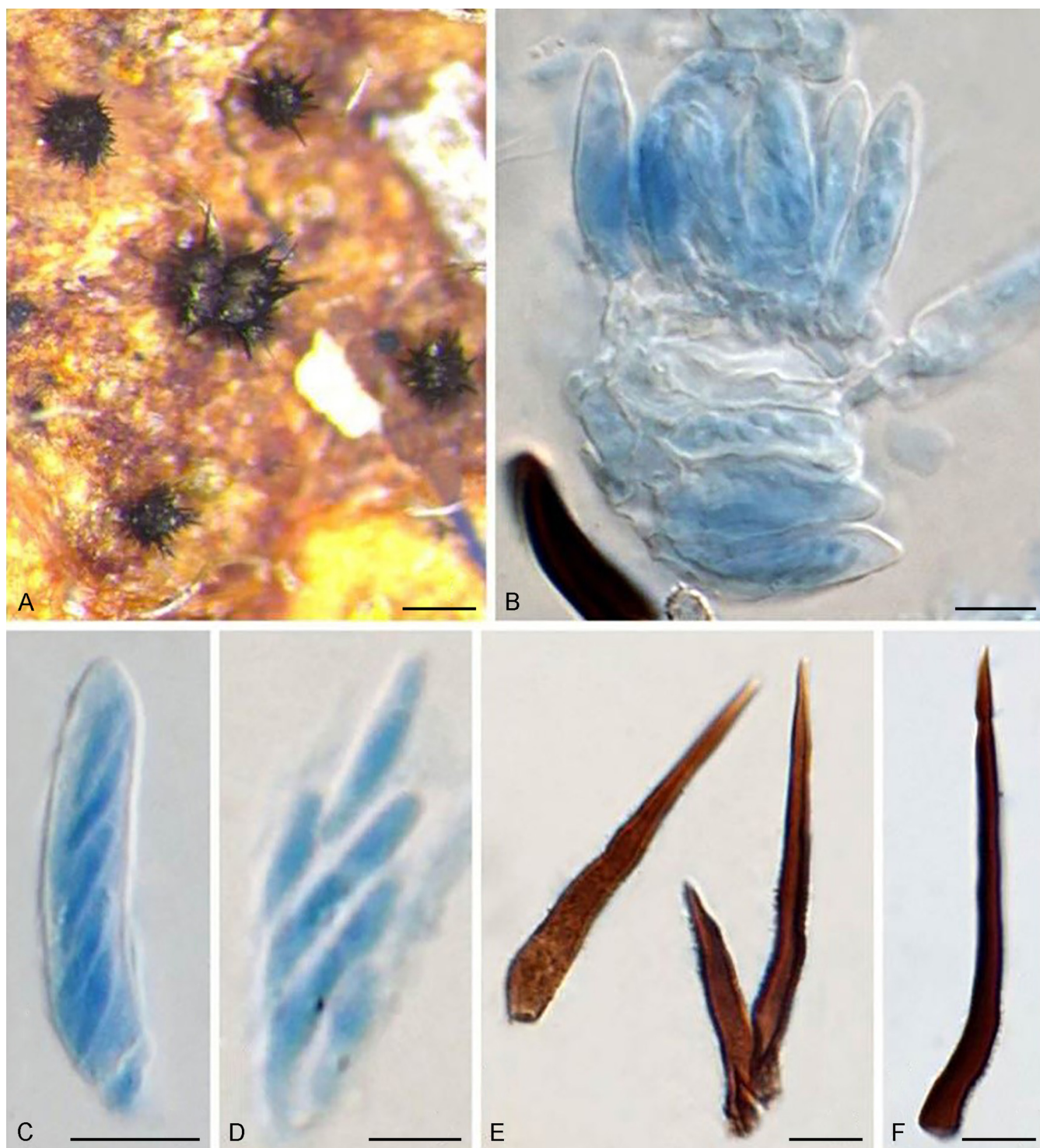
*Notes*: *Venturia rhois* was described by Sawada (1959) without a Latin diagnosis, rendering it invalid. Its hyaline, 1-septate ascospores and absence of paraphyses point to *Mycosphaerellaceae*.

## DISCUSSION

A total of 30 genera are treated in the *Venturiales*, of which eight are newly described. For 19 of these genera, the phylogenetic status has been confirmed via DNA data of the type species, i.e., *Bellamyces*, *Cylindrosymptodioides*, *Cylindrosymptodium*, *Fagicola*, *Fraxinicola*, *Neofusicladium*, *Parafusicladium*, *Fuscohilum*, *Pinaceicola*, *Pseudoanungitea*, *Scolecobasidium*, *Sterila*, *Sympodiella*, *Sympoventuria*, *Tothia*, *Tyrannosorus*, *Venturia* s. str., *Veronaeopsis* and *Verruconis*. Although more than 20 genera have previously been linked to *Venturiales* (Hyde et al. 2013,



**Fig. 75.** *Venturia nebulosa* (holotype NY 00938216) sexual morph. **A.** Ascomata scattered on the host surface. **B.** A crushed ascostroma with setae. **C.** Dark brown seta. **D, F, G.** Oblong asci (D and G in cotton blue). **E.** Section of the peridium. **H.** Hyaline, 1-septate ascospores (in cotton blue). **I.** Evanescent pseudoparaphyses (in cotton blue). Scale bars: A = 200  $\mu$ m; B = 50  $\mu$ m; C–I = 10  $\mu$ m.



**Fig. 76.** *Venturia pezizoidea* (syntype MICH 15151) sexual morph. **A.** Ascomata scattered on the host surface. **B, C.** Broadly cylindrical asci (in cotton blue). **D.** Subcylindrical, hyaline ascospores (in cotton blue). **E, F.** Dark brown setae. Scale bars: A = 100  $\mu$ m; B–F = 10  $\mu$ m.

Wijayawardene *et al.* 2014, 2017), these proposed classifications were mostly devoid of DNA data.

Based on the multilocus datasets generated in the present study, three families are now recognised within *Venturiales*, *i.e.*, *Cylindrosympodiaceae*, *Symptoventuriaceae* and *Venturiaceae*. The *Cylindrosympodiaceae* includes the genera *Cylindrosyndium*, *Pseudoanungitea*, *Septonema*, *Sympodiella* and *Tothia*. Morphologically, the hyphomycetous asexual morph, sympodial conidiogenesis, solitary as well as concatenate, subcylindrical, ampulliform to fusoid-ellipsoid conidia point to

*Venturiales*. Although the lifestyles of only a few members of *Cylindrosympodiaceae* were clarified, where known, they are saprophytic (Fig. 1). The host range of genera of *Cylindrosympodiaceae* is rather wide, with *Sympodiella* occurring on members of *Pinus* (*Pinaceae*), *Betula* (*Betulaceae*) or *Fagus* (*Fagaceae*), and *Cylindrosyndium* on *Laurus* (*Lauraceae*) or *Pinus* (*Pinaceae*). Geographically, almost all of the known species of *Cylindrosympodiaceae* are from Europe, which could be due to limited sampling on other continents.

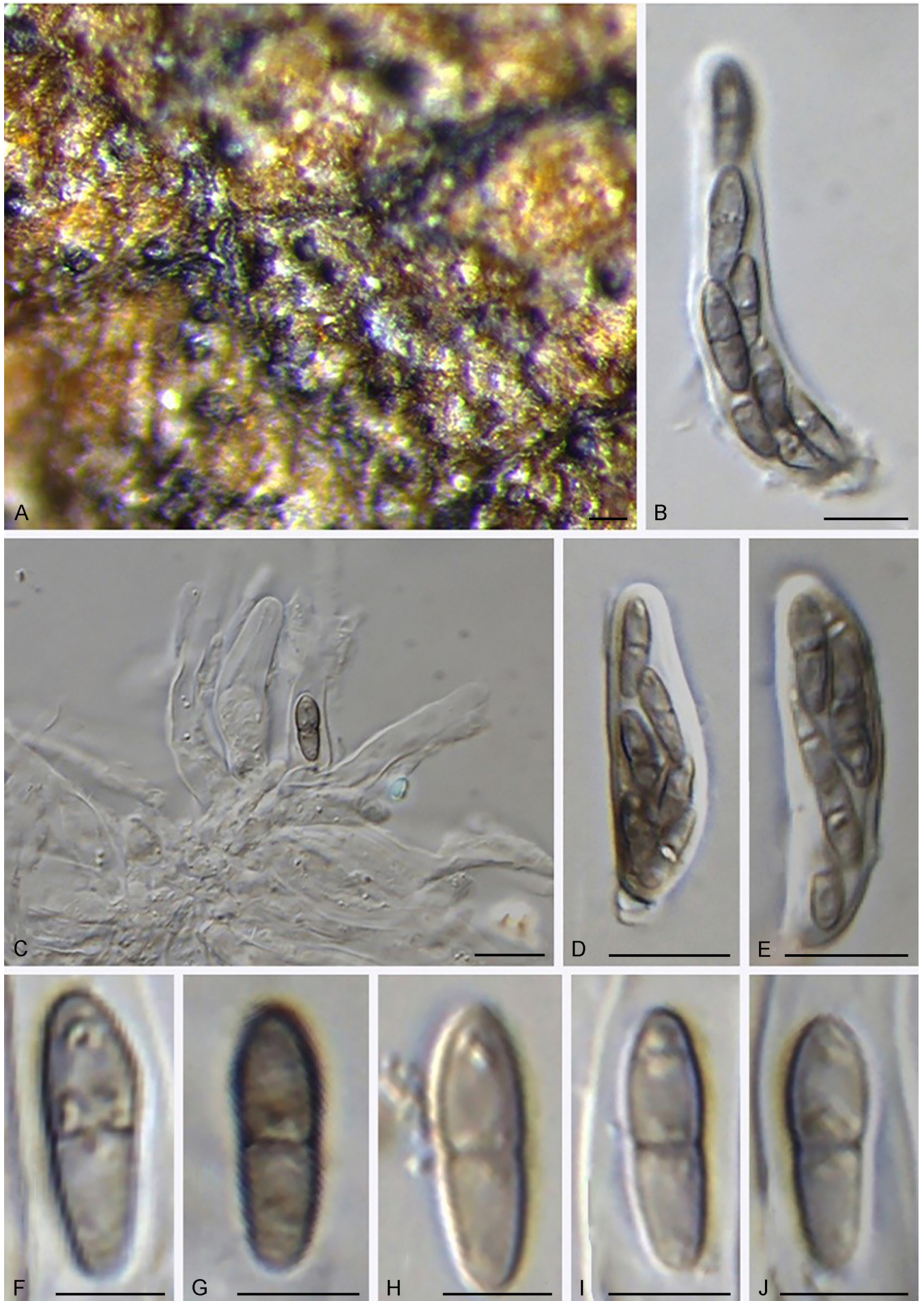


Fig. 77. *Venturia pruni* (holotype NY 00914448) sexual morph. A. Ascomata densely scattered on the host surface. B, D, E. Broadly cylindrical to somewhat obclavate asci. C. Squash mount with several immature asci. F–J. Olivaceous to medium olivaceous, 1-septate ascospores. Scale bars: A = 100 µm; B–J = 10 µm.



**Fig. 78.** *Venturia pulchella* (HMAS 43696) sexual morph. **A.** Ascomata densely scattered on the host surface. **B.** Section of an ascoma, the peridium of which comprises a few layers of *textura angularis*. **C, D.** Evanescent pseudoparaphyses. **E–G.** Broadly cylindrical to somewhat obclavate asci. **H.** Seta. **I–M.** Pale brown to olivaceous brown, 1-septate, asymmetrical ascospores. Scale bars: A = 200  $\mu$ m; B = 20  $\mu$ m; C–H = 10  $\mu$ m; I applies to I–M = 10  $\mu$ m.

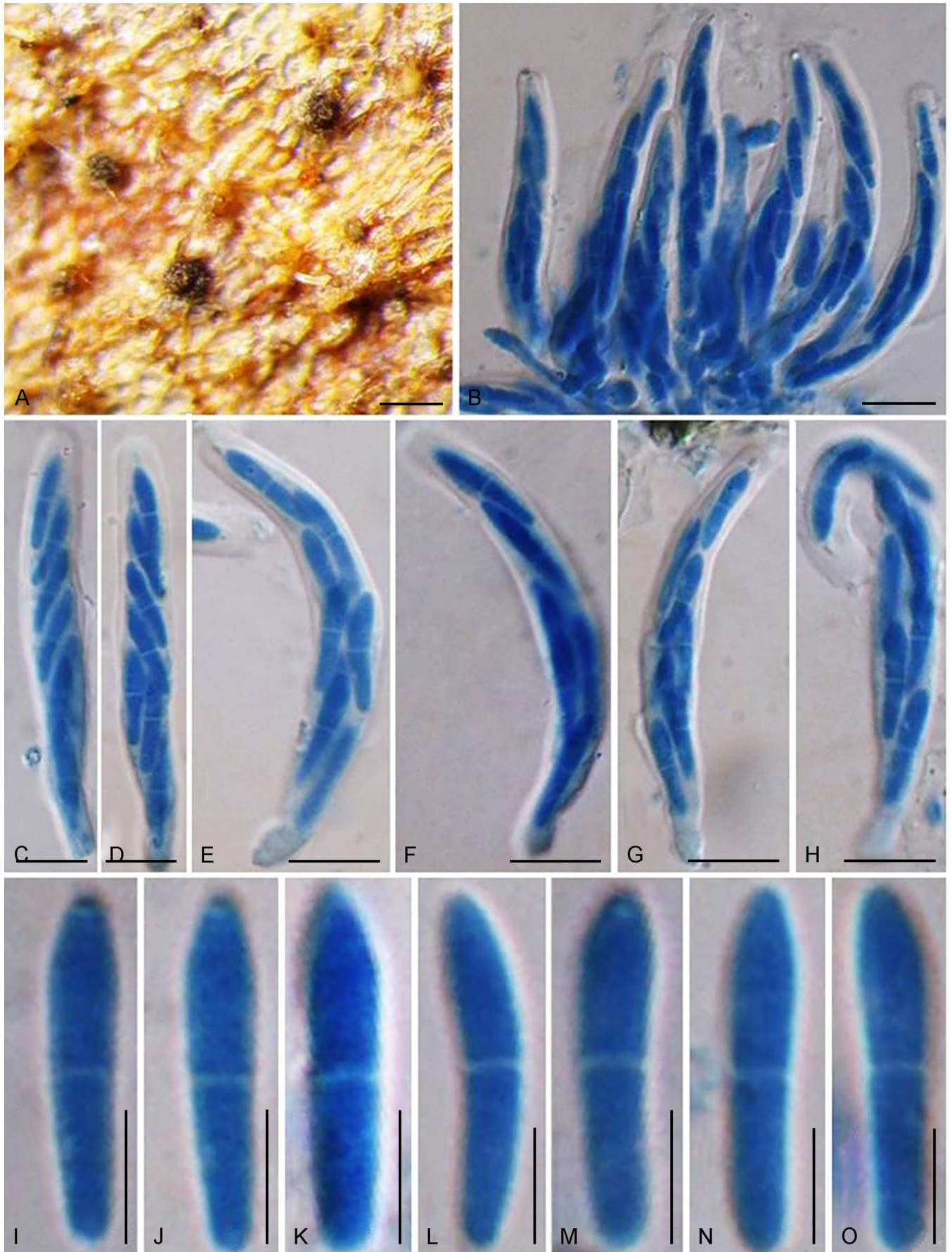


Fig. 79. *Venturia rhois* (type HMAS 11670) sexual morph. A. Ascomata scattered on the host surface. B–H. Cylindrical to subclavate asci (in cotton blue). I–O. Hyaline, 1-septate ascospores (in cotton blue). Scale bars: A = 100  $\mu$ m; B–H = 10  $\mu$ m; I–O = 5  $\mu$ m.



The *Venturiaceae* is the largest family within *Venturiales*, comprising 11 genera, of which two, *Fraxinicola* and *Fagicola*, are newly described. *Venturia*, the largest genus within the *Venturiaceae*, had a rather confused history. *Venturia* De Not. was introduced to accommodate *V. rosea* and *V. dianthi* (De Notaris 1844). Subsequently, Cesati & De Notaris (1863) described two additional species, i.e., *V. dickiei* and *V. eres*. Saccardo (1882) emended the description of *Venturia* De Not., excluded both *V. rosea* and *V. dianthi*, while accepting *V. dickiei* and *V. eres*. *Venturia* Sacc. was widely accepted, and was neotypified by *V. inaequalis* (Korf 1956, Sivanesan 1977). The circumscription of *Venturia* had been modified several times (Saccardo 1883, Sydow 1932, Korf 1956, Müller & Menon 1956, Sivanesan 1977). Based on morphology, ecological characteristics and DNA sequence comparisons, Zhang *et al.* (2011) proposed a narrower concept for *Venturia*, comprising plant parasitic species closely related to the generic type, *V. inaequalis*. By comparing morphological characteristics and related DNA sequence data, *Venturia* was re-defined as follows: 1) *ascomata* immersed, semi-immersed or superficial, scattered or gregarious, often papillate and ostiolate with setae (except for members with immersed *ascomata*); 2) *hamathecium* narrowly cellular, hyaline, evanescent in mature *ascomata*; 3) *asci* 8-spored, bitunicate, fissitunicate, broadly cylindrical to obclavate, usually lacking a pedicel; 4) *ascospores* pale olivaceous to brown, 1-septate, usually asymmetrical (Zhang *et al.* 2016a, b). This generic circumscription of *Venturia* was followed in the present study. Of the 59 specimens of species loaned from herbaria, 37 (59 %) were accepted within *Venturia*, while other species were reallocated to *Gibbera*, *Niesslia*, or the *Mycosphaerellaceae*.

The *Sympoventuriaceae* was introduced based on a well-supported subclade comprising *Sympoventuria*, *Veronaepsis simplex* and fusicladium-like species (Zhang *et al.* 2011). Subsequently, more genera have been accepted in the family, such as *Ochroconis*, *Scolecobasidium* and *Verruconis* (Machouart *et al.* 2014, Samerpitak *et al.* 2014). *Scolecobasidium*, the largest genus within the *Sympoventuriaceae*, was described based on two species, *S. terreum* and *S. constrictum*, which are characterised by rust-brown to olivaceous colonies producing small, brownish conidiophores bearing small numbers of dark, septate, rough-walled, rhexolytic conidia (Abbott 1927, Ellis 1976). *Scolecobasidium terreum* was designated as the generic type, which has Y-shaped and yellowish conidia (Abbott 1927). More species with unbranched and darker conidia were described within *Scolecobasidium* (Matsushima 1975), which led to the introduction of another genus, *Ochroconis* (de Hoog & von Arx 1974). *Ochroconis*, typified by *O. constricta*, has sympodial conidiogenesis and unbranched, subspherical to cylindrical or clavate, melanised conidia. The number of species in the generic complex has increased significantly over the years (De Hoog 1985, Samerpitak *et al.* 2014, 2017). *Ochroconis* is a rather common genus of saprotrophic soil hyphomycetes, some of which are parasitic on humans, fish or other animals (Samerpitak *et al.* 2017). The type strains of both *S. terreum* (CBS 203.27) and *O. constricta* (CBS 202.27), unfortunately, are now sterile (Horré *et al.* 1999, Gams 2015). Based on the single-locus analyses of *nuSSU*, *nuLSU*, ITS, *ACT1*, *TUB2*, and *tef1-a*, Samerpitak *et al.* (2014) indicated that *Ochroconis* and *Scolecobasidium* clustered together, while *Scolecobasidium* was considered as doubtful because of the type material was

“ambiguous”. This proposal, however, was not recognised by some researchers (Seifert *et al.* 2011, Gams 2015). Although the ex-type strain of *S. terreum* is sterile, there are many reliably named cultures of *S. terreum* globally, which clearly define the identity of this characteristic fungus (Gams 2015), which clusters with species accommodated in *Ochroconis*. Based on the principle of priority, *Scolecobasidium* was thus chosen over *Ochroconis* in the present study. Furthermore, six new genera were introduced within *Sympoventuriaceae*. The multilocus phylogenetic analyses indicated that *Scolecobasidium* and its closely related neighbours belong to the family *Sympoventuriaceae* in the order *Venturiales* (Machouart *et al.* 2014, this study).

The morphological characteristics of sexual morphs within *Venturiales* are rather conservative. Due to the overlapping morphological characteristics of sexual morphs among venturiaceous species, the asexual morph proved to be more reliable for species identification (Schubert *et al.* 2003). The morphology of the conidial apparatus, including conidiophores, conidiogenous cells and conidia has been widely used in the traditional taxonomy of *Venturiales* (Sivanesan 1977, Schubert *et al.* 2003, Crous *et al.* 2007b). Of all the features plotted in Figs 1, 2, conidial arrangement (solitary or in chains), proved to be informative at the generic level (except in *Venturia s. str.*). The mode of conidiogenesis, i.e., sympodial proliferation (*Fusicladium*), monoblastic, determinate to percurrent proliferation (*Pollaccia*, with few rather inconspicuous annellations) and percurrent proliferation with conspicuous annellations (*Spilocaea*) showed little significance at generic level classification. This view was also supported by Schubert *et al.* (2003) for *Venturia*, and for various genera in *Mycosphaerellaceae* (Videira *et al.* 2017).

The *Venturia* clade presently includes isolates from various host families such as *Betulaceae*, *Caprifoliaceae*, *Convolvulaceae*, *Gentianaceae*, *Oleaceae*, *Polygonaceae*, *Rosaceae*, *Salicaceae* as well as lichens. The tendency of host-shift speciation between hosts and *Venturia* species had been documented by Schnabel *et al.* (1999) and Schubert *et al.* (2003). In this study, some well-circumscribed genera, such as *Fraxinicola*, *Neofusicladium*, *Parafusicladium*, *Sympoventuria* and *Tyrannosorus* showed a stronger host generic specialization. In contrast, the current *Venturia s. str.* clade seems not well resolved, as it contains taxa associated with various host genera or families.

The ancestral state of *Venturiales* is most likely saprobic, and plant pathogens appear to be a new evolutionary state, as has been reported for *Capnodiales* (Abdollahzadeh *et al.* 2020) and *Dothideomycetes* in general (Haridas *et al.* 2020). Members of plant pathogens have arisen from saprotrophic members in both *Venturiaceae* and *Sympoventuriaceae*, clustering terminal in the phylogenetic trees (Figs 1, 2). Similar results have been reported for the majority of lineages in the larger context of *Ascomycota* (Schoch *et al.* 2009a, b), or at ordinal level, such as *Pleosporales* and *Capnodiales* (Crous *et al.* 2009, Zhang *et al.* 2009). The most interesting is that saprotrophic fungal ancestors had repeatedly lost their plant cell wall degradation enzymes and obtained effector-like secreted proteins to fit a plant-fungal associated lifestyle (as ectomycorrhizas, ECM) (Kohler *et al.* 2015, Martin *et al.* 2016). Thus, the saprotrophic lifestyle seems ancestral at ordinal level (*Venturiales*), as well as at class level (*Dothideomycetes*) (Haridas *et al.* 2020).

Although the present study has clarified our understanding of families and genera in *Venturiales*, future studies will undoubtedly add many more genera and species to this order, given its wide ecological and geographic distribution.

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