Resolving the *Phoma* enigma

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Abstract: The *Didymellaceae* was established in 2009 to accommodate *Ascochyta*, *Didymella* and *Phoma*, as well as several related phoma-like genera. The family contains numerous plant pathogenic, saprobic and endophytic species associated with a wide range of hosts. *Ascochyta* and *Phoma* are morphologically difficult to distinguish, and species from both genera have in the past been linked to *Didymella* sexual morphs. The aim of the present study was to clarify the generic delimitation in *Didymellaceae* by combing multi-locus phylogenetic analyses based on ITS, LSU, *rpb2* and *tub2*, and morphological observations. The resulting phylogenetic tree revealed 17 well-supported monophyletic clades in *Didymellaceae*, leading to the introduction of nine genera, three species, two *nomina nova* and 84 combinations. Furthermore, 11 epitypes and seven neotypes were designated to help stabilise the taxonomy and use of names. As a result of these data, *Ascochyta*, *Didymella* and *Phoma* were delineated as three distinct genera, and the generic circumscriptions of *Ascochyta*, *Didymella*, *Epicoccum* and *Phoma* emended. Furthermore, the genus *Microsphaeropsis*, which is morphologically distinct from the members of *Didymellaceae*, grouped basal to the *Didymellaceae*, for which a new family *Microsphaeropsidaceae* was introduced.

Key words: *Ascochyta*, *Didymella*, Multi-locus phylogeny, *Phoma*, Taxonomy.

Taxonomic novelties: New family: *Microsphaeropsidaceae* Q. Chen, L. Cai & Crous; **New genera:** *Allophoma* Q. Chen & L. Cai, *Calophoma* Q. Chen & L. Cai, *Heterophoma* Q. Chen & L. Cai, *Neoascochyta* Q. Chen & L. Cai, *Neodidymelliopsis* Q. Chen & L. Cai, *Nothophoma* Q. Chen & L. Cai, *Paraboeremia* Q. Chen & L. Cai, *Phomatodes* Q. Chen & L. Cai, *Xenodidymella* Q. Chen & L. Cai; **New names:** ***Ascochyta*** *medicaginicola* var. *medicaginicola* Q. Chen & L. Cai, ***Didymella*** *senecionicola* Q. Chen & L. Cai; **New species:** ***Allophoma*** *nicaraguensis* Q. Chen & L. Cai, ***Phoma*** *neerlandica* Q. Chen & L. Cai, ***Stagonosporopsis*** *helianthi* Q. Chen & L. Cai; **New combinations:** ***Allophoma*** *labilis* (Sacc.) Q. Chen & L. Cai, *All. minor* (Aveskamp *et al.*) Q. Chen & L. Cai, *All. piperis* (Tassi) Q. Chen & L. Cai, *All. tropica* (R. Schneid. & Boerema) Q. Chen & L. Cai, *All. zantedeschiae* (Dippen.) Q. Chen & L. Cai, ***Ascochyta*** *herbicola* (Wehm.) Q. Chen & L. Cai, *As. medicaginicola* var. *macrospora* (Boerema *et al.*) Q. Chen & L. Cai, *As. nigripycnidia* (Boerema *et al.*) Q. Chen & L. Cai, *As. phacae* (Corbaz) Q. Chen & L. Cai, *As. versabilis* (Boerema *et al.*) Q. Chen & L. Cai, ***Boeremia*** *lilacis* (Sacc.) Q. Chen & L. Cai, ***Calophoma*** *aquilegiicola* (M. Petrov) Q. Chen & L. Cai, *Ca. clematidina* (Thüm.) Q. Chen & L. Cai, *Ca. clematidis-rectae* (Petr.) Q. Chen & L. Cai, *Ca. complanata* (Tode) Q. Chen & L. Cai, *Ca. glaucii* (Brunaud) Q. Chen & L. Cai, *Ca. vodakii* (E. Müll.) Q. Chen & L. Cai, ***Didymella*** *acetosellae* (A.L. Sm. & Ramsb.) Q. Chen & L. Cai, *D. aliena* (Fr.) Q. Chen & L. Cai, *D. americana* (Morgan-Jones & J.F. White) Q. Chen & L. Cai, *D. anserina* (Marchal) Q. Chen & L. Cai, *D. aurea* (Gruyter *et al.*) Q. Chen & L. Cai, *D. bellidis* (Neerg.) Q. Chen & L. Cai, *D. boeremae* (Gruyter) Q. Chen & L. Cai, *D. calidophila* (Aveskamp *et al.*) Q. Chen & L. Cai, *D. chenopodii* (P. Karst. & Har.) Q. Chen & L. Cai, *D. coffeae-arabicae* (Aveskamp *et al.*) Q. Chen & L. Cai, *D. curtisii* (Berk.) Q. Chen & L. Cai, *D. dactylidis* (Aveskamp *et al.*) Q. Chen & L. Cai, *D. dimorpha* (Aveskamp *et al.*) Q. Chen & L. Cai, *D. eucalyptica* (Sacc.) Q. Chen & L. Cai, *D. gardeniae* (S. Chandra & Tandon) Q. Chen & L. Cai, *D. glomerata* (Corda) Q. Chen & L. Cai, *D. heteroderae* (Boerema *et al.*) Q. Chen & L. Cai, *D. longicolla* (Aveskamp *et al.*) Q. Chen & L. Cai, *D. mascrostoma* (Mont.) Q. Chen & L. Cai, *D. maydis* (Arny & R.R. Nelson) Q. Chen & L. Cai, *D. microchlamydospora* (Aveskamp & Verkley) Q. Chen & L. Cai, *D. molleriana* (G. Winter) Q. Chen & L. Cai, *D. musae* (P. Joly) Q. Chen & L. Cai, *D. negriana* (Thüm.) Q. Chen & L. Cai, *D. nigricans* (P.R. Johnst. & Boerema) Q. Chen & L. Cai, *D. pedeiae* (Aveskamp *et al.*) Q. Chen & L. Cai, *D. pinodella* (L.K. Jones) Q. Chen & L. Cai, *D. pomorum* (Thüm.) Q. Chen & L. Cai, *D. protuberans* (Lév.) Q. Chen & L. Cai, *D. rhei* (Ellis & Everh.) Q. Chen & L. Cai, *D. rumicicola* (Boerema & Loer.) Q. Chen & L. Cai, *D. sancta* (Aveskamp *et al.*) Q. Chen & L. Cai, *D. subglomerata* (Boerema *et al.*) Q. Chen & L. Cai, *D. subherbarum* (Gruyter *et al.*) Q. Chen & L. Cai, *D. viburnicola* (Oudem.) Q. Chen & L. Cai, ***Epicoccum*** *brasiliense* (Aveskamp *et al.*) Q. Chen & L. Cai, *E. draconis* (Berk. ex Cooke) Q. Chen & L. Cai, *E. henningsii* (Sacc.) Q. Chen & L. Cai, *E. huancayense* (Turkenst.) Q. Chen & L. Cai, *E. plurivorum* (P.R. Johnst.) Q. Chen & L. Cai, ***Heterophoma*** *adonidis* (Moesz) Q. Chen & L. Cai, *H. nobilis* (Kabát & Bubák) Q. Chen & L. Cai, *H. novae-verbascicola* (Aveskamp *et al.*) Q. Chen & L. Cai, *H. poolensis* (Taubenh.) Q. Chen & L. Cai, *H. sylvatica* (Sacc.) Q. Chen & L. Cai, ***Neoascochyta*** *desmazieri* (Cavara) Q. Chen & L. Cai, *Neoa. europaea* (Punith) Q. Chen & L. Cai, *Neoa. exitialis* (Morini) Q. Chen & L. Cai, *Neoa. graminicola* (Punith.) Q. Chen & L. Cai, *Neoa. paspali* (P.R. Johnst.) Q. Chen & L. Cai, ***Neodidymelliopsis*** *cannabis* (Aa & Boerema) Q. Chen & L. Cai, *Neod. polemonii* (Cooke) Q. Chen & L. Cai, *Neod. xanthina* (Sacc.) Q. Chen & L. Cai, ***Nothophoma*** *anigozanthi* (Tassi) Q. Chen & L. Cai, *No. arachidis-hypogaeae* (V.G. Rao) Q. Chen & L. Cai, *No. gossypiicola* (Gruyter) Q. Chen & L. Cai, *No. infossa* (Ellis & Everh.) Q. Chen & L. Cai, *No. quercina* (Syd.) Q. Chen & L. Cai, ***Paraboeremia*** *adianticola* (Aa & Boerema) Q. Chen & L. Cai, *Pa. putaminum* (Speg.) Q. Chen & L. Cai, *Pa. selaginellae* (Sacc.) Q. Chen & L. Cai, ***Phomatodes*** *aubrietiae* (Moesz) Q. Chen & L. Cai, *Phomat. nebulosa* (Pers.) Q. Chen & L. Cai, ***Xenodidymella*** *applanata* (Niessl) Q. Chen & L. Cai, *X. asphodeli* (E. Müll.) Q. Chen & L. Cai, *X. catariae* (Cooke & Ellis) Q. Chen & L. Cai, *X. humicola* (J.C. Gilman & E.V. Abbott) Q. Chen & L. Cai.

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INTRODUCTION

Although the first *Phoma* spp. were already described in 1821 (Sutton 1980), the genus was only officially introduced 60 years later by Saccardo (1880), the concept of which was emended by Boerema & Bollen (1975). *Phoma* has been shown to be highly polyphyletic with phoma-like species scattered in at least six families within the *Pleosporales* (Aveskamp *et al.* 2010).

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Studies in Mycology

Although Boerema *et al.* (2004) subdivided the genus *Phoma* into nine sections (*i.e. Phoma*, *Heterospora*, *Paraphoma*, *Peyronellaea*, *Phyllostictoides*, *Sclerophomella*, *Plenodomus*, *Macrospora* and *Pilosa*) based on morphological characters (Boerema 1997), these classifications have been shown to be artificial and failed to reflect the natural evolutionary history of this group of fungi (Aveskamp *et al.* 2008, 2010). Presently the monophyletic lineage anchored by its type species *Phoma herbarum*, is regarded as *Phoma s. str.*, which belongs to the *Didymellaceae* (Aveskamp *et al.* 2010).

Results of a phylogenetic study including the type species of all nine *Phoma* sections and allied coelomycetous genera demonstrated that all nine sections grouped in the *Pleosporales* (de Gruyter *et al.* 2009). The type species of the sections *Macrospora*, *Peyronellaea*, *Phoma*, *Phyllostictoides* and *Sclerophomella* resided in *Didymellaceae* (de Gruyter *et al.* 2009, 2012). However, the four other sections, namely *Heterospora*, *Paraphoma*, *Pilosa* and *Plenodomus* clustered in several distinct clades outside *Didymellaceae*, and were thus excluded from *Phoma* (de Gruyter *et al.* 2009, Aveskamp *et al.* 2010).

Approximately 70 % of the species recognised by Boerema *et al.* (2004) could be accommodated in *Didymellaceae*. The phylogenetic relationships of *Phoma* species in *Didymellaceae*, mainly from sections *Macrospora*, *Peyronellaea*, *Phoma*, *Phyllostictoides* and *Sclerophomella* were further assessed, resulting in many species being reclassified in existing genera (e.g. *Didymella*, *Stagonosporopsis*), or transferred to *Boeremia*, *Epicoccum* and *Peyronellaea* (Aveskamp *et al.* 2010). These results also revealed most morphological sections to be polyphyletic, the one exception being section *Plenodomus* (Aveskamp *et al.* 2010, de Gruyter *et al.* 2010, 2012). Species originally classified in sections *Heterospora*, *Paraphoma*, *Pilosa* and *Plenodomus* were subsequently revised by de Gruyter *et al.* (2010, 2012). Members of *Phoma* sect. *Paraphoma* were transferred to a range of genera including *Coniothyrium* (*Coniothyriaceae*), *Paraphoma*, *Setophoma* (*Phaeosphaeriaceae*), *Pyrenochaeta* and *Pyrenochaetopsis* (*Cucurbitariaceae*) (de Gruyter *et al.* 2010, 2012). Furthermore, *Phoma* sect. *Heterospora* was elevated to generic rank in *Leptosphaeriaceae* (de Gruyter *et al.* 2012). Species of *Phoma* sect. *Plenodomus* were reclassified into *Chaetosphaeronema* (*Phaeosphaeriaceae*) (de Gruyter *et al.* 2010), *Leptosphaeria*, *Paraleptosphaeria*, *Plenodomus* and *Subplenodomus* (*Leptosphaeriaceae*) (de Gruyter *et al.* 2012). Finally, species of *Phoma* sect. *Pilosa* were determined to belong to *Pleosporaceae* (Aveskamp *et al.* 2010, de Gruyter *et al.* 2012).

The genus *Ascochyta* was established by Libert in 1830, and typified by *As. pisi* (Boerema & Bollen 1975). *Ascochyta* and *Phoma* have long been considered closely related since members from both genera are often highly similar in morphology, physiology, pathogenicity and nucleotide sequences (Aveskamp *et al.* 2010). Research efforts attempting to distinguish these genera have been carried out since Saccardoan times, using their substrate and morphological characters, such as presence or absence of conidial septa (Aveskamp *et al.* 2010). In *Phoma*, septate conidia are rare *in vitro*, although common *in vivo* (Aveskamp *et al.* 2008), whereas isolates of *Ascochyta* produce septate conidia both *in vivo* and *in vitro* (de Gruyter *et al.* 2009). Boerema & Bollen (1975) differentiated *Phoma* from *Ascochyta* based on differences in conidiogenesis and conidial septation. They emphasised that in *Phoma* conidia are produced from phialides with distinct collarettes (Boerema & Bollen 1975), and that conidial euseptation is a secondary process which occurs independently from conidiogenesis, namely after conidial secession (Boerema & Bollen 1975, Aveskamp *et al.* 2010). In contrast, in *Ascochyta* conidia arise from the accumulation of annellations or from a gradually increasing collar of periclinal annellations, and conidial septation is an essential part of conidium development, which can be regarded as holoblastic (Boerema & Bollen 1975, Aveskamp *et al.* 2010). Later Punithalingam (1979a) redefined *Ascochyta*, and reported that holoblastic conidiogenesis was temporary, whereas phialidic conidiogenesis remained functional at the completion of conidial development. He also concluded that conidial development and septation should not be used as taxonomic criteria for distinguishing species in these two genera.

In spite of these arguments, the taxonomy of these two genera remains confused. This is largely demonstrated by the high number of synonyms in this complex (Aveskamp *et al.* 2008). Furthermore, in recent studies the type species of the genus *Ascochyta*, *As. pisi*, also nested in the *Didymellaceae* (de Gruyter *et al.* 2009), close to the type species of *Phoma* (Peever *et al.* 2007, de Gruyter *et al.* 2009, Aveskamp *et al.* 2010). Because merging the genera *Ascochyta* and *Phoma* would prove highly unpopular among phytopathologists, both generic names are still in use, and their links to sexual genera in the *Didymellaceae* remain unresolved (Aveskamp *et al.* 2010).

Didymella was first used at the generic level by Saccardo in 1880, with the description of *Didymella exigua* (Holm 1975, Corlett 1981), which was later accepted as the type or lectotype species of the genus (von Höhnel 1918, Corbaz 1957, Müller & von Arx 1962, Holm 1975, von Arx & Müller 1975). *Didymella* was originally accommodated in the *Mycosphaerellaceae*, and then placed in the *Pleosporaceae*, *Phaeosphaeriaceae*, *Venturiaceae*, or considered as *incertae sedis* in the *Pleosporales* (de Gruyter *et al.* 2009). In the study of de Gruyter *et al.* (2009), a new family *Didymellaceae* was introduced for the "*Didymella* clade", which included most members of *Phoma* and related asexual genera. As a genus with phytopathological importance, *Didymella* is also in urgent need of taxonomic revision (Aveskamp *et al.* 2010), as it appears to be polyphyletic. The four sexual genera that have been linked to *Phoma* include *Didymella*, *Leptosphaeria*, *Mycosphaerella* and *Pleospora* (Boerema *et al.* 2004), while *Ascochyta* has sexual connections in both *Didymella* and *Mycosphaerella* (Corlett 1981, Peever *et al.* 2007). In recent studies, however, it has been shown that the genus *Didymella* is the only genus that is correctly linked to *Phoma s. str.* (Woudenberg *et al.* 2009, Aveskamp *et al.* 2010) and *Ascochyta* (Chilvers *et al.* 2009, de Gruyter *et al.* 2009). Nevertheless, *Didymella* is still a poorly understood genus, with numerous species that remain phylogenetically unresolved. As both *Ascochyta* and *Phoma* have been regarded as polyphyletic, a proper study of the genera traditionally accommodating their sexual morphs is urgently needed (Aveskamp *et al.* 2010).

The genus *Phoma* is ubiquitous and species-rich, with species occurring on a diverse range of substrates, from soil to air, plants to animals, and even humans (Aveskamp *et al.* 2008, 2010). *Phoma* is notorious because includes many important plant pathogen species, some of which are of quarantine concern (Aveskamp *et al.* 2008, 2010, Chen *et al.* 2015). After the studies by Aveskamp *et al.* (2010) and de Gruyter *et al.* (2009, 2012), significant progress has been made to clarify generic boundaries in *Didymellaceae*. However, nearly 70 *Phoma* species embedded in the *Didymellaceae* could not be assigned to definite genera due to a lack of phylogenetic support

(Aveskamp *et al.* 2010). In previous molecular phylogenetic studies, partial small subunit nrDNA (18S, SSU) and partial large subunit nrDNA (28S, LSU) nucleotide sequences were used to resolve the relationships above family level (de Gruyter *et al.* 2009, 2010, 2012), with many species excluded from *Phoma* and *Didymellaceae*. As the LSU and SSU sequence data did not provide sufficient phylogenetic information to distinguish closely related genera nor species, Aveskamp *et al.* (2009a) sequenced the internal transcribed spacer regions 1 & 2 and intervening 5.8S nrDNA (ITS), and partial gene regions of β-tubulin (*tub2*) and gamma-actin (*actA*) to clarify the phylogeny of dictyochlamydospore-producing *Phoma* taxa. LSU and ITS combined with *tub2* were used to infer a phylogeny for genera and species in *Didymellaceae* (Aveskamp *et al.* 2010). Although improved resolutions were obtained, most of the internal nodes in the trees remained unresolved, and it was concluded that more DNA loci should be employed to fully resolve closely related taxa in this family. In a subsequent study the RNA polymerase II second largest subunit (*rpb2*) gene was successfully applied in a combination with ITS, LSU and *tub2* to distinguish closely related species in *Phoma* (Chen *et al.* 2015).

Given the complexities of *Ascochyta*, *Didymella* and *Phoma*, the objectives of this study were: 1) to determine the phylogenetic relationships of these genera using multi-locus sequence data, *viz*. LSU, ITS, *rpb2* and *tub2*; 2) to delineate the phylogenetic lineages within *Didymellaceae*, and revise its taxonomy by adopting a polyphasic approach; 3) and to designate epitypes to stabilise the application of names within the family.

MATERIALS AND METHODS

Isolates and type specimens

Isolates used in this study included the majority used in Aveskamp *et al.* (2010). Furthermore, additional isolates previously identified as *Ascochyta*, *Didymella* and *Phoma* based solely on morphological characters, were also selected. In total, 287 strains were obtained from the culture collection of the CBS-KNAW Fungal Biodiversity Centre, Utrecht, the Netherlands (CBS), and the Dutch National Plant Protection Organization, Wageningen, the Netherlands (PD) (Table 1). Freeze-dried isolates were revived overnight in 2 mL malt/peptone (50 % / 50 %) liquid medium and subsequently transferred to oatmeal agar (OA), 2 % malt extract agar (MEA) and potato dextrose agar (PDA) (recipes according to Crous *et al.* 2009), and incubated at room temperature. Some of the cultures were incubated under near-ultraviolet (UV) light (12 h light, 12 h dark) or on pine needle agar (PNA) (Smith *et al.* 1996, Su *et al.* 2012) to promote sporulation if necessary. Loan requests of type specimens were sent to 34 fungaria, *viz*. ABD, B, BHG, BP, BPI, BR, BRNM, DAR, E, FI, G, H, ILL, K, KIEL, L(U), LE, PAD, PAV, PC, PDD, PR, PRC, PRM, ROPV, S, SIENA, UPS, UV, VALPL, W, WU, Z and ZT. Additional specimens were loaned from BR, BPI, IMI, K, L, M, PDD, SIENA and ZT.

Morphology

Morphological studies of living cultures were conducted following the methods described by Boerema *et al.* (2004) for the cultures grown on MEA, OA and PDA. Colony diameters were measured after 7 d, and colony morphologies determined after 14 d of incubation. Colony colours on the surface and reverse of inoculated Petri dishes were assessed according to the colour charts of Rayner (1970). Micromorphological descriptions and measurements for 30 replicates of relevant features were carried out from mature conidiomata and conidia mounted in water (Aveskamp *et al.* 2010, Chen *et al.* 2015). For conidiomatal pycnidia, pycnidial walls and conidiogenous cells, measurements were taken from 5–10 samples. Observations were conducted with a Leica M125 dissecting microscope and with a Zeiss Axio Imager A2 compound microscope under differential interference contrast (DIC) illumination. Sections of pycnidia were prepared using a Leica CM1950 freezing microtome, to study the anatomy of pycnidial walls and the morphology of conidiogenous cells (Aveskamp *et al.* 2010, Chen *et al.* 2015). The NaOH spot test was carried out on MEA cultures to detect the production of metabolite E (Boerema *et al.* 2004). For the fungarium specimens studied, pycnidia and ascomata were rehydrated in 10 % lactic acid or 5 % KOH for examination. Observations and sections of these materials were conducted using the same methods as described for cultures above.

DNA isolation, PCR amplification and sequencing

Genomic DNA was extracted following the protocol of Cubero *et al.* (1999), from fungal mycelium growing on MEA. Some of the DNAs were provided by the authors of Aveskamp *et al.* (2010; Utrecht, the Netherlands), which were extracted using the UltraClean Microbial DNA Isolation Kit (Mo Bio Laboratories, Inc., Carlsbad, CA, USA). The LSU region was amplified with the primer pair LR0R (Rehner & Samuels 1994) and LR7 (Vilgalys & Hester 1990), the ITS region with V9G (de Hoog & Gerrits van den Ende 1998) and ITS4 (White *et al.* 1990), the *tub2* region with the primers Btub2Fd and Btub4Rd (Woudenberg *et al.* 2009), and the *rpb2* region with RPB2-5F2 (Sung *et al.* 2007) and fRPB2-7cR (Liu *et al.* 1999), respectively. The PCR amplifications were performed in a total volume of 25 µL containing 2.5 µL 10× EasyTaq Buffer (TransGen Biotech, Beijing, China), 50 µM dNTPs, 0.1 µM of each primer, 0.75 U Taq DNA polymerase and 1–10 ng genomic DNA. PCR conditions for LSU, ITS and *tub2* were set as follows: an initial denaturation at 95 °C for 5 min, followed by 35 cycles of denaturation, annealing and extension, and a final extension step at 72 °C for 10 min. For the LSU amplification, the 35 cycles consisted of 45 s at 95 °C, 45 s at 48 °C and 2 min at 72 °C; for the ITS 30 s at 95 °C, 30 s at 48 °C and 80 s at 72 °C; and for the *tub2* region 30 s at 95 °C, 30 s at 52 °C and 80 s at 72 °C. The PCR program for *rpb2* amplification consisted of 5 cycles of 45 s at 94 °C, 45 s at 60 °C and 2 min at 72 °C, then 5 cycles with a 58 °C annealing temperature and 30 cycles with a 54 °C annealing temperature (Woudenberg *et al.* 2013). Sequencing was conducted by the Omega Genetics Company (Beijing, China) using the PCR primers and the additional internal sequence primer LR5 (Vilgalys & Hester 1990) for LSU.

Phylogenetic analyses

Sequences from each primer combination were used to obtain consensus sequences with MEGA v. 6.0 (Tamura *et al.* 2013). Reference sequences from Aveskamp *et al.* (2010) were

Table 1. Isolates used in this study and their GenBank accession numbers. Newly generated sequences are indicated in **bold**.

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
Allophoma labilis	*Phoma labilis*	CBS 124.93; PD 87/269		*Solanum lycopersicum*	The Netherlands	GU238091	GU237765	**KT389552**	GU237619
All. minor	*Phoma minor*	CBS 325.82	T	*Syzygium aromaticum*	Indonesia	GU238107	GU237831	**KT389553**	GU237632
All. nicaraguensis		CBS 506.91; PD 91/876; IMI 215229	T	*Coffea arabica*	Nicaragua	GU238058	GU237876	**KT389551**	GU237596
All. piperis	*Phoma piperis*	CBS 268.93; CBS 108.93; PD 88/720	T	*Peperomia pereskiifolia*	The Netherlands	GU238129	GU237816	**KT389554**	GU237644
		CBS 108.93; PD 90/2011		*Peperomia* sp.	The Netherlands	GU238130	GU237921	**KT389555**	GU237645
All. tropica	*Phoma tropica*	CBS 436.75; DSM 63365	T	*Saintpaulia ionantha*	Germany	GU238149	GU237864	**KT389556**	GU237663
All. zantedeschiae	*Phoma zantedeschiae*	CBS 131.93; PD 69/140		*Calla* sp.	The Netherlands	GU238159	FJ427084	**KT389557**	FJ427188
	Didymella rabiei	CBS 229.32		*Cicer arietinum*	Romania	**KT389690**	**KT389473**	**KT389558**	**KT389767**
Alternaia japonica	*Alternaia japonica*	CBS 118390		*Brassica chinensis*	USA	KC584281	KC584201	KC584405	—
Ascochyta fabae	*Ascochyta fabae*	CBS 524.77		*Phaseolus vulgaris*	Belgium	GU237963	GU237880	—	GU237526
		CBS 649.71		*Vicia faba*	The Netherlands	GU237964	GU237902	—	GU237527
		PD 83/492		*Phaseolus vulgaris*	The Netherlands	GU237965	GU237917	—	GU237528
As. herbicola	*Phoma herbicola*	CBS 629.97; PD 76/1017	R	Water	USA	GU238083	GU237898	KP330421	GU237614
As. lentis	*Ascochyta lentis*	CBS 370.84; PD 81/783		*Lens culinaris*	—	**KT389691**	**KT389474**	—	**KT389768**
As. medicaginicola var. *macrospora*	*Phoma medicaginis* var. *macrospora*	CBS 112.53	T	*Medicago sativa*	USA	GU238101	GU237749	—	GU237628
		CBS 404.65; IMI 116999	R	*Medicago sativa*	Canada	GU238102	GU237859	KP330423	GU237629
As. medicaginicola var. *medicaginicola*	*Phoma medicaginis* var. *medicaginis*	CBS 316.90		*Medicago sativa*	Czech Republic	GU238103	GU237828	—	GU237630
As. nigripycnidia	*Phoma nigripycnidia*	CBS 116.96; PD 95/7930	T	*Vicia cracca*	Russia	GU238118	GU237756	—	GU237637
As. phacae	*Didymella phacae*	CBS 184.55	T	*Phaca alpina*	Switzerland	**KT389692**	**KT389475**	—	**KT389769**
As. pisi	*Ascochyta pisi*	CBS 122750; ATCC 201619		*Pisum sativum*	USA	**KT389694**	**KT389477**	—	**KT389771**
		CBS 122751; ATCC 201620		*Pisum sativum*	Canada	KP330444	KP330432	EU874867	KP330388
		CBS 122785; PD 78/517	T	*Pisum sativum*	The Netherlands	GU237969	GU237763	—	GU237532
		CBS 126.54		*Pisum sativum*	The Netherlands	EU754137	GU237772	DQ677967	GU237531
	As. juglandis	CBS 108.49		*Juglans regia*	The Netherlands	**KT389693**	**KT389476**	—	**KT389770**
As. rabiei	*As. rabiei*	CBS 206.30		—	—	**KT389695**	**KT389478**	**KT389559**	**KT389772**
		CBS 237.37	T	*Cicer arietinum*	Bulgaria	**KT389696**	**KT389479**	**—**	**KT389773**
		CBS 534.65		*Cicer arietinum*	India	GU237970	GU237886	KP330405	GU237533
Ascochyta sp. 1	*As. fabae*	CBS 372.84; PD 80/1246		*Pisum sativum*	Australia	**KT389697**	**KT389480**	—	**KT389774**
		CBS 373.84; PD 80/1247		*Pisum sativum*	Australia	**KT389698**	**KT389481**	**KT389560**	**KT389775**

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
Ascochyta sp. 2	*Didymella astragalina*	CBS 113797		*Lathyrus vernus*	Sweden	**KT389699**	**KT389482**	**—**	**KT389776**
As. syringae	*Ascochyta syringae*	CBS 545.72		*Syringa vulgaris*	The Netherlands	**KT389700**	**KT389483**	—	**KT389777**
As. versabilis	*Phoma versabilis*	CBS 876.97; PD 82/1008	R	*Silene* sp.	The Netherlands	GU238152	GU237909	**KT389561**	GU237664
As. viciae	*Ascochyta viciae*	CBS 451.68		*Vicia sepium*	The Netherlands	**KT389701**	**KT389484**	**KT389562**	**KT389778**
As. viciae-pannonicae	*As. viciae-pannonicae*	CBS 254.92		*Vicia pannonica*	Czech Republic	**KT389702**	**KT389485**	—	**KT389779**
Bipolaris maydis	*Bipolaris maydis*	CBS 134.39; DSM 1149		*Zea mays*	—	AY544645	DQ491489	DQ247790	—
Boeremia crinicola	*Boeremia crinicola*	CBS 109.79; PD 77/747	R	*Crinum powellii*	The Netherlands	GU237927	GU237737	**KT389563**	GU237489
Boeremia diversispora	*B. diversispora*	CBS 102.80; IMI 331907; PD 79/61		*Phaseolus vulgaris*	Kenya	GU237930	GU237725	**KT389565**	GU237492
		CBS 101194; PD 79/687; IMI 373349		*Phaseolus vulgaris*	The Netherlands	GU237929	GU237716	**KT389564**	GU237491
B. exigua	*Ascochyta cheiranthi*	CBS 118.38		*Cheiranthus cheiri*	Denmark	**KT389706**	**KT389489**	**KT389582**	**KT389783**
	As. ducometii	CBS 119.38		*Nicotiana tabacum*	—	**KT389707**	**KT389490**	**KT389583**	**KT389784**
	As. abelmoschi	CBS 107.21		*Abelmoschus esculentus*	—	**KT389708**	**KT389491**	—	**KT389785**
B. exigua var. *coffeae*	*Boeremia exigua* var. *coffeae*	CBS 119730		*Coffea arabica*	Brazil	GU237942	GU237759	**KT389567**	GU237504
		CBS 109183; PD 2000/10506; IMI 300060	R	*Coffea arabica*	Cameroon	GU237943	GU237748	**KT389566**	GU237505
B. exigua var. *exigua*	*B. exigua* var. *exigua*	CBS 431.74; PD 74/2447	R	*Solanum tuberosum*	The Netherlands	EU754183	FJ427001	**KT389569**	FJ427112
B. exigua var. *forsythiae*	*B. exigua* var. *forsythiae*	CBS 101197; PD 95/721		*Forsythia* sp.	The Netherlands	GU237931	GU237718	**KT389570**	GU237493
		CBS 101213; PD 92/959	R	*Forsythia* sp.	The Netherlands	GU237932	GU237723	**KT389571**	GU237494
B. exigua var. gilvescens	*B. exigua* var. *exigua*	CBS 101150; PD 79/118		*Cichorium intybus*	The Netherlands	EU754182	GU237715	**KT389568**	GU237495
B. exigua var. *heteromorpha*	*B. exigua* var. *heteromorpha*	CBS 443.94	T	*Nerium oleander*	Italy	GU237935	GU237866	**KT389573**	GU237497
		CBS 101196; PD 79/176		*Nerium oleander*	France	GU237934	GU237717	**KT389572**	GU237496
B. exigua var. *linicola*	*B. exigua* var. *linicola*	CBS 114.28		*Linum usitatissimum*	The Netherlands	GU237937	GU237752	—	GU237499
		CBS 116.76; ATCC 32332; IMI 197074; PD 75/544	R	*Linum usitatissimum*	The Netherlands	GU237938	GU237754	**KT389574**	GU237500
	Phoma nemophilae	CBS 248.38		*Nemophila insignis*	The Netherlands	**KT389703**	**KT389486**	**KT389575**	**KT389780**
B. exigua var. *populi*	*Boeremia exigua* var. *populi*	CBS 100167; PD 93/217	T	*Populus* (×) *euramericana*	The Netherlands	GU237939	GU237707	—	GU237501

(*continued on next page*)

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
B. exigua var. *pseudolilacis*	*B. exigua* var. *pseudolilacis*	CBS 101207; PD 94/614	T	*Syringa vulgaris*	The Netherlands	GU237941	GU237721	—	GU237503
	Ascochyta lamiorum	CBS 462.67		*Lamium maculatum*	The Netherlands	**KT389705**	**KT389488**	—	**KT389782**
	As. lathyri	CBS 423.67		*Lathyrus* sp.	The Netherlands	**KT389704**	**KT389487**	**KT389576**	**KT389781**
B. exigua var. *viburni*	*Boeremia exigua* var. *viburni*	CBS 100354; PD 83/448	R	*Viburnum opulus*	The Netherlands	GU237944	GU237711	**KT389577**	GU237506
B. foveata	*B. foveata*	CBS 109176; PD 94/1394	R	*Solanum tuberosum*	Bulgaria	GU237946	GU237742	**KT389578**	GU237508
B. hedericola	*B. hedericola*	CBS 367.91; PD 87/229	R	*Hedera helix*	The Netherlands	GU237949	GU237842	**KT389579**	GU237511
B. lilacis	*B. exigua* var. *lilacis*	CBS 569.79; PD 72/741; IMI 331909	R	*Syringa vulgaris*	The Netherlands	GU237936	GU237892	—	GU237498
	Ascochyta philadelphi	CBS 588.67		*Philadelphus* sp.	The Netherlands	**KT389709**	**KT389492**	—	**KT389786**
B. lycopersici	*Boeremia lycopersici*	CBS 378.67; PD 67/276	R	*Solanum lycopersicum*	The Netherlands	GU237950	GU237848	**KT389580**	GU237512
B. noackiana	*B. noackiana*	CBS 101203; PD 79/1114		*Phaseolus vulgaris*	Colombia	GU237953	GU237720	**KT389581**	GU237515
		CBS 100353; PD 87/718	R	*Phaseolus vulgaris*	Guatemala	GU237952	GU237710	—	GU237514
B. sambuci-nigrae	*B. sambuci-nigrae*	CBS 629.68; CECT 20048; IMI 331913; PD 67/753	T	*Sambucus nigra*	The Netherlands	GU237955	GU237897	—	GU237517
B. strasseri	*B. strasseri*	CBS 126.93; PD 73/642		*Mentha* sp.	The Netherlands	GU237956	GU237773	**KT389584**	GU237518
B. telephii	*B. telephii*	CBS 760.73; PD 71/1616	R	*Sedum telephium*	The Netherlands	GU237959	GU237905	—	GU237521
		CBS 109175; PD 79/524	R	*Sedum telephium*	The Netherlands	GU237958	GU237741	**KT389585**	GU237520
Calophoma aquilegiicola	*Ascochyta aquilegiae*	CBS 107.31		*Aquilegia* sp.	—	**KT389710**	**KT389493**	—	**KT389787**
	Phoma aquilegiicola	CBS 107.96; PD 73/598	R	*Aconitum pyramidale*	The Netherlands	GU238041	GU237735	**KT389586**	GU237581
	Phoma aquilegiicola	CBS 108.96; PD 79/611	R	*Aquilegia* sp.	The Netherlands	GU238042	GU237736	—	GU237582
	Phoma aquilegiicola	CBS 109.96; PD 83/832		*Aquilegia* sp.	The Netherlands	**KT389711**	**KT389494**	—	**KT389788**
	Phoma aquilegiicola	CBS 116402		*Thalictrum dipterocarpum*	New Zealand	**KT389712**	**KT389495**	—	**KT389789**
Ca. clematidina	*Phoma clematidina*	CBS 102.66		*Clematis* sp.	UK	FJ515630	FJ426988	**KT389587**	FJ427099
		CBS 108.79; PD 78/522	T	*Clematis* sp.	The Netherlands	FJ515632	FJ426989	**KT389588**	FJ427100
Ca. clematidis-rectae	*Phoma clematidis-rectae*	CBS 507.63; PD 07/03486747; MUCL 9574		*Clematis* sp.	The Netherlands	FJ515647	FJ515606	**KT389589**	FJ515624
Ca. complanata	*Phoma complanata*	CBS 268.92 = PD 75/3		*Angelica sylvestris*	The Netherlands	EU754180	FJ515608	GU371778	FJ515626
		CBS 100311		*Heracleum sphondylium*	The Netherlands	EU754181	GU237709	**KT389590**	GU237594
Ca. glaucii	*Phoma glaucii*	CBS 112.96; PD 79/765		*Dicentra* sp.	The Netherlands	GU238077	GU237750	—	GU237610
		CBS 114.96; PD 94/888		*Chelidonium majus*	The Netherlands	FJ515649	FJ515609	—	FJ515627
Calophoma sp. 1	*Didymella vincetoxici*	CBS 186.55		*Vincetoxicum officinale*	Switzerland	**KT389713**	**KT389496**	—	**KT389790**

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
Ca. vodakii	*D. vodakii*	CBS 173.53	T	*Hepatica triloba*	Switzerland	**KT389714**	**KT389497**	—	**KT389791**
Coniothyrium cartei	*Coniothyrium cartei*	CBS 105.91		*Quercus robur*	Germany	GQ387594	JF740181	**KT389591**	KF252700
Co. glycines	*C. glycines*	CBS 124141		*Glycine max*	Zimbabwe	GQ387598	JF740185	—	KF252702
Co. palmarum	*C. palmarum*	CBS 400.71		*Chamaerops humilis*	Italy	EU754153	AY720708	**KT389592**	**KT389792**
Co. telephii	*C. telephii*	CBS 188.71		Air	Finland	GQ387599	JF740188	**KT389593**	**KT389793**
Cucurbitaria berberidis	*Cucurbitaria berberidis*	CBS 363.93		*Berberis vulgaris*	The Netherlands	GQ387606	JF740191	—	**KT389794**
Didymella acetosellae	*Phoma acetosellae*	CBS 179.97		*Rumex hydrolapathum*	The Netherlands	GU238034	GU237793	KP330415	GU237575
D. aliena	*Phoma aliena*	CBS 379.93; PD 82/945		*Berberis* sp.	The Netherlands	GU238037	GU237851	KP330416	GU237578
D. americana	*Peyronellaea americana*	CBS 185.85; PD 80/1191	R	*Zea mays*	USA	GU237990	FJ426972	**KT389594**	FJ427088
		CBS 568.97; ATCC 44494; PD 94/1544		*Glycine max*	USA	GU237991	FJ426974	—	FJ427090
D. anserina	*Phoma radicis-callunae*	CBS 253.80		—	Germany	**KT389715**	**KT389498**	**KT389595**	**KT389795**
		CBS 285.29		*Calluna* sp.	UK	**KT389716**	**KT389499**	—	**KT389796**
	Peyronellaea anserina	CBS 360.84	R	Potato flour	The Netherlands	GU237993	GU237839	**KT389596**	GU237551
	Phoma radicis-callunae	CBS 397.65		Plastic	Germany	**KT389717**	**KT389500**	**KT389597**	**KT389797**
D. arachidicola	*Peyronellaea arachidicola*	CBS 333.75; ATCC 28333; IMI 386092; PREM 44889	T	*Arachis hypogaea*	South Africa	GU237996	GU237833	**KT389598**	GU237554
D. aurea	*Pe. aurea*	CBS 269.93; PD 78/1087	T	*Medicago polymorpha*	New Zealand	GU237999	GU237818	**KT389599**	GU237557
D. bellidis	*Phoma bellidis*	CBS 714.85; PD 74/265	R	*Bellis perennis*	The Netherlands	GU238046	GU237904	KP330417	GU237586
		PD 94/886		*Bellis* sp.	The Netherlands	GU238047	GU237923	—	GU237587
D. boeremae	*Phoma boeremae*	CBS 109942; PD 84/402	T	*Medicago littoralis* cv. Harbinger	Australia	GU238048	FJ426982	**KT389600**	FJ427097
D. calidophila	*Phoma calidophila*	CBS 448.83	T	Soil	Egypt	GU238052	FJ427059	—	FJ427168
		PD 84/109		*Cucumis sativus*	The Netherlands	GU238053	FJ427060	—	FJ427169
D. chenopodii	*Phoma chenopodiicola*	CBS 128.93; PD 79/140	R	*Chenopodium quinoa* cv. Sajana	Peru	GU238055	GU237775	**KT389602**	GU237591
D. coffeae-arabicae	*Peyronellaea coffeae-arabicae*	CBS 123380; PD 84/1013	T	*Coffea arabica*	Ethiopia	GU238005	FJ426993	**KT389603**	FJ427104
D. curtisii	*Pe. curtisii*	CBS 251.92; PD 86/1145	R	*Nerine* sp.	The Netherlands	GU238013	FJ427038	—	FJ427148
		PD 92/1460		*Sprekelia* sp.	The Netherlands	GU238012	FJ427041	**KT389604**	FJ427151
D. dactylidis	*Phoma dactylidis*	CBS 124513; PD 73/1414	T	*Dactylis glomerata*	USA	GU238061	GU237766	—	GU237599
D. dimorpha	*Phoma dimorpha*	CBS 346.82	T	*Opuntiae* sp	Spain	GU238068	GU237835	—	GU237606
D. eucalyptica	*Peyronellaea eucalyptica*	CBS 377.91; PD 79/210	R	*Eucalyptus* sp.	Australia	GU238007	GU237846	**KT389605**	GU237562
D. exigua	*Didymella exigua*	CBS 183.55	T	*Rumex arifolius*	France	EU754155	GU237794	EU874850	GU237525

(*continued on next page*)

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
D. gardeniae	*Peyronellaea gardeniae*	CBS 626.68; IMI 108771	T	*Gardenia jasminoides*	India	GQ387595	FJ427003	**KT389606**	FJ427114
D. glomerata	*Pe. glomerata*	CBS 133.72		Fresco in church	Romania	**KT389718**	FJ427004	—	FJ427115
		CBS 528.66; PD 63/590	R	*Chrysanthemum* sp.	The Netherlands	EU754184	FJ427013	GU371781	FJ427124
D. heteroderae	*Pe. heteroderae*	CBS 109.92; PD 73/1405	T	Undefined food material	The Netherlands	GU238002	FJ426983	**KT389601**	FJ427098
D. lethalis	*Pe. lethalis*	CBS 103.25		—	—	GU238010	GU237729	**KT389607**	GU237564
D. longicolla	*Phoma longicolla*	CBS 124514; PD 80/1189	T	*Opuntia* sp.	Spain	GU238095	GU237767	—	GU237622
D. mascrostoma	*Phoma mascrostoma* var. *mascrostoma*	CBS 482.95		*Larix decidua*	Germany	GU238099	GU237869	**KT389609**	GU237626
		CBS 529.66; PD 66/521	R	*Malus sylvestris*	The Netherlands	GU238098	GU237885	—	GU237625
	Phoma mascrostoma var. *incolorata*	CBS 223.69	R	*Acer pseudoplatanus*	Switzerland	GU238096	GU237801	**KT389608**	GU237623
	Phoma libertiana	CBS 247.38		*Pinus nigra* var. *astriaca*	—	**KT389719**	**KT389501**	—	**KT389798**
D. maydis	*Peyronellaea maydis*	CBS 588.69	T	*Zea mays*	USA	EU754192	FJ427086	GU371782	FJ427190
D. microchlamydospora	*Phoma microchlamydospora*	CBS 105.95	T	*Eucalyptus* sp.	UK	GU238104	FJ427028	KP330424	FJ427138
D. molleriana	*Phoma digitalis*	CBS 229.79; LEV 7660	R	*Digitalis purpurea*	New Zealand	GU238067	GU237802	KP330418	GU237605
		CBS 109179; PD 90/835-1		*Digitalis* sp.	The Netherlands	GU238066	GU237744	—	GU237604
D. musae	*Peyronellaea musae*	CBS 463.69	R	*Mangifera indica*	India	GU238011	FJ427026	—	FJ427136
D. negriana	*Phoma negriana*	CBS 358.71	R	*Vitis vinifera*	Germany	GU238116	GU237838	**KT389610**	GU237635
D. nigricans	*Peyronellaea australis*	CBS 444.81; PDDCC 6546	T	*Actinidia chinensis*	New Zealand	GU238000	GU237867	—	GU237558
		PD 77/919		*Actinidea chinensis*	New Zealand	GU238001	GU237915	**KT389611**	GU237559
D. pedeiae	*Phoma pedeiae*	CBS 124517; PD 92/612A	T	*Schefflera elegantissima*	The Netherlands	GU238127	GU237770	**KT389612**	GU237642
D. pinodella	*Peyronellaea pinodella*	CBS 318.90; PD 81/729		*Pisum sativum*	The Netherlands	GU238016	FJ427051	—	FJ427161
		CBS 531.66		*Trifolium pretense*	USA	GU238017	FJ427052	**KT389613**	FJ427162
D. pinodes	*Pe. pinodes*	CBS 525.77	T	*Pisum sativum*	Belgium	GU238023	GU237883	**KT389614**	GU237572
D. pomorum	*Pe. pomorum* var. *circinata*	CBS 285.76; ATCC 26241; IMI 176742; VKM F-1843		*Heracleum dissectum*	Russia	GU238025	FJ427053	**KT389615**	FJ427163
	Pe. pomorum var. *cyanea*	CBS 388.80		*Triticum* sp.	South Africa	GU238027	FJ427055	**KT389617**	FJ427165
	Pe. pomorum var. *pomorum*	CBS 539.66; ATCC 16791; IMI 122266; PD 64/914	R	*Polygonum tataricum*	The Netherlands	GU238028	FJ427056	**KT389618**	FJ427166
	Phoma triticina	CBS 354.52		*Triticum spelta*	Switzerland	**KT389720**	**KT389502**	**KT389616**	**KT389799**
D. protuberans	*Peyronellaea alectorolophi*	CBS 132.96; PD 93/853		*Rhinanthus major*	The Netherlands	GU237989	GU237778	—	GU237550
	Pe. obtusa	CBS 377.93; PD 80/976		*Daucus carota*	The Netherlands	GU238014	GU237847	**KT389619**	GU237565
		CBS 391.93; PD 80/87		*Spinacia oleracea*	The Netherlands	GU238015	GU237858	**KT389621**	GU237566

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
	Pe. protuberans	CBS 381.96; PD 71/706	T	*Lycium halifolium*	The Netherlands	GU238029	GU237853	**KT389620**	GU237574
D. rhei	*Phoma rhei*	CBS 109177; LEV 15165; PD 2000/9941	R	*Rheum rhaponticum*	New Zealand	GU238139	GU237743	KP330428	GU237653
D. rumicicola	*Phoma rumicicola*	CBS 683.79; LEV 15094	T	*Rumex obtusifolius*	New Zealand	**KT389721**	**KT389503**	**KT389622**	**KT389800**
D. sancta	*Peyronellaea sancta*	CBS 281.83	T	*Ailanthus altissima*	South Africa	GU238030	FJ427063	**KT389623**	FJ427170
D. senecionicola	*Phoma senecionis*	CBS 160.78; LEV 11451	R	*Senecio jacobaea*	New Zealand	GU238143	GU237787	—	GU237657
Didymella sp. 1	*Didymella adianticola*	CBS 379.96		*Pteris* sp.	The Netherlands	**KT389722**	**KT389504**	**KT389624**	**KT389801**
Didymella sp. 2	*Ascochyta pyrethri*	CBS 115.58; DSM 62044		*Chrysanthemum roseum*	Germany	**KT389723**	**KT389505**	**KT389625**	**KT389802**
D. subglomerata	*Peyronellaea subglomerata*	CBS 110.92; PD 76/1010	R	*Triticum* sp.	USA	GU238032	FJ427080	**KT389626**	FJ427186
D. subherbarum	*Phoma subherbarum*	CBS 249.92; PD 78/1088		*Solanum* sp.	Peru	GU238144	GU237808	—	GU237658
		CBS 250.92; DAOM 171914; PD 92/371	T	*Zea mays*	Canada	GU238145	GU237809	—	GU237659
D. viburnicola	*Phoma viburnicola*	CBS 523.73; PD 69/800	R	*Viburnum cassioides*	The Netherlands	GU238155	GU237879	KP330430	GU237667
Epicoccum brasiliense	*Phoma brasiliensis*	CBS 120105	T	*Amaranthus* sp.	Brazil	GU238049	GU237760	**KT389627**	GU237588
E. draconis	*Phoma draconis*	CBS 186.83; PD 82/47	R	*Dracaena* sp.	Rwanda	GU238070	GU237795	**KT389628**	GU237607
E. henningsii	*Phoma henningsii*	CBS 104.80; PD 74/1017	R	*Acacia mearnsii*	Kenya	GU238081	GU237731	**KT389629**	GU237612
E. huancayense	*Phoma huancayensis*	CBS 105.80; PD 75/908	T	*Solanum* sp.	Peru	GU238084	GU237732	**KT389630**	GU237615
E. nigrum	*Epicoccum nigrum*	CBS 125.82; IMI 331914; CECT 20044		Human toenail	The Netherlands	GU237974	FJ426995	**KT389631**	FJ427106
		CBS 173.73; ATCC 24428; IMI 164070	T	*Dactylis glomerata*	USA	GU237975	FJ426996	**KT389632**	FJ427107
E. pimprinum	*E. pimprinum*	CBS 246.60; ATCC 22237; ATCC 16652; IMI 81601	T	Soil	India	GU237976	FJ427049	—	FJ427159
		PD 77/1028		Soil	India	GU237977	FJ427050	**KT389633**	FJ427160
E. plurivorum	*Phoma plurivora*	CBS 558.81; PDDCC 6873	T	*Setaria sp.*	New Zealand	GU238132	GU237888	**KT389634**	GU237647
E. sorghinum	*Epicoccum sorghinum*	CBS 179.80; PD 76/1018		*Sorghum vulgare*	Puerto Rico	GU237978	FJ427067	**KT389635**	FJ427173
		CBS 627.68; PD 66/926		*Citrus* sp.	France	GU237979	FJ427072	**KT389636**	FJ427178
Heterophoma adonidis	*Didymella adonidis*	CBS 114309; UPSC 2982		*Adonis vernalis*	Sweden	**KT389724**	**KT389506**	**KT389637**	**KT389803**
H. dictamnicola	*Phoma dictamnicola*	CBS 507.91; PD 74/148		*Dictamnus albus*	The Netherlands	GU238065	GU237877	**KT389638**	GU237603
H. novae-verbascicola	*Phoma novae-verbascicola*	CBS 127.93; PD 92/347		*Verbascum densiflorum*	The Netherlands	GU238120	GU237774	—	GU237639
H. poolensis	*Phoma poolensis*	CBS 113.20; PD 92/774		—	—	GU238119	GU237751	—	GU237638
		CBS 116.93; PD 71/884		*Antirrhinum majus*	The Netherlands	GU238134	GU237755	—	GU237649
H. sylvatica	*Phoma sylvatica*	CBS 874.97; PD 93/764		*Melampyrum pratense*	The Netherlands	GU238148	GU237907	—	GU237662

(*continued on next page*)

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
Leptosphaeria conoidea	*Leptosphaeria conoidea*	CBS 616.75; ATCC 32813; IMI 199777; PD 74/56		*Lunaria annua*	The Netherlands	JF740279	JF740201	**KT389639**	**KT389804**
Leptosphaeria doliolum	*Leptosphaeria doliolum*	CBS 505.75	T	*Urtica dioica*	The Netherlands	GQ387576	JF740205	**KT389640**	JF740144
Leptosphaerulina americana	*Leptosphaerulina americana*	CBS 213.55		*Trifolium pratense*	USA	GU237981	GU237799	**KT389641**	GU237539
L. arachidicola	*L. arachidicola*	CBS 275.59; ATCC 13446		*Arachis hypogaea*	Taiwan, China	GU237983	GU237820	—	GU237543
L. australis	*L. australis*	CBS 317.83		*Eugenia aromatica*	Indonesia	EU754166	GU237829	GU371790	GU237540
L. trifolii	*L. trifolii*	CBS 235.58		*Trifolium* sp.	The Netherlands	GU237982	GU237806	—	GU237542
Macroventuria anomochaeta	*Macroventuria anomochaeta*	CBS 502.72		*Medicago sativa*	South Africa	GU237985	GU237873	—	GU237545
		CBS 525.71	T	Decayed canvas	South Africa	GU237984	GU237881	GU456346	GU237544
Ma. wentii	*Ma. wentii*	CBS 526.71	T	Plant litter	USA	GU237986	GU237884	**KT389642**	GU237546
Microsphaeropsis olivacea	*Microsphaeropsis olivacea*	CBS 233.77		*Pirus laricio*	France	GU237988	GU237803	**KT389643**	GU237549
		CBS 432.71		*Sarothamnus* sp.	The Netherlands	GU237987	GU237863	—	GU237548
Mi. proteae	*Mi. proteae*	CBS 111319; CPC 1425		*Protea nitida*	South Africa	JN712563	JN712497	—	JN712650
Neoascochyta desmazieri	*Ascochyta desmazieri*	CBS 247.79		*Gramineae*	Austria	**KT389725**	**KT389507**	—	**KT389805**
	As. desmazieri	CBS 297.69	T	*Lolium perenne*	Germany	**KT389726**	**KT389508**	**KT389644**	**KT389806**
	As. agrostidis	CBS 758.97		Hay	Norway	**KT389727**	**KT389509**	—	**KT389807**
Neoa. europaea	*As. hordei* var. *europaea*	CBS 819.84		*Hordeum vulgare*	Germany	**KT389728**	**KT389510**	**KT389645**	**KT389808**
		CBS 820.84	T	*Hordeum vulgare*	Germany	**KT389729**	**KT389511**	**KT389646**	**KT389809**
Neoa. exitialis	*Didymella arcuata*	CBS 118.40		—	—	**KT389732**	**KT389514**	**KT389647**	**KT389812**
	D. exitialis	CBS 389.86		*Triticum aestivum*	Switzerland	**KT389733**	**KT389515**	**KT389648**	**KT389813**
	Ascochyta avenae	CBS 811.84		*Secale cereale*	Germany	**KT389734**	**KT389516**	—	**KT389814**
	As. avenae	CBS 812.84		*Hordeum vulgare*	Germany	**KT389735**	**KT389517**	—	**KT389815**
	As. skagwayensis	CBS 110124		*Triticum* sp.	The Netherlands	**KT389730**	**KT389512**	—	**KT389810**
	As. allii	CBS 113693; UPSC 1929		*Allium* sp.	Sweden	**KT389731**	**KT389513**	—	**KT389811**
Neoa. graminicola	*As. sorghi*	CBS 301.69		*Lolium multiflorum*	Germany	**KT389737**	**KT389519**	**KT389650**	**KT389817**
	Didymella exitialis	CBS 447.82		*Triticum aestivum*	Germany	**KT389738**	**KT389520**	—	**KT389818**
	Ascochyta graminea	CBS 586.79		*Hordeum vulgare*	Belgium	**KT389739**	**KT389521**	—	**KT389819**
	As. hordei var. *americana*	CBS 815.84		*Hordeum vulgare*	Germany	**KT389740**	**KT389522**	—	**KT389820**
	As. hordei var. *americana*	CBS 816.84		*Hordeum vulgare*	Germany	**KT389741**	**KT389523**	**KT389651**	**KT389821**
	Didymella graminicola	CBS 102789	R	*Lolium perenne*	New Zealand	**KT389736**	**KT389518**	**KT389649**	**KT389816**

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
Neoa. paspali	*Phoma paspali*	CBS 560.81; PD 92/1569	T	*Paspalum dilatatum*	New Zealand	GU238124	FJ427048	KP330426	FJ427158
Neoascochyta sp. 1	*Ascochyta hordei*	CBS 112524		*Triticum aestivum*	Argentina	**KT389742**	**KT389524**	—	**KT389822**
Neoascochyta sp. 2	*Didymella graminicola*	CBS 516.81		*Oryza sativa*	Italy	**KT389743**	**KT389525**	**KT389653**	**KT389823**
Neoascochyta sp. 3	*Ascochyta festucae*	CBS 689.97		Hay	Norway	**KT389744**	**KT389526**	**KT389654**	**KT389824**
Neoascochyta sp. 4	*As. hordei* var. *hordei*	CBS 544.74		*Triticum aestivum*	South Africa	EU754134	GU237887	**KT389652**	GU237488
Neoascochyta sp. 5	*As. brachypodii*	CBS 876.72		Straw	South Africa	**KT389745**	**KT389527**	—	**KT389825**
Neodidymelliopsis cannabis	*Didymella urticicola*	CBS 121.75; ATCC 32164; IMI 194767; PD 73/584	T	*Urtica dioica*	The Netherlands	GU237972	GU237761	—	GU237535
	D. cannabis	CBS 234.37		*Cannabis sativa*	—	GU237961	GU237804	KP330403	GU237523
	D. eupyrena	CBS 591.67		*Urtica dioica*	The Netherlands	**KT389746**	**KT389528**	—	**KT389826**
	D. cannabis	CBS 629.76		Packing material	The Netherlands	**KT389747**	**KT389529**	—	**KT389827**
Neod. polemonii	*Ascochyta polemonii*	CBS 375.67		*Polemonium caeruleum*	The Netherlands	**KT389748**	**KT389530**	—	**KT389828**
	Phoma polemonii	CBS 109181; PD 83/757	T	*Polemonium caeruleum*	The Netherlands	GU238133	GU237746	KP330427	GU237648
Neodidymelliopsis sp. 1	*Ascochyta achlydis*	CBS 256.77		*Achlys triphylla*	Canada	**KT389749**	**KT389531**	—	**KT389829**
Neodidymelliopsis sp. 2	*As. scotinospora*	CBS 382.96		Soil in desert	Israel	**KT389750**	**KT389532**	—	**KT389830**
Neod. xanthina	*As. aquilegiae*	CBS 168.70		*Delphinium* sp.	The Netherlands	**KT389751**	**KT389533**	—	**KT389831**
	Phoma xanthina	CBS 383.68	T	*Delphinium* sp.	The Netherlands	GU238157	GU237855	KP330431	GU237668
Nothophoma anigozanthi	*Phoma anigozanthi*	CBS 381.91; PD 79/1110	T	*Anigozanthus maugleisii*	The Netherlands	GU238039	GU237852	**KT389655**	GU237580
No. arachidis-hypogaeae	*Phoma arachidis-hypogaeae*	CBS 125.93; PD 77/1029	R	*Arachis hypogaea*	India	GU238043	GU237771	**KT389656**	GU237583
No. gossypiicola	*Phoma gossypiicola*	CBS 377.67		*Gossypium* sp.	USA	GU238079	GU237845	**KT389658**	GU237611
No. infossa	*Phoma infossa*	CBS 123395	T	*Fraxinus pennsylvanica*	Argentina	GU238089	FJ427025	**KT389659**	FJ427135
No. quercina	*Phoma fungicola*	CBS 633.92; ATCC 36786; VKM MF-325		*Microsphaera alphitoides* from *Quercus* sp.	Ukraine	EU754127	GU237900	**KT389657**	GU237609
Ophiosphaerella herpotricha	*Ophiosphaerella herpotricha*	CBS 620.86		*Bromus erectus*	Switzerland	DQ678062	KF498728	DQ677958	—
Paraboeremia adianticola	*Didymella adianticola*	CBS 187.83; PD 82/128		*Polystichum adiantiforme*	USA	GU238035	GU237796	KP330401	GU237576
		CBS 260.92; PD 86/1103		*Pteris ensiformis*	—	**KT389752**	**KT389534**	—	**KT389832**
Pa. putaminum	*Phoma putaminum*	CBS 130.69; CECT 20054; IMI 331916	R	*Malus sylvestris*	Denmark	GU238138	GU237777	—	GU237652
		CBS 372.91; PD 75/960	R	*Ulmus* sp.	The Netherlands	GU238137	GU237843	—	GU237651
Pa. selaginellae	*Phoma selaginellicola*	CBS 122.93; PD 77/1049	T	*Selaginella* sp.	The Netherlands	GU238142	GU237762	—	GU237656
Paraleptosphaeria nitschkei	*Paraleptosphaeria nitschkei*	CBS 306.51	T	*Cirsium spinosissimum*	Switzerland	JF740308	JF740239	**KT389660**	**KT389833**

(*continued on next page*)

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
Phaeosphaeria ammophilae	*Phaeosphaeria ammophilae*	CBS 114595		*Ammophila arenaria*	Sweden	GU301859	KF766146	GU371724	—
Phaeosphaeriopsis triseptata	*Phaeosphaeriopsis triseptata*	MFLUCC 13-0347		*Ruscus aculeatus*	Italy	KJ522480	KJ522476	KJ522486	—
Phoma neerlandica		CBS 134.96; PD 84/676	T	*Delphinium* sp.	The Netherlands	**KT389753**	**KT389535**	**KT389661**	**KT389834**
Phoma herbarum	*Phoma cruris-hominis*	CBS 377.92; IMI 213845		Human leg	The Netherlands	**KT389756**	**KT389536**	**KT389663**	**KT389837**
	Phoma herbarum	CBS 502.91; PD 82/276		*Nerium* sp.	The Netherlands	GU238082	GU237874	KP330419	GU237613
	Phoma herbarum	CBS 615.75; PD 73/665; IMI 199779	R	*Rosa multiflora* cv. Cathayensis	The Netherlands	EU754186	FJ427022	KP330420	FJ427133
	Atradidymella muscivora	CBS 127589; UAMH 10909		*Polytrichum juniperinum*	USA	**KT389757**	**KT389539**	**KT389664**	**KT389838**
	Phoma acuum	CBS 274.37		*Picea excelsa*	UK	**KT389754**	**KT389537**	**KT389662**	**KT389835**
	Leptosphaeria millefolii	CBS 304.51		*Achillea millefolium*	Switzerland	**KT389755**	**KT389538**	—	**KT389836**
Phomatodes aubrietiae	*Phoma aubrietiae*	CBS 383.67; PD 65/223	R	*Aubrietia hybrida* cv. Superbissima	The Netherlands	GU238044	GU237854	—	GU237584
		CBS 627.97; PD 70/714	T	*Aubrietia* sp.	The Netherlands	GU238045	GU237895	**KT389665**	GU237585
Phomat. nebulosa	*Phoma nebulosa*	CBS 117.93; PD 83/90		*Mercurialis perennis*	The Netherlands	GU238114	GU237757	KP330425	GU237633
		CBS 100191		*Thlaspi arvense*	Poland	KP330446	KP330434	**KT389666**	KP330390
		CBS 740.96		*Armoracia rusticana*	The Netherlands	**KT389758**	**KT389540**	**KT389667**	**KT389839**
Plenodomus biglobosus	*Plenodomus biglobosus*	CBS 532.66; PD 65/911		*Brassica* sp.	The Netherlands	**KT389759**	**KT389541**	**KT389668**	**KT389840**
Plen. lingam	*Plen. lingam*	CBS 275.63		*Brassica* sp.	UK	JF740306	JF740234	**KT389669**	**KT389841**
Pleospora betae	*Pleospora betae*	CBS 523.66		*Beta vulgaris*	The Netherlands	EU754179	FJ426981	**KT389670**	**KT389842**
Pleo. herbarum	*Pleo. herbarum*	CBS 191.86	T	*Medicago sativa*	India	GU238160	KC584239	KC584471	—
Pleo. typhicola	*Pleo. typhicola*	CBS 132.69		*Typha angustifolia*	The Netherlands	JF740325	JF740105	KC584505	**KT389843**
Pyrenochaeta cava	*Pyrenochaeta cava*	CBS 257.68; CECT 20043; IMI 331911		Soil from wheat-field	Germany	EU754199	JF740260	—	**KT389844**
Pyrenochaeta nobilis	*Pyrenochaeta nobilis*	CBS 407.76	T	*Laurus nobilis*	Italy	EU754206	NR_103598	DQ677991	**KT389845**
Pyrenochaetopsis pratorum	*Pyrenochaetopsis pratorum*	CBS 445.81	T	*Lolium perenne*	New Zealand	GU238136	NR_111623	**KT389671**	**KT389846**
Pyrenophora phaeocomes	*Pyrenophora phaeocomes*	DAOM 222769		*Calamagrostis villosa*	Switzerland	JN940093	JN943649	DQ497614	—
Setomelanomma holmii	*Setomelanomma holmii*	CBS 110217		*Picea pungens*	USA	GQ387633	**KT389542**	GU371800	—
Sporomiella minima	*Sporomiella minima*	CBS 524.50		Dung of goat	Panama	DQ678056	**KT389543**	DQ677950	—
Stagonosporopsis actaeae	*Stagonosporopsis actaeae*	CBS 106.96; PD 94/1318	T	*Actaea spicata*	The Netherlands	GU238166	GU237734	**KT389672**	GU237671

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
	Didymella hellebori	CBS 114303; UPSC 2962		*Actaea spicata*	Sweden	**KT389760**	**KT389544**	—	**KT389847**
S. ajacis	*S. ajacis*	CBS 177.93; PD 90/115	T	*Delphinium* sp.	Kenya	GU238168	GU237791	**KT389673**	GU237673
S. andigena	*S. andigena*	CBS 101.80; PD 75/909; IMI 386090	R	*Solanum* sp.	Peru	GU238169	GU237714	—	GU237674
		CBS 269.80; PD 75/914		*Solanum* sp.	Peru	GU238170	GU237817	—	GU237675
S. artemisiicola	*S. artemisiicola*	CBS 102636; PD 73/1409	R	*Artemisia dracunculus*	France	GU238171	GU237728	**KT389674**	GU237676
S. astragali	*S. astragali*	CBS 178.25; MUCL 9915	R	*Astragalus* sp.	—	GU238172	GU237792	—	GU237677
S. caricae	*S. caricae*	CBS 248.90		*Carica papaya*	Chile	GU238175	GU237807	—	GU237680
		CBS 282.76		*Brassica* sp.	Indonesia	GU238177	GU237821	—	GU237682
S. chrysanthemi	*S. chrysanthemi*	CBS 500.63; MUCL 8090	R	*Chrysanthemum indicum*	Germany	GU238190	GU237871	—	GU237695
		CBS 137.96; PD 84/75	R	*Chrysanthemum indicum*	The Netherlands	GU238191	GU237783	—	GU237696
S. crystalliniformis	*S. crystalliniformis*	CBS 713.85; ATCC 76027; PD 83/826	T	*Solanum lycopersicum*	Colombia	GU238178	GU237903	**KT389675**	GU237683
S. cucurbitacearum	*S. cucurbitacearum*	CBS 133.96;PD 79/127		*Cucumis* sp.	New Zealand	GU238181	GU237780	**KT389676**	GU237686
S. dennisii	*S. dennisii*	CBS 631.68; PD 68/147	T	*Solidago floribunda*	The Netherlands	GU238182	GU237899	**KT389677**	GU237687
S. dorenboschii	*S. dorenboschii*	CBS 426.90; IMI 386093; PD 86/551	T	*Physostegia virginiana*	The Netherlands	GU238185	GU237862	**KT389678**	GU237690
S. helianthi		CBS 200.87	T	*Helianthus annuus*	Italy	**KT389761**	**KT389545**	**KT389683**	**KT389848**
S. heliopsidis	*S. heliopsidis*	CBS 109182; PD 74/231	R	*Heliopsis patula*	The Netherlands	GU238186	GU237747	**KT389679**	GU237691
S. hortensis	*S. hortensis*	CBS 104.42	R	—	The Netherlands	GU238198	GU237730	**KT389680**	GU237703
		CBS 572.85; PD 79/269	R	*Phaseolus vulgaris*	The Netherlands	GU238199	GU237893	**KT389681**	GU237704
S. inoxydabilis	*S. inoxydabilis*	CBS 425.90; PD 81/520	T	*Chrysanthemum parthenii*	The Netherlands	GU238188	GU237861	**KT389682**	GU237693
S. loticola	*S. loticola*	CBS 562.81; PDDCC 6884	T	*Lotus pedunculatus*	New Zealand	GU238192	GU237890	**KT389684**	GU237697
S. lupini	*S. lupini*	CBS 101494; PD 98/5247	T	*Lupinus albus*	UK	GU238194	GU237724	**KT389685**	GU237699
S. oculo-hominis	*S. oculo-hominis*	CBS 634.92; IMI 193307	T	Human corneal ulcer	USA	GU238196	GU237901	**KT389686**	GU237701
S. rudbeckiae	*S. rudbeckiae*	CBS 109180; PD 79/175	R	*Rudbeckia bicolor*	The Netherlands	GU238197	GU237745	—	GU237702
S. tanaceti	*S. tanaceti*	CBS 131484	T	*Tanacetum cinerariifolium*	Australia	JQ897461	NR_111724	—	JQ897496
S. trachelii	*S. trachelii*	CBS 379.91; PD 77/675	R	*Campanula isophylla*	The Netherlands	GU238173	GU237850	**KT389687**	GU237678
		CBS 384.68	R	*Campanula isophylla*	Sweden	GU238174	GU237856	—	GU237679
S. valerianellae	*S. valerianellae*	CBS 273.92; PD 82/43		*Valerianella locusta*	The Netherlands	GU238200	GU237819	—	GU237705
		CBS 329.67; PD 66/302	T	*Valerianella locusta* var. *oleracea*	The Netherlands	GU238201	GU237832	—	GU237706

(*continued on next page*)

Table 1. (Continued).

Species	Old name	Strain number[1]	Status[2]	Host, substrate	Country	GenBank accession numbers[3]			
						LSU	ITS	*rpb2*	*tub2*
Subplenodomus violicola	*Subplenodomus violicola*	CBS 306.68		*Viola tricolor*	The Netherlands	GU238156	FJ427083	—	**KT389849**
Xenodidymella applanata	*Didymella applanata*	CBS 195.36	T	*Rubus idaeus*	The Netherlands	**KT389764**	**KT389548**	—	**KT389852**
		CBS 205.63		*Rubus idaeus*	The Netherlands	GU237998	GU237798	KP330402	GU237556
		CBS 115577		*Rubus idaeus*	Sweden	**KT389762**	**KT389546**	**KT389688**	**KT389850**
		CBS 115578		*Rubus arcticus* nothossp. *stellarcticus*	Sweden	**KT389763**	**KT389547**	—	**KT389851**
X. asphodeli	*D. asphodeli*	CBS 375.62	T	*Asphodelus albus*	France	**KT389765**	**KT389549**	**KT389689**	—
		CBS 499.72		*Asphodelus ramosus*	Italy	**KT389766**	**KT389550**	—	**KT389853**
X. catariae	*D. catariae*	CBS 102635; PD 77/1131		*Nepeta catenaria*	The Netherlands	GU237962	GU237727	KP330404	GU237524
X. humicola	*Phoma humicola*	CBS 220.85; PD 71/1030	R	*Franseria* sp.	USA	GU238086	GU237800	KP330422	GU237617

[1] ATCC: American Type Culture Collection, Virginia, USA; CBS: Centraalbureau voor Schimmelcultures, Utrecht, The Netherlands; CECT: Colección Española de Cultivos Tipo, Valencia University, Spain; CPC: Culture collection of Pedro Crous, housed at CBS; DAOM: Canadian Collection of Fungal Cultures, Ottawa, Canada; DSM: Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, Braunschweig, Germany; IMI: International Mycological Institute, CABI-Bioscience, Egham, Bakeham Lane, UK; LEV: Plant Health and Diagnostic Station, Auckland, New Zealand; MFLUCC: Mae Fah Luang University Culture Collection, Chiang Rai, Thailand; MUCL: Mycotheque de l'Universite catholique de Louvain, Louvain-la-Neuve, Belgium; PD: Plant Protection Service, Wageningen, the Netherlands; PDDCC: Plant Diseases Division Culture Collection, Auckland, New Zealand; PREM: National Collection of Fungi: Culture Collection, Pretoria, South Africa; UAMH: University of Alberta Microfungus Collection and Herbarium, Canada; UPSC: Uppsala University Culture Collection, Sweden; VKM: All-Russian Collection of Microorganisms, Pushchino, Russia.

[2] T: ex-type strain; R: representative strain.

[3] ITS: internal transcribed spacer regions 1 & 2 including 5.8S nrDNA gene; LSU: 28S large subunit of the nrRNA gene; *rpb2*: RNA polymerase II second largest subunit; *tub2*: ß-tubulin.

downloaded from GenBank, and are listed in Table 1. Alignments of all consensus sequences, as well as the reference sequences were generated with MAFFT v. 7 (http://mafft.cbrc.jp/alignment/server/index.html; Katoh & Standley 2013), and were improved manually when necessary. Ambiguous regions were excluded from the analyses and gaps were treated as missing data. A 70 % neighbour-joining (NJ) reciprocal bootstrap method with maximum-likelihood distance was applied to check the congruence of the individual loci in the multi-locus dataset (Mason-Gamer & Kellogg 1996). Phylogenetic analyses of both individual and combined aligned data consisted of Bayesian and maximum-likelihood analyses.

MrModeltest v. 2.3 (Nylander 2004) was used to determine the best nucleotide substitution model settings for each locus. The Bayesian analyses of the combined four-locus dataset and individual locus data were performed with MrBayes v. 3.2.1 (Ronquist *et al.* 2012) based on the results of the MrModeltest. The Markov Chain Monte Carlo sampling (MCMC) analysis of four chains started in parallel from a random tree topology. The number of generations was set at 10 million and the run was stopped automatically when the average standard deviation of split frequencies fall below 0.01. Trees were saved each 1 000 generations. Burn-in was set at 25 % after which the likelihood values were stationary and the remaining trees were used to calculate posterior probabilities. Maximum-likelihood analyses including 1 000 bootstrap replicates were conducted using RAxML v. 7.2.6 (Stamatakis & Alachiotis 2010). A general time reversible model (GTR) was applied with a gamma-distributed rate variation. Novel sequences generated in this study were deposited in GenBank (Table 1), the final matrices used for phylogenetic analyses in TreeBASE (www.treebase.org; accession number: S18162), and novel taxonomic descriptions and nomenclature in MycoBank (www.MycoBank.org; Crous *et al.* 2004).

RESULTS

Phylogenetic analyses

The final concatenated alignment contained 286 ingroup taxa with a total of 2 620 characters including gaps (966 characters for LSU, 648 for ITS, 395 for *tub2* and 599 for *rpb2*) of which 883 were unique site patterns (45 for LSU, 270 for ITS, 216 for *tub2* and 352 for *rpb2*), and *Sporormiella minima* (CBS 524.50) served as the outgroup taxon. The first 57 and the last 342 characters including gaps of the original LSU alignment was excluded from the analyses as these regions are unalignable. The general time reversible model with inverse gamma rates (GTR + I + G) was determined to be the best for all four loci by MrModeltest. The LSU, ITS, *tub2* and *rpb2* sequence datasets did not show any conflicts in the tree topologies for the 70 % reciprocal bootstrap trees, which allowed to combine the four loci for the multi-locus analysis.

The single locus phylogenies of LSU and ITS display low resolution at both generic and species level. The LSU phylogeny was only able to distinguish *Boeremia*, *Calophoma*, *Leptosphaerulina*, *Macroventuria*, *Neoascochyta* and *Neodidymelliopsis* clades, but failed for the other 11 genera. The ITS phylogeny was only able to distinguish 9 of 17 generic clades and failed for *Allophoma*, *Ascochyta*, *Didymella*, *Epicoccum*, *Heterophoma*, *Macroventuria*, *Nothophoma* and *Xenodidymella*. The *rpb2* phylogeny was able to distinguish all 17 generic clades and with good resolution of species among these genera. The *tub2* phylogeny was able to distinguish 13 of 17 generic clades and failed for *Allophoma*, *Ascochyta*, *Calophoma* and *Stagonosporopsis*.

For the multi-locus analyses, a total of 12 858 trees were sampled after the burn-in with a stop value of 0.01. The topology of the BI tree confirmed that of ML tree for the distinctions of 17 well supported monophyletic clades, and therefore only the ML consensus tree with Bayesian posterior probabilities (BPP) and RAxML bootstrap support (MLBS) values are indicated in Fig. 1. Clustering basal in the four-locus tree (Fig. 1) were the outgroup taxon *Sporormiella minima* (CBS 524.50) and five monophyletic groups representing the five other families in *Pleosporales* close to *Didymellaceae*, namely *Coniothyriaceae* (BPP = 0.93; MLBS = 75 %) comprising four species, *Coniothyrium carteri*, *Co. glycines*, *Co. palmarum* and *Co. telephii*; *Leptosphaeriaceae* (BPP = 1; MLBS = 69 %) containing six species, *Leptosphaeria conoidea*, *Leptosphaeria doliolum*, *Paraleptosphaeria nitschkei*, *Plenodomus biglobosus*, *Plen. lingam* and *Subplenodomus violicola*; *Cucurbitariaceae* (BPP = 1; MLBS = 50 %) comprising four species, *Cucurbitaria berberidis*, *Pyrenochaeta cava*, *Pyrenochaeta nobilis* and *Pyrenochaetopsis pratorum*; *Pleosporaceae* (BPP = 1; MLBS = 83 %) comprising six species, *Alternaria japonica*, *Bipolaris maydis*, three *Pleospora* species, *viz*. *Pleospora betae*, *Pleo. herbarum* and *Pleo. typhicola*, and *Pyrenophora phaeocomes*; and *Phaeosphaeriaceae* (BPP = 1; MLBS = 100 %) comprising four species, *Ophiosphaerella herpotricha*, *Phaeosphaeria ammophilae*, *Phaeosphaeriopsis triseptata* and *Setomelanomma holmii*.

The remaining ingroup could be divided into a basal *Microsphaeropsis* clade (BPP = 0.99; MLBS = 94 %, three isolates including the type species of *Microsphaeropsis*, *Mi. olivacea*) and the main *Didymellaceae* clade (BPP = 0.98; MLBS = 67 %). In the *Didymellaceae* clade, 17 well-supported monophyletic lineages were resolved, of which eight represent existing genera, and the remaining nine are described as new genera.

At the most terminal position, a well-supported clade, **Clade 1** (BPP = 1; MLBS = 91 %, 29 isolates) accommodated all the species of the genus *Stagonosporopsis*, which was in congruence with the results of Aveskamp *et al.* (2010). **Clade 2** (BPP = 1; MLBS = 100 %, eight isolates) comprised five "*Phoma*" species and a novel species, which formed a novel genus *Allophoma*, *i.e. All. nicaraguensis*, *All. labilis* (syn. *Phoma labili*), *All. minor* (syn. *Phoma minor*), *All. piperis* (syn. *Phoma piperis*), *All. tropica* (syn. *Phoma tropica*), and *All. zantedeschiae* (syn. *Phoma zantedeschiae*). **Clade 3** (BPP = 1; MLBS = 97 %, six isolates) comprised five species accommodated in a novel genus *Heterophoma*, *i.e. H. adonidis* (syn. *Didymella adonidis*), *H. nobilis* (syn. *Ascochyta nobilis*), *H. novae-verbascicola* (syn. *Phoma novae-verbascicola*), *H. poolensis* (syn. *Phoma poolensis*), and *H. sylvatica* (syn. *Phoma sylvatica*). In congruence with the study of Aveskamp *et al.* (2010), the *Boeremia* species grouped in a well-defined cluster. **Clade 4** (BPP = 1; MLBS = 100 %, 33 isolates), including *B. exigua* varieties and 10 other *Boeremia* species. **Clade 5** (BPP = 0.98; MLBS = 99 %, 11 isolates) included three species of the genus *Epicoccum*, *E. nigrum*, *E. pimprinum* and *E. sorghinum*, and another five species of *Phoma* which were recombined into this genus, *E. brasiliense* (syn. *Phoma brasiliensis*), *E. draconis* (syn. *Phoma draconis*), *E. henningsii* (syn. *Phoma henningsii*), *E. huancayense* (syn. *Phoma huancayensis*) and *E. plurivorum*

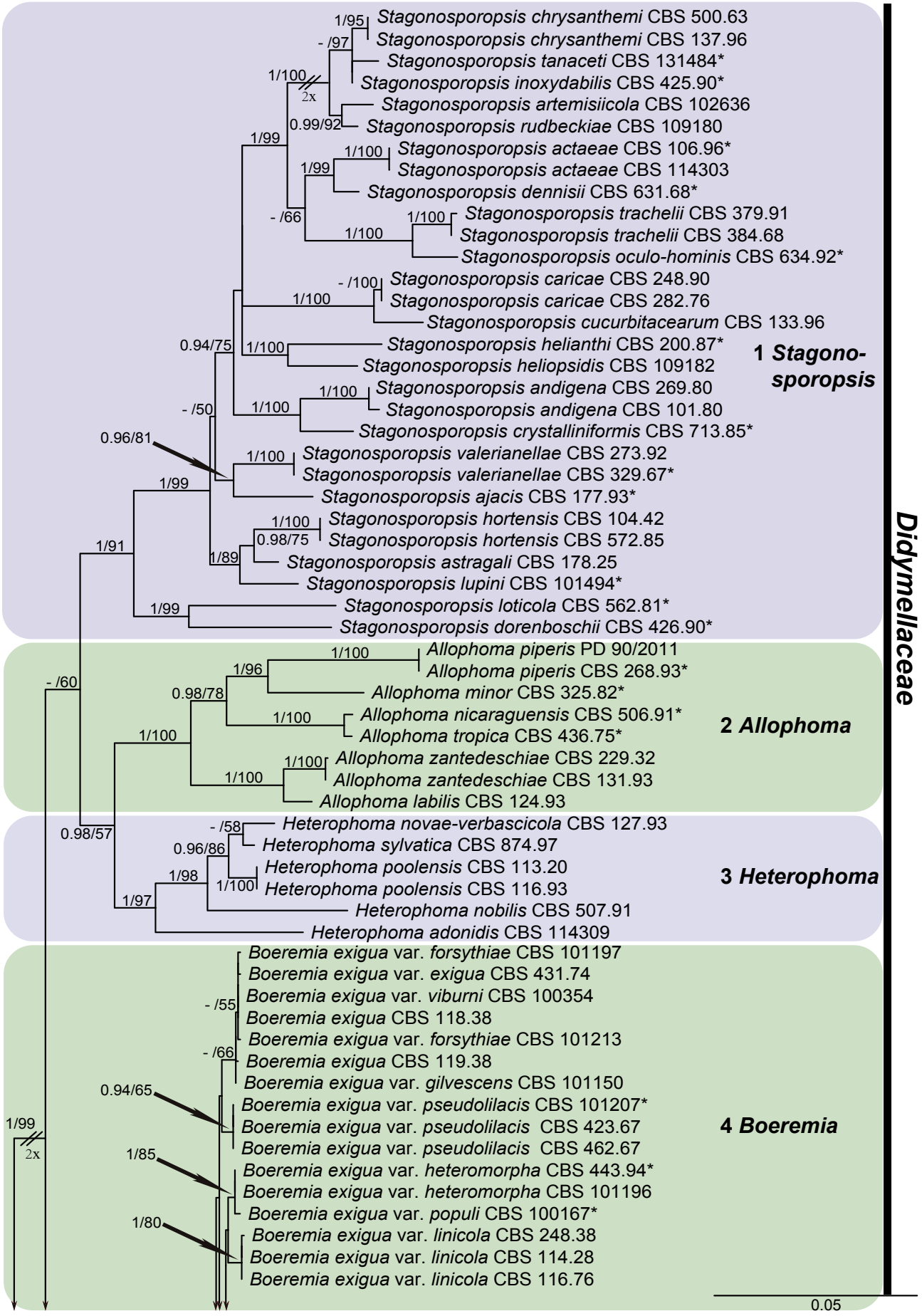

Fig. 1. Phylogenetic tree inferred from a Maximum likelihood analysis based on a concatenated alignment of LSU, ITS, *rpb2* and *tub2* sequences of 287 strains representing *Didymellaceae* and allied families. The RAxML bootstrap support values (MLBS) and Bayesian posterior probabilities (BPP) are given at the nodes (BPP/MLBS). Some branches were shortened to fit them to the page – these are indicated by two diagonal lines with the number of times a branch was shortened indicated next to the lines. Ex-type strains are marked by an asterisk (*). The tree was rooted to *Sporormiella minima* (CBS 524.50).

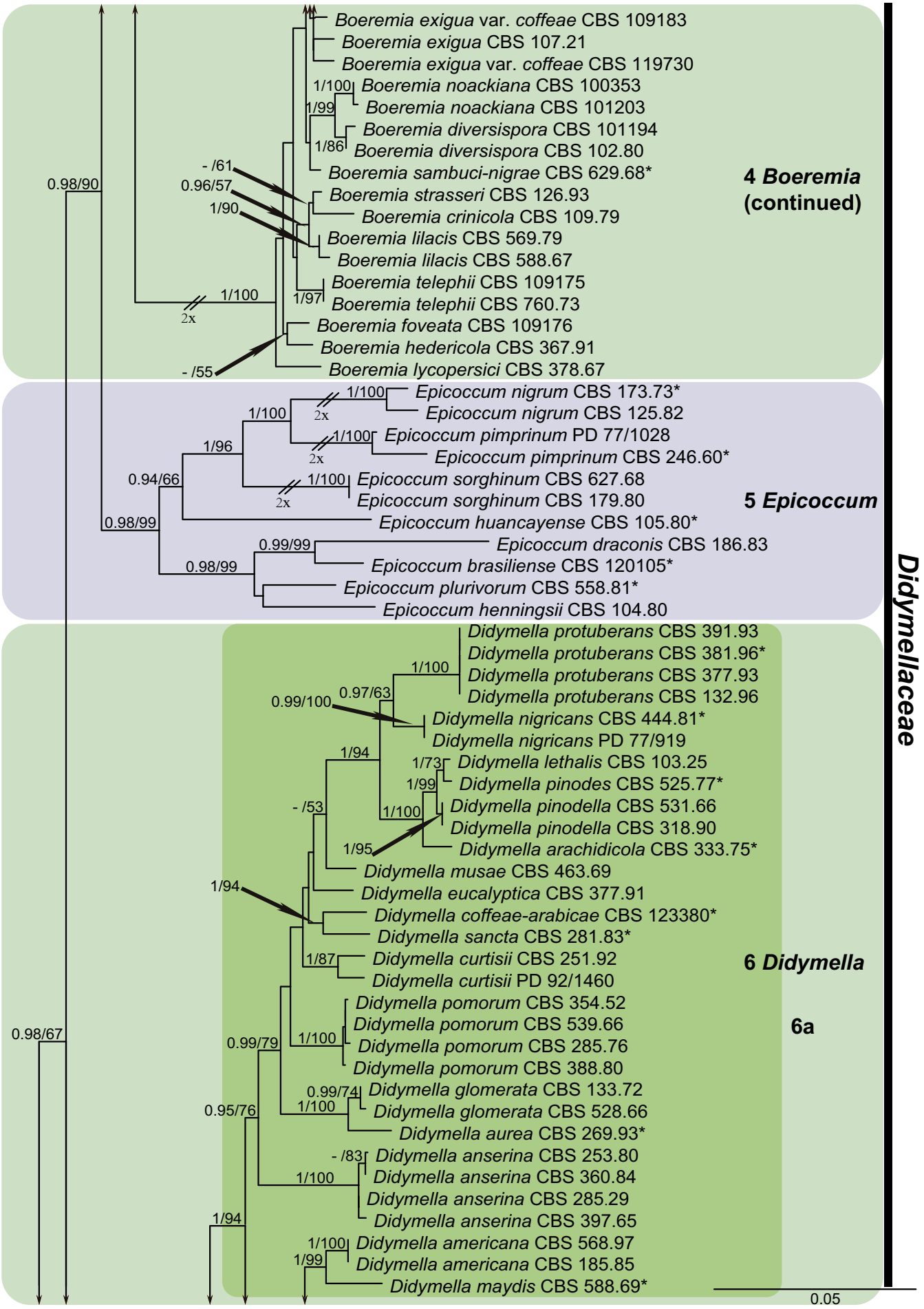

Fig. 1. (Continued).

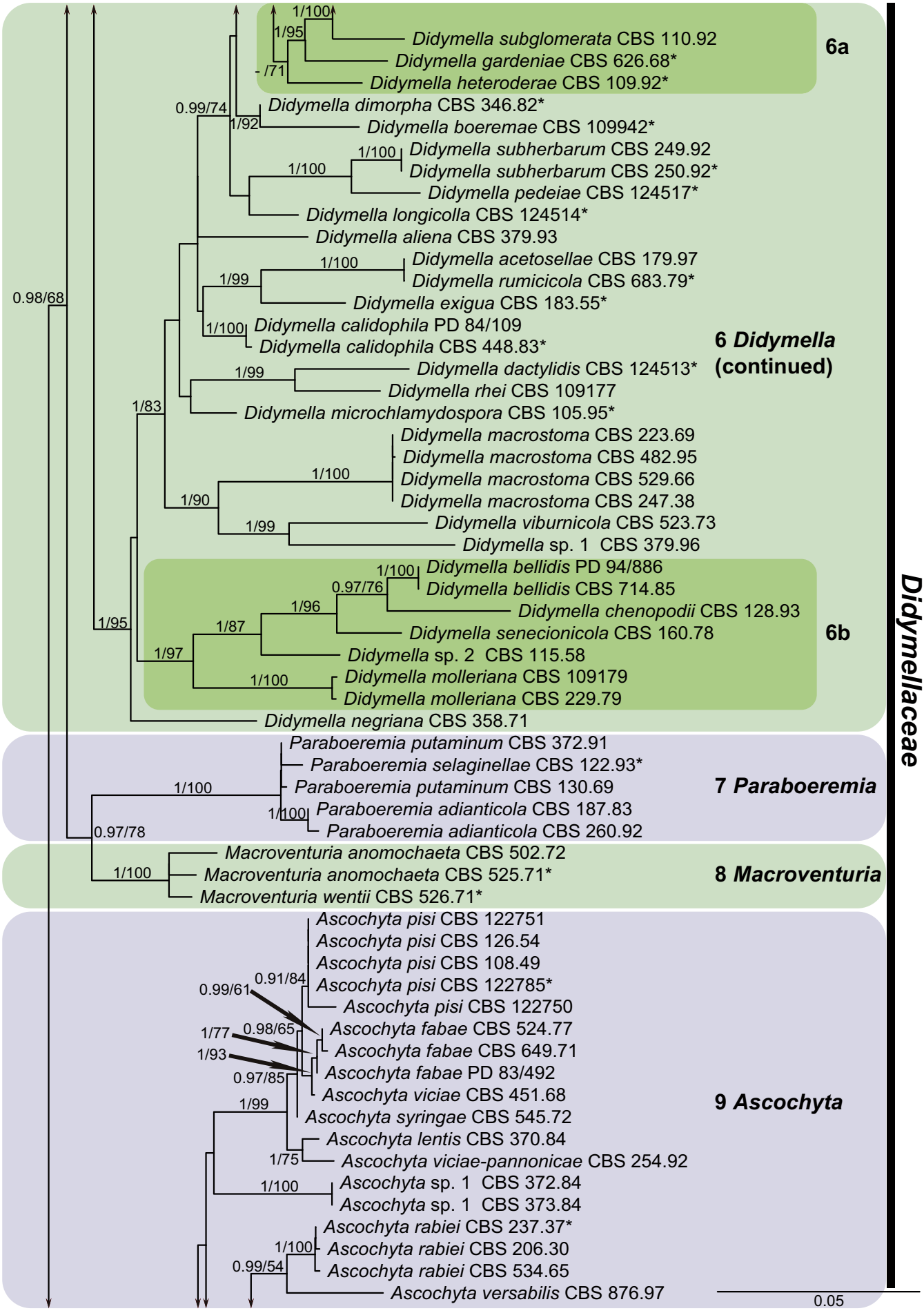

Fig. 1. (Continued).

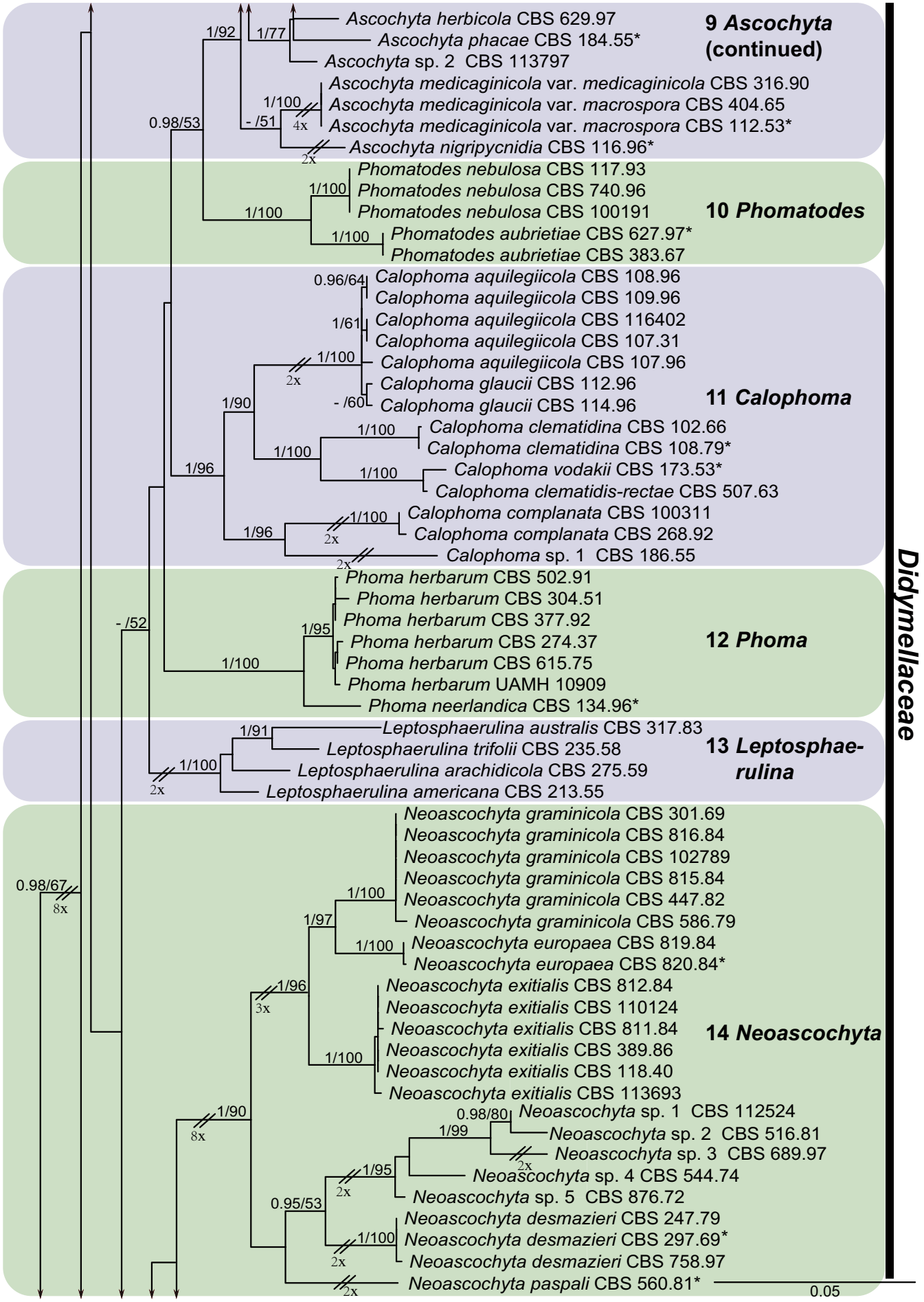

Fig. 1. (Continued).

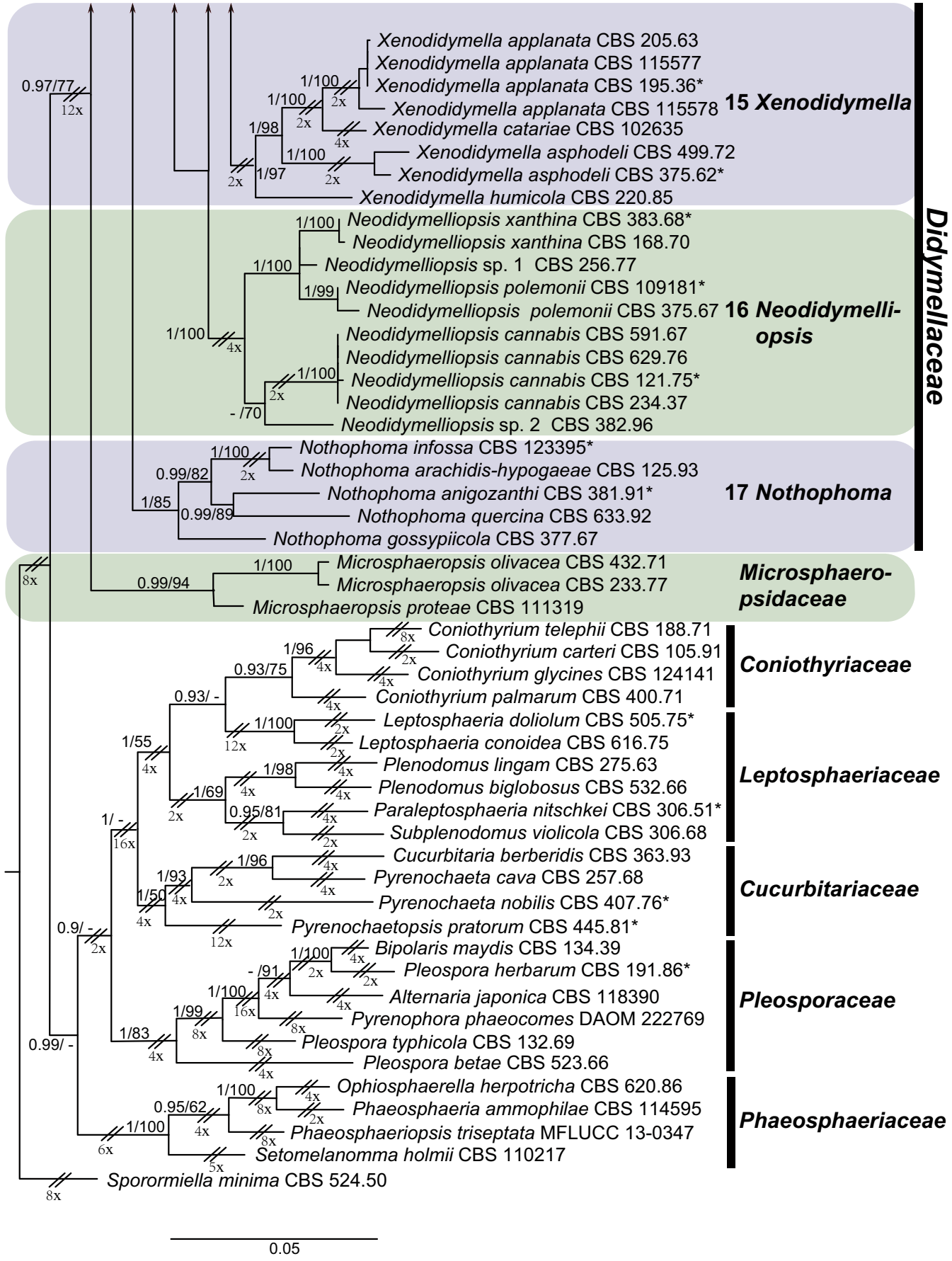

Fig. 1. (Continued).

(syn. *Phoma plurivora*). **Clade 6** (BPP = 1; MLBS = 95 %, 62 isolates) accommodated the type genus of the family *Didymellaceae*, *Didymella*, with the type species *D. exigua* (CBS 183.55). The **subclade 6a** accommodated 20 taxa belonging to the recently resurrected genus *Peyronellaea*, which were recombined into the genus *Didymella*. The **subclade 6b** comprised a cluster containing *D. bellidis* (syn. *Phoma bellidis*), *D. chenopodii* (syn. *Phoma chenopodiicola*), *D. molleriana* (syn. *Phoma digitalis*), *D. senecionicola* (syn. *Phoma senecionis*) and an isolate received as "*Ascochyta pyrethri*" (CBS 115.58). Between these two subclades there were several small groups comprised of *D. acetosellae* (syn. *Phoma acetosellae*), *D. aliena* (syn. *Phoma aliena*), *D. boeremae* (syn. *Phoma boeremae*), *D. calidophila* (syn. *Phoma calidophila*), *D. dactylidis* (syn. *Phoma dactylidis*), *D. dimorpha* (syn. *Phoma dimorpha*), the aforementioned *D. exigua*, *D. longicolla* (syn. *Phoma longicolla*), *D. mascrostoma* (syn. *Phoma mascrostoma* var. *mascrostoma*), *D. microchlamydospora* (syn. *Phoma microchlamydospora*), *D. pedeiae* (syn. *Phoma pedeiae*), *D. rhei* (syn. *Phoma rhei*), *D. rumicicola* (syn. *Phoma rumicicola*), *D. subherbarum* (syn. *Phoma subherbarum*), *D. viburnicola* (syn. *Phoma viburnicola*), an isolate received as "*Phoma libertiana*" (CBS 247.38) and an isolate representing a single lineage (CBS 379.96). **Clade 7** (BPP = 1; MLBS = 100 %) comprised five isolates representing three species, which belong to a newly introduced genus *Paraboeremia*, namely *Pa. adianticola* (syn. *D. adianticola*), *Pa. putaminum* (syn. *Phoma putaminum*), and *Pa. selaginellae* (syn. *Phoma selaginellicola*). **Clade 8** (BPP = 1; MLBS = 100 %) contained three isolates of *Macroventuria* including the generic type, *Ma. anomochaeta*. **Clade 9** (BPP = 1; MLBS = 92 %, 25 isolates) accommodated the genus *Ascochyta* with its type species, *As. pisi*, and other *Ascochyta* species, *As. fabae*, *As. herbicola* (syn. *Phoma herbicola*), *As. lentis*, *As. medicaginicola* var. *macrospora* (syn. *Phoma medicaginis* var. *macrospora*), *As. medicaginicola* var. *medicaginicola* (syn. *Phoma medicaginis* var. *medicaginis*), *As. nigripycnidia* (syn. *Phoma nigripycnidia*), *As. rabiei*, *As. syringae*, *As. versabilis* (syn. *Phoma versabilis*), *As. viciae*, *As. viciae-pannonicae*, *As. phacae* and three isolates representing two insufficiently known species (CBS 372.84, CBS 373.84, CBS 113797). Two species that produced phoma-like conidia were embedded in **clade 10** (BPP = 1; MLBS = 100 %, five isolates), which is proposed here as a new genus, *Phomatodes*, including *Phomat. aubrietiae* (syn. *Phoma aubrietiae*) and *Phomat. nebulosa* (syn. *Phoma nebulosa*). The majority of the isolates that clustered in **clade 11** (BPP = 1; MLBS = 96 %, 14 isolates) were identified as "*Phoma*" sp., and a new generic name *Calophoma* is introduced below for this clade, which comprised five accepted species, *Ca. aquilegiicola* (syn. *Phoma aquilegiicola*), *Ca. clematidina* (syn. *Phoma clematidina*), *Ca. clematidis-rectae* (syn. *Phoma clematidis-rectae*), *Ca. complanata* (syn. *Phoma complanata*), *Ca. glaucii* (syn. *Phoma glaucii*), *Ca. vodakii* (syn. *D. vodakii*) and an insufficiently known species (CBS 186.55). **Clade 12** (BPP = 1; MLBS = 100 %, seven isolates) accommodated the genus *Phoma*, including the generic type, *Phoma herbarum* and its sexual morph (based on *Atradidymella muscivora* strain UAMH 10909), and a new species *Phoma neerlandica*. **Clade 13** (BPP = 1; MLBS = 100 %) comprised four isolates of *Leptosphaerulina*, including its type species, *L. australis*. **Clade 14** (BPP = 1; MLBS = 90 %, 23 isolates) comprised a "*Phoma*" isolate and 22 isolates formerly identified as "*Ascochyta*", and a "*Didymella*" species, most of which were subjected to molecular analysis for the first time. A new generic name *Neoascochyta* is proposed below for these taxa. These included *Neoa. desmazieri* (syn. *Ascochyta desmazieri*), *Neoa. exitialis* (syn. *Didymella exitialis*), *Neoa. graminicola* (syn. *Didymella graminicola*), *Neoa. europaea* (syn. *As. hordei* var. *europaea*), *Neoa. paspali* (syn. *Phoma paspali*) and five insufficiently known isolates (CBS 516.81, CBS 544.74, CBS 689.97, CBS 876.72 and CBS 112524). **Clade 15** (BPP = 1; MLBS = 97 %, eight isolates) accommodated a newly established sexual genus, *Xenodidymella*, including *X. applanata* (syn. *Didymella applanata*), *X. asphodeli* (syn. *D. asphodeli*), *X. catariae* (syn. *D. catariae*) and *X. humicola* (syn. *Phoma humicola*). **Clade 16** (BPP = 1; MLBS = 100 %) contained 10 isolates initially classified in the genera *Ascochyta* and *Didymella*, as well as *Phoma*, and for this well-supported cluster the new generic name *Neodidymelliopsis* is proposed below, including six species, *Neod. cannabis* (syn. *D. cannabis*), *Neod. polemonii* (syn. *Phoma polemonii*), *Neod. xanthina* (syn. *Phoma xanthina*) and two insufficiently known isolates (CBS 256.77, CBS 382.96). **Clade 17** (BPP = 1; MLBS = 85 %, five isolates) contained five species that were accommodated in a new genus proposed below, *Nothophoma*, namely *No. anigozanthi* (syn. *Phoma anigozanthi*), *No. arachidis-hypogaeae* (syn. *Phoma arachidis-hypogaeae*), *No. quercina* (syn. *Phoma fungicola*), *No. gossypiicola* (syn. *Phoma gossypiicola*) and *No. infossa* (syn. *Phoma infossa*).

Taxonomy

Phylogenetic analyses based on the combined LSU, ITS, *tub2* and *rpb2* sequences resolved a total of 24 clades, in which 17 clades including 162 taxa belonged to the *Didymellaceae*. With morphological examination of the type specimens and isolates, nine new genera, three new species, 84 new combinations, two new names and 11 epitypifications and seven neotypifications are proposed below. All recognised clades are treated, and the novelties, as well as epitypifications and neotypifications are described and illustrated below. The main morphological characters of accepted genera in *Didymellaceae* were provided in Table 2. The identity of several species and / or isolates could not be resolved, mostly because the type materials were unavailable for study. Their identities remain uncertain and will be resolved in future studies. The genus *Microsphaeropsis* grouped basal to the *Didymellaceae*, for which a new family *Microsphaeropsidaceae* was introduced.

Treatment of monophyletic lineages

Clade 1: *Stagonosporopsis*

Stagonosporopsis Died. emend. Aveskamp *et al.*, Stud. Mycol. 65: 44. 2010.

Conidiomata pycnidial, globose to subglobose, superficial on or immersed into the agar, solitary or confluent, ostiolate or poroid. *Pycnidial wall* pseudoparenchymatous, 2–6-layered, with an outer wall composed of 1–3 layers of brown olivaceous cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform or doliiform. *Conidia* often dimorphic: majority aseptate, hyaline, ellipsoidal to subglobose, thin- and smooth-walled. Conidia of the second type smaller in size, can be produced both *in vivo* and *in vitro* in the same pycnidia, unicellular or with up to 3 septa. *Ascomata* pseudothecial, if present, occurring only *in vivo*, globose to subglobose, sometimes with a somewhat conical neck. *Asci* cylindrical or subclavate, 8-

Table 2. Overview of the main characters of genera in *the Didymellaceae*.

Genera	Asexual morph			Sexual morph	
	Conidia	**Septa**	**Chlamydospores**	**Ascospores**	**Septa**
Allophoma	ovoid, oblong, ellipsoidal to cylindrical, or slightly allantoid	aseptate	–	–	–
Ascochyta	ovoid, oblong, subcylindrical, ellipsoidal, cymbiform, allantoid	0–1(–3)	unicellular or multicellular	ovoid to ellipsoidal, slightly biconic	1 or 3
Boeremia	variable in shape	0–1(–2)	–	ellipsoidal	1
Calophoma	subglobose, subcylindrical, ellipsoidal, somewhat obclavate-fusiform	0–1	unicellular or multicellular	–	–
Didymella	ellipsoidal to subglobose, cylindrical, oblong, ovoid, sometimes allantoid	aseptate	unicellular or multicellular	ellipsoidal to cymbiform	1 or multiseptate
Epicoccum	ovoid, ellipsoidal to oblong, (sub-)cylindrical; epicoccoid conidia: multicellular-phragmosporous, subglobose-pyriform	aseptate; septa being obscured by the dark verrucose wall	unicellular or multicellular	–	–
Heterophoma	ellipsoidal, oblong, cylindrical, reniform, or slightly allantoid	0–1(–2)	unicellular	–	–
Leptosphaerulina	–	–	–	muriform, oblong, ellipsoidal to obovoid, subfusoid	1(–6)
Macroventuria	–	–	–	ellipsoidal	1
Neoascochyta	fusoid to cylindrical, obclavate-ovoid to ellipsoidal	0–1	–	cylindrical to ovoid, ellipsoidal	1
Neodidymelliopsis	ovoid to ellipsoidal, cylindrical, allantoid	0–1	unicellular or multicellular	subovoid to oblong, ellipsoidal	1(–3)
Nothophoma	ovoid, oblong to ellipsoidal	aseptate	–	–	–
Paraboeremia	ellipsoidal	aseptate	–	subcylindrical	1
Phoma	oblong to cylindrical, ellipsoidal, sometimes fusiform	aseptate	–	fusiform	1
Phomatodes	cylindrical to allantoid	aseptate	–	–	–
Stagonosporopsis	ellipsoidal to subglobose	0–3	–	ellipsoidal, fusiform or obovoid	1
Xenodidymella	ellipsoidal to allantoid, subcylindrical, oblong, pyriform	0–1	unicellular	obovoid to oblong, clavate, ellipsoidal	1

spored, biseriate. *Ascospores* ellipsoidal, fusiform or obovoid, 1-septate, guttulate (from Aveskamp *et al.* 2010).

Type species: *Stagonosporopsis hortensis* (Sacc. & Malbr.) Petr., Ann. Mycol. 19: 21. 1921.

Stagonosporopsis actaeae (Allesch.) Died., Ann. Mycol. 10: 141. 1912.
Basionym: *Actinonema actaeae* Allesch., Ber. Bayer. Bot. Ges. 5: 7. 1897.
= *Phoma actaeae* Boerema *et al.*, Persoonia 16: 347. 1997.

Specimens examined: **Sweden**, Uppland, Dalby par., Jerusalem, from *Actaea spicata*, 16 Jun. 1989, K. & L. Holm, CBS 114303 = UPSC 2962. **The Netherlands**, Limburg, Schaersbergerbos, from a leaf spot of *Actaea spicata*, 22 Sep. 1994 (**holotype** of *Phoma actaeae* L 992.167-501, culture ex-holotype CBS 106.96 = PD 94/1318).

Notes: Isolate CBS 114303, received as "*Didymella hellebori*", was also isolated from the same host as the holotype of *Stagonosporopsis actaeae*, and is genetically identical to CBS 106.96 in all sequenced loci. It appears that CBS 114303 represents the sexual morph for *S. actaeae*.

Stagonosporopsis ajacis (Thüm.) Aveskamp *et al.*, Stud. Mycol. 65: 44. 2010.
Basionym: *Phyllosticta ajacis* Thüm., Boll. Soc. Adriat. Sci. Nat. Trieste 6: 329. 1880.
= *Phoma ajacis* Aa & Boerema, Persoonia 15: 383. 1993.

Specimen examined: **Kenya**, from *Delphinium* sp., 1990, Hopman (**neotype** of *Phoma ajacis* L 993.034.225, culture ex-neotype CBS 177.93 = PD 90/115).

Stagonosporopsis andigena (Turkenst.) Aveskamp *et al.*, Stud. Mycol. 65: 44. 2010.
Basionym: *Phoma andigena* Turkenst., Persoonia 16: 131. 1995.

Specimens examined: **Peru**, Dep. Junin, Huancayo, near Valle del Mantaro, from a leaf of *Solanum* sp., deposited in CBS Jan. 1980, G.H. Boerema, CBS 101.80 = PD 75/909 = IMI 386090; Dep. Junin, Huancayo, near Valle del Mantaro, from a leaf of *Solanum* sp., 1975, L.J. Turkensteen, CBS 269.80 = PD 75/914.

Stagonosporopsis artemisiicola (Hollós) Aveskamp *et al.*, Stud. Mycol. 65: 44. 2010.
Basionym: *Phoma artemisiicola* Hollós, Mat. Term. Közlem. 35: 40. 1926. (as "*artemisaecola*")

Specimen examined: **France**, from a stem base of *Artemisia dracunculus*, deposited in CBS Mar. 2000, CBS 102636 = PD 73/1409.

Stagonosporopsis astragali (Cooke & Harkn.) Aveskamp *et al.*, Stud. Mycol. 65: 45. 2010.
Basionym: *Phoma astragali* Cooke & Harkn., Grevillea 13: 111. 1885.

Specimen examined: **Unknown origin**, from *Astragalus* sp., deposited in CBS Sep. 1925, A.W. Archer, CBS 178.25 = MUCL 9915.

Stagonosporopsis caricae (Syd. & P. Syd.) Aveskamp *et al.*, Stud. Mycol. 65: 45. 2010.
Basionym: *Mycosphaerella caricae* Syd. & P. Syd., Ann. Mycol. 11: 403. 1913.
= *Ascochyta caricae-papayae* Tarr., The fungi and plant diseases of Sudan: 53. 1955.
≡ *Phoma caricae-papayae* (Tarr.) Punith., Trans Brit. Mycol. Soc. 75: 340. 1980.
= *Phoma caricae* Punith., C.M.I. Descript. Pathog. Fungi Bact. 634: 1. 1979.

Specimens examined: **Chile**, from fruit of *Carica papaya*, deposited in CBS Jun. 1990, CBS 248.90. **Indonesia**, Java, Segunung, from *Brassica* sp., Feb. 1976, H. Vermeulen, CBS 282.76.

Stagonosporopsis chrysanthemi (F. Stevens) Crous *et al.*, Australas. Pl. Pathol. 41: 681. 2012.
Basionym: *Ascochyta chrysanthemi* F. Stevens, Bot. Gaz. 44: 246. 1907.
= *Mycosphaerella ligulicola* K.F. Baker *et al.*, Phytopathology 39: 799. 1949.
≡ *Didymella ligulicola* (K.F. Baker *et al.*) Arx, Beitr. Kryptogamenfl. Schweiz. 11: 364. 1962.
≡ *Didymella ligulicola* var. *ligulicola* (K.F. Baker *et al.*) Arx, Stud. Mycol. 32: 9. 1990.
≡ *Stagonosporopsis ligulicola* var. *ligulicola* (K.F. Baker *et al.*) Aveskamp *et al.*, Stud. Mycol. 65: 46. 2010.
= *Phoma ligulicola* var. *ligulicola* Boerema, Stud. Mycol. 32: 9. 1990.

Specimens examined: **Germany**, Berlin, from *Chrysanthemum indicum*, deposited in CBS Dec. 1963, R. Schneider, CBS H-11952, culture CBS 500.63 = MUCL 8090. **The Netherlands**, near Lisse, from a leaf of *Chrysanthemum indicum*, deposited in CBS Feb. 1996, CBS 137.96 = PD 84/75.

Stagonosporopsis crystalliniformis (Loer. *et al.*) Aveskamp *et al.*, Stud. Mycol. 65: 45. 2010.
Basionym: *Phoma andina* var. *crystalliniformis* Loer. *et al.*, Fitopatología 21: 100. 1986.
≡ *Phoma crystalliniformis* (Loer. *et al.*) Noordel. & Gruyter, Mycol. Res. 97: 1344. 1993.

Specimens examined: **Colombia**, Antioquia, Rionegro, from a stem base of *Lycopersicon esculentum*, 1983, R. Navarro (**holotype** CBS H-3926, culture ex-holotype CBS 713.85 = ATCC 76027 = PD 83/826).

Stagonosporopsis cucurbitacearum (Fr.) Aveskamp *et al.*, Stud. Mycol. 65: 45. 2010.
Basionym: *Sphaeria cucurbitacearum* Fr., Syst. Mycol. 2: 502. 1823.
≡ *Phoma cucurbitacearum* (Fr.) Sacc., Syll. Fung. 3: 148. 1884.
= *Sphaeria bryoniae* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 112. 1870.
≡ *Didymella bryoniae* (Fuckel) Rehm, Ber. Naturhist. Vereins Augsburg 26: 27. 1881.

Specimen examined: **New Zealand**, from *Cucumis* sp., deposited in CBS May 1996, CBS 133.96 = PD 79/127.

Stagonosporopsis dennisii Boerema *et al.*, Persoonia 16: 350. 1997. Fig. 2.
= *Phoma dennisii* Boerema, Trans. Brit. Mycol. Soc. 67: 307. 1976.

Description from ex-epitype culture (CBS 631.68): *Conidiomata* pycnidial, confluent, subglobose, glabrous, superficial on or immersed into the agar, (110–)170–400 × (110–)130–275(–300) µm. *Ostioles* 1–2, slightly papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, composed of oblong to isodiametric cells, 2–3 layers, 11–14 µm thick. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 5–8.5 × 3.5–7(–9.5) µm. *Conidia* ellipsoidal to cylindrical, thin-walled, smooth, aseptate, 3.5–5.5 × 1.5–3.5 µm, egutullate or sometimes with 1–3 small guttules. *Conidial matrix* cream to buff.

Culture characteristics: Colonies on OA, 65–70 mm diam after 7 d, margin regular, in some sectors covered by floccose aerial mycelia, white to greenish olivaceous; reverse olivaceous, buff in some sectors. Colonies on MEA 65–70 mm diam after 7 d, margin regular, aerial mycelium sparse, white to pale olivaceous; reverse white, pale olivaceous near the centre. Colonies on PDA, 70–75 mm diam after 7 d, margin regular, floccose aerial mycelium covering the whole colony, white to pale grey; reverse hazel with some sectors in brown olivaceous. NaOH spot test: a slight reddish discolouration on MEA.

Specimens examined: **The Netherlands**, Arnhem, from a stem of *Solidago floribunda*, deposited in CBS Sep. 1968 (**epitype designated here** HMAS 246703, MBT202490, culture ex-epitype CBS 631.68 = PD 68/147); Wageningen, from dead stems of *Solidago virgaurea*, Oct. 1976, M.M.J. Dorenbosch (**holotype** L 996, 047-028).

Notes: This fungus was originally described from dead stems of *Solidago virgaurea*, with conidia 2.5–8.5 × 1–3.5 µm (Boerema 1976). The epitype from *Solidago floribunda* agrees well in morphology with the type material as conidia are aseptate, measuring 3.5–5.5 × 1.5–3.5 µm.

Stagonosporopsis dorenboschii (Noordel. & Gruyter) Aveskamp *et al.*, Stud. Mycol. 65: 45. 2010.
Basionym: *Phoma dorenboschii* Noordel. & Gruyter, Persoonia 15: 83. 1992.

Specimen examined: **The Netherlands**, Rijnsburg, from *Physostegia virginiana*, deposited in CBS Oct. 1990, M.E. Noordeloos (**holotype** L 988.202-121, **isotype** CBS H-7604, culture ex-holotype CBS 426. 90 = IMI 386093 = PD 86/551).

Stagonosporopsis heliopsidis (H.C. Greene) Aveskamp *et al.*, Stud. Mycol. 65: 45. 2010.
Basionym: *Phyllosticta heliopsidis* H.C. Greene, Trans. Wisconsin Acad. Sci. 50: 158. 1961.
≡ *Phoma heliopsidis* (H.C. Greene) Aa & Boerema, Persoonia 18: 40. 2002.

Specimen examined: **The Netherlands**, from *Heliopsis patula*, deposited in CBS Jan. 2001, H. de Gruyter, CBS 109182 = PD 74/231.

Stagonosporopsis hortensis (Sacc. & Malbr.) Petr., Ann. Mycol. 19: 21. 1921.
Basionym: *Hendersonia hortensis* Sacc. & Malbr., Michelia 2: 629. 1882.
= *Phoma subboltshauseri* Boerema *et al.*, Persoonia 16: 360. 1997.
= *Ascochyta boltshauseri* Sacc. Z. Pflanzenkrankh. 1: 136. 1891.

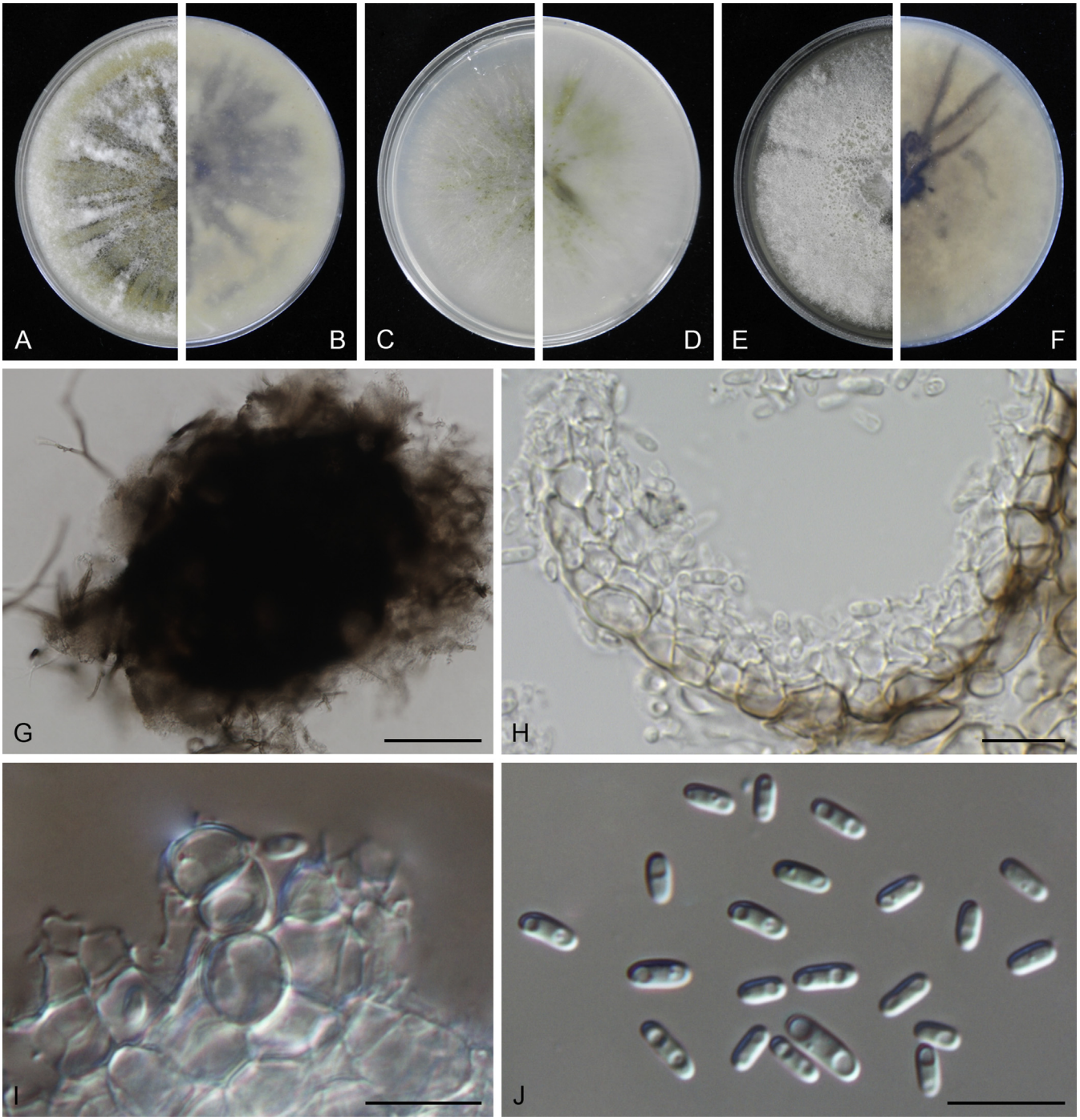

Fig. 2. *Stagonosporopsis dennisii* (CBS 631.68). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidium. H. Section of pycnidial wall. I. Conidiogenous cells. J. Conidia. Scale bars: G = 100 µm; H–J = 10 µm.

≡ *Stagonosporopsis boltshauseri* (Sacc.) Died., Ann Mycol. 10: 141. 1912.

Specimen examined: **The Netherlands**, from an unknown substrate, deposited in CBS Mar. 1942, N. Hubbeling, CBS 104.42; from *Phaseolus vulgaris*, deposited in CBS Sep. 1985, G.H. Boerema, culture CBS 572.85 = PD 79/269.

Note: As no generic type was designated by Diedicke (1912) when he established the genus *Stagonosporopsis*, *S. hortensis* was chosen as the type for this genus (Boerema & Verhoeven 1979, Vaghefi *et al.* 2012).

Stagonosporopsis inoxydabilis (Boerema) Crous *et al.*, Australas. Pl. Pathol. 41: 682. 2012.
Basionym: *Didymella ligulicola* var. *inoxydabilis* Boerema, Stud. Mycol. 32: 9. 1990.

≡ *Stagonosporopsis ligulicola* var. *inoxydabilis* (Boerema) Aveskamp *et al.*, Stud. Mycol. 65: 45. 2010.
= *Phoma ligulicola* var. *inoxydabilis* Boerema, Stud. Mycol. 32: 10. 1990.
Description and illustration (Vaghefi *et al.* 2012).

Specimen examined: **The Netherlands**, from *Chrysanthemum parthenii*, deposited in CBS Oct. 1990, (**holotype** CBS H-7611, culture ex-holotype CBS 425.90 = PD 81/520).

Stagonosporopsis helianthi Q. Chen & L. Cai, **sp. nov.** MycoBank MB814078. Fig. 3.

Etymology: Name after the host genus from which it was collected, *Helianthus*.

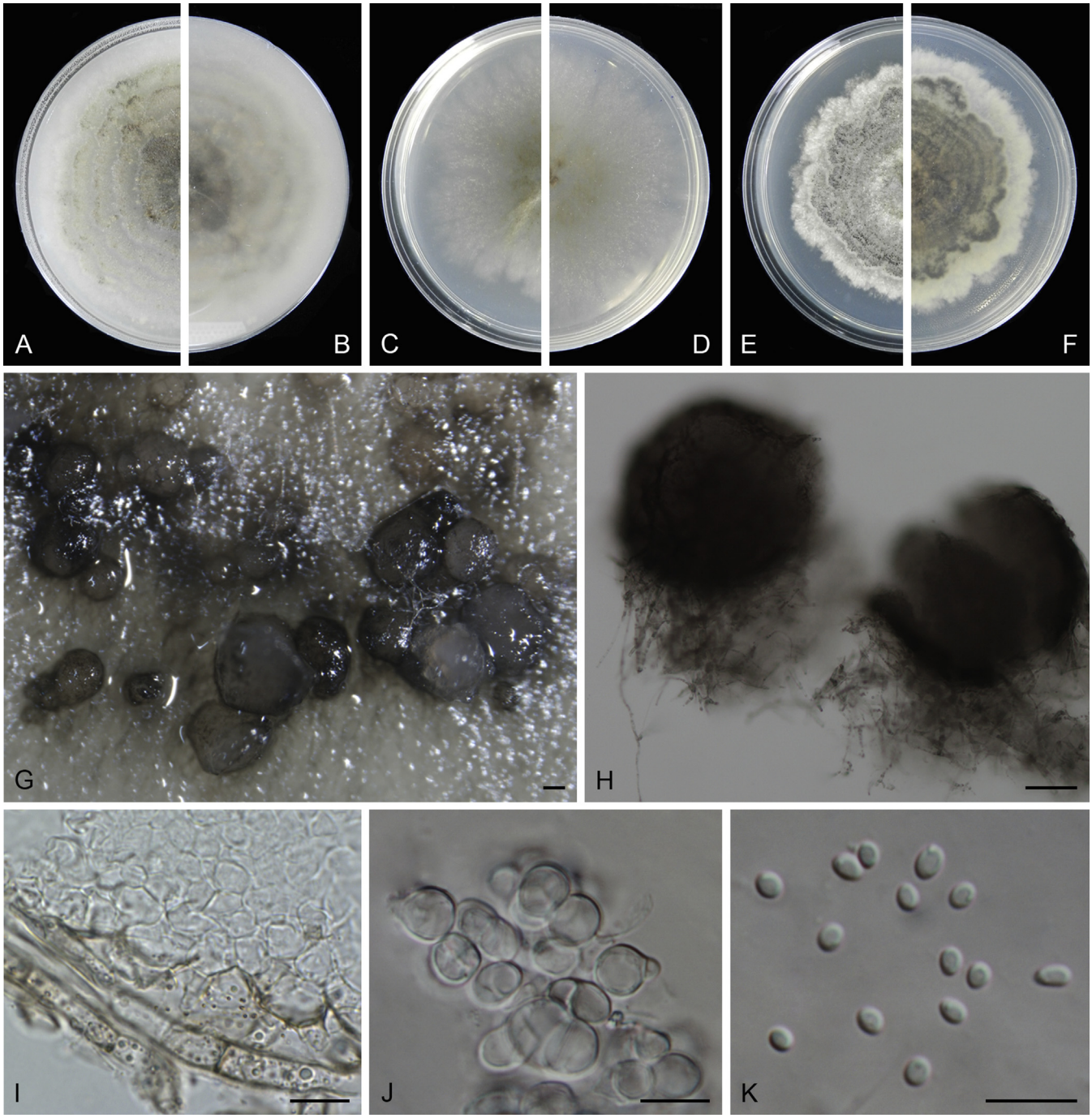

Fig. 3. *Stagonosporopsis helianthi* (CBS 200.87). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidia. I. Section of pycnidial wall. J. Conidiogenous cells. K. Conidia. Scale bars: G = 200 µm; H = 100 µm; I–K = 10 µm.

Description from ex-holotype culture (CBS 200.87): *Conidiomata* pycnidial, solitary or aggregated, subglobose, glabrous or covered with hyphal outgrows, mostly produced on the agar surface, sometimes immersed, 350–550 × 330–550 µm. *Ostiole* single, slightly papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 2–4 layered, 13–25 µm thick, composed of isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, 6–10.5 × 6.5–10 µm. *Conidia* broadly ellipsoidal, hyaline, smooth- and thin-walled, aseptate, 2–4 × 2–3 µm, with 0–3 guttules. *Conidial matrix* whitish cream.

Culture characteristics: Colonies on OA, 45–50 mm diam after 7 d, margin regular, aerial mycelia sparse, abundant pycnidia semi-immersed in concentric rings, pale grey to olivaceous; reverse concolourous. Colonies on MEA 30–35 mm diam after 7 d, margin regular, aerial mycelium sparse, wooly, white, pale olivaceous near the centre; reverse concolourous. Colonies on PDA, 45–50 mm diam after 7 d, margin regular, floccose, pycnidia produced in concentric rings, grey, white near the colony margin and somewhat olivaceous near the centre; reverse dark grey in concentric rings, white near the margin and buff near the centre. NaOH spot test: a slight greenish discolouration on MEA, reddish near the margin.

Specimen examined: **Italy**, Perugia, from *Helianthus annuus*, deposited in CBS Mar. 1987 (**holotype** HMAS 246704, culture ex-holotype CBS 200.87).

Notes: Isolate CBS 200.87 was received as "*Didymella lophospora*", which was isolated from *Helianthus annuus*, and is different from the original host of *D. lophospora* (*Pteridium*

aquilinum). The type material of *D. lophospora* was not obtained from the fungaria consulted (see Materials and Methods). Although we did not observe the sexual morph of CBS 200.87, we consider this isolate to represent a different species from *D. lophospora*, because they are from different host families, and there is no record of an asexual morph of *D. lophospora* to compare with our isolate CBS 200.87. Therefore we introduce a new species, *Stagonosporopsis helianthi* based on CBS 200.87. *Stagonosporopsis helianthi* was resolved in a sister clade to *S. heliopsidis* (CBS 109182), and is significantly different from *S. heliopsidis* in morphology: pycnidia (*ca.* 350–550 µm diam in *S. helianthi vs.* 70–300 µm diam in *S. heliopsidis*), conidiogenous cells (6–10.5 × 6.5–10 µm in *S. helianthi vs.* 4–8 × 4–8 µm in *S. heliopsidis*), and conidia (2–4 × 2–3 µm in *S. helianthi vs.* 6–8 × 1.5–3 µm in *S. heliopsidis*).

Stagonosporopsis loticola (Died.) Aveskamp *et al.*, Stud. Mycol. 65: 46. 2010.
Basionym: *Phoma loticola* Died., Kryptog.-Fl. Mark Brandenburg. 9: 152. 1912.
= *Phoma lotivora* P.R. Johnst., New Zealand J. Bot. 19: 178. 1981

Specimen examined: **New Zealand**, Auckland, Mt. Albert, from *Lotus pedunculatus*, May 1980, P.R. Johnston (**isotype** CBS H-7612, culture ex-isotype CBS 562.81 = PDDCC 6884).

Stagonosporopsis lupini (Boerema & R. Schneid.) Boerema *et al.*, Persoonia 17: 283. 1999.
Basionym: *Ascochyta lupini* Boerema & R. Schneid., Verslagen Meded. Plantenziektenk. Dienst Wageningen 162: 28. 1984.
= *Phoma schneiderae* Boerema *et al.*, Persoonia 17: 282. 1999.

Specimen examined: **UK**, Cambridgeshire, Mepal, from *Lupinus albus*, Apr. 1998 (**holotype** of *Phoma schneiderae* L 998.099.105, culture ex-holotype CBS 101494 = PD 98/5247).

Stagonosporopsis oculo-hominis (Punith.) Aveskamp *et al.*, Stud. Mycol. 65: 46. 2010.
Basionym: *Phoma oculi-hominis* Punith., Trans. Brit. Mycol. Soc. 67: 142. 1976. (as "*oculo-hominis*")
≡ *Phoma dennisii* var. *oculo-hominis* (Punith.) Boerema *et al.*, Persoonia 16: 351. 1997.

Specimen examined: **USA**, Tennessee, Nashville, from a man's corneal ulcer, Apr. 1975, Y.M. Clayton (culture **ex-holotype** CBS 634.92 = IMI 193307).

Stagonosporopsis rudbeckiae (Fairm.) Aveskamp *et al.*, Stud. Mycol. 65: 46. 2010.
Basionym: *Phoma rudbeckiae* Fairm., Proc. Rochester Acad. Sci. 1: 51. 1890.

Specimen examined: **The Netherlands**, from *Rudbeckia bicolor*, deposited in CBS Jan. 2001, H. de Gruyter, CBS 109180 = PD 79/175.

Stagonosporopsis tanaceti Vaghefi *et al.*, Australas. Pl. Pathol. 41: 682. 2012.

Specimen examined: **Australia**, Northern Tasmania, Scottsdale, from *Tanacetum cinerariifolium*, S.J. Pethybridge (**holotype** CBS H-20947, culture ex-holotype CBS 131484).

Stagonosporopsis trachelii (Allesch.) Aveskamp *et al.*, Stud. Mycol. 65: 46. 2010.
Basionym: *Phoma trachelii* Allesch., Hedwigia 34: 259. 1895.
= *Ascochyta bohemica* Kabát & Bubák, Hedwigia 44: 352. 1905.
≡ *Stagonosporopsis bohemica* (Kabát & Bubák) Boerema *et al.*, Persoonia 16: 361. 1997.
Description and illustrations (Vaghefi *et al.* 2012).

Specimens examined: **Sweden**, Svalöv, from *Campanula isophylla*, deposited in CBS May 1968, W. Södergren, CBS H-8972, culture CBS 384.68. **The Netherlands**, from a leaf of *Campanula isophylla*, deposited in CBS Jun. 1991, CBS 379.91 = PD 77/675.

Stagonosporopsis valerianellae (Gindrat *et al.*) Aveskamp *et al.*, Stud. Mycol. 65: 46. 2010.
Basionym: *Phoma valerianellae* Gindrat *et al.*, Rev. Hort. Suisse. 40: 350. 1967.

Specimens examined: **The Netherlands**, Wageningen, from *Valerianella locusta* var. *oleracea*, deposited in CBS Jul. 1967, G.H. Boerema (**holotype** L 965.300.24, **isotype** CBS H-7631, culture ex-isotype CBS 329.67 = PD 66/302); from *Valerianella locusta*, deposited in CBS Jun. 1992, J. de Gruyter, CBS 273.92 = PD 82/43.

Clade 2: *Allophoma*

Allophoma Q. Chen & L. Cai, **gen. nov.** MycoBank MB814058.

Etymology: Allo = allos in Greek, different; phoma-like conidia.

Conidiomata pycnidial, globose to flask-shaped, superficial on or immersed into the agar, solitary or confluent, ostiolate. *Pycnidial wall* pseudoparenchymatous, 2–5-layered. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, sometimes flask-shaped or isodiametric. *Conidia* variable in shape and size, hyaline, thin-walled, smooth, aseptate, *i.e.* ovoid, oblong, ellipsoidal to cylindrical, or slightly allantoid, mostly guttulate.

Type species: *Allophoma tropica* (R. Schneid. & Boerema) Q. Chen & L. Cai.

Allophoma labilis (Sacc.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814068.
Basionym: *Phoma labilis* Sacc., Michelia 2: 341. 1881.
Description (de Gruyter *et al.* 1993).

Specimen examined: **The Netherlands**, Barendrecht, from a stem of *Lycopersicon esculentum*, deposited in CBS Jan 1993, J. de Gruyter, CBS 124.93 = PD 87/269.

Allophoma minor (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814069.
Basionym: *Phoma minor* Aveskamp *et al.*, Stud. Mycol. 65: 42. 2010.
Description and illustration (Aveskamp *et al.* 2010).

Specimen examined: **Indonesia**, Sumatra, from *Syzygium aromaticum*, Apr. 1982, R. Kasim (**holotype** CBS H-20236, culture ex-holotype CBS 325.82).

Allophoma nicaraguensis Q. Chen & L. Cai, **sp. nov.** MycoBank MB814067. Fig. 4.

Etymology: Epithet refers to the country of origin, Nicaragua.

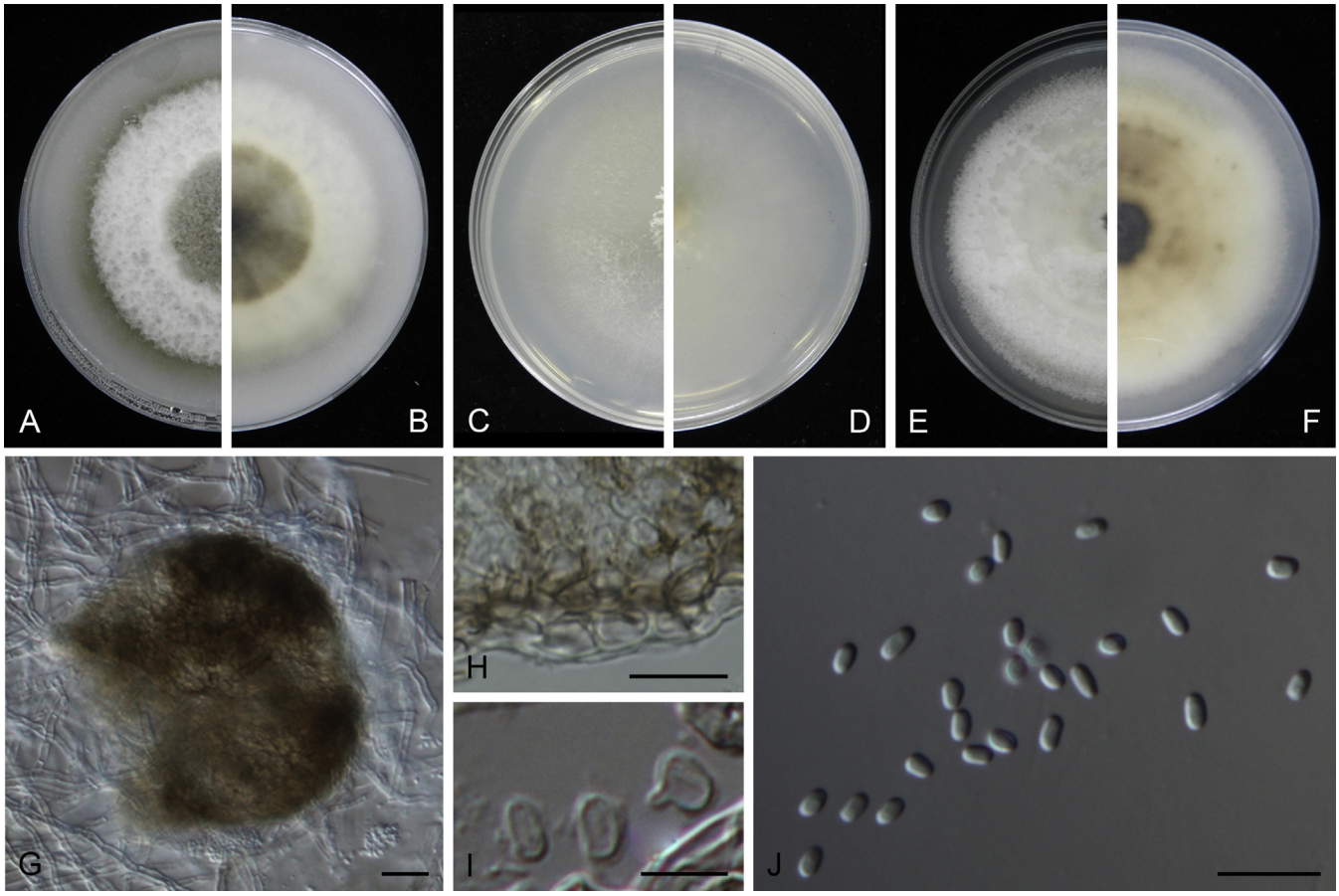

Fig. 4. *Allophoma nicaraguensis* (CBS 506.91). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidium. H. Section of pycnidial wall. I. Conidiogenous cells. J. Conidia. Scale bars: G = 20 µm; H, J = 10 µm; I = 5 µm.

Description from ex-holotype culture (CBS 506.91): *Conidiomata* pycnidial, solitary, globose to flask-shaped, glabrous, semi-immersed or immersed, 30–150(–180) × 28–120(–165) µm. *Ostiole* single, slightly papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, 8–12 µm thick, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 3–4.5 × 3.5–4.5(–5.5) µm. *Conidia* ellipsoidal to oblong, thin-walled, smooth, aseptate, 2.5–4 × 1.5–2.5 µm, egutullate or sometimes with 1(–3) small guttules. *Conidial matrix* whitish.

Culture characteristics: Colonies on OA, 45–50 mm diam after 7 d, margin regular, floccose, greenish olivaceous, white near the margins; reverse white, olivaceous near the centre. Colonies on MEA 45–50 mm diam after 7 d, margin regular, aerial mycelium sparse, white to pale olivaceous; reverse white, pale olivaceous near the centre. Colonies on PDA, 45–50 mm diam after 7 d, margin regular, floccose, white to pale olivaceous; reverse white to pale brown, olivaceous near the centre. NaOH test negative.

Specimen examined: **Nicaragua**, from a twig of *Coffea arabica*, deposited in CBS Sep. 1991, J. de Gruyter (**holotype** HMAS 246701, culture ex-holotype CBS 506.91 = PD 91/876 = IMI 215229).

Notes: Since isolate CBS 506.91 was collected from *Coffea arabica*, the same host as *Phoma costaricensis*, this isolate was initially identified as "*P. costaricensis*". However, its conidia (2.5–4 × 1.5–2.5 µm) were found to differ from the original description of *P. costaricensis* [5–6(–7) × 2–3 µm; Echandi 1957]. We therefore introduced a new species, *All. nicaraguensis*, to accommodate this isolate. *Allophoma nicaraguensis* showed a close phylogenetic relationship with *All. tropica* (syn. *Phoma tropica*). However, the pycnidia of *All. tropica* (100–300 µm) are larger than *All. nicaraguensis* (50–150 µm), and with more conspicuous ostioles (1–5), as compared to a single ostiole in *All. nicaraguensis* (Boerema *et al.* 2004).

Allophoma piperis (Tassi) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814070. Fig. 5.

Basionym: *Phyllosticta piperis* Tassi, Bull. Labor. Ort. Bot. Siena 3: 28. 1900.

≡ *Phoma piperis* (Tassi) Aa & Boerema, Persoonia 15: 398. 1993.

Description from holotype (N 354): *Leaf spots* elliptical to circular, brown to black. *Conidiomata* pycnidial, on leaves of *Peperomia pereskifolia*, solitary, subglobose, 115–245 × 85–230 µm. *Ostiole* single, slightly papillate. *Pycnidial wall* pseudoparenchymatous, composed of isodiametric cells. *Conidiogenous cells* phialidic, hyaline, simple, smooth, doliiform. *Conidia* ellipsoidal to ovoid, thin-walled, smooth, aseptate, 3.5–5.5 × 1.5–2.5 µm, with 1–2 large guttules.

Description from ex-epitype culture (CBS 268.93): *Conidiomata* pycnidial, solitary, globose to subglobose, glabrous or with some hyphal outgrowths, on the agar surface, 110–240 × 100–200 µm. *Ostiole* single, slightly papillate. *Pycnidial wall* pseudoparenchymatous, composed of oblong to isodiametric cells, 3–5 layers, 7.5–12.5 µm thick. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 2.5–3.5 × 2–3 µm. *Conidia* oblong to ellipsoidal, thin-walled, smooth, aseptate, 2.5–4 × 1.5–2.5 µm, with 2 polar guttules. Conidial exudates not recorded.

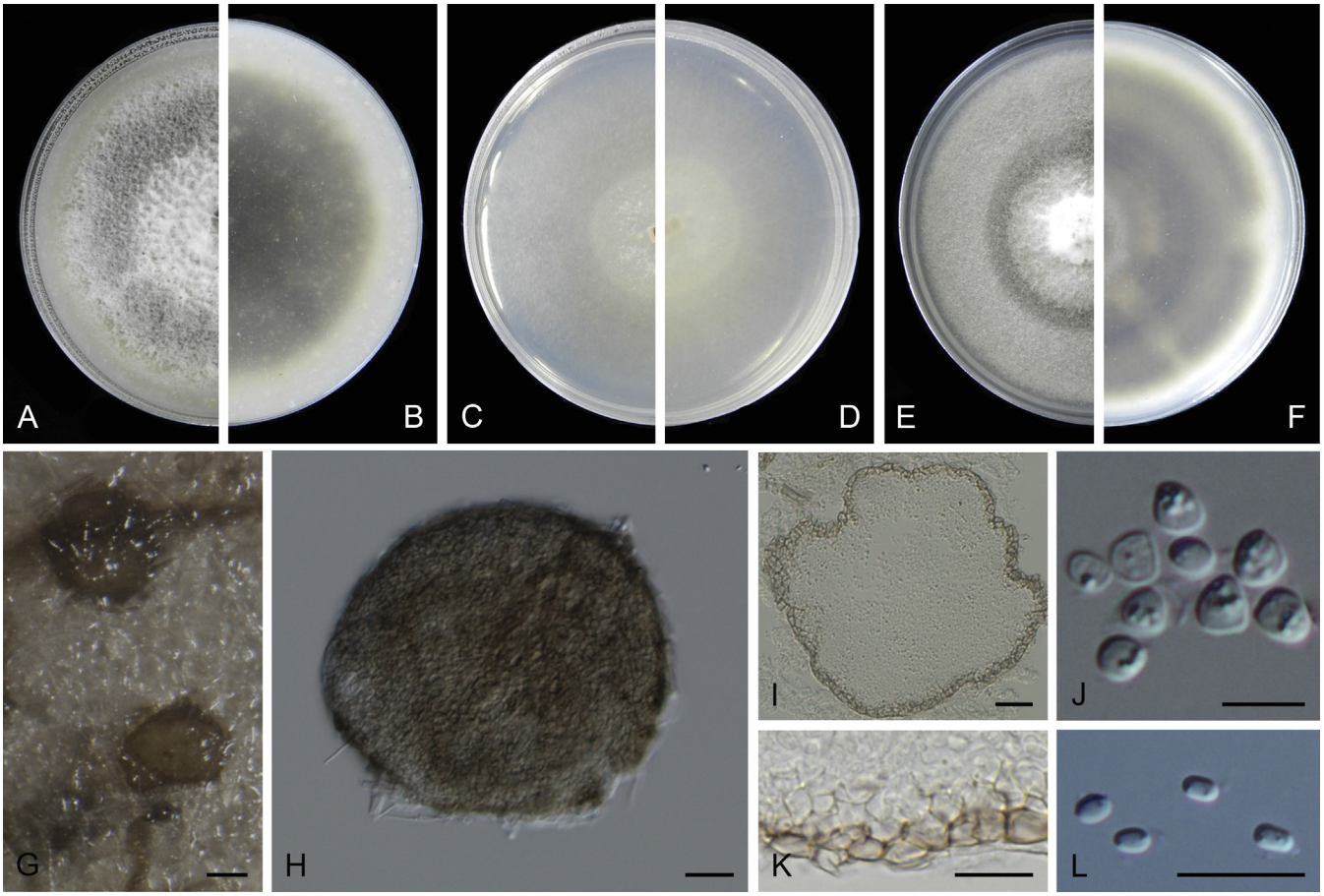

Fig. 5. *Allophoma piperis* (CBS 268.93). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidium. I. Section of pycnidium. J. Conidiogenous cells. K. Section of pycnidial wall. L. Conidia. Scale bars: G = 100 µm; H–I = 20 µm; J = 5 µm; K–L = 10 µm.

Culture characteristics: Colonies on OA, 40–45 mm diam after 7 d, margin regular, covered by floccose aerial mycelia, dull green, pale grey olivaceous near the colony margin; reverse olivaceous. Colonies on MEA 35–40 mm diam after 7 d, margin regular, aerial mycelium sparse, white, pale green near the centre; reverse concolourous. Colonies on PDA, 40–45 mm diam after 7 d, margin regular, covered by densely grey felty aerial mycelium, pycnidia in a concentric ring; reverse dull green to olivaceous. NaOH test negative.

Specimens examined: **Italy**, from leaves of *Piper longum*, Mar. 1899 (**holotype** N 354 in SIENA). **The Netherlands**, Tiel, from a leaf of *Peperomia pereskiifolia*, deposited in CBS Apr 1993, J. de Gruyter (**epitype designated here** HMAS 246702, MBT202493, culture ex-epitype CBS 268.93 = PD 88/720); Ressen, from *Peperomia pereskiifolia*, deposited in CBS Jan. 1993, J. de Gruyter, CBS 108.93 = PD 90/2011.

Notes: The holotype of *Phoma piperis* was described from *Piper longum* collected in Italy, with conidia measuring 3.5–5.5 × 1.5–2.5 µm. De Gruyter *et al.* (1993) reported a similar conidial size of 3–5 × 1.5 µm based on an authentic strain CBS 268.93, which was from the Netherlands and from *Peperomia pereskiifolia*, another host genus in *Piperaceae*. The collection HMAS 246702 (living culture CBS 268.93) is from the same host family, and the conidia we observed (2.5–4 × 1.5–2.5 µm) generally agree with the type material and that of de Gruyter *et al.* (1993). We thus designated HMAS 246702 as epitype. *Allophoma piperis* was reported as a pathogen that caused leaf spots of *Piper* spp., especially *Piper longus*, and sometimes also infected *Peperomia* spp. (de Gruyter *et al.* 1993).

Allophoma tropica (R. Schneid. & Boerema) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814071.
Basionym: *Phoma tropica* R. Schneid. & Boerema, Phytopathol. Z. 83: 361. 1975.
Description (de Gruyter & Noordeloos 1992).

Specimen examined: **Germany**, Horrheim, from *Saintpaulia ionantha*, deposited in CBS Aug. 1975, R. Schneider (**isotype** CBS H-7629, culture ex-isotype CBS 436.75 = DSM 63365).

Allophoma zantedeschiae (Dippen.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814072.
Basionym: *Phoma zantedeschiae* Dippen., S. African J. Sci. 28: 284. 1931.
= *Phyllosticta richardiae* F.T. Brooks, Ann. Appl. Biol.: 18. 1932.
Description (Boerema 1993).

Specimens examined: **Romania**, from *Cicer arietinum*, deposited in CBS Apr. 1932, T. Savulescu, CBS 229.32. **The Netherlands**, from a bulb of *Zantedeschiae* sp., deposited in CBS Jan 1993, J, de Gruyter, CBS 131.93 = PD 69/140.

Notes: The isolate CBS 229.32 was received as "*Didymella rabiei*". It is however genetically distinct from other strains of *D. rabiei* (CBS 206.30, CBS 237.37 and CBS 534.65), but identical to the authentic strain of *Phoma zantedeschiae* (CBS 131.93) based on four sequenced loci.

Clade 3: *Heterophoma*

Heterophoma Q. Chen & L. Cai, **gen. nov.** MycoBank MB814059.

Etymology: Heter = ἕτερος in Greek, other; morphologically similar to but phylogenetically different from *Phoma*.

Conidiomata pycnidial, globose to subglobose, superficial on or immersed into the agar, solitary or confluent, ostiolate. *Pycnidial wall* pseudoparenchymatous, 5–12-layered. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform. *Conidia* variable in shape and size, hyaline, thin-walled, smooth, 0–1(–2) septate, *i.e.* ellipsoidal, oblong, cylindrical, reniform, or slightly allantoid, mostly guttulate. *Chlamydospores* unicellular, globose, intercalary in chains, olivaceous.

Type species: *Heterophoma sylvatica* (Sacc.) Q. Chen & L. Cai.

Heterophoma adonidis (Moesz) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814073. Fig. 6.
Basionym: *Didymella adonidis* Moesz, Bot. Közlem. 8: 219. 1909.

Description from culture (CBS 114309): *Conidiomata* pycnidial, solitary or aggregated, (sub-)globose, glabrous or with some hyphal outgrows, superficial and immersed, later developing to black subglobose or irregular conidiomata and with a short wide elongated neck around the ostiole, (85–)100–400(–450) × (80–)100–245 µm. *Ostiole* single, slightly papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 6–8 layered, 27–35 µm thick, composed of isodiametric cells, outer wall 2–3–layered, pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 4.5–8.5 × 4.5–8(–9) µm. *Conidia* oblong to cylindrical, hyaline, thin-walled, smooth, often uniseptate, 10.5–16.5 × 3–4 µm, always somewhat constricted at the septum, with 5–15 guttules per cell. *Conidial matrix* yellowish.

Culture characteristics: Colonies on OA, 35–40 mm diam after 7 d, margin regular, floccose, white, pale olivaceous near the centre, flat near the margin; reverse buff. Colonies on MEA 40–45 mm diam after 7 d, margin regular, aerial mycelium sparse, white to pale olivaceous; reverse white, pale olivaceous near the centre. Colonies on PDA, 40–45 mm diam after 7 d, margin regular, floccose, white or somewhat buff; reverse pale saffron. NaOH spot test: a luteous discolouration on MEA, later changing to three colour layers, via dull green, dark brown to reddish, from the centre to outer ring.

Specimen examined: **Sweden**, Öland, Mörbylilla, on *Adonis vernalis*, Jun. 1989, K. & L. Holm, CBS 114309 = UPSC 2982.

Notes: The holotype of *Didymella adonidis* was on *Adonis vernalis* from Hungary, and could not be located from BP or MICH for examination. The culture CBS 114309, isolated from same host from Sweden, was deposited in CBS under the name "*Didymella adonidis*". The original description of *D. adonidis* only had details of a sexual morph, with asci clavate, 50–66 × 12–13 µm and uniseptate ascospores, oblong-ellipsoidal, 19–26.5 × 3–5 µm. CBS 114309 was however, strictly asexual in culture.

Heterophoma nobilis (Kabát & Bubák) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814074.
Basionym: *Ascochyta nobilis* Kabát & Bubák, Oesterr. Bot. Z. 54: 3. 1904.
≡ *Phoma dictamnicola* Boerema *et al.*, Persoonia 15: 90. 1992.
Description (de Gruyter & Noordeloos 1992).

Specimen examined: **The Netherlands**, Arnhem, from a stem of *Dictamnus albus*, deposited in CBS Sep. 1991, J. de Gruyter, CBS 507.91 = PD 74/148.

Notes: *Heterophoma nobilis* is the only species that produces chlamydospores in this genus, and its conidia are more variable in size and shape *in vivo* than those *in vitro*. This species was originally described in the genus *Ascochyta* based on its large, septate conidia, and later replaced by a new name *Phoma dictamnicola* by de Gruyter & Noordeloos (1992).

Heterophoma novae-verbascicola (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814075.
Basionym: *Phoma novae-verbascicola* Aveskamp *et al.*, Stud. Mycol. 65: 41. 2010.
Description (de Gruyter *et al.* 1993).

Specimens examined: **The Netherlands**, Zeist, Abburg nursery, from *Verbascum* sp. (**holotype** L 9893.00.134); Haarlem, from dead stem material of *Verbascum densiflorum*, deposited in CBS Jan 1993, J, de Gruyter, CBS 127.93 = PD 92/347.

Heterophoma poolensis (Taubenh.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814076.
Basionym: *Phoma poolensis* Taubenh., Dis. Greenhouse Crops: 203. 1919.
Description (de Gruyter *et al.* 1993).

Specimens examined: **The Netherlands**, Bennekom, from a stem of *Antirrhinum majus*, deposited in CBS Jan 1993, J. de Gruyter, CBS 116.93 = PD 71/884. **Unknown origin**, from unknown substrate, deposited in CBS Aug. 1920, E.M. Smiley, CBS 113.20 = PD 92/774.

Note: According to the records in the USDA database, this is the only species in *Phoma s. lat.* that is reported to be associated with *Antirrhinum* sp. (Farr & Rossman 2015).

Heterophoma sylvatica (Sacc.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814077. Fig. 7.
Basionym: *Phoma sylvatica* Sacc., Michelia 2: 337. 1881.

Description from ex-neotype culture (CBS 874.97): *Conidiomata* pycnidial, solitary or confluent, globose to subglobose, with some hyphal outgrows, superficial on and immersed into the agar, 110–330 µm diam. *Ostiole* mainly single, occasionally two ostiolate, non-papillate or slightly papillate. *Pycnidial wall* 5–9(–20)-layered, outer layers pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, bottle-shaped, 3–6 × 3–6 µm. *Conidia* cylindrical, sometimes slightly allantoid, smooth- and thin-walled, aseptate, 3.5–6 × 1–2 µm, with 2 small polar guttules. Conidial exudates not recorded.

Culture characteristics: Colonies on OA, 65–75 mm diam after 7 d, margin regular to slightly irregular, floccose, pale olivaceous grey, black pycnidia visible; reverse concolourous. Colonies on MEA 60–65 mm diam after 7 d, margin regular to slightly irregular, woolly, dull green to (pale) olivaceous grey; reverse greenish olivaceous to dull green, partly with vinaceous buff tinges,

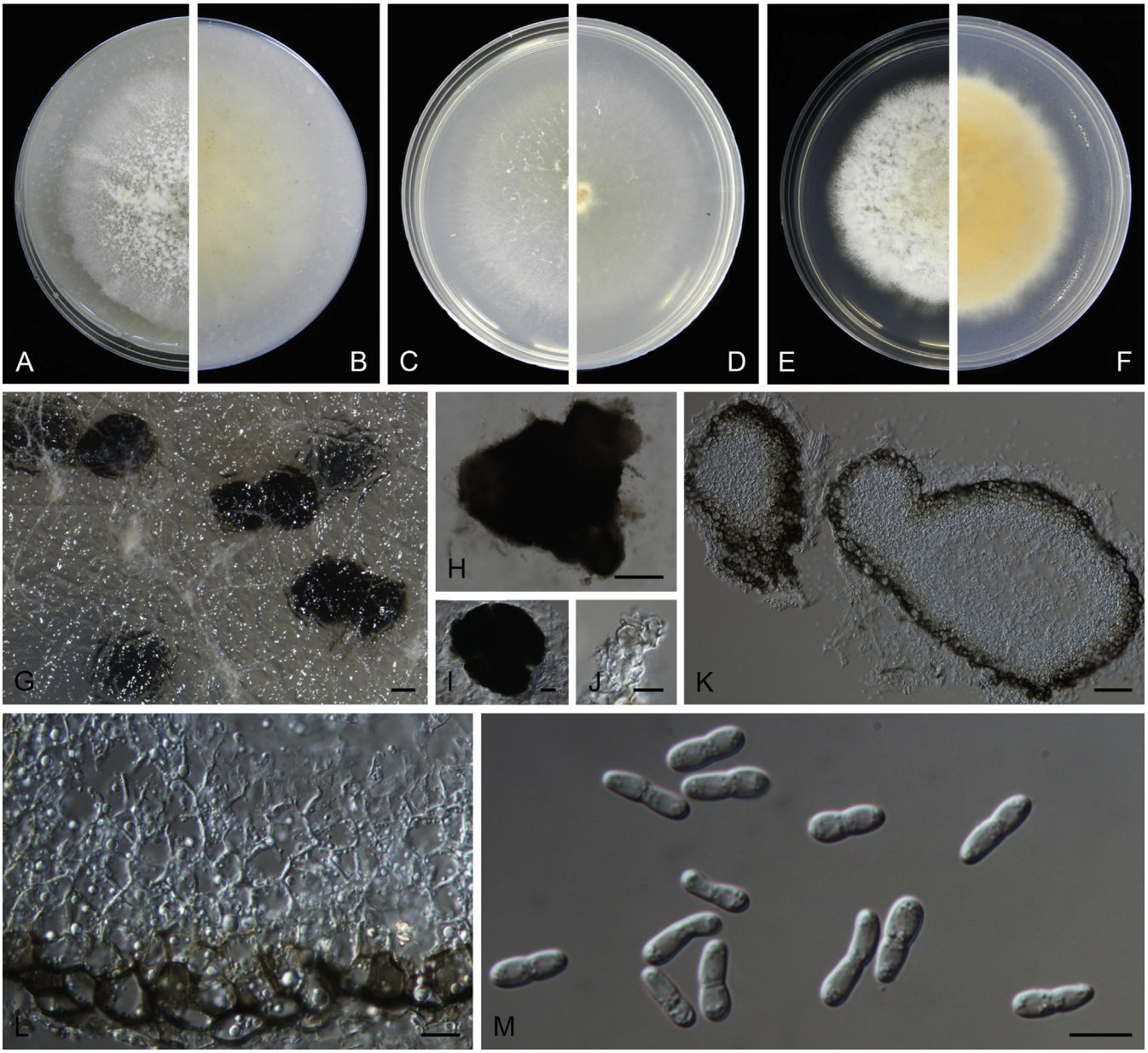

Fig. 6. *Heterophoma adonidis* (CBS 114309). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H–I. Pycnidia. J. Conidiogenous cells. K. Section of pycnidia. L. Section of pycnidial wall. M. Conidia. Scale bars: G = 200 µm; H = 100 µm; K = 50 µm; I = 20 µm; J, L, M = 10 µm.

olivaceous black near the centre. Colonies on MEA, 55–60 mm diam after 7 d, margin irregular, with compact, woolly to floccose, pale olivaceous grey to olivaceous, staining the agar in sienna to scarlet due to the production of a diffusible pigment; reverse olivaceous to sepia. NaOH spot test: a greenish discolouration on MEA, later changing to red (from Boerema & de Gruyter 1998).

Specimen examined: **The Netherlands**, Wageningen, from a stem of *Melampyrum pratense*, deposited in CBS Jun. 1997 (**neotype designated here** HMAS 246700, MBT202494, culture ex-neotype CBS 874.97 = PD 93/764).

Notes: The holotype of *Phoma sylvatica* was not located in any of the fungaria consulted, and is considered lost. Here we designate CBS 874.97 as neotype, as conidial size of the neotype (3.5–6 × 1–2 µm) agrees well with the original description of *Phoma sylvatica* (4 × 1 µm). Although *H. sylvatica* is morphologically similar to *H. novae-verbascicola*, *H. sylvatica* was frequently reported on *Melampyrum* spp. (Boerema & de Gruyter 1998), while *H. novae-verbascicola* occurs on *Verbascum* spp. (Aveskamp *et al.* 2010). In the phylogenetic tree, they are clearly distinct from each other, forming two sister clades.

Clade 4: *Boeremia*

Boeremia Aveskamp *et al.*, Stud. Mycol. 65: 36. 2010.

Conidiomata pycnidial, variable in shape and size, mostly globose to subglobose, superficial on or immersed into the agar, solitary or confluent. *Ostioles* 1–2(–3), non-pappillate or pappillate, lined internally with a hyaline cells when mature. *Pycnidial wall* pseudoparenchymatous, 2–8-layered, outer wall 1–3-layered, brown pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform. *Conidia* variable in shape, hyaline, smooth- and thin-walled, mainly aseptate, but regularly 1(–2)-septate larger conidia may be found. *Ascomata* pseudothecial, only recorded in one species *in vivo*, subglobose. *Asci* cylindrical or subclavate, always 8-spored,

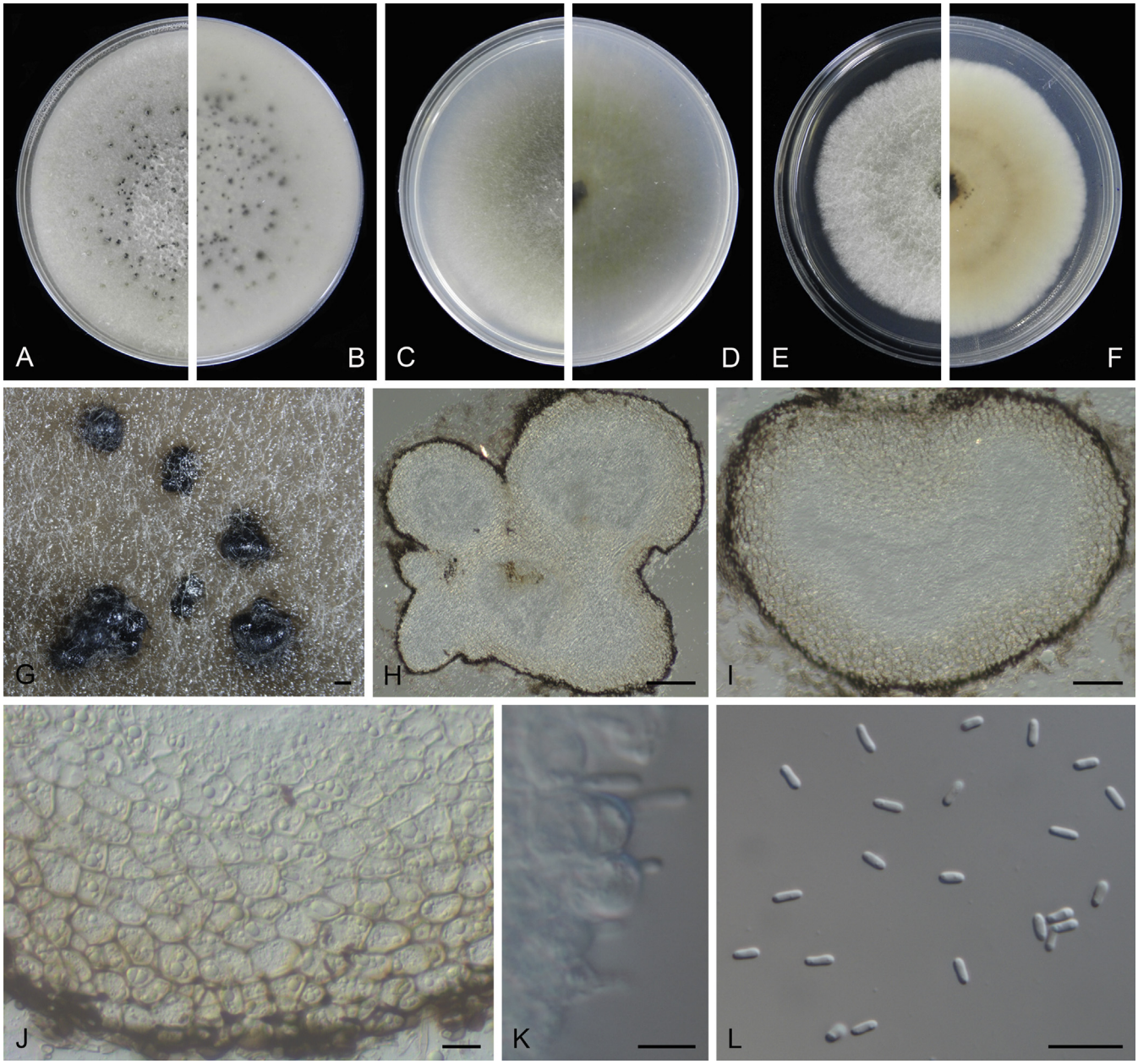

Fig. 7. *Heterophoma sylvatica* (CBS 874.97). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H–I. Section of pycnidia. J. Section of pycnidial wall. K. Conidiogenous cells. L. Conidia. Scale bars: G = 200 µm; H = 100 µm; I = 50 µm; J, L = 10 µm; K = 5 µm.

biseriate. *Ascospores* ellipsoidal, 1-septate (from Aveskamp *et al.* 2010).

Type species: *Boeremia exigua* (Desm.) Aveskamp *et al.*, Stud. Mycol. 65: 36. 2010.

Boeremia crinicola (Siemasko) Aveskamp *et al.*, Stud. Mycol. 65: 37. 2010.
Basionym: *Phyllosticta crinicola* Siemasko, Acta Soc. Bot. Poloniae 1: 22. 1923.
≡ *Phoma crinicola* (Siemasko) Boerema, Verslagen Meded. Plantenziektenk. Dienst Wageningen 153: 18. 1979.

Specimen examined: **The Netherlands**, Haarlem, from a bulb of *Crinum powellii*, Mar. 1976, G.H. Boerema, CBS H-16198, culture CBS 109.79 = PD 77/747.

Boeremia diversispora (Bubák) Aveskamp *et al.*, Stud. Mycol. 65: 37. 2010.
Basionym: *Phoma diversispora* Bubák, Oesterr. Bot. Z. 55: 78. 1905.
≡ *Phoma exigua* var. *diversispora* (Bubák) Boerema, Gewasbescherming 11: 122. 1980.

Specimens examined: **Kenya**, from a pod of *Phaseolus vulgaris*, 1979, G.H. Boerema, CBS H-16308, CBS 102.80 = CECT 20049 = IMI 331907 = PD 79/61. **The Netherlands**, near Tilburg, from *Phaseolus vulgaris*, deposited in CBS Sep. 1998, J. de Gruyter, CBS 101194 = PD 79/687 = IMI 373349.

Boeremia exigua (Desm.) Aveskamp *et al.*, Stud. Mycol. 65: 36. 2010.

Specimen examined: **Denmark**, from necrotic stems of *Cheiranthus cheiri*, Apr. 1938, CBS 118.38. **Unknown origin**, from *Nicotiana tabacum*, deposited in CBS Jun. 1938, R. Fourmont, CBS 119.38; from *Abelmoschus esculentus*, deposited in CBS Feb. 1921, L.L. Harter, CBS 107.21.

Notes: CBS 118.38 and CBS 119.38, received as "*Ascochyta cheiranthi*" and "*Ascochyta ducometii*", clustered together with

Boeremia exigua var. *exigua* (CBS 431.74), *B. exigua* var. *forsythiae* (CBS 101197, CBS 101213), and *B. exigua* var. *viburni* (CBS 100354) in the phylogenetic tree (Fig. 1). Therefore, these two isolates were reidentified as *B. exigua* here. *Ascochyta cheiranthi* and *As. ducometii* might be synonyms of *B. exigua*, but this needs to be confirmed by examining the type specimens.

Isolate CBS 107.21 was received as "*Ascochyta abelmoschi*" and is from the original host of *A. abelmoschi* (*Abelmoschus esculentus*). It clustered in a single lineage, which is distinct from other varieties in the *B. exigua* clade (Fig. 1), and might represent a new variety.

Boeremia exigua var. ***coffeae*** (Henn.) Aveskamp *et al.*, Stud. Mycol. 65: 37. 2010.
Basionym: *Ascochyta coffeae* Henn., Hedwigia 41: 307. 1902; non *Phoma coffeae* Delacr. 1897.
= *Ascochyta tarda* R.B. Stewart, Mycologia 49: 430. 1957.
≡ *Phoma tarda* (R.B. Stewart) H. Verm., Coffee Berry Dis. Kenya: 14. 1979.

Specimens examined: **Brazil**, Patrocínio, from leaf of *Coffea arabica*, deposited in CBS by L.H. Pfenning, CBS 119730. **Cameroon**, Bemenda, from *Coffea arabica*, deposited in CBS Jan. 2001, H. de Gruyter, CBS 109183 = PD 2000/10506 = IMI 300060.

Boeremia exigua var. ***exigua*** (Desm.) Aveskamp *et al.*, Stud. Mycol. 65: 37. 2010.
Basionym: *Phoma exigua* Desm., Ann. Sci. Nat. Bot. III 11: 282. 1849.

Specimens examined: **The Netherlands**, Emmeloord, from a tuber of *Solanum tuberosum*, deposited in CBS Jul. 1974, G.H. Boerema, CBS 431.74 = PD 74/2447; from a graft of *Ulmus*, 1961, H.M. Heybroek, CBS 373.61.

Boeremia exigua var. ***forsythiae*** (Sacc.) Aveskamp *et al.*, Stud. Mycol. 65: 37. 2010.
Basionym: *Phyllosticta forsythiae* Sacc., Michelia 1: 93. 1877.
≡ *Ascochyta forsythiae* (Sacc.) Höhn., Verh. Naturf. Vereins Brünn 47: 36. 1909.
≡ *Phoma exigua* var. *forsythiae* (Sacc.) Aa *et al.*, Persoonia 17: 452. 2000.

Specimens examined: **The Netherlands**, from *Forsythia* sp., deposited in CBS Sep. 1998, J. de Gruyter, CBS 101213 = PD 92/959; from *Forsythia* sp., deposited in CBS Sep. 1998, J. de Gruyter, CBS 101197 = PD 95/721.

Boeremia exigua var. ***gilvescens*** Aveskamp *et al.*, Stud. Mycol. 65: 37. 2010.

Specimens examined: **The Netherlands**, Baarn, from leaves of *Dactylis purpurea*, 1970, H.A. van der Aa (**holotype** CBS H-16281, culture ex-holotype CBS 761.70); Emmeloord, from *Cichorium intybus*, deposited in CBS Sep. 1998, H. de Gruyter, CBS 101150 = PD 79/118.

Boeremia exigua var. ***heteromorpha*** (Schulzer & Sacc.) Aveskamp *et al.*, Stud. Mycol. 65: 38. 2010. Fig. 8.
Basionym: *Phoma heteromorpha* Schulzer & Sacc., Hedwigia 23: 107. 1884.
≡ *Phoma exigua* var. *heteromorpha* (Schulzer & Sacc.) Noordel. & Boerema, Verslagen Meded. Plantenziektenk. Dienst Wageningen 166: 109. 1989.

Description from ex-neotype culture (CBS 443.94): *Conidiomata* pycnidial, solitary or aggregated, globose to subglobose, glabrous or with few hyphal outgrows, superficial and immersed, later developing to irregular conidiomata and with a short broad elongated neck, 120–320 × 105–285 µm. *Ostioles* 1–4(–5), on a short elongated neck. *Pycnidial wall* pseudoparenchymatous 3–8-layered, 16–50 µm thick, composed of oblong to isodiametric cells, outer wall 2–3-layered, pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 3–8 × 3–5.5 µm. *Conidia* ovoid, ellipsoidal to cylindrical, thin-walled, smooth, mainly aseptate, occasionally 1–2 septate, 4.5–8(–10.5) × 2.5–4 µm, with (0–)2–8 minute guttules. *Conidial matrix* buff.

Culture characteristics: Colonies on OA, 45–50 mm diam after 7 d, margin regular, floccose, white, honey to pale olivaceous near the centre; reverse concolourous. Colonies on MEA 40–45 mm diam after 7 d, margin irregular, aerial mycelium sparse, white to pale olivaceous; reverse concolourous. Colonies on PDA, 15–20 mm diam after 7 d, margin regular, floccose, white, brown near the centre; reverse buff to brown, white near the margin. NaOH spot test: a greenish discolouration on MEA, later changing to reddish near the margin.

Specimens examined: **France**, Antibes, from *Nerium oleander*, deposited in CBS Sep. 1998, J. de Gruyter, CBS 101196 = PD 79/176. **Italy**, Perugia, from *Nerium oleander*, deposited in CBS Aug. 1994, A. Zazzerini (**neotype designated here** HMAS 246695, MBT202495, culture ex-neotype CBS 443.94).

Notes: The type specimen of *Phoma heteromorpha* could not be located, and is presumed lost. Conidia of the neotype are mostly aseptate, 4.5–8(–10.5) × 2.5–4 µm, which agree well with the original description. *Boeremia exigua* var. *heteromorpha* clustered with *B. exigua* var. *populi* in the phylogenetic tree, but *B. exigua* var. *heteromorpha* occurred on *Nerium oleander*, while *B. exigua* var. *populi* on *Populus* and *Salix* spp. respectively (Boerema *et al.* 2004).

Boeremia exigua var. ***linicola*** (Naumov & Vassiljevsky) Aveskamp *et al.*, Stud. Mycol. 65: 39. 2010.
Basionym: *Ascochyta linicola* Naumov & Vassiljevsky, Mater. Mikol. Fitopatol. 5: 3. 1926.
≡ *Phoma exigua* var. *linicola* (Naumov & Vassiljevsky) P.W.T. Maas, Netherlands J. Pl. Pathol. 71: 118. 1965.

Specimens examined: **The Netherlands**, Flevoland, from a stem of *Linum usitatissimum*, deposited in CBS Feb. 1976, G.H. Boerema, CBS 116.76 = ATCC 32332 = CECT 20022 = CECT 20023 = IMI 197074 = PD 75/544; Wageningen, from seeds of *Nemophila insignis*, deposited in CBS Oct. 1938, P. Neergaard, CBS 248.38; Zierikzee, from *Linum usitatissimum*, deposited in CBS Dec.1928, H.A. Diddens, CBS 114.28.

Notes: Isolate CBS 248.38, deposited as "*Phoma nemophilae*", clustered with authentic cultures of *B. exigua* var. *linicola* (CBS 114.28, CBS 116.76) in the phylogenetic tree. The LSU, ITS, *tub2* and *rpb2* loci sequences proved to be identical among these three strains originating from the Netherlands. It is therefore concluded that the materials studied belong to the same variety, *B. exigua* var. *linicola*.

Boeremia exigua var. ***populi*** (Gruyter & P. Scheer) Aveskamp *et al.*, Stud. Mycol. 65: 39. 2010.
Basionym: *Phoma exigua* var. *populi* Gruyter & P. Scheer, J. Phytopathol. 146: 413. 1998.

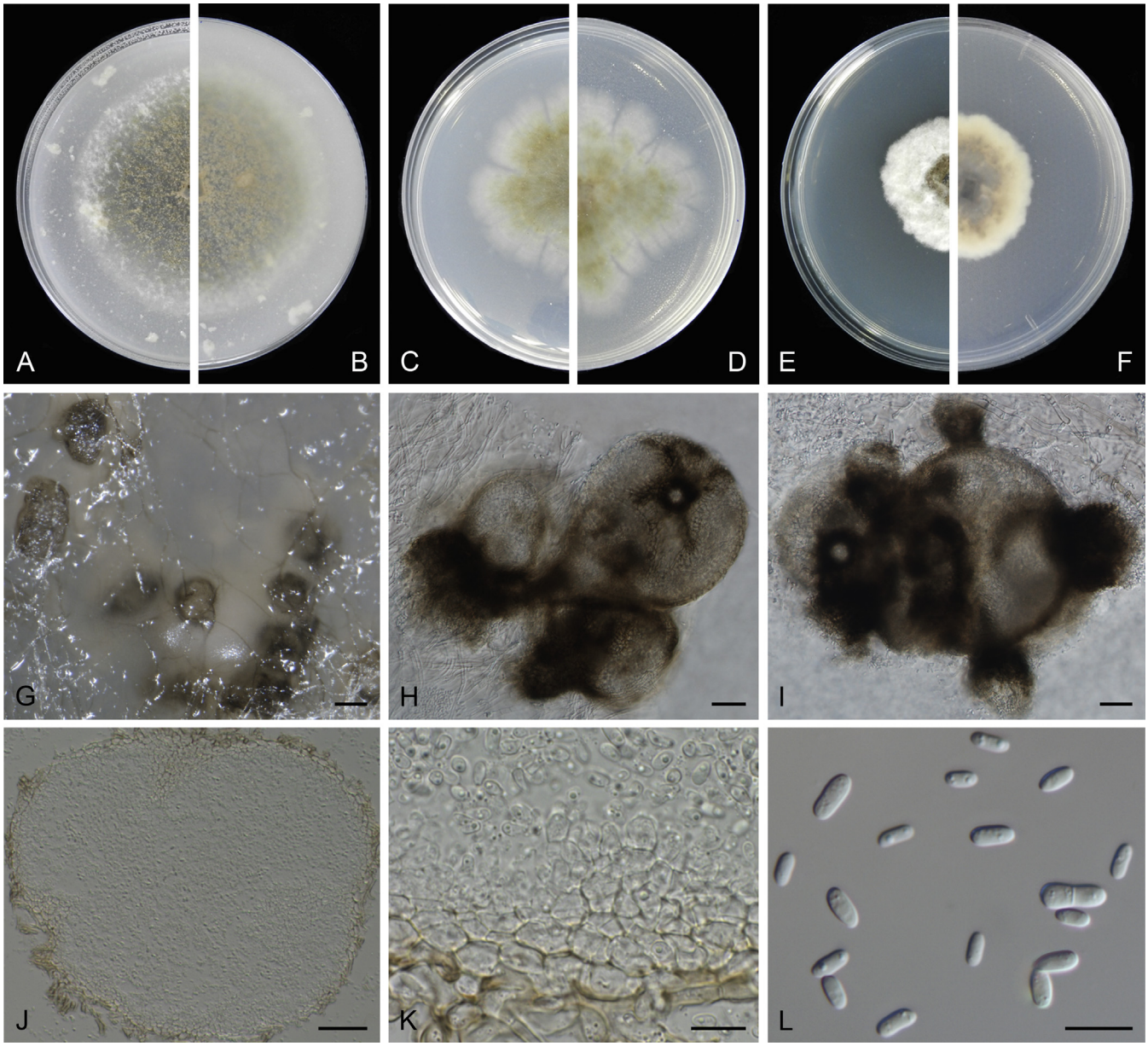

Fig. 8. *Boeremia exigua* var. *heteromorpha* (CBS 443.94). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H–I. Pycnidia. J. Section of pycnidia. K. Section of pycnidial wall. L. Conidia. Scale bars: G = 200 µm; H–I = 40 µm; J = 50 µm; K–L = 10 µm.

Specimen examined: **The Netherlands**, Deil, from a twig of *Populus* (×) *euramericana* cv. Robusta, deposited in CBS Nov. 1997 (**holotype** L 995.263.325, culture ex-holotype CBS 100167 = PD 93/217).

Boeremia exigua var. ***pseudolilacis*** Aveskamp *et al.*, Stud. Mycol. 65: 39. 2010.

Specimens examined: **The Netherlands**, Baarn, from leaf spots in *Lamium maculatum*, deposited in CBS Nov. 1967, CBS 462.67; Baarn, from leaf spots of *Lathyrus* sp., deposited in CBS Oct. 1967, H.A. van der Aa, CBS H-9059, culture CBS 423.67; near Boskoop, from *Syringa vulgaris*, deposited in CBS Sep. 1998, J. de Gruyter (**holotype** CBS H-20371, culture ex-holotype CBS 101207 = PD 94/614).

Notes: Isolates CBS 462.67 and CBS 423.67 were initially deposited as "*Ascochyta lamiorum*" and "*Ascochyta lathyri*" respectively. But these two isolates grouped with the ex-type culture of *B. exigua* var. *pseudolilacis* (CBS 101207) in the phylogenetic tree with all four sequenced loci being identical. Therefore, we concluded that CBS 462.67 and CBS 423.67 belong to a same variety *B. exigua* var. *pseudolilacis*.

Boeremia exigua var. ***viburni*** (Roum. ex. Sacc.) Aveskamp *et al.*, Stud. Mycol. 65: 39. 2010.

Basionym: *Ascochyta viburni* Roum. ex. Sacc., Syll. Fung. 3: 387. 1884.

≡ *Phoma viburni* (Roum. ex. Sacc.) Boerema & M.J. Griffin, Trans. Brit. Mycol. Soc. 63: 110. 1974.

≡ *Phoma exigua* var. *viburni* (Roum. ex. Sacc.) Boerema, J. Phytopathol. 146: 414. 1998.

Specimen examined: **The Netherlands**, Boskoop, from *Viburnum opulus*, deposited in CBS Jan 1998, CBS 100354 = PD 83/448.

Boeremia foveata (Foister) Aveskamp *et al.*, Stud. Mycol. 65: 40. 2010.

Basionym: *Phoma foveata* Foister, Trans. & Proc. Bot. Soc. Edinburgh 33: 66. 1940.

Specimen examined: **Bulgaria**, from a tuber of *Solanum tuberosum*, deposited in CBS Jan. 2001, H. de Gruyter, CBS 109176 = CECT 2828 = PD 94/1394.

Boeremia hedericola (Durieu & Mont.) Aveskamp *et al.*, Stud. Mycol. 65: 40. 2010.

Basionym: *Phyllosticta hedericola* Durieu & Mont., Flore d'Algérie Cryptog. 1: 611. 1849. (as "*hederaecola*"; see also Sylloge Pl. crypt.: 279. 1856.)

≡ *Phoma hedericola* (Durieu & Mont.) Boerema, Trans. Brit. Mycol. Soc. 67: 295. 1976.

Specimens examined: **The Netherlands**, from *Hedera helix*, deposited in CBS Jun. 1991, J. de Gruyter, CBS 367.91 = PD 87/229.

Boeremia lilacis (Sacc.) Q. Chen & L. Cai, **comb. et stat. nov.** MycoBank MB814751.

Basionym: *Phoma herbarum* f. *lilacis* Sacc., Michelia 2: 93. 1880.

≡ *Phoma exigua* var. *lilacis* (Sacc.) Boerema, Phytopathol. Medit. 18: 105. 1980.

≡ *Boeremia exigua* var. *lilacis* (Sacc.) Aveskamp *et al.*, Stud. Mycol. 65: 38. 2010.

Specimen examined: **The Netherlands**, Baarn, from leaf spots of *Philadelphus* sp., Nov. 1967, H.A. van der Aa, CBS H-9070, culture CBS 588.67; Wageningen, from a twig of *Syringa vulgaris*, deposited in CBS Aug. 1979, G.H. Boerema, CBS H-163131, culture CBS 569.79 = PD 72/741 = CECT 20050 = IMI 331909.

Notes: This taxon was elevated to species level based on the multilocus phylogeny of the *Boeremia exigua* varieties (Berner *et al.* 2015). A single isolate deposited as "*Ascochyta philadelphi*" was re-identified as *B. lilacis* in this study. The name *As. philadelphi* might need to be synonymised, but since the type was not obtained for comparison, this awaits confirmation in future study.

Boeremia lycopersici (Cooke) Aveskamp *et al.*, Stud. Mycol. 65: 40. 2010.

Basionym: *Phoma lycopersici* Cooke, Grevelia 13: 94. 1885.

= *Didymella lycopersici* Kleb., Z. Pflanzenkrankh. 31: 9. 1921.

Specimen examined: **The Netherlands**, Heerde, from fruit of *Lycopersicon esculentum*, deposited in CBS Aug. 1967, G.H. Boerema, CBS 378.67 = PD 67/276.

Boeremia noackiana (Allesch.) Aveskamp *et al.*, Stud. Mycol. 65: 40. 2010. Fig. 9.

Basionym: *Phyllosticta noackiana* Allesch., Bol. Técn. Inst. Agron. Estado São Paulo 9: 85. 1898.

≡ *Phoma exigua* var. *noackiana* (Allesch.) Aa, Boerema & Gruyter, Persoonia 17: 450. 2000.

Description from ex-epitype culture (CBS 101203): *Conidiomata* pycnidial, solitary or confluent, globose to subglobose, covered with hyphal outgrowths, semi-immersed or immersed, 130–315(–345) × 110–265(–310) µm. *Ostioles* 1–2, slightly papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous 3–5-layered, 6–12 µm thick, composed of oblong to isodiametric cells, outer cell layer brown. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to flask-shaped, 3–5 × 2–3.5 µm. *Conidia* ellipsoidal to oblong, sometimes allantoid, hyaline, thin-walled, smooth, mainly aseptate, 4.5–8.5 × 2–3 µm, but occasionally 1-septate, 8–13 × 3.5–5 µm, with small guttules. *Conidial matrix* yellowish.

Culture characteristics: Colonies on OA, 45–50 mm diam after 7 d, margin regular, covered by white, wooly aerial mycelia, olivaceous to iron grey, with dendritic leaden-black zones; reverse buff to olivaceous, with some leaden-black zones. Colonies on MEA 25–30 mm diam after 7 d, margin regular, white aerial mycelium sparse, olivaceous to greenish olivaceous; reverse concolourous. Colonies on PDA, 25–30 mm diam after 7 d, margin regular, felty, pale olivaceous, white near the margin; reverse olivaceous, white near the margin. NaOH spot test: a brown discolouration on MEA.

Specimens examined: **Brazil**, Brasilien, Campinas, from *Phaseolus* sp., Mar. 1897, F. Noack (**holotype** F52544). **Colombia**, from *Phaseolus vulgaris*, deposited in CBS Sep. 1998, J. de Gruyter (**epitype designated here** HMAS 246697, MBT202496, culture ex-epitype CBS 101203 = PD 79/1114). **Guatemala**, from *Phaseolus vulgaris*, deposited in CBS Jan. 1998, IPO Wageningen, CBS 100353 = PD 87/718.

Notes: *Boeremia noackiana* was formerly treated as a variety of *Phoma exigua* (van der Aa *et al.* 2000), but in our analysis it appears to be genetically distinct from the *Phoma exigua* complex, which is in congruence with the results of Aveskamp *et al.* (2010), who elevated it to species level. The type specimen of *Phyllosticta noackiana* is preserved in B, and conidia of this species were described as oblong, 4–6 × 2 µm (Saccardo 1902). The morphological characters of HMAS 246697 agree well with those of the representative culture of this species reported by van der Aa *et al.* (2000). Here we designate HMAS 246697 as its epitype because it agrees well with the original description with regard to morphology, host and locality.

Boeremia sambuci-nigrae (Sacc.) Aveskamp *et al.*, Stud. Mycol. 65: 40. 2010.

Basionym: *Phoma herbarum* f. *sambuci-nigrae* Sacc., Syll. Fung. 3: 133. 1884.

≡ *Phoma exigua* var. *sambuci-nigrae* (Sacc.) Boerema & Höweler, Persoonia 5: 26. 1967.

≡ *Phoma sambuci-nigrae* (Sacc.) E. Monte, Bridge & B. Sutton, Mycopathologia 115: 102. 1991.

Specimen examined: **The Netherlands**, Wageningen, from a leaf of *Sambucus nigra*, deposited in CBS Sep. 1968 (**lectotype** CBS H-16314, culture ex-lectotype CBS 629.68 = CECT 20048 = IMI 331913 = PD 67/753).

Boeremia strasseri (Moesz) Aveskamp *et al.*, Stud. Mycol. 65: 40. 2010. Fig. 10.

Basionym: *Phoma strasseri* Moesz, Bot. Közlem. 22: 45. 1924.

Description from ex-neotype culture (CBS 126.93): *Conidiomata* pycnidial, solitary or confluent, globose to subglobose, glabrous or covered with hyphae, semi-immersed or immersed, (145–) 175–330(–355) × 125–320 µm. *Ostioles* 1–3, slightly papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, composed of oblong to isodiametric cells, 5–7 layers, 15–30 µm thick. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 4–7 × (2.5–)3.5–5.5 µm. *Conidia* ellipsoidal to cylindrical, hyaline, thin-walled, smooth, aseptate, 4–7 × 2–3 µm, with 2–4 polar guttules. *Conidial matrix* whitish.

Culture characteristics: Colonies on OA, 60–65 mm diam after 7 d, margin regular, felty, pale grey olivaceous; reverse olivaceous near the margin, towards the centre of colony becoming buff, pale olivaceous to olivaceous. Colonies on MEA 65–70 mm diam after 7 d, margin regular, aerial mycelium sparse, greenish olivaceous; reverse concolourous. Colonies on PDA, 70–75 mm diam after 7 d, margin regular, floccose, white; reverse olivaceous with buff tinge in some sections. NaOH spot test: a brown discolouration on MEA.

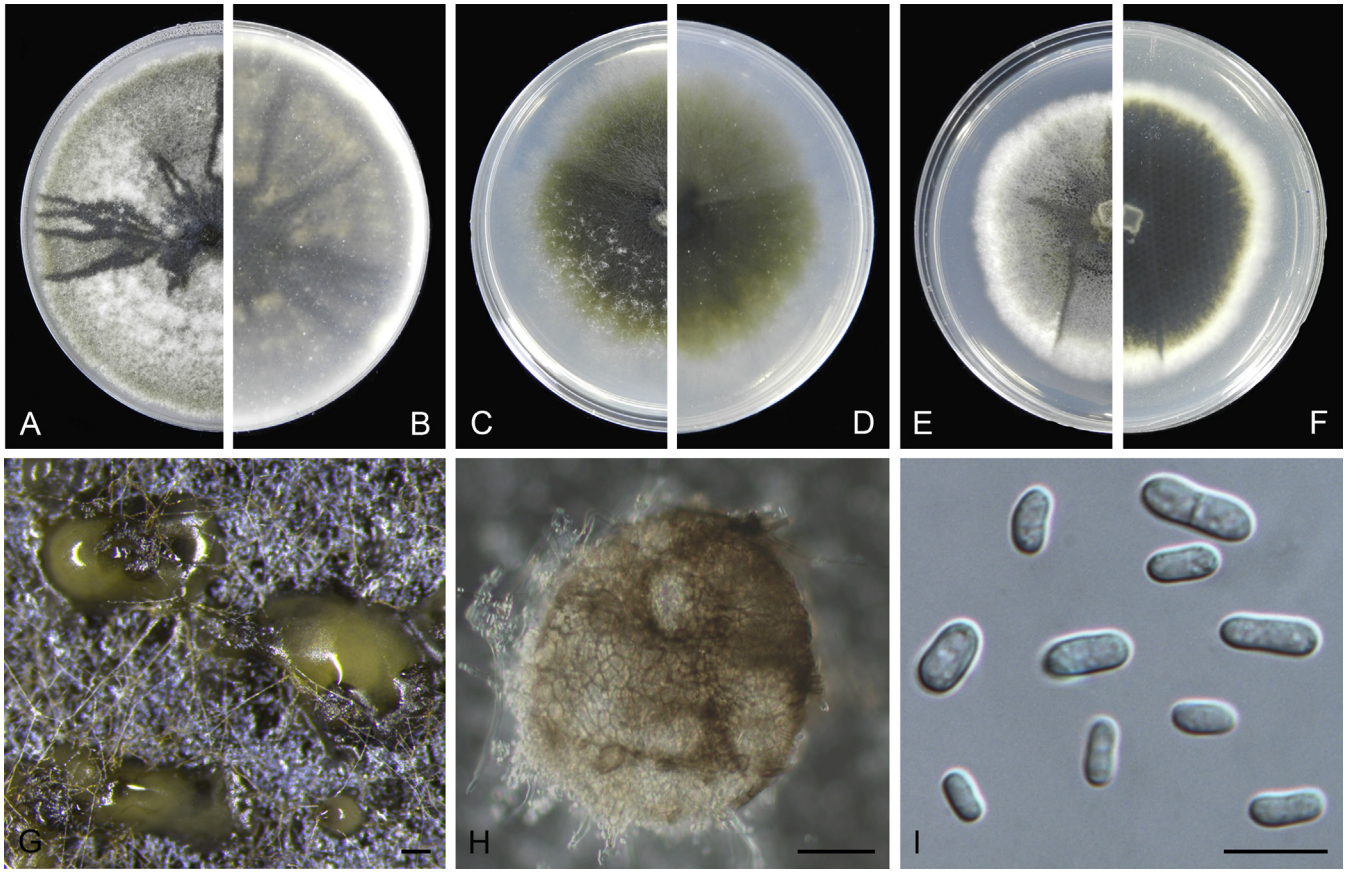

Fig. 9. *Boeremia noackiana* (CBS 101203). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Colonies sporulating on OA.H. Pycnidium. I. Conidia. Scale bars: G = 200 µm; H = 50 µm; I = 10 µm.

Specimen examined: **The Netherlands**, Arnhem, from a stem of *Mentha* sp., deposited in CBS Jan 1993, J, de Gruyter (**neotype designated here** HMAS 246698, MBT202497, culture ex-neotype CBS 126.93 = PD 73/642).

Notes: This species was initially described as *Phoma menthae* Strasser. However, this name was illegitimate and thus replaced by a new name, *Phoma strasseri* (Moesz 1925). The type specimen of this species could not be located, and is considered lost. The holotype was on *Mentha silvestris* collected from Austria, with conidia measuring 4–5 × 3–3.5 µm (Moesz 1925). Strain CBS 126.93 was also from *Mentha* sp., with conidia measuring 4–7 × 2–3 µm, which is in general agreement with the original description. Hence the specimen HMAS 246698 (ex CBS 126.93) is designated as neotype.

This species is phylogenetically and morphological similar to *B. crinicola*, but *B. strasseri* is only known from *Amaryllidaceae* (de Gruyter *et al.* 1993), while *B. crinicola* is mainly known from *Mentha* spp. or occasionally from other species also belonging to *Labiatae* (de Gruyter *et al.* 2002).

Boeremia telephii (Vestergr.) Aveskamp *et al.*, Stud. Mycol. 65: 40. 2010.

Basionym: *Ascochyta telephii* Vestergr., Öfvers. Finska Vetensk.-Soc. Förh. 54: 41. 1897.

≡ *Phoma telephii* (Vestergr.) Kesteren, Netherlands J. Pl. Pathol. 78: 117. 1972.

Specimens examined: **The Netherlands**, Utrecht, from a stem of *Sedum telephium*, deposited in CBS Sep. 1973, G.H. Boerema, CBS 760.73 = PD 71/1616; from *Sedum spectabile*, deposited in CBS Jan. 2001, H. de Gruyter, CBS 109175 = PD 79/524.

Clade 5: *Epicoccum*

Epicoccum Link, Mag. Neuesten Entdeck. Gesammten Naturk. Ges. Naturf. Freunde Berlin 7: 32. 1815, **emend.** Q. Chen & L. Cai.

Conidiomata pycnidial, globose to subglobose, or to irregularly shaped, superficial on or immersed into the agar, solitary or confluent. *Ostioles* papillate or non-papillate, sometimes on pronounced necks. *Pycnidial wall* pseudoparenchymatous, 2–9-layered, outer wall brown olivaceous. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, globose to flask-shaped. *Conidia* variable in shape and size, hyaline or in later stages a slight brownish pigmentation may be found, smooth- and thin-walled, *i.e.* ovoid, ellipsoidal to oblong, (sub-)cylindrical, sometimes slightly curved, always aseptate. Synasexual morph: *Sporodochia* semi-immersed, scattered or aggregated, clavate. *Conidia* multicellular-phragmosporous, but septa being obscured by the dark verrucose wall, subglobose-pyriform, often with a basal cell, variable in dimensions, arising in gradually growing clusters as solitary, terminal elements of mycelial branches, from a more or less globose pseudoparenchymatous stroma. *Chlamydospores* variable and irregular, unicellular or multicellular, intercalary or terminal, solitary or in chains, smooth, verrucose or incidentally tuberculate, subhyaline to dark brown, where multicellular globose or irregular shaped, dictyosporous or botryoid (Punithalingam *et al.* 1972, Boerema *et al.* 2004, Aveskamp *et al.* 2010).

Type species: *Epicoccum nigrum* Link, Mag. Neuesten Entdeck. Gesammten Naturk. Ges. Naturf. Freunde Berlin 7: 32. 1815.

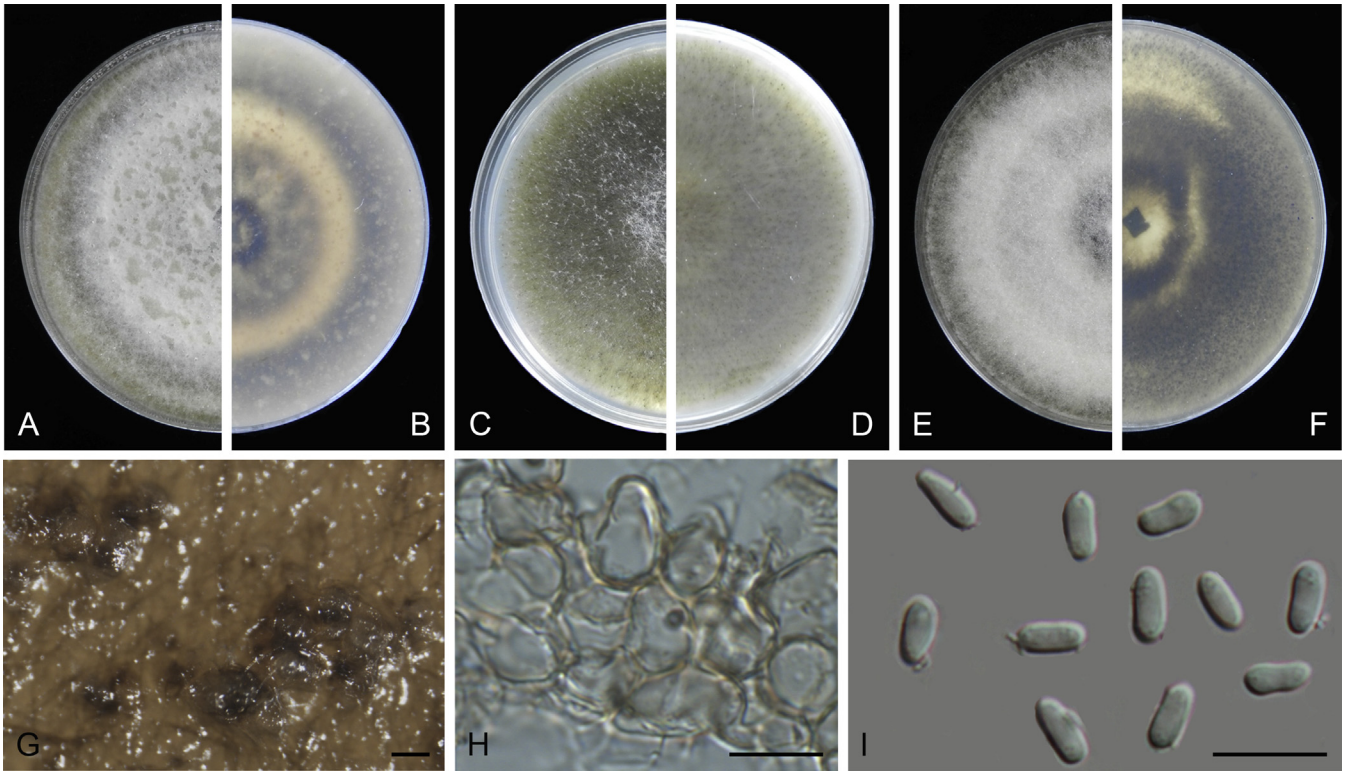

Fig. 10. *Boeremia strasseri* (CBS 126.93). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia producing on OA. H. Section of pycnidial wall. I. Conidia. Scale bars: G = 100 µm; H–I = 10 µm.

Notes: Based on our phylogenetic results, five *Phoma* species were recombined into the genus *Epicoccum*. The generic circumscription of *Epicoccum* is therefore emended to incorporate the morphological features of epicoccoid conidia and these newly added species, such as irregular pycnidial conidiomata and subcylindrical shaped conidia.

Epicoccum brasiliense (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814079.
Basionym: *Phoma brasiliensis* Aveskamp *et al.*, Stud. Mycol. 65: 35. 2010.
Description and illustrations (Aveskamp *et al.* 2010).

Specimen examined: **Brazil**, from *Amaranthus* sp., Nov. 2007, E. Rosskopf (**holotype** CBS H-20235, culture ex-holotype CBS 120105).

Epicoccum draconis (Berk. ex Cooke) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814080.
Basionym: *Phyllosticta draconis* Berk. ex Cooke, Grevillea 19: 8. 1890.
≡ *Phoma draconis* (Berk. ex Cooke) Boerema, Jaarb. Plziektenk. Dienst Wageningen 159: 24. 1982.
Description (de Gruyter *et al.* 1998).

Specimen examined: **Rwanda**, from a leaf of *Dracaena* sp., deposited in CBS Feb. 1983, G.H. Boerema, CBS H-16207, culture CBS 186.83 = PD 82/47.

Notes: In the original description of *Phyllosticta draconis*, the ellipsoidal conidia are cited as 7 × 3 µm (Cooke 1890). However, de Gruyter *et al.* (1998) described a representative culture of *Phoma draconis* (CBS 186.83), whose conidia measure 4–8.5 × 2–4 µm, which agrees with the holotype. CBS 186.83 clustered in the *Epicoccum* clade in Fig. 1, and thus we treat this taxon as a new combination in the genus *Epicoccum*, *E. draconis*.

Epicoccum henningsii (Sacc.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814081.
Basionym: *Phoma henningsii* Sacc., Syll. Fung. 10: 139. 1892.
Description (de Gruyter *et al.* 1993).

Specimen examined: **Kenya**, Maguga, from the bark of *Acacia mearnsii*, deposited in CBS Jan 1980, G.H. Boerema, CBS H-16354, culture CBS 104.80 = PD 74/1017.

Notes: "*Phoma acacia* Henn." was the first name of this species, which was illegitimate and therefore replaced by *Phoma henningsii* Sacc., with conidia measuring 3.5–5 × 2 µm (Saccardo 1892). Herein a new combination in *Epicoccum* is proposed for this species.

Epicoccum huancayense (Turkenst.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814082.
Basionym: *Phoma huancayensis* Turkenst., Fitopatologia 13: 68. 1978.
Description (de Gruyter *et al.* 1998).

Specimen examined: **Peru**, Dep. Junin, Huancayo, near Vallis Mantaro, from a stem of *Solanum* sp., Feb. 1974, L.J. Turkensteen (**isotype** CBS H-7609, culture ex-isotype CBS 105.80 = PD 75/908).

Epicoccum nigrum Link, Mag. Neuesten Entdeck. Gesammten Naturk. Ges. Naturf. Freunde Berlin 7: 32. 1815.
= *Phoma epicoccina* Punith., Tulloch & Leach, Trans. Brit. Mycol. Soc. 59: 341. 1972.

Specimens examined: **The Netherlands**, Geleen, from human toenail, deposited in CBS Dec. 1981, CBS 125.82 = IMI 331914 = CECT 20044. **USA**, Oregon, from seeds of *Dactylis glomerata*, deposited in CBS Jan 1973, M. Tulloch (**holotype** of *Phoma epicoccina* IMI 164070, culture ex-holotype CBS 173.73 = ATCC 24428 = IMI 164070).

Notes: Sequences of the two isolates studied here were identical in LSU, ITS and *tub2* (Aveskamp *et al.* 2010), but have 22 bp differences in *rpb2*, which is responsible for their distance in the phylogenetic tree. Since CBS 173.73 is the ex-type culture, further study is required to confirm if CBS 125.82 represents the same or a different species.

Epicoccum pimprinum (P.N. Mathur *et al.*) Aveskamp *et al.*, Stud. Mycol. 65: 35. 2010.
Basionym: *Phoma pimprina* P.N. Mathur *et al.*, Sydowia 13: 146. 1959.

Specimens examined: **India**, Poona, Pimpri, from soil, deposited in CBS Jun. 1960, M.J. Thirumalachar (culture **ex-isotype** CBS 246.60 = ATCC 22237 = ATCC 16652 = IMI 81601); from soil, 1977, PD 77/1028.

Notes: Isolate PD 77/1028 differs from the ex-type culture CBS 246.60 in one bp and 10 bp differences in LSU and *tub2* respectively. Since the sequencing of the *rpb2* locus of CBS 246.60 was unsuccessful, it can not be compared in the present study. If PD 77/1028 represents a different species remains to be confirmed.

Epicoccum plurivorum (P.R. Johnst.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814083.
Basionym: *Phoma plurivora* P.R. Johnst., New Zealand J. Bot. 19: 181. 1981.
Description (de Gruyter *et al.* 1998).

Specimen examined: **New Zealand**, Auckland, Mt Albert, from a leaf of *Setaria sp.*, Feb. 1979, P.R. Johnston (**holotype** PDD 40397, CBS H-7624, culture ex-isotype CBS 558.81 = PDDCC 6873).

Epicoccum sorghinum (Sacc.) Aveskamp *et al.*, Stud. Mycol. 65: 36. 2010.
Basionym: *Phyllosticta sorghina* Sacc., Michelia 1: 140. 1878.
≡ *Phoma sorghina* (Sacc.) Boerema *et al.*, Persoonia 7: 134. 1973.

Specimens examined: **France**, Antibes, from a twig of *Citrus* sp., deposited in CBS Sep. 1968, CBS 627.68 = PD 66/926. **Puerto Rico**, Mayaguez, from *Sorghum vulgare*, deposited in CBS Apr. 1980, G.H. Boerema, CBS 179.80 = PD 76/1018.

Clade 6: *Didymella*

Didymella Sacc. ex Sacc., Syll. Fung. 1: 545. 1882. **emend**. Q. Chen & L. Cai.
= *Peyronellaea* Goid. ex Togliani, Ann. Sperim. Agrar. II 6: 93. 1952.

Conidiomata pycnidial, subglobose to ellipsoidal, becoming irregular, superficial on or immersed into the agar, solitary or confluent, ostiolate or poroid, sometimes with elongated necks. Micropycnidia occur in some species. *Pycnidial wall* pseudoparenchymatous, 2–8-layered, with a pigmented outer wall. *Conidiogenous cells* phialidic, hyaline, smooth, flask-shaped, ampulliform or doliiform. *Conidia* generally aseptate, variable in shape, smooth- and thin-walled, *i.e.* ellipsoidal to subglobose, cylindrical, oblong, ovoid, sometimes allantoid, hyaline, but in older cultures conidia may become pigmented, larger or septated conidia may occur in at least one species, mostly guttulate. *Unicellular chlamydospores* often abundantly formed in and on the agar and in the aerial mycelium, globose, intercalary, brown or (pale) olivaceous pigmented. *Multicellular chlamydospores* mainly alternarioid, terminal or intercalary, often in chains, brown or (pale) olivaceous . *Ascomata* pseudothecial, immersed or erumpent, (sub-)globose to flattened, solitary or confluent, ostiolate, 2–5(–8)-layered, composed of pseudoparenchymatous cells. *Asci* cylindrical to clavate or saccate, 8-spored, bitunicate, arising from a broad hymenium among pseudoparaphyses. *Ascospores* mostly hyaline or brownish, ellipsoidal to cymbiform, uniseptate, symmetrical or asymmetrical, constricted at the septum, or multiseptate (de Gruyter *et al.* 2009, Aveskamp *et al.* 2010, Zhang *et al.* 2012).

Type species: *Didymella exigua* (Niessl) Sacc., Michelia 2: 58. 1880.

Notes: The genus *Didymella* was emended to accommodate the genus *Peyronellaea* and several other associated phoma-like species that clustered together with type species of *Didymella*, *i.e. D. exigua*. Most species in this genus produced chlamydospores in culture.

Didymella acetosellae (A.L. Sm. & Ramsb.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814089.
Basionym: *Phyllosticta acetosellae* A.L. Sm. & Ramsb., Trans. Brit. Mycol. Soc. 4: 173. 1913.
≡ *Phoma acetosellae* (A.L. Sm. & Ramsb.) Aa & Boerema, Persoonia 18: 16. 2002.
Description (de Gruyter *et al.* 2002).

Specimen examined: **The Netherlands**, Baarn, from a stem of *Rumex hydrolapathum*, Mar. 1996, H.A. van der Aa, CBS 179.97.

Didymella aliena (Fr.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814090.
Basionym: *Sphaeria aliena* Fr., Syst. Mycol. 2: 502. 1823.
≡ *Phoma aliena* (Fr.) Aa & Boerema, Persoonia 16: 486. 1998.
Description (de Gruyter *et al.* 1998).

Specimens examined: **France**, Vosges, from branches of *Euonymus europeus*, B.D. Mougeot (**neotype** PAD Roum. F. gallici exs. 765). **The Netherlands**, from a twig of *Berberis* sp., deposited in CBS Jul. 1993, J. de Gruyter, CBS 379.93 = PD 82/945.

Didymella americana (Morgan-Jones & J.F. White) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814091.
Basionym: *Phoma americana* Morgan-Jones & J.F. White, Mycotaxon 16: 406. 1983.
≡ *Peyronellaea americana* (Morgan-Jones & J.F. White) Aveskamp *et al.*, Stud. Mycol. 65: 31. 2010.
Description (Boerema 1993).

Specimens examined: **USA**, Arkansas, from pod lesions of *Glycine max*, 1981, H.J. Walters, CBS 568.97 = ATCC 44494 = PD 94/1544; Georgia, from *Zea mays*, deposited in CBS Mar. 1985, G.H. Boerema, CBS H-16144, culture CBS 185.85 = PD 80/1191.

Notes: The holotype of *Phoma americana* is from leaves of *Triticum aestivum* collected by A.K. Hagan in the USA. Strains described by Boerema (1993) are morphologically similar to the original description, and our sequence data revealed that this species belongs to the genus *Didymella*.

Didymella anserina (Marchal) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814092.
Basionym: *Phoma anserina* Marchal, Champignon Copr. 11: 1891.

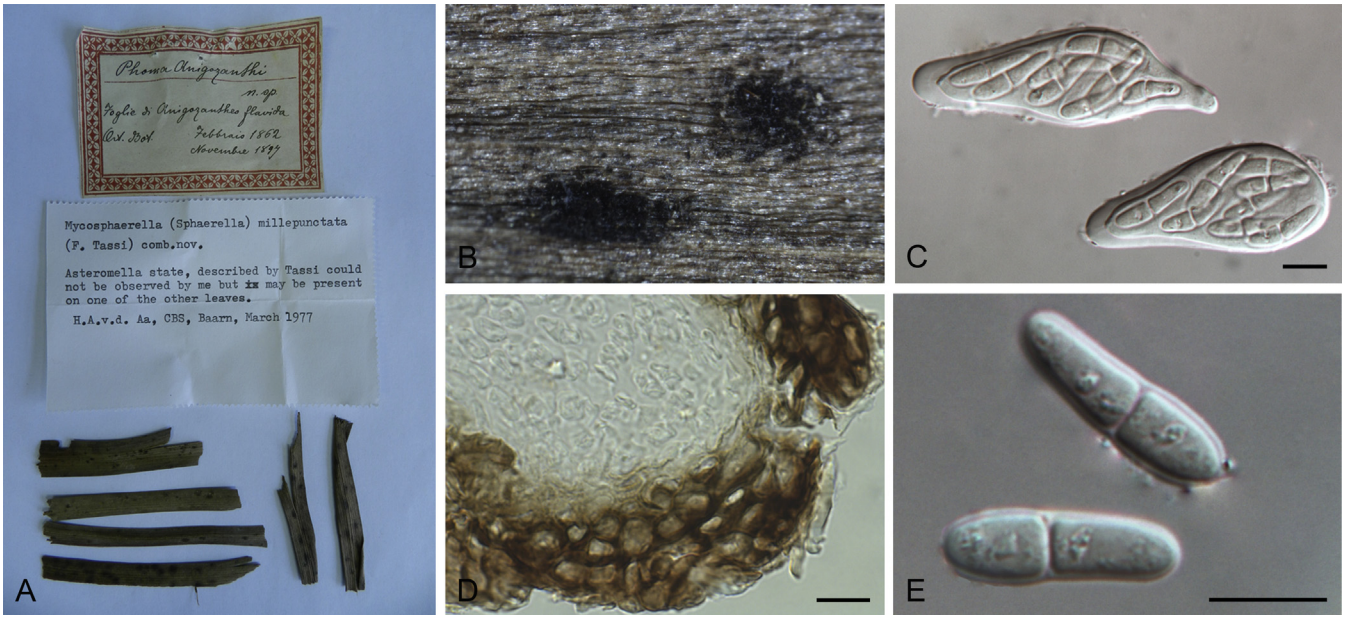

Fig. 11. *Nothophoma anigozanthi* (N 3622). A. Type collection packet. B. Ascomata on host substrate. C. Asci. D. Section of ascomata. E. Ascospores. Scale bar: C–E = 10 µm.

≡ *Peyronellaea anserina* (Marchal) Aveskamp *et al.*, Stud. Mycol. 65: 31. 2010.

= *Phoma radicis-callunae* R.W. Rayner, Bot. Gaz. 73: 231. 1922.

= *Phoma suecica* J.F.H. Beyma, Antonie van Leeuwenhoek 8: 110. 1942.

Description (de Gruyter & Noordeloos 1992).

Specimens examined: **Germany**, Giessen, Dec. 1979, R. Hadlok, CBS H-16562, culture CBS 253.80; former West-Germany, from plastic, deposited in CBS Dec. 1965, H. Kühlwein, CBS 397.65. **The Netherlands**, Ter Apel, from potato flour, 1983, CBS 360.84. **UK**, from *Calluna* sp., deposited in CBS Nov. 1929, R.W. Rayner (culture **ex-holotype** of "*Phoma radicis-callunae*" CBS 285.29).

Notes: This species was treated as new combination (*Peyronellaea anserina*) by Aveskamp *et al.* (2010), and here we recombine it into *Didymella*, as *D. anserina*. *Phoma radicis-callunae* was initially isolated from *Calluna* as endophyte (Rayner 1922), and reduced to synonymy of *P. anserina* (Boerema *et al.* 2004). Isolate CBS 397.65 was initially identified as *P. suecica*, which is also a synonym of *P. anserina*.

Didymella arachidicola (Khokhr.) Tomilin, Opredelitel' gribov roda Mycosphaerella Johans: 285. 1979.

Basionym: *Mycosphaerella arachidicola* Khokhr., Bolezni i vrediteli maslichnykh kul'tur 1: 29. 1934.

≡ *Peyronellaea arachidicola* (Khokhr.) Aveskamp *et al.*, Stud. Mycol. 65: 31. 2010.

= *Phoma arachidicola* Marasas, Pauer & Boerema, Phytophylactica 6: 200. 1974.

Specimens examined: **South Africa**, Cape Province, Jan Kempdorp, Vaalharts Research Station, from a leaf of *Arachis hypogaea*, deposited in CBS May 1975, W.F.O. Marasas (**isotype** of *Phoma arachidicola* CBS H-7601, culture ex-isotype CBS 333.75 = ATCC 28333 = IMI 386092).

Notes: The sexual morph of *Didymella arachidicola* was originally described as *Mycosphaerella arachidicola* (Khokhriakov 1934), and later transferred to *Didymella* (Tomilin 1979) and *Peyronellaea* (Aveskamp *et al.* 2010). Here we reinstate the *Didymella* name based on its phylogenetic affinity.

Didymella aurea (Gruyter *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814093.

Basionym: *Phoma aurea* Gruyter *et al.*, Persoonia 15: 394. 1993.

≡ *Peyronellaea aurea* (Gruyter *et al.*) Aveskamp *et al.*, Stud. Mycol. 65: 31. 2010.

Description (de Gruyter *et al.* 1993).

Specimen examined: **New Zealand**, Auckland, from a stem of *Medicago polymorpha*, deposited in CBS Jan 1993, J. de Gruyter (**holotype** L 992.177.422, culture ex-holotype CBS 269.93 = PD 78/1087).

Didymella bellidis (Neerg.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814094.

Basionym: *Phoma bellidis* Neerg., Friesia 4: 74. 1950.

Description (de Gruyter *et al.* 1993).

Specimens examined: **The Netherlands**, from seed of *Bellis perennis*, deposited in CBS Nov. 1985, G.H. Boerema, CBS H-5200, culture CBS 714.85 = PD 74/265; from *Bellis* sp., 1994, J. de Gruyter, PD 94/886.

Notes: The type of *Phoma bellidis* is on *Bellis perennis* collected from Denmark. Conidia from the ex-type strain measure 4.5–6 × 1.5–3 µm, which is in agreement with that of CBS 714.85 as described by de Gruyter *et al.* (4–6.5 × 2–2.5 µm; 1993). Hence, we introduce a new combination for this species as *Didymella bellidis*.

Didymella boeremae (Gruyter) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814095.

Basionym: *Phoma boeremae* Gruyter, Persoonia 18: 91. 2002.

Description (de Gruyter *et al.* 2002).

Specimen examined: **Australia**, Victoria, Burnley Gardens, from seed of *Medicago littoralis* cv. Harbinger, deposited in CBS Jan. 2002, H. de Gruyter (**neotype** L 996.294.536, culture ex-neotype CBS 109942 = PD 84/402).

Didymella calidophila (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814096.

Basionym: *Phoma calidophila* Aveskamp *et al.*, Mycologia 101: 368. 2009.

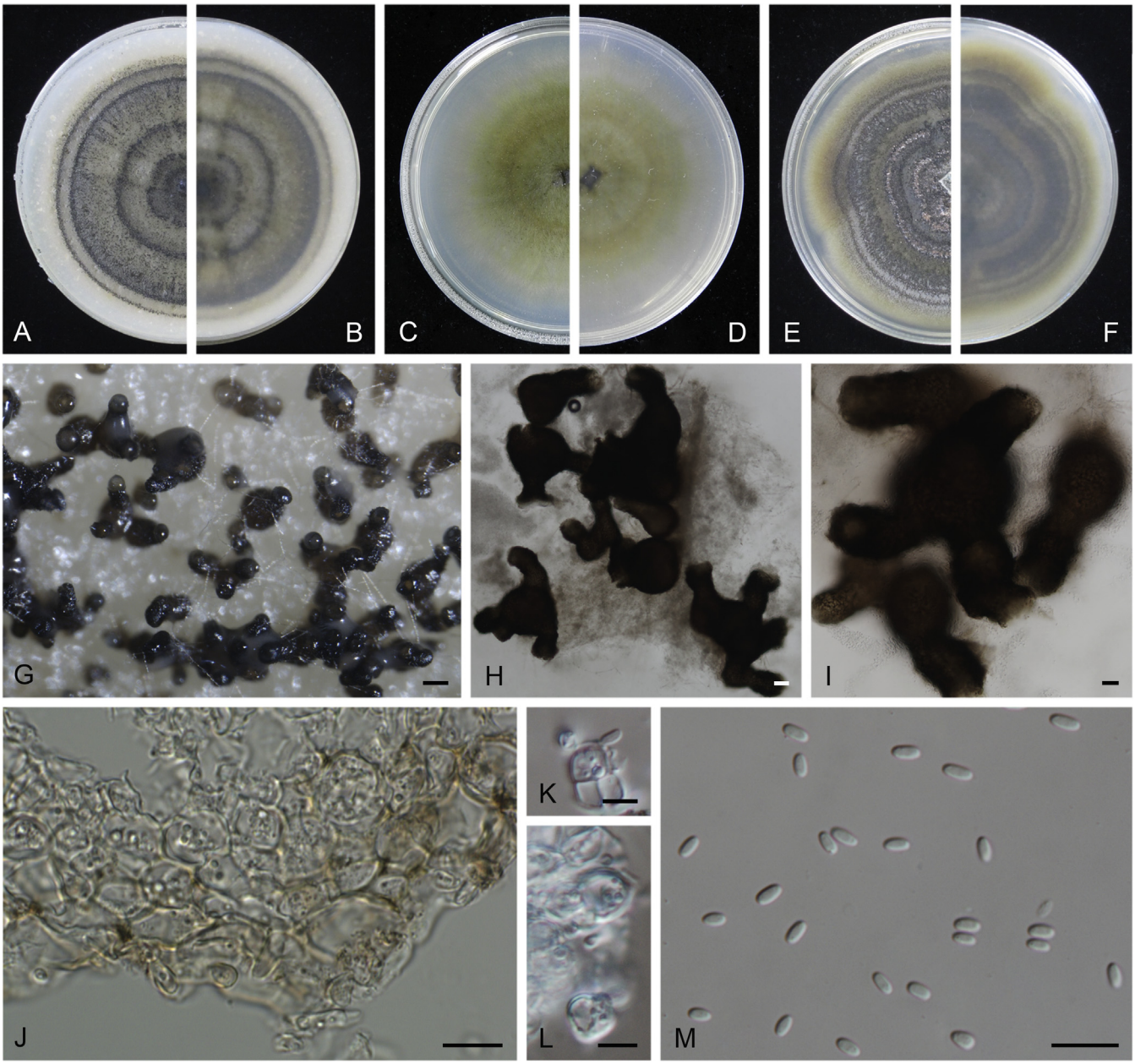

Fig. 12. *Nothophoma anigozanthi* (CBS 381.91). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H–I. Pycnidia. J. Section of pycnidial wall. K–L. Conidiogenous cells. M. Conidia. Scale bars: G = 200 µm; H = 40 µm; I = 20 µm; J, M = 10 µm; K–L = 5 µm.

Description (Boerema 1993).

Specimens examined: **Egypt**, from desert soil, deposited in CBS Jun. 1983, M.I.A. Abdel-Kader (**neotype** CBS H-20168, culture ex-neotype CBS 448.83). **The Netherlands**, Wageningen, from seeds of Cucumis sativus, RPVZ, PD 84/109.

Didymella chenopodii (P. Karst. & Har.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814097.

Basionym: *Gloeosporium chenopodii* P. Karst. & Har., J. Bot., Paris 3: 207. 1889.

≡ *Phoma chenopodiicola* Gruyter *et al.*, Persoonia 15: 395. 1993.

Description (de Gruyter *et al.* 1993).

Specimen examined: **Peru**, from a stem of *Chenopodium quinoa* cv. Sajana, deposited in CBS Jan 1993, J, de Gruyter, CBS 128.93 = PD 79/140.

Notes: This species was initially described as *Gloeosporium chenopodii*, and later replaced by a *nomen novum*, *Phoma chenopodiicola* (de Gruyter *et al.* 1993). Here a new combination is proposed for this species as *Didymella chenopodii*. The type specimen was collected from *Chenopodium album* in France, and is preserved in PC.

Didymella coffeae-arabicae (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814098.

Basionym: *Phoma coffeae-arabicae* Aveskamp *et al.*, Mycologia 101: 371. 2009.

≡ *Peyronellaea coffeae-arabicae* (Aveskamp *et al.*) Aveskamp *et al.*, Stud. Mycol. 65: 32. 2010.

Description (Aveskamp *et al.* 2009a).

Specimen examined: **Ethiopia**, from *Coffea arabica*, 1984, M.M.J. Dorenbosch (**holotype** CBS H-20143, culture ex-holotype CBS 123380 = PD 84/1013).

Didymella curtisii (Berk.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814099.

Basionym: *Hendersonia curtisii* Berk., Nuovo Giorn. Bot. Ital. 10: 19. 1878.

≡ *Stagonosporopsis curtisii* (Berk.) Boerema, Verslagen Meded. Plantenziektenk. Dienst Wageningen 157: 20. 1981.

≡ *Peyronellaea curtisii* (Berk.) Aveskamp *et al.*, Stud. Mycol. 65: 32. 2010.

= *Phyllosticta narcissi* Aderh., Centralbl. Bakteriol., 2 Abth. 6: 632. 1900.

≡ *Phoma narcissi* (Aderh.) Boerema *et al.*, Persoonia 15: 215. 1993.

Description (Boerema 1993).

Specimens examined: **The Netherlands**, from *Nerine* sp., deposited in CBS May 1992, J. de Gruyter, culture CBS 251.92 = PD 86/1145; from *Sprekelia* sp., PD 92/1460.

Notes: This species was recombined into *Peyronellaea* by Aveskamp *et al.* (2010) as *Peyronellaea curtisii*, and herein we treat it as a new combination in *Didymella*. The two isolates have two and five bp differences in ITS and *tub2* respectively, and thus may not be conspecific. Since the type material was not obtained, its taxonomy awaits future study.

Didymella dactylidis (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814100.

Basionym: *Phoma dactylidis* Aveskamp *et al.*, Stud. Mycol. 65: 48. 2010.

Description and illustration (Aveskamp *et al.* 2010).

Specimen examined: **USA**, Oregon, on *Dactylis glomerata*, 1973 (**holotype** CBS H-20237, culture ex-holotype CBS 124513 = PD 73/1414).

Didymella dimorpha (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814101.

Basionym: *Phoma dimorpha* Aveskamp *et al.*, Stud. Mycol. 65: 29. 2010.

Description and illustration (Aveskamp *et al.* 2010).

Specimen examined: **Spain**, Canary Isles, Gran Canaria, from phyllocladium of *Opuntia* sp., Oct. 1979, J.A. von Arx (**holotype** CBS H-20234, culture ex-holotype CBS 346.82).

Didymella eucalyptica (Sacc.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814103.

Basionym: *Phoma eucalyptica* Sacc., Syll. Fung. 3: 78. 1884.

≡ *Peyronellaea eucalyptica* (Sacc.) Aveskamp *et al.*, Stud. Mycol. 65: 32. 2010.

Description (de Gruyter & Noordeloos 1992).

Specimen examined: **Australia**, Western Australia, from a leaf of *Eucalyptus* sp., deposited in CBS Jun. 1991, CBS 377.91 = PD 79/210.

Notes: *Phoma eucalyptica* was recombined into *Peyronellaea* by Aveskamp *et al.* (2010), as *Pe. curtisii*, and we here introduce the new combination *Didymella eucalyptica* for this species based on its phylogenetic relationship.

Didymella exigua (Niessl) Sacc., Michelia 2: 57. 1880. Fig. 13.

Basionym: *Didymosphaeria exigua* Niessl, Oesterr. bot. Z. 25: 165. 1875.

≡ *Cercidospora exigua* (Niessl) Kuntze, Revis. gen. pl. 3: 454. 1898.

Description from ex-neotype culture (CBS 183.55): *Ascomata* subepidermal in the cortex of stems or in bracts of dead inflorescences, erumpent, subglobose to flattened, small, up to 170 µm diam, papillate; wall 10–15 µm thick, outer wall consisting of 2–3 layers of cells of *textura angularis*. *Pseudoparaphyses* hyaline, 1.5–2.5 µm diam, septate. *Asci* bitunicate, clavate to short cylindrical, 45–70 × 10–12 µm. *Ascospores* uni- to biseriate, ellipsoidal, straight to slightly curved, 12–16 × 4.5–6 µm, hyaline, smooth, apex obtuse, base broadly obtuse to subobtuse, medianly 1-septate, upper cell often wider than lower cell, slightly constricted at the septum.

Specimen examined: **France**, Menise sur Tholon, from *Rumex arifolius*, deposited in CBS May 1955, E. Müller (**neotype** CBS H-20123, culture ex-neotype CBS 183.55).

Note: Conidiomata *in vivo* and *in vitro* resemble ascomata in size, and give rise to conidia that are short cylindrical to bacilliform, 0(–1)-septate, hyaline, 9–13 × 4–6 µm (Corbaz 1957).

Didymella gardeniae (S. Chandra & Tandon) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814104.

Basionym: *Pyrenochaeta gardeniae* S. Chandra & Tandon, Mycopathol. Mycol. Appl. 29: 274. 1966.

≡ *Phoma gardeniae* (S. Chandra & Tandon) Boerema, Verslagen Meded. Plantenziektenk. Dienst Wageningen 156: 27. 1980.

≡ *Peyronellaea gardeniae* (S. Chandra & Tandon) Aveskamp *et al.*, Stud. Mycol. 65: 32. 2010.

Description (de Gruyter & Boerema 2002).

Specimen examined: **India**, Allahabad, from the leaf of *Gardenia jasminoides*, deposited in CBS Sep. 1968, S. Chandra & R.N. Tandon (**isotype** CBS H-7605, culture ex-isotype CBS 626.68 = IMI 108771).

Didymella glomerata (Corda) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814105.

Basionym: *Coniothyrium glomeratum* Corda, Icon. Fung. (Prague) 4: 39. 1840.

≡ *Phoma glomerata* (Corda) Wollenw. & Hochapfel, Z. Parasitenk. 3: 592. 1936.

≡ *Peyronellaea glomerata* (Corda) Goid. ex Togliani, Ann. Sperim. Agrar. III 6: 93. 1952.

Description (Boerema 1993).

Specimens examined: **Romania**, Bucuresti, from fresco in church, Nov. 1971, I. Ionita, CBS H-16340, culture CBS 133.72. **The Netherlands**, from *Chrysanthemum* sp., deposited in CBS Sep. 1963, CBS 528.66 = PD 63/590.

Didymella heteroderae (Chen *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814106.

Basionym: *Phoma heteroderae* Sen Y. Chen *et al.*, Mycologia 88: 885. 1996 (1997).

≡ *Peyronellaea heteroderae* (Sen Y. Chen *et al.*) Crous, Persoonia 32: 223. 2014.

= *Phoma pomorum* var. *calorpreferens* Boerema *et al.*, Persoonia 15: 207. 1993.

≡ *Phoma calorpreferens* (Boerema *et al.*) Aveskamp *et al.*, Mycologia 101: 370. 2009.

≡ *Peyronellaea calorpreferens* (Boerema *et al.*) Aveskamp *et al.*, Stud. Mycol. 65: 31. 2010.

Description (Boerema 1993).

Specimen examined: **The Netherlands**, from undefined food material, 1973, G.H. Boerema (**holotype** L 990.290.418, culture ex-holotype CBS 109.92 = PD 73/1405).

Notes: This species was treated as *Peyronellaea calorpreferens* (Aveskamp *et al.* 2010), which was later considered as a *nom. illeg.*, and then a new combination was introduced as *Pe. heteroderae*, citing the basionym as *Phoma heteroderae* (Crous *et al.* 2014).

Fig. 13. *Didymella exigua* (CBS 183.55). A. Ascomata on host. B. Surface view of ascoma. C–G. Asci with ascospores (arrow denotes pseudoparaphyse). H. Hyaline 1-septate ascospores. Scale bars: B–H = 10 µm.

Didymella lethalis (R. Stone) Sivan., Bitunicate Ascomycetes and their Anamorphs: 424. 1984.
Basionym: *Mycosphaerella lethalis* R. Stone, Ann. Mycol. 10: 587. 1912.
= *Ascochyta lethalis* Ellis & Barthol., Fungi Columb. 1808. 1903.
≡ *Peyronellaea lethalis* (Ellis & Barthol.) Aveskamp, Gruyter & Verkley, Stud. Mycol. 65: 32. 2010.

Specimen examined: **Unknown origin**, from unknown substrate, deposited in CBS Sep. 1925, A.W. Archer, CBS 103.25.

Notes: Sivanesan (1984) published the link between *Ascochyta lethalis* and *Didymella lethalis*. However, this connection requires molecular verification. The phylogenetic data indicated that *Didymella lethalis* (CBS 103.25) is closely related to *D. pinodes* (CBS 525.77), but they differ in seven bp in four sequenced loci. Here we tentatively retain them as two distinct species. Clarification of the relationship between the two species awaits the examination of the type specimen of *Didymella lethalis*.

Didymella longicolla (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814107.
Basionym: *Phoma longicolla* Aveskamp *et al.*, Stud. Mycol. 65: 49. 2010.
Description and illustration (Aveskamp *et al.* 2010).

Specimen examined: **Spain**, Canary Isles, from *Opuntia* sp., J. de Gruyter (**holotype** CBS H-20238, culture ex-holotype CBS 124514 = PD 80/1189).

Didymella macrostoma (Mont.) Q. Chen & L. Cai, **comb. et stat. nov.** MycoBank MB814108.
Basionym: *Phoma macrostoma* var. *macrostoma* Mont., Ann. Sci. Nat. Bot. III 11: 52. 1849.
= *Polyopeus purpureus* var. *incoloratus* A.S. Horne, J. Bot. 58: 240. 1920.
≡ *Phoma macrostoma* var. *incolorata* (A.S. Horne) Boerema & Dorenb., Persoonia 6: 55. 1970. (as "*macrostomum* var. *incolorata*")
Description (de Gruyter *et al.* 2002).

Specimens examined: **Germany**, near München, from the bark of *Larix decidua*, deposited in CBS Jun. 1995, L. Pehl, CBS 482.95. **Switzerland**, Vierwaldstättersee, near Brunnen, from a leaf of *Acer pseudoplatanus*, Oct. 1968, J. Gemmen, CBS H-16477, culture CBS 223.69. **The Netherlands**, Wageningen, from wood of *Malus sylvestris*, deposited in CBS Sep. 1969, G.H. Boerema, CBS H-16431, culture CBS 529.66 = PD 66/521. **Unknown origin**, from seed of *Pinus nigra* var. *astriaca*, deposited in CBS Aug. 1938, J.G. ten Houten, CBS 247.38.

Notes: The representative isolate of *Phoma macrostoma* var. *incolorata* (CBS 223.69) was genetically identical, and ecologically and morphologically highly similar to the representative isolates of *P. macrostoma* var. *macrostoma* (CBS 482.95, CBS 529.66). *Phoma macrostoma* var. *incolorata* only differs from the type variety in lacking hyphal pigmentation and having a negative reaction in NaOH (de Gruyter *et al.* 2002), which may be related to the production of cholesterol (Rajak & Rai 1983). Since these characteristics may vary under different incubation conditions and on different media for cultivation, we concluded that these two varieties should be combined to *Didymella mascrostoma*. Isolate CBS 247.38, which was received as *Phoma libertiana*, grouped with *D. macrostoma* in the same well-supported clade with identical sequences in all four loci, and we therefore re-identify it as *D. macrostoma*.

Didymella maydis (Arny & R.R. Nelson) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814109.
Basionym: *Phyllosticta maydis* Arny & R.R. Nelson, Phytopathology 61: 1171. 1971.
≡ *Phoma zeae-maydis* Punith., Mycopathologia 112: 50. 1990. (*nom. nov.* for *Phyllosticta maydis* in *Phoma*)
≡ *Peyronellaea maydis* (Arny & R.R. Nelson) Crous, Persoonia 32: 223. 2014.
= *Mycosphaerella zeae-maydis* Mukunya & Boothr., Phytopathology 63: 530. 1973.

≡ *Didymella zeae-maydis* (Mukunya & Boothr.) Arx, Beih. Nova Hedwigia 87: 288. 1987.
≡ *Peyronellaea zeae-maydis* (Mukunya & Boothr.) Aveskamp *et al.*, Stud. Mycol. 65: 33. 2010.
Description (de Gruyter 2002).

Specimens examined: **USA**, New York, Aurora, Cornell University, from dead *Zea mays*, Apr. 1972, D.M. Mukuya & C.W. Boothroyd (**holotype** of *Mycosphaerella zeae-maydis* CUP 52727); Wisconsin, Hancock, from *Zea mays*, Aug. 1970, D.C. Arny, culture ex-holotype of "*Phyllosticta maydis*" CBS 588.69.

Notes: Mukunya & Boothroyd (1973) established the sexual and asexual connection between *Mycosphaerella zeae-maydis* and *Phyllosticta maydis*. This species was recombined into *Peyronellaea* as *Pe. zeae-maydis* by Aveskamp *et al.* (2010), and later this treatment was corrected as a new combination *Pe. maydis* (Crous *et al.* 2014). Here we treat it based on the asexual morph and introduce a new combination, *Didymella maydis*.

Didymella microchlamydospora (Aveskamp & Verkley) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814110.
Basionym: *Phoma microchlamydospora* Aveskamp & Verkley, Mycologia 101: 374. 2009.
Description and illustration (Aveskamp *et al.* 2009a).

Specimen examined: **UK**, from leaves of *Eucalyptus* sp., 1994, A.M. Ainsworth (**holotype** CBS H-20147, culture ex-holotype CBS 105.95).

Didymella molleriana (G. Winter) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814102.
Basionym: *Ascochyta molleriana* G. Winter, Bol Soc. Brot. 1883: 26. 1884.
= *Phoma digitalis* Boerema, Verslagen Meded. Plantenziektenk. Dienst Wageningen 153: 19. 1979.
Description (de Gruyter *et al.* 2002).

Specimens examined: **New Zealand**, Levin, from a leaf of *Digitalis purpurea*, Oct. 1973, G.H. Boerema, CBS H-16201, culture CBS 229.79 = LEV 7660. **The Netherlands**, Ommen, from *Digitalis* sp., deposited in CBS Jan. 2001, H. de Gruyter, CBS 109179 = PD 90/835-1.

Note: Ascochyta molleriana Wint. was a replaced synonym of *Phoma digitalis*, and we recombine this species into *Didymella* based on its phylogeny.

Didymella musae (P. Joly) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814111.
Basionym: *Peyronellaea musae* P. Joly, Rev. Mycol. 26: 97. 1961.
≡ *Phoma jolyana* Piroz. & Morgan-Jones, Trans. Brit. Mycol. Soc. 51: 200. 1968.
Description (Boerema 1993).

Specimen examined: **India**, from fruit of *Mangifera indica*, deposited in CBS Jun. 1969, CBS 463.69.

Didymella negriana (Thüm.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814112.
Basionym: *Phoma negriana* Thüm. "*Ph. negrianum*", Die Pilze des Weinstockes, Vienna: 185. 1878.
≡ *Phyllosticta negriana* (Thüm.) Allesch., Rabenh. Krypt.-Fl. 1: 98. 1898.
Description (de Gruyter *et al.* 1998).

Specimen examined: **Germany**, Oberdollendorf am Rhein, from *Vitis vinifera*, deposited in CBS Mar. 1971, L. Kiewnik, CBS H-16511, culture CBS 358.71.

Didymella nigricans (P.R. Johnst. & Boerema) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814113.
Basionym: *Phoma nigricans* P.R. Johnst & Boerema, New Zealand J. Bot. 19: 394. 1982.
≡ *Peyronellaea australis* Aveskamp *et al.*, Stud. Mycol. 65: 31. 2010.
Description (de Gruyter *et al.* 1998).

Specimens examined: **New Zealand**, Auckland, Mt. Albert, from a leaf of *Actinidia chinensis*, Apr. 1979, P.R. Johnston (**isotype** CBS H-7619, culture ex-isotype CBS 444.81 = PDDCC 6546); from *Actinidea chinensis*, 1977, P.R. Johnston, PD 77/919.

Didymella pedeiae (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814114.
Basionym: *Phoma pedeiae* Aveskamp *et al.*, Stud. Mycol. 65: 27. 2010.
Description and illustration (Aveskamp *et al.* 2010).

Specimen examined: **The Netherlands**, Aalsmeer region, on *Schefflera elegantissima*, 1992, isolated by J. de Gruyter (**holotype** CBS H-20239, culture ex-holotype CBS 124517 = PD 92/612A).

Didymella pinodella (L.K. Jones) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814115.
Basionym: *Ascochyta pinodella* L.K. Jones, Bull. New York Agric. Exp. Sta., Geneva 547: 10. 1927.
≡ *Phoma medicaginis* var. *pinodella* (L.K. Jones) Boerema, Netherlands J. Pl. Pathol. 71: 88. 1965.
≡ *Phoma pinodella* (L.K. Jones) Morgan-Jones & K.B. Burch, Mycotaxon 29: 485. 1987.
≡ *Peyronellaea pinodella* (L.K. Jones) Aveskamp *et al.*, Stud. Mycol. 65: 33. 2010.
Description (de Gruyter *et al.* 2002).

Specimens examined: **The Netherlands**, from a stem of *Pisum sativum*, deposited in CBS Jul. 1990, M.E. Noordeloos, CBS 318.90 = PD 81/729. **USA**, Minnesota, from *Trifolium pratense*, deposited in CBS Sep. 1966, CBS 531.66.

Didymella pinodes (Berk. & A. Bloxam) Petr., Ann. Mycol. 22: 16. 1924. Figs 14–15.
Basionym: *Sphaeria pinodes* Berk. & A. Bloxam, Ann. Mag. Nat. Hist., Ser. III 7: 454. 1861.
≡ *Mycosphaerella pinodes* (Berk. & A. Bloxam) Vestergr., Ann. Mycol. 10: 581. 1912.
≡ *Peyronellaea pinodes* (Berk. & A. Bloxam) Aveskamp *et al.*, Stud. Mycol. 65: 33. 2010.
= *Ascochyta pinodes* L.K. Jones, Bull. New York Agric. Exp. Sta., Geneva 547: 4. 1927.

Description from holotype (K 56275): *Pseudothecia* solitary, on the surface of stems, brown, uniloculate, subglobose to globose, 125–215 × 100–205 µm, ostiolate. *Asci* cylindrical to subclavate, 33–74 × 10–15 µm, 8-spored, biseriate. *Ascospores* broadly fusiform to ellipsoidal, 11–20 × 4–8 µm, smooth, straight or slightly curved, hyaline, 1-septate, slightly constricted at the septum, guttulate, upper cells usually broader and longer than the lower cells.

Description from ex-epitype culture (CBS 525.77): *Conidiomata* pycnidial, solitary or confluent, (sub-)globose, glabrous or with some hyphal outgrows, produced on the agar surface or immersed, (130–)170–270(–320) × 130–210(–235) µm. *Ostioles* 1–2, papillate. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, 14–23 µm thick, composed of oblong to isodiametric cells, outer wall 2–3-layered, pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, 6.5–8.5 × 5–6 µm.

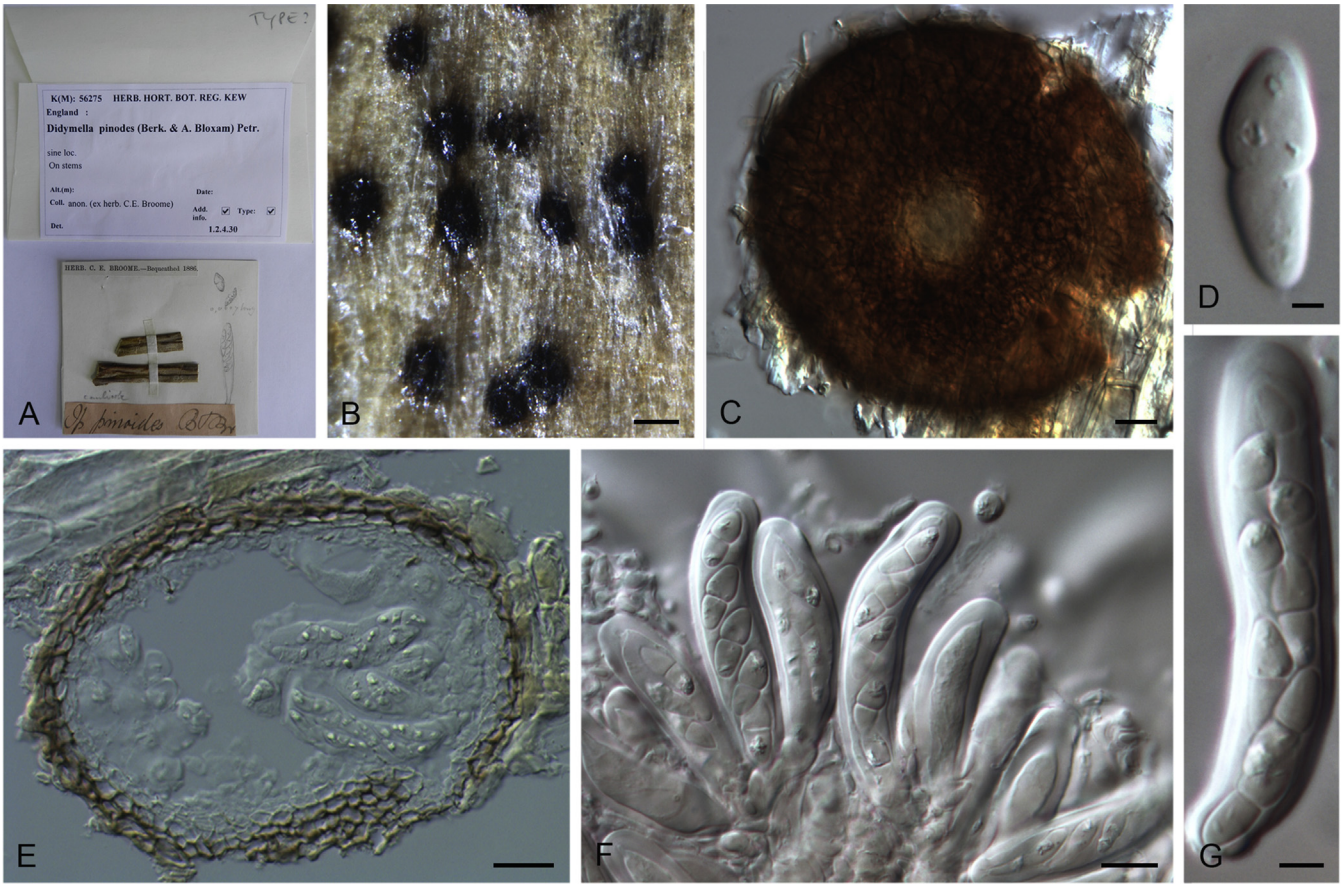

Fig. 14. *Didymella pinodes* (K 56275). A. Type collection packet. B. Ascomata on host substrate. C. Ascomata. D. Ascospore. E. Section of ascomata. F. Asci. G. Ascus. Scale bar: B = 200 µm; C, E = 20 µm; D = 2.5 µm, F = 10 µm, G = 5 µm.

Conidia variable in shape and size, cylindrical, allantoid to fabiform, smooth- and thin-walled, hyaline, 0–2-septate, mostly 1-septate, 7–16.5 × 4–6 µm, somewhat constricted at the septum, with 5–20 guttules per cell. *Conidial matrix* pale salmon.

Culture characteristics: Colonies on OA, 35–40 mm diam after 7 d, margin regular, white, floccose in concentric rings, with sparse mycelia near the centre, and an olivaceous background; reverse olivaceous, buff rings near the margin. Colonies on MEA 40–45 mm diam after 7 d, margin regular, white, with concentric rings; reverse concolourous. Colonies on PDA, 35–40 mm diam after 7 d, margin regular, densely covered by floccose, white, pale olivaceous near the centre; reverse white in outer ring, darkening towards the centre of the colony via buff, hazel to pale brown olivaceous. NaOH test negative.

Specimens examined: **Belgium**, Gembloux, from *Pisum sativum*, Sep. 1977, G. Sommereyns (**epitype designated here** CBS H-14681, MBT202499, culture ex-epitype CBS 525.77). **UK**, from stems of *Pisum sativum*, 1886 (**holotype** K 56275).

Notes: We only observed the sexual morph from the holotype specimen of *Didymella pinodes*. By comparing the morphological characters of the asexual morph (pycnidia, conidiogenous cells and conidia) of CBS H-14681 with the descriptions published by Punithalingam (1972) and Mel'nik (1977), we designate CBS H-14681 as epitype of this species.

Didymella pomorum (Thüm.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814116.

Basionym: *Phoma pomorum* Thüm., Fungi Pomicoli: 105. 1879.

≡ *Peyronellaea pomorum* var. *pomorum* (Thüm.) Aveskamp *et al.*, Stud. Mycol. 65: 33. 2010.

= *Peyronellaea circinata* Kusnezowa, Novoste Sist. Nizsh. Rast. 8: 189. 1971.

≡ *Phoma jolyana* var. *circinata* (Kusnezowa) Boerema. & Kesteren, Kew Bull. 31: 535. 1977.

≡ *Phoma pomorum* var. *circinata* (Kusnezowa) Aveskamp *et al.*, Mycologia 101: 377. 2009.

≡ *Peyronellaea pomorum* var. *circinata* (Kusnezowa) Aveskamp *et al.*, Stud. Mycol. 65: 33. 2010.

= *Phoma cyanea* Jooste & Papendorf, Mycotaxon 12: 444. 1981.

≡ *Phoma pomorum* var. *cyanea* (Jooste & Papendorf) Aveskamp *et al.*, Mycologia 101: 377. 2009.

≡ *Peyronellaea pomorum* var. *cyanea* (Jooste & Papendorf) Aveskamp *et al.*, Stud. Mycol. 65: 32. 2010.

= *Phoma triticina* E. Müll., Phytopathol. Z. 19: 413. 1952.

Description (Boerema 1993).

Specimens examined: **Russia**, West Siberia, Novosibirsk, from *Heracleum dissectum*, deposited in CBS May 1976 (**isotype** of "*Phoma pomorum* var. *circinata*" CBS H-3747, culture ex-isotype CBS 285.76 = ATCC 26241 = IMI 176742 = VKM F-1843). **South Africa**, Heilbron, from straw of *Triticum* sp., 1972, W.J. Jooste **(holotype** of "*Phoma pomorum* var. *cyanea*" PREM 45736, culture ex-holotype CBS 388.80). **Switzerland**, Zürich, Oerlikon, from *Triticum spelta*, deposited in CBS Mar. 1952, E. Müller (culture **ex-holotype** of "*Phoma triticina*" CBS 354.52). **The Netherlands**, Wageningen, from *Polygonum tataricum*, deposited in CBS Sep. 1966, CBS H-16540, culture CBS 539.66 = ATCC 16791 = IMI 122266 = PD 64/914.

Notes: The isolates of the respective *Phoma pomorum* varieties, *viz*. vars. *circinata* (CBS 285.76), *cyanea* (CBS 388.80) and *pomorum* (CBS 539.66), and the species *P. triticina* (CBS 354.52), clustered in a well-supported clade. Sequences of these four isolates are nearly identical in all four loci, and these four taxa have only negligible differences in morphology. Thus, we

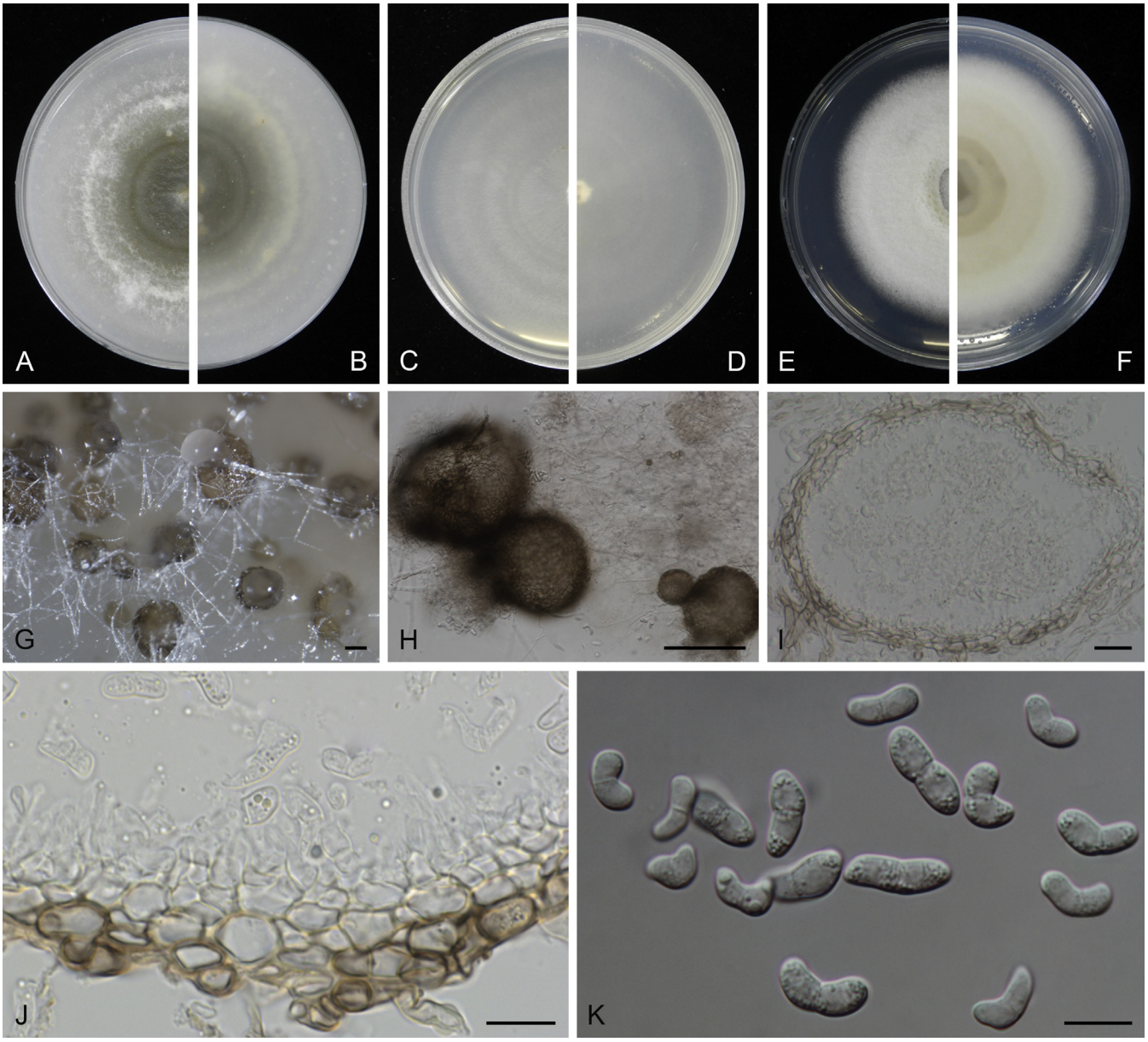

Fig. 15. *Didymella pinodes* (CBS 525.77). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidia. I. Section of pycnidium. J. Section of pycnidial wall. K. Conidia. Scale bars: G = 200 µm; H = 100 µm; I = 20 µm; J–K = 10 µm.

regarded these four taxa to be conspecific, and treat them as a single species, *Didymella pomorum*.

Didymella protuberans (Lév.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814117. Fig. 16.

Basionym: *Phoma protuberans* Lév., Ann. Sci. Nat. Bot. III 5: 281. 1846.

≡ *Peyronellaea protuberans* (Lév.) Aveskamp *et al.*, Stud. Mycol. 65: 33. 2010.

= *Didymella alectorolophi* Rehm, Hedwigia 64: 294. 1923.

≡ *Peyronellaea alectorolophi* (Rehm.) Aveskamp *et al.*, Stud. Mycol. 65: 31. 2010.

= *Phoma alecotorolophi* Boerema *et al.*, Persoonia 16: 366. 1997.

= *Phoma obtusa* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 378. 1870.

≡ *Peyronellaea obtusa* (Fuckel) Aveskamp *et al.*, Stud. Mycol. 65: 33. 2010.

Description from ex-neotype culture (CBS 381.96): *Conidiomata* pycnidial, solitary or aggregated, irregularly globose, glabrous or covered with some hyphal outgrowths, semi-immersed or immersed, 110–280(–350) × 95–220(–295) µm. *Ostioles* 1–2, slightly papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 5–7-layered, 15–25 µm thick, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 3.5–5(–6) × 3–4.5 µm. *Conidia* ellipsoidal, hyaline, thin-walled, smooth, aseptate, 4.5–7.5 × 3–5(–6.5) µm, egutullate or sometimes with 1(–3) small guttules. *Conidial matrix* whitish.

Culture characteristics: Colonies on OA, 55–60 mm diam after 7 d, margin regular, floccose, white to pale greenish olivaceous; reverse buff to white. Colonies on MEA 50–55 mm diam after 7 d, margin regular, white, with tufts of aerial mycelium; reverse olivaceous, greenish olivaceous near the centre. Colonies on PDA, 50–55 mm diam after 7 d, margin regular, white, floccose, pale leaden near the centre; reverse white to buff, olivaceous near the centre. NaOH spot test: a luteous discolouration on MEA, later changing to dull green to vinaceous-black, from the centre to outer ring.

Specimens examined: **Germany**, Hessen, from stalks of *Daucus carota*, K.W.G. Fuckel (**holotype** of "*Phoma obtusa*" G00266302 & G00266303). **The Netherlands**, from seed of *Rhinanthus major*, deposited in CBS Feb. 1996,

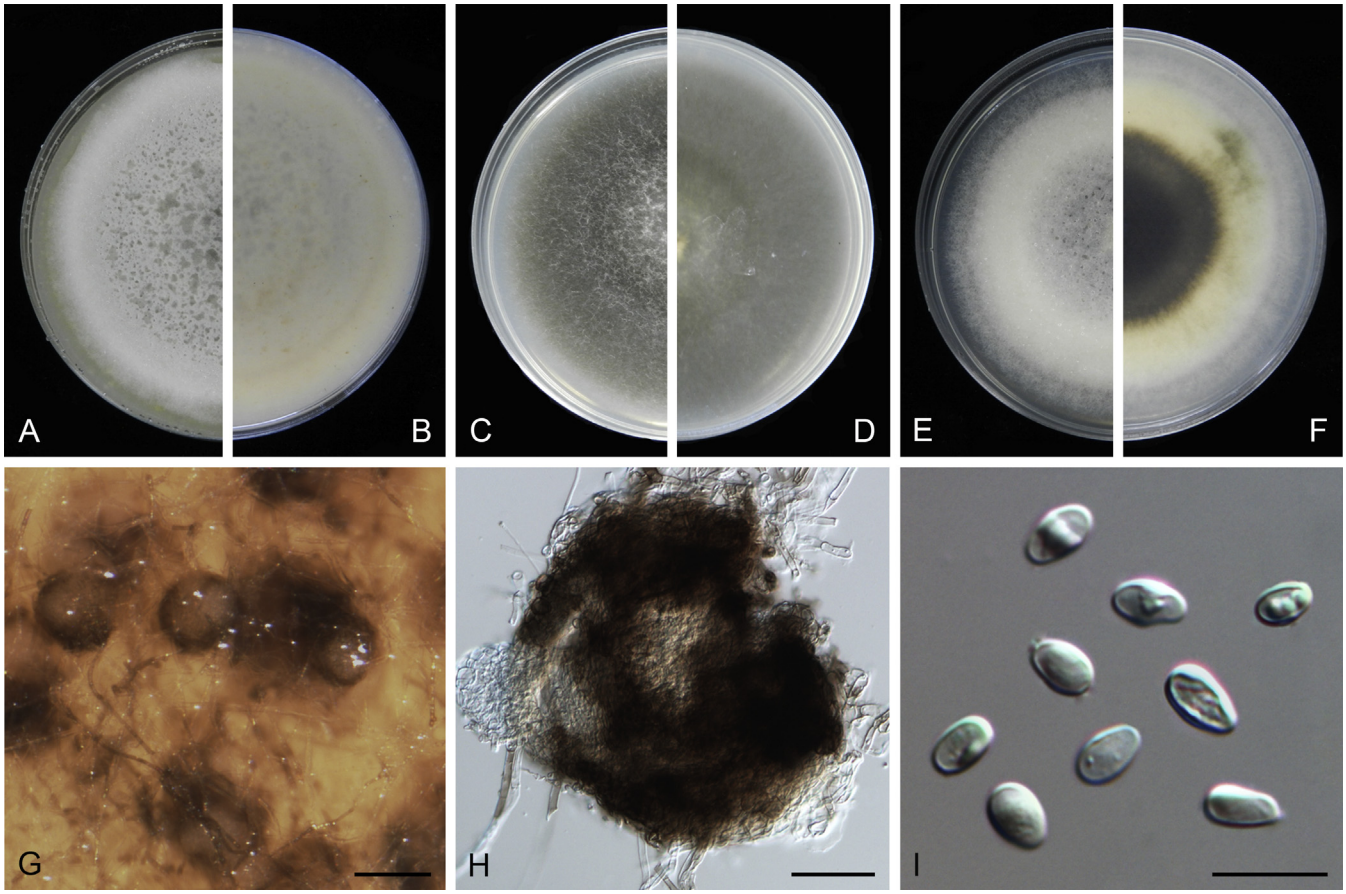

Fig. 16. *Didymella protuberans* (CBS 381.96). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidium. I. Conidia. Scale bars: G = 100 µm; H = 50 µm; I = 10 µm.

(**holotype** of "*Phoma alecotorolophi*" L 992.167.515, culture ex-holotype CBS 132.96 = PD 93/853); from a root of *Daucus carota*, deposited in CBS Jul. 1993, J. de Gruyter, CBS 377.93 = PD 80/976; from *Spinacia oleracea*, deposited in CBS Jul. 1993, J. de Gruyter, CBS 391.93 = PD 80/87; from a leaf of *Lycium halifolium*, deposited in CBS Apr. 1996 (**neotype of *Phoma protuberans* designated here** HMAS 246694, MBT202500, culture ex-neotype CBS 381.96 = PD 71/706).

Notes: The type specimen of *Phoma protuberans* could not be traced. The original description lacks conidial dimensions. In the specimen HMAS 246694, collected from *Lycium halifolium* in the Netherlands, the aseptate conidia measured 4.5–7.5 × 3–5(–6.5) µm, which is, in general agreement with the description by Boerema *et al.* (1997), 4–10.5 × 2–5 µm *in vitro*. Therefore, HMAS 246694 is selected as neotype.

Strains CBS 132.96 (ex-holotype of "*Phoma alecotorolophi*"), CBS 377.93 and CBS 391.93, grouped in a well-supported clade together with the neotype of *Didymella protuberans*. Sequences used in the multi-locus analyses of these four strains are identical, and there is no detectable difference in morphology among them. Based on current data, we confirmed that these four strains represent the same species, for which the name *Didymella protuberans* is adopted.

Didymella rhei (Ellis & Everh.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814156.

Basionym: *Ascochyta rhei* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 45: 160. 1893.

≡ *Phoma rhei* (Ellis & Everh.) Aa & Boerema, Persoonia 18: 42. 2002.

Description (de Gruyter *et al.* 2002).

Specimen examined: **New Zealand**, from a leaf of *Rheum rhaponticum*, deposited in CBS Jan. 2001, H. de Gruyter, CBS 109177 = LEV 15165 = PD 2000/9941.

Didymella rumicicola (Boerema & Loer.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814118. Figs 17–18.

Basionym: *Phoma rumicicola* Boerema & Loer., New Zealand J. Bot. 18: 473. 1980.

Description from holotype (PDD 50667): *Conidiomata* pycnidial, solitary or confluent, subglobose, glabrous, (100–)145–335(–470) × (100–)145–240(–330) µm. *Ostioles* 1–4, papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, 18–35 µm thick, composed of isodiametric cells, outer wall 2–3-layered, pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, 3.5–5.5 × 3–4 µm. *Conidia* ellipsoidal to cylindrical, smooth- and thin-walled, aseptate, 6.5–11.5 × 3–4.5 µm, guttulate.

Description from ex-isotype culture (CBS 683.79): *Conidiomata* pycnidial, solitary or confluent, subglobose, glabrous, superficial or immersed, (75–)345–480 × (50–)250–370 µm. *Ostioles* 1–4, papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 2–4-layered, 20–31 µm thick, composed of isodiametric cells, outer cell layer pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, 3.5–8.5 × 3–7 µm. *Conidia* ellipsoidal to cylindrical, thin-walled, smooth, aseptate, 4.5–9(–12.5) × 2.5–5 µm, with many minute guttules, *ca.* 5–25 guttules. *Conidial matrix* yellowish cream.

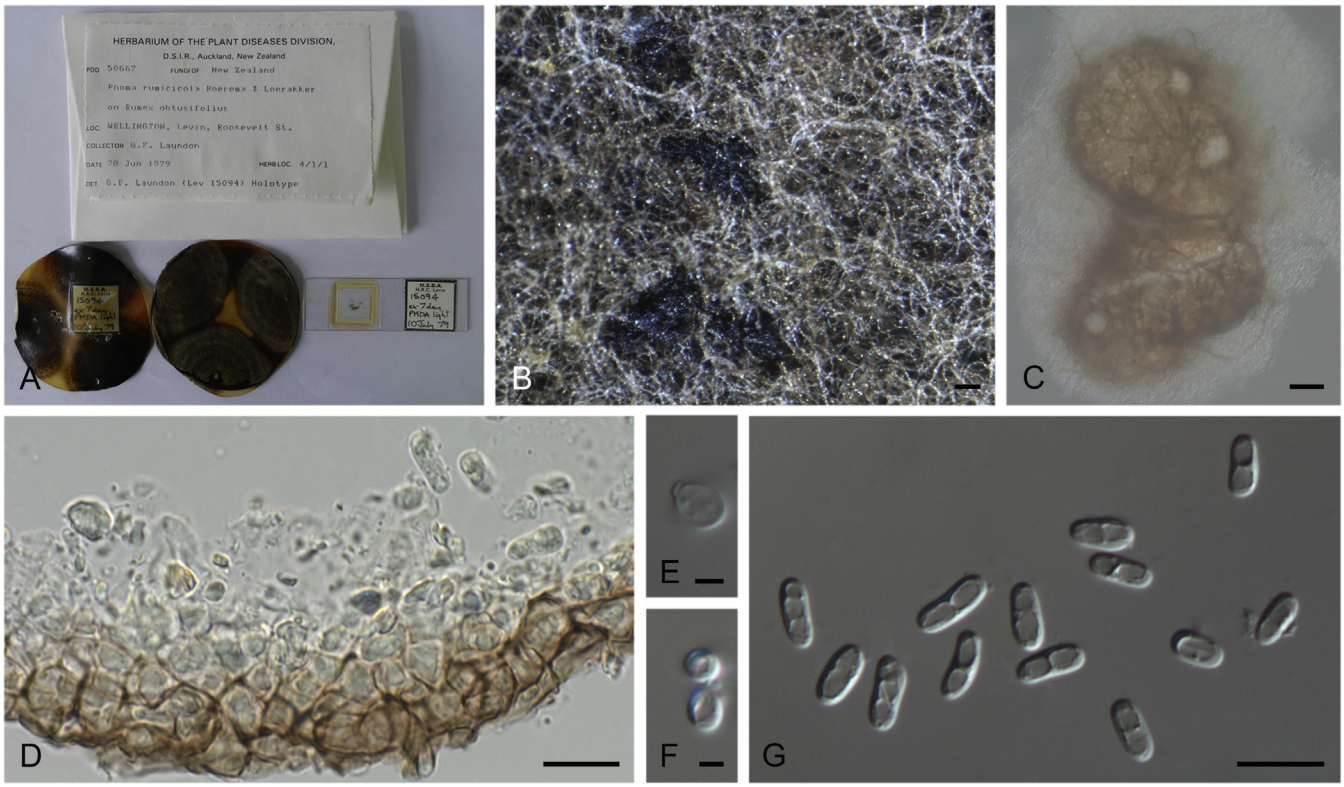

Fig. 17. *Didymella rumicicola* (PDD 50667). A. Type collection packet. B. Pycnidia on dried culture. C. Pycnidia. D. Section of pycnidial wall. E–F. Conidiogenous cells. G. Conidia. Scale bars: B = 100 µm; C = 50 µm; D, G = 10 µm; E–F = 2.5 µm.

Culture characteristics: Colonies on OA, 60–65 mm diam after 7 d, margin regular, felty, olivaceous; reverse concolourous. Colonies on MEA 55–60 mm diam after 7 d, margin regular, wooly, white, grey olivaceous near the margin; reverse buff, pale grey olivaceous near the margin. Colonies on PDA, 55–60 mm diam after 7 d, margin regular, floccose, white, abundant black pycnidia visible, giving an iron-black colour near the centre and margin; reverse dark olivaceous with some white zones. NaOH test negative.

Specimen examined: **New Zealand**, Levin, from *Rumex obtusifolius*, deposited in CBS Nov. 1979, G.F. Laundon (**holotype** PDD 50667, **isotype** CBS H-7627, culture ex-isotype CBS 683.79 = LEV 15094).

Notes: The isotype of *Didymella rumicicola* clustered in a well-supported clade with CBS 179.97 (*D. acetosellae*, originally identified as *Phoma acetosellae*) without any difference in the sequenced loci. These two species were both initially isolated from *Rumex* spp. However, *D. rumicicola* is distinguished from *D. acetosellae* in the faster growing rate (60–65 mm *vs.* 20–30 mm after 7 d on OA), and the smaller conidiogenous cells (3.5–8.5 × 3–7 µm in *D. rumicicola vs.* 5–13 × 6–12 µm in *D. acetosellae*; Boerema *et al.* 1980). Since CBS 179.97 is not the ex-type culture of *D. acetosellae*, the potential conspecificity of *D. rumicicola* and *D. acetosellae* remains to be confirmed.

Didymella sancta (Aveskamp *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814119.

Basionym: *Phoma sancta* Aveskamp *et al.*, Mycologia 101: 377. 2009.

≡ *Peyronellaea sancta* (Aveskamp *et al.*) Aveskamp *et al.*, Stud. Mycol. 65: 33. 2010.

Description and illustration (Aveskamp *et al.* 2009a).

Specimen examined: **South Africa**, from dead branches of *Ailanthus altissima*, Oct. 1982, C. Jansen (**holotype** CBS H-16332, culture ex-holotype CBS 281.83).

Didymella senecionicola Q. Chen & L. Cai, **nom. nov.** MycoBank MB814120.

≡ *Phoma senecionis* P. Syd., Hedwigia. 38: 136. 1899, non *Didymella senecionis* Hollós, 1908.

Description (de Gruyter *et al.* 1993).

Specimen examined: **New Zealand**, Raetihi, from a stem of *Senecio jacobaea*, deposited in CBS Jan. 1978, G.H. Boerema, CBS 160.78 = LEV 11451.

Notes: As the epithet "*senecionis*" was occupied in *Didymella*, a new name is proposed for this species. The name *Didymella senecionis* was based on the sexual morph, producing uniseptate ascospores arranged uniseriately into the clavate asci (Saccardo & Trotter 1913). *Didymella senecionicola* is presently only known from its asexual morph, producing aseptate, oblong to ellipsoidal conidia (de Gruyter *et al.* 1993).

Didymella sp. 1

Specimen examined: **The Netherlands**, Wageningen, Alphen aan de Rijn, from a leaf of *Pteris* sp., deposited in CBS Apr. 1996, CBS 379.96.

Notes: This isolate was incorrectly identified as "*Didymella adianticola*", as it is phylogenetically distant from the authentic strains of *D. adianticola* (CBS 187.83 and CBS 260.92). It is probably a novel species, and will be treated after further study.

Didymella sp. 2

Specimen examined: **Germany**, Berlin, from a flower-stalk of *Chrysanthemum roseum*, deposited in CBS Sep. 1958, R. Schneider, CBS 115.58 = DSM 62044.

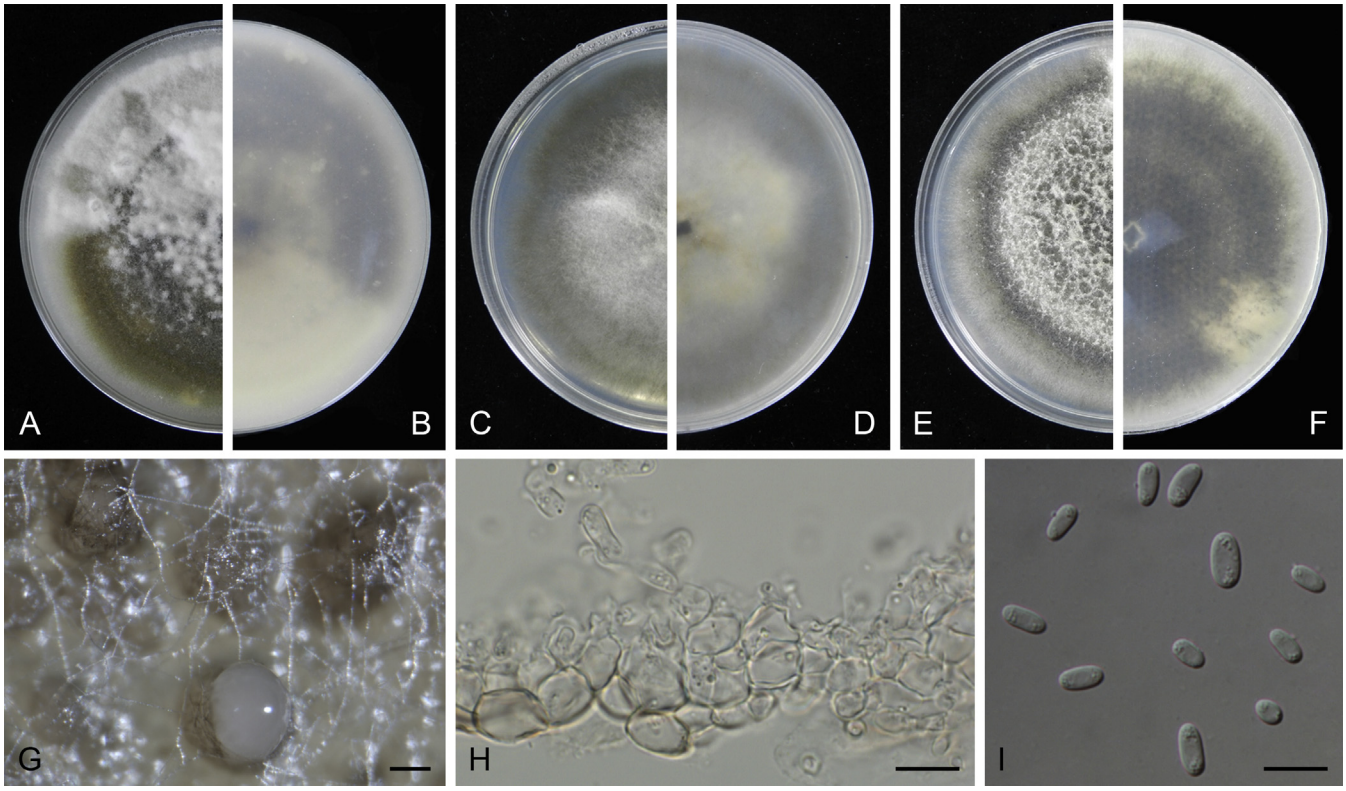

Fig. 18. *Didymella rumicicola* (CBS 683.79). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Section of pycnidial wall. I. Conidia. Scale bars: G = 200 µm; H–I = 10 µm.

Notes: CBS 115.58 was originally received as "*Ascochyta pyrethri*", and clustered in a distinct lineage (Fig. 1). Since the type of *As. pyrethri* is not available for comparison, we are unsure if CBS 115.58 represents a new species or is conspecific to *As. pyrethri*. This isolate awaits further study.

Didymella subglomerata (Boerema *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814121.
Basionym: *Phoma subglomerata* Boerema *et al.*, Persoonia 15: 204. 1993.
≡ *Peyronellaea subglomerata* (Boerema *et al.*) Aveskamp *et al.*, Stud. Mycol. 65: 33. 2010.
Description (Boerema 1993).

Specimen examined: **USA**, North Dakota, from *Triticum* sp., deposited in CBS Sep. 1992, J. de Gruyter, CBS 110.92 = PD 76/1010.

Didymella subherbarum (Gruyter *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814122.
Basionym: *Phoma subherbarum* Gruyter *et al.*, Persoonia 15: 387. 1993.
Description (de Gruyter *et al.* 1993).

Specimens examined: **Canada**, Ontario, from overwintered seeds of *Zea mays*, deposited in CBS May 1992, J. de Gruyter (**holotype** L 992.177.439, culture ex-holotype CBS 250.92 = DAOM 171914 = PD 92/371). **Peru**, from *Solanum* sp., deposited in CBS May 1992, J. de Gruyter, CBS 249.92 = PD 78/1088.

Didymella viburnicola (Oudem.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814123.
Basionym: *Phoma viburnicola* Oudem., Ned. Kruidk. Arch. 2: 247. 1900.
Description (de Gruyter & Noordellos 1992).

Specimen examined: **The Netherlands**, Wageningen, Aboretum, from *Viburnum cassioides*, deposited in CBS May 1973, CBS H-16605, culture CBS 523.73 = PD 69/800.

Notes: *Phoma viburnicola* was first collected on *Viburnum oxycoccus* from the Netherlands, with conidia measuring 5–6 × 3.5 µm (Saccardo 1902). De Gruyter & Noordeloos (1992) confirmed the conidial size of the representative isolates as 3.5–5.5 × 1.6–2.2 µm, which agrees with the original description. We herewith treat this species as a new combination in *Didymella*.

Clade 7: *Paraboeremia*

Paraboeremia Q. Chen & L. Cai, **gen. nov.** MycoBank MB814061.

Etymology: Morphologically resembling the genus *Boeremia*, but being phylogenetically distinct.

Conidiomata pycnidial, globose to subglobose, or irregular shaped, superficial on or immersed into the agar, solitary or confluent, ostiolate, sometimes with a short neck around the ostioles. *Pycnidial wall* pseudoparenchymatous, 3–6-layered, outer layers pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, globose to flask-shaped. *Conidia* ellipsoidal, sometimes curved, hyaline, smooth- and thin-walled, generally aseptate, guttulate, sometimes with greenish colour. *Ascomata* pseudothecial, subglobose to pyriform, ostiolate. *Asci* 8-spored, bitunicate. *Ascospores* subcylindrical, hyaline, 1-septate, the upper cell wider than the lower cell, constricted at the septum.

Type species: *Paraboeremia selaginellae* (Sacc.) Q. Chen & L. Cai.

Paraboeremia adianticola (Aa & Boerema) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814124. Fig. 19.

Basionym: *Didymella adianticola* Aa & Boerema, Verslagen Meded. Plantenziektenk. Dienst Wageningen 159 (Jaarboek 1982): 25. 1983.

= *Phyllosticta adianticola* E. Young, Mycologia 7: 144. 1915.

≡ *Phoma adianticola* (E. Young) Boerema, Verslagen Meded. Plantenziektenk. Dienst Wageningen 159 (Jaarboek 1982): 25. 1983.

Description from culture (CBS 260.92): *Conidiomata* pycnidial, solitary, globose to subglobose, glabrous, semi-immersed or immersed, (150–)170–265 × (120–)140–245 µm. *Ostioles* 1–3, spalely papillate. *Pycnidial wall* pseudoparenchymatous, 4–6-layered, 13–24 µm thick, composed of isodiametric cells, outer layer brown. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to dolliform, 5.5–7 × 3–6.5 µm. *Conidia* ellipsoidal to cylindrical, smooth- and thin-walled, aseptate, 4–7 × 2–2.8 µm, with 2 large polar guttules. *Conidial matrix* white.

Culture characteristics: Colonies on OA, 55–60 mm diam after 7 d, margin regular, buff to salmon, abundant pycnidia visible; reverse pale salmon. Colonies on MEA 20–25 mm diam after 7 d, margin regular, aerial mycelium sparse, pale saffron to brown, grey near the centre; reverse pale saffron, pale brown near the centre. Colonies on PDA, 35-40 mm diam after 7 d, margin regular, floccose, white or somewhat pale pink; reverse saffron. Application of NaOH results in a greenish olivaceous discolouration of the agar.

Specimens examined: **Unknown origin**, from *Pteris ensiformis*, deposited in CBS May 1992, J. de Gruyter, CBS 260.92 = PD 86/1103. **USA**, Florida, from a leaf of *Polystichum adiantiforme*, deposited in CBS Feb. 1983, G.H. Boerema, CBS H-16142, culture CBS 187.83 = PD 82/128.

Notes: Our taxonomic treatment was based on the sexual morph. Boerema (1983) connected the sexual (*Didymella adianticola*) and asexual (*Phoma adianticola*) morphs, which however requires molecular verification.

Paraboeremia putaminum (Speg.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814125.

Basionym: *Phoma putaminum* Speg., Atti Soc. Crittog. Ital. 3: 66. 1881.

Description (de Gruyter & Noordeloos 1992).

Specimens examined: **Denmark**, from the rhizosphere of *Malus sylvestris*, deposited in CBS Feb. 1969, E. Sønderhousen, CBS 130.69 = CECT 20054 = IMI 331916. **The Netherlands**, from a branch of *Ulmus* sp., deposited in CBS Jun. 1991, G.H. Boerema, CBS 372.91 = PD 75/960.

Notes: The two representative cultures of "*Phoma putaminum*" (CBS 130.69 and CBS 372.91) clustered in the *Paraboeremia* clade, and thus a new combination *Paraboeremia putaminum* is proposed. This species has identical LSU sequence with the type species, *Pa. selaginellae*, but is distinct in two bp and three bp in ITS and *tub2* sequences respectively. The clarification of their relationship awaits further study.

Paraboeremia selaginellae (Sacc.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814126. Fig. 20.

Basionym: *Phyllosticta selaginellae* Sacc., Malpighia 11: 304. 1897.

= *Phoma selaginellicola* Gruyter *et al.*, Persoonia 15: 399. 1993.

Description from ex-neotype culture (CBS 122.93): *Conidiomata* pycnidial, solitary, globose to obpyriform, glabrous, semi-immersed or immersed, 130–360 × 120–320 µm. *Ostioles* 2–3, slightly papillate. *Pycnidial wall* pseudoparenchymatous, 4–7-layered, 16–23 µm thick, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 5–6.5 × 3.5–5.5 µm. *Conidia* ellipsoidal to cylindrical, hyaline, smooth- and thin-walled, aseptate, 2.5–5 × 1–2 µm, sometimes with 1–2 guttules. *Conidial matrix* whitish.

Culture characteristics: Colonies on OA, 45–50 mm diam after 7 d, margin regular, floccose, grey olivaceous, white near the margin; reverse grey olivaceous to buff near the centre. Colonies on MEA 35–40 mm diam after 7 d, margin crenate, aerial mycelium sparse, olivaceous, white near the centre; reverse concolourous. Colonies on PDA, 35–40 mm diam after 7 d, margin crenate, floccose, with concentric rings, white to pale olivaceous; reverse olivaceous to pale brown, dull green near the centre. Application of NaOH results in a brown discolouration of the agar.

Specimen examined: **The Netherlands**, from a leaf of *Selaginella* sp., deposited in CBS Jan 1993, J. de Gruyter (**neotype of *Phyllosticta selaginellae* designated here** HMAS 246693, MBT202501, culture ex-neotype CBS 122.93 = PD 77/1049).

Notes: The type specimen of *Phyllosticta selaginellae* could not be located, and is presumably lost. The strain CBS 122.93 from *Selaginella* sp. had ellipsoidal to cylindrical conidia, 2.5–5 × 1–2 µm, which is in agreement with the original description based on *Selaginella helvetica*, and hence this collection is designated as neotype.

Paraboeremia selaginellae has a close phylogenetic relationship to *Pa. putaminum*, but can be distinguished by its narrower conidia (2.5–5 × 1–2 µm). Conidia of *Pa. putaminum* are guttulate, 3–4 × 2–2.5 µm, and conspicuous greenish in colour (de Gruyter & Noordeloos 1992).

Clade 8: *Macroventuria*

Macroventuria Aa, Persoonia 6: 359. 1971.

Ascomata perithecial, globose, ostiolate, erumpent on the agar surface, setose in the upper part. *Asci* ellipsoidal or saccate, bitunicate, 8-spored. *Ascospores* mostly hyaline, ellipsoidal, 2-celled (from van der Aa 1971).

Type species: *Macroventuria anomochaeta* Aa, Persoonia 6: 362. 1971.

Notes: This genus was established by van der Aa (1971), accommodating two species in the family *Venturiaceae* which produced relatively large, nearly hyaline, two-celled ascospores, differing from *Leptosphaerulina* (van der Aa 1971). Later *Macroventuria* was placed in *Pseudosphaeriaceae* by Barr (1982) and then in *Pleosporaceae* by Eriksson & Hawksworth (1986) (Kodsueb *et al.* 2006). In the study of Aveskamp *et al.* (2010) this genus was accommodated in the *Didymellaceae*, which is confirmed in the present study.

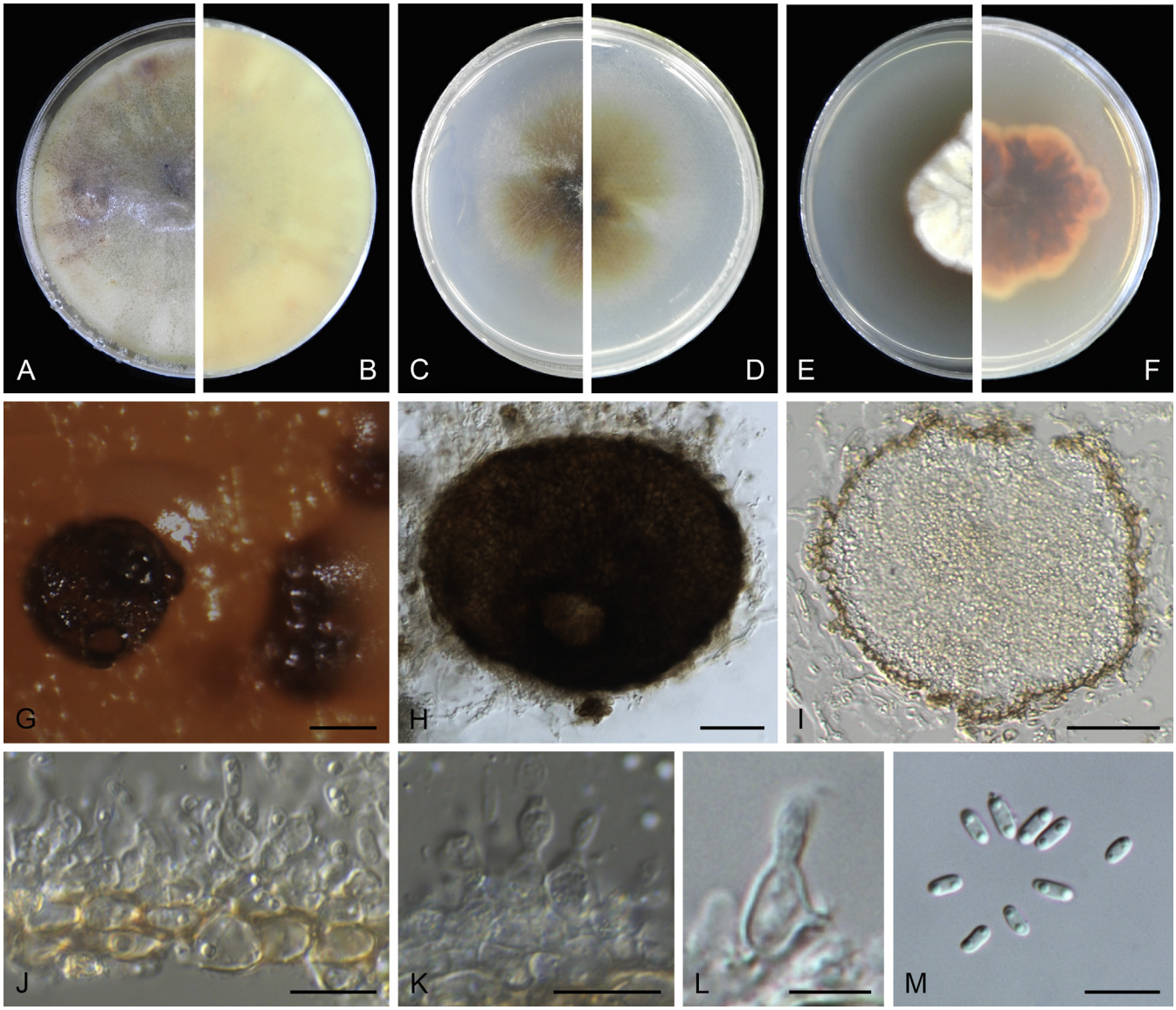

Fig. 19. *Paraboeremia adianticola* (CBS 260.92). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidia. I. Section of pycnidia. J. Section of pycnidial wall. K–L. Conidiogenous cells. M. Conidia. Scale bars: G = 100 µm; H–I = 50 µm; J, K, M = 10 µm; L = 5 µm.

Macroventuria anomochaeta Aa, Persoonia 6: 362. 1971.

Specimens examined: **South Africa**, Karoo Desert, from decayed canvas, deposited in CBS Aug. 1971, M.C. Papendorf (**holotype** CBS H-14192, culture ex-holotype CBS 525.71); Cape Province, from a trunk of *Medicago sativa*, Jun. 1972, W.F.O. Marasas, CBS 502.72.

Notes: Strain CBS 502.72, which was also received as "*M. anomochaeta*" appears to be phylogenetically distinct from the ex-holotype (CBS 525.71). Genetically, CBS 502.72 differs from CBS 525.71 in only three bp in the four loci sequenced. As we have not examined the morphology of CBS 502.72, its classification awaits further study. The type of *M. wentii* (CBS 526.71) differs from that of *M. anomochaeta* (CBS 525.71) in 19 bp in the four loci sequenced.

Macroventuria wentii Aa, Persoonia 6: 361. 1971.

Specimen examined: **USA**, Nevada, Death Valley, from plant litter, 1970, F.W. Went (**holotype** CBS H-14195, culture ex-holotype CBS 526.71).

Clade 9: *Ascochyta*

Ascochyta Lib., Pl. crypt. Arduenna, fasc. 1: no. 59. 1830. **emend**. Q. Chen & L. Cai.

Conidiomata pycnidial, subglobose or ampulliform to mammiform, sometimes irregularly shaped, superficial on or immersed into the agar, solitary or confluent, ostiolate or poroid opening formed at the end of the growing process. *Pycnidial wall* pseudoparenchymatous, 1–8-layered, outer wall pigmented. *Conidiogenous cells* annellidic or phialidic, hyaline, smooth, variable in shape, *i.e.* subglobose, cylindrical, flask-shaped, obpyriform, ampulliform to doliiform. *Conidia* variable in shape, *i.e.* ovoid, oblong, subcylindrical, ellipsoidal, cymbiform, allantoid, straight or slightly curved, hyaline or sometimes slightly coloured (yellow to pale brown), smooth- and thin-walled, aseptate or septate, mostly uniseptate, sometimes 2–3-septate, eguttulate or guttulate (Boerema & Bollen 1975, Boerema *et al.* 2004). *Chlamydospores* occasionally occur in old cultures. *Ascomata* pseudothecial, immersed or erumpent,

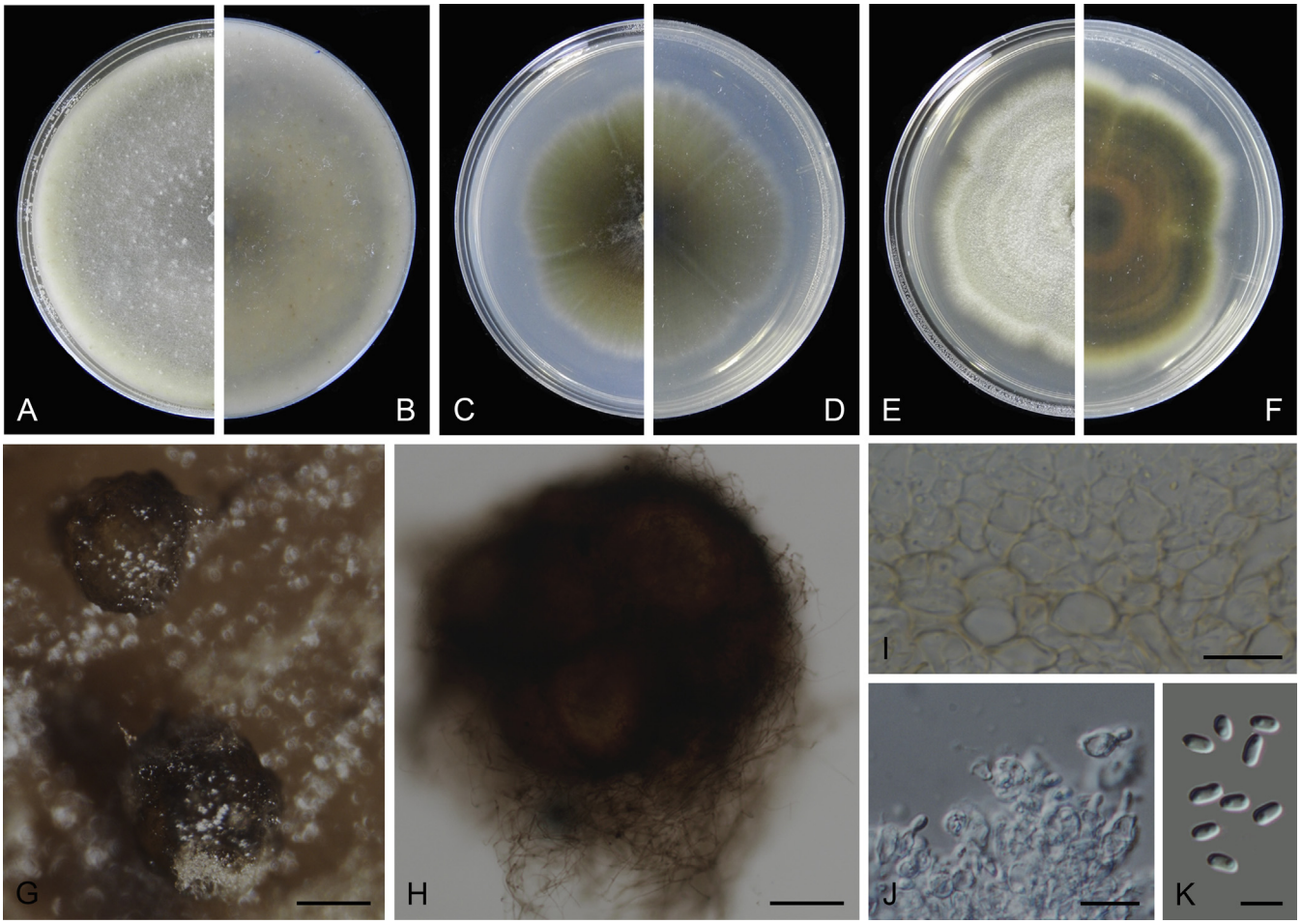

Fig. 20. *Paraboeremia selaginellae* (CBS 122.93). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidium. I. Section of pycnidial wall. J. Conidiogenous cells. K. Conidia. Scale bars: G = 200 µm; H = 100 µm; I–J = 10 µm; K = 5 µm.

subglobose to flattened, or irregular, solitary or confluent, ostiolate, sometimes developing an elongated neck. *Asci* subcylindrical to subclavate, or saccate, sometimes slightly curved, 8-spored, bitunicate, sometimes short-stipitate. *Pseudoparaphyses* filamentous, hyaline, thin-walled, septate, conspicuous in immature fructifications, and disappear at maturity. *Ascospores* ovoid to ellipsoidal, slightly biconic, hyaline to yellowish into the ascus, may become brown when released, smooth, 1-septate, sometimes 3-septate, symmetrical or asymmetrical, constricted at the septum, uniseriate or biseriate (Jellis & Punithalingam 1991, Trapero-Casas & Kaiser 1992, Kaiser *et al.* 1997, Chilvers *et al.* 2009).

Type species: *Ascochyta pisi* Lib., Pl. crypt. Arduenna, fasc. 1: no. 59. 1830.

Notes: In most cases, the host ranges of species belonging to this genus are rather restricted, occurring mostly on the *Campanulaceae*, *Chenopodiaceae*, *Leguminosae*, *Poaceae*, *Solanaceae* and *Umbelliferae*. Some species are associated with one specific host, but may also be found on other related species of the same genus or family (Boerema & Bollen 1975). As the sexual morphs of several *Ascochyta* species were linked to their asexual morphs (Kaiser *et al.* 1997, Chilvers *et al.* 2009, Woudenberg *et al.* 2009), we incorporated these features into the generic circumscription.

Ascochyta fabae Speg. Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 321. 1898–1899.

= *Ascochyta pisi* f. *foliicola* Sacc. & Marchal, Rev. Mycol. (Toulouse) 7: 148. 1885.
= *Didymella fabae* G.J. Jellis & Punith, Pl. Pathol. 40: 151. 1991.

Description from holotype of Didymella fabae (IMI 336944): *Ascomata* arranged in rows on bean straw of *Vicia faba*. *Ascomata* pseudothecial, immersed, becoming partially erumpent, dark brown to blackish brown, subglobose, solitary or confluent, 180–240 × 130–150 µm, with short necks, ostiolate. *Ostiole* nearly circular, 35–50 µm wide, surrounded by dark brown cells. *Ascomatal wall* pseudoparenchymatous, of *textura angularis*, 5–8 layered, outer wall 3–4-layered, dark brown. *Asci* arranged in a relatively flat layer, hyaline, cylindrical to subclavate, 8-spored, 55–70 × 10–14 µm, usually constricted near the base to form a distinct foot. *Pseudoparaphyses* hyaline, thin-walled, septate, 1–2 µm, conspicuous in immature fructifications. *Ascospores* irregularly biseriate, hyaline, smooth, slightly biconic, broadly ellipsoidal, 1-septate, constricted at the septum, with the upper cell broader than the lower cell, 15–18 × 5.5–6.5 µm. Naturally discharged ascospores on bean straw later turn yellowish brown to dark brown and sometimes 2-septate (from Jellis & Punithalingam 1991).

Specimens examined: **Belgium**, Gembloux, from *Phaseolus vulgaris*, Sep. 1977, G. Sommereyns, CBS H-8998, culture CBS 524.77. **The Netherlands**, Randwijk, from a leaf of *Vicia faba*, deposited in CBS Oct. 1971, G.H. Boerema, CBS 649.71; from *Phaseolus vulgaris*, PD 83/492. **UK**, Great Britain, from a dead stem of *Vicia faba*, Jan. 1990, G.J. Jellis (**holotype** of "*Didymella fabae*" IMI 336944).

Notes: The sexual morph of *Ascochyta fabae* was published by Jellis & Punithalingam (1991) as *Didymella fabae*, which was recorded on overwintering bean straw of *Vicia faba* in Cambridge. *Ascochyta viciae* (CBS 451.68) is phylogenetically closely related to *As. fabae*, but they are distinguishable based on morphology. Conidia of *As. viciae* are much longer and narrower than those of *As. fabae* (30–60 × 2.5 µm *vs.* 10–25 × 5–6 µm) (Saccardo 1884, Saccardo 1902).

Ascochyta herbicola (Wehm.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814127.
Basionym: *Phoma herbicola* Wehm., Mycologia 38: 319. 1946.
Description (de Gruyter *et al.* 1998).

Specimens examined: **USA**, Montana, Missoula, head of Seeley Lake, from water, deposited in CBS Mar. 1997, CBS H-16581, culture CBS 629.97 = PD 76/1017; Wyoming, Jackson, Glory Mountain, from stems of *Syntheris dissecta*, Jul. 1040, L.E. Wehmeyer (**holotype** 1032b).

Ascochyta lentis Vassiljevsky, Acta Inst. Bot. Acad. Sci. Pl. Crypt, ser II: 358. 1938.
= *Didymella lentis* W.J. Kaiser, B.C. Wang & J.D. Rogers, Pl. Dis. 81: 815. 1997.

Specimen examined: **Unknown origin**, from seeds of *Lens culinaris*, deposited in CBS Sep. 1984, G.H. Boerema, CBS H-9060, culture CBS 370.84 = PD 81/783.

Ascochyta medicaginicola var. ***medicaginicola*** Q. Chen & L. Cai, **nom. nov.** MycoBank MB814129.
≡ *Phoma medicaginis* var. *medicaginis* Malbr. & Roum., Rev. Mycol. 8: 91. 1886.
Description (de Gruyter *et al.* 2002).

Specimens examined: **Czech Republic**, from *Medicago sativa*, deposited in CBS Jul. 1990, M.E. Noordeloos, CBS 316.90 = CCM F-187. **France**, Rounen, from *Medicago sativa*, Oct. 1885, C. Roumeguère (**isotype** BR 5020155793119).

Notes: *Ascochyta medicaginicola* var. *macrospora* and *As. medicaginicola* var. *medicaginicola* clustered in the same branch without any difference in four sequenced loci. However, these two varieties could be distinguished based on morphology and physiology. *Ascochyta medicaginicola* var. *medicaginicola* usually produces aseptate conidia measuring (4.2–)5.7–7.2(–12.7) × (1.4–)2.1–2.3(–3.5) µm, that differ from variety *A. medicaginicola* var. *macrospora* which produces 1–3-septate, larger conidia [(2.8–)6.3–11.1(–27.8) × (1.4–)2.1–2.9(–5.8) µm] (Boerema *et al.* 1993), especially when incubated at low temperature. Additionally, *As. medicaginicola* var. *macrospora* showed relatively stronger specific pathogenicity to the primary host of both varieties, lucerne (*Medicago sativa*), than *As. medicaginicola* var. *medicaginicola* (Boerema *et al.* 1993). Hence, we maintain these two varieties and propose two new names.

Ascochyta medicaginicola var. ***macrospora*** (Boerema *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814128.
≡ *Phoma medicaginis* var. *macrospora* Boerema *et al.*, Netherlands J. Pl. Pathol. 99 (Suppl. 1): 19. 1993.
Description (de Gruyter *et al.* 2002).

Specimens examined: **Canada**, Saskatchewan, Saskatoon, from seed of *Medicago sativa*, deposited in CBS Jun. 1965, G.H. Boerema, CBS 404.65 = IMI 116999. **USA**, Minnesota, from *Medicago sativa*, Sep. 1953, M.F. Kernkamp (**holotype** CBS H-16487, culture ex-holotype CBS 112.53).

Note: As the epithet "*medicaginis*" was occupied in *Ascochyta*, we introduce the new epithet "*medicaginicola*" for the varieties of *Phoma medicaginis* (see above).

Ascochyta nigripycnidia (Boerema *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814130.
Basionym: *Phoma nigripycnidia* Boerema *et al.*, Persoonia 16: 356. 1997.
Description (Boerema *et al.* 1997).

Specimen examined: **Czech Republic**, from a leaf of *Vicia cracca*, deposited in CBS Jan 1996, M. Ondrej (**holotype** L 992.163.150, culture ex-holotype CBS 116.96 = CCMF 243 = PD 95/7930).

Ascochyta phacae (Corbaz) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814131. Fig. 21.
Basionym: *Didymella phacae* Corbaz, Sydowia 9: 229. 1955.

Description from holotype (ZT Myc 54988): *Pseudothecia* on stems of *Phaca alpina*, solitary, brown to black, uniloculate, subglobose to globose, 110–255 × 110–245 µm, ostiolate single. *Ascomatal wall* pseudoparenchymatous, of *textura angularis*, 3–5-layered, 18–23.5 µm thick. *Asci* cylindrical to subclavate, 40–60 × 11.5–15 µm, 8-spored, biseriate. *Ascospores* broadly fusiform, 11.5–14.5 × 4.5–6.5 µm, smooth, hyaline, uniseptate, slightly constricted at the septum, guttulate, upper cells usually broader than the lower cells.

Specimens examined: **Switzerland**, Valais, Gabi, Feehrbergen, from dead stems of *Phaca alpina*, deposited in CBS May 1955, E. Müller (**holotype** ZT Myc 54988, culture ex-holotype CBS 184.55).

Notes: *Didymella phacae* was linked to an ascochyta-like asexual morph (Corbaz 1955, 1957, Corlett 1981), but this morph was not formally named and described. A new combination is proposed here, as *Ascochyta phacae*.

Ascochyta pisi Lib., Pl. crypt. Arduenna, fasc. 1: no. 59. 1830. Figs 22–23.
≡ *Septoria leguminum* var. *pisorum* (Lib.) Desm., Ann. Sci. Nat. Bot., sér. 2, 19: 344. 1843.
= *Didymella pisi* Chilvers *et al.*, Mycol. Res. 113: 396. 2009.

Description from isotype (BR 5020059493320): *Leaf spots* elliptical to circular, brown to black. Pycnidia on bean pod surface of *Laburnum anagyroides*, solitary or confluent, subglobose, 65–210 × 45–185 µm. *Ostiole* single. *Pycnidial wall* pseudoparenchymatous, 3–4-layered, 14–24 µm thick, composed of isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, doliiform. *Conidia* fusiform to cylindrical, smooth- and thin-walled, hyaline, uniseptate, 11–18.5 × 3–5 µm, with 2–5 guttules.

Description from holotype of Didymella pisi: *Ascomata* pseudothecial, globose to irregular, 200–400 µm diam, with inconspicuous ostiole, brown to blackish, soft. *Asci* bitunicate, cylindrical to saccate, 8-spored, 46–168 × 10–15 µm. *Ascospores* usually uniseriately arranged, hyaline, more or less equally bicellular, constricted at the septum, rounded at both ends or with one end more acute, smooth, 12–17.5 × 6.5–8.5 µm. *Hamathecial* elements sparse or absent. *Pseudothecia* formed on pea stems only when opposite mating types were present (from Chilvers *et al.* 2009).

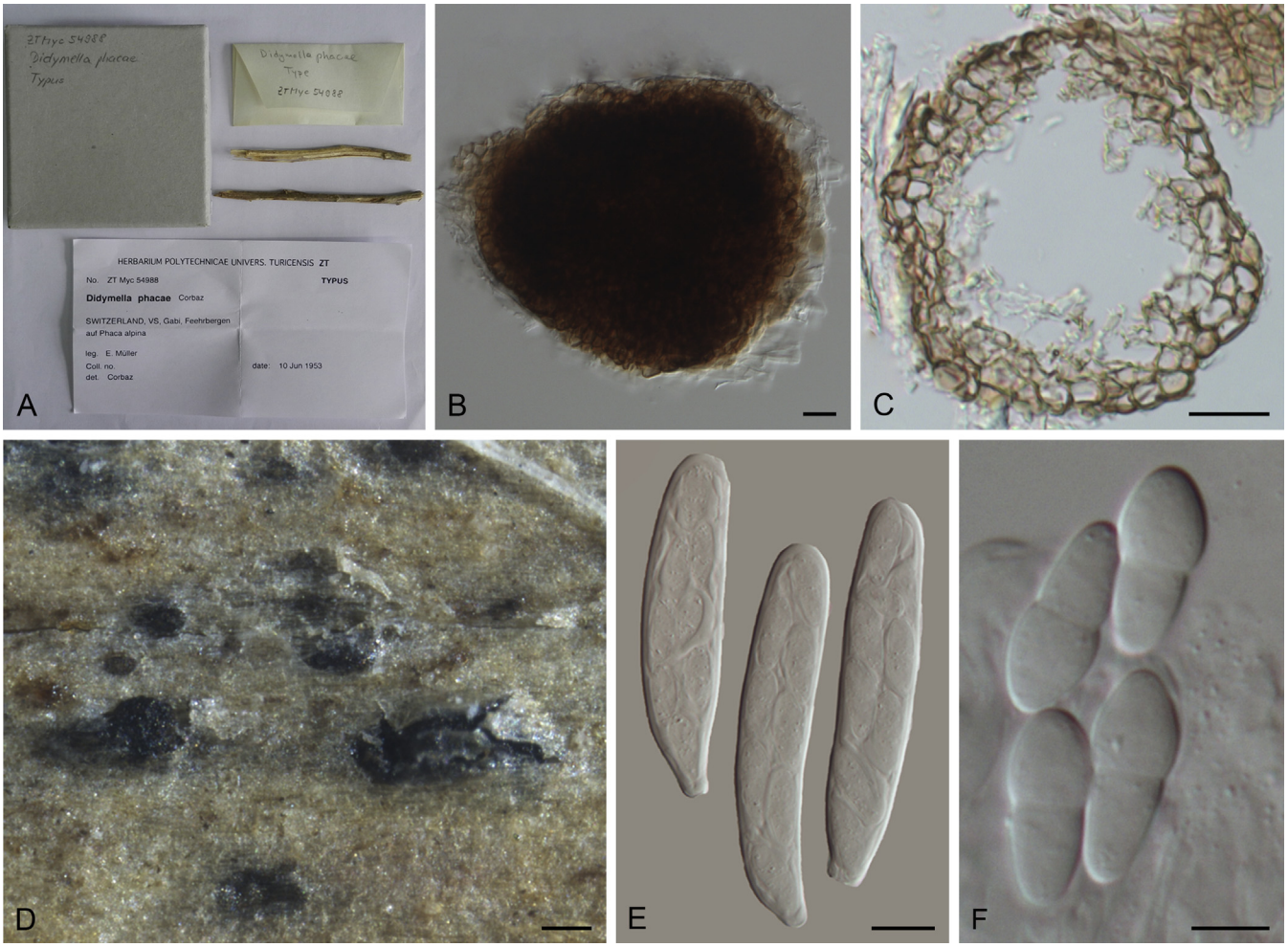

Fig. 21. *Ascochyta phacae* (ZT Myc 54988). A. Type collection packet. B. Pseudothecium. C. Section of pseudothecial wall. D. Pseudothecia on host substrate. E. Asci. F. Ascospores. Scale bars: B–C = 20 µm; D = 200 µm; E = 10 µm; F = 5 µm.

Description from ex-epitype culture (CBS 122785): *Conidiomata* pycnidial, solitary, globose to subglobose, with some hyphal outgrows, produced on the agar surface and immersed, 90–195 × 75–160 µm. *Ostiole* single, slightly papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 3–4 layered, 14.5–29 µm thick, composed of isodiametric cells. *Conidiogenous cells* annellidic, hyaline, smooth, flask-shaped to obpyriform, 5.5–8.5 × 4.5–8 µm. *Conidia* oblong to cylindrical, thin-walled, smooth, mainly uniseptate, incidentally aseptate or 2-septate, 7–16 × 3–5 µm, always somewhat constricted at the septum, with (4–)6–14(–16) guttules. *Conidial matrix* pale pink.

Culture characteristics: Colonies on OA, 45–50 mm diam after 7 d, margin regular, floccose, white, slight grey near the centre; reverse buff to pale salmon, somewhat pale olivaceous near the centre. Colonies on MEA 35–40 mm diam after 7 d, margin regular floccose, white, sparse near the margin; reverse white, pale green near the centre. Colonies on PDA, 25–30 mm diam after 7 d, margin regular, wooly, white; reverse white, buff to amber near the centre. NaOH test negative.

Specimens examined: **Belgium**, from pods of *Pisum sativum* (**isotype** of *Ascochyta pisi* BR 5020059493320). **Canada**, Saskatoon, from *Pisum sativum*, B. Gossen, CBS 122751 = ATCC 201620. **The Netherlands**, Venlo, from *Pisum sativum*, M.M.J. Dorenbosch (**epitype designated here** of *Ascochyta pisi*, HMAS 246705, MBT202502, culture ex-epitype CBS 122785 = PD 78/517); from *Pisum sativum*, deposited in CBS Qct. 1954, J.A. von Arx, CBS 126.54; from *Juglans regia*, deposited in CBS Mar. 1949, PD, CBS 108.49 = DSM 62041. **USA**, Idaho, from *Pisum sativum*, 1995, D. Webster, CBS 122750 = ATCC 201619.

Notes: *Ascochyta pisi* was originally described from *Pisum sativum* in Ardenne, on the borders of France and Belgium (Saccardo 1884). The conidia observed on the isotype (11–18.5 × 3–5 µm) and epitype (7–16 × 3–5 µm) of *As. pisi* are congruent with that of the original description (14–16 × 4–6 µm). Therefore, the specimen HMAS 246705 (ex CBS 122785) is designated as epitype for this species.

Didymella pisi was confirmed to be the sexual morph of *As. pisi* from the cross between two *As. pisi* isolates (CBS 122750 and CBS 122751; Chilvers *et al.* 2009). CBS 122750 has four bp differences in *tub2* sequence from other isolates, but is identical in other loci. The isolate CBS 108.49 was initially identified as *Ascochyta juglandis* when deposited in CBS, but clustered with other *As. pisi* strains in a well-supported clade with sequences of four loci being identical to other strains in the clade. Therefore, we reclassified this strain as *As. pisi*.

Ascochyta rabiei (Pass.) Labr., Rev. Pathol. Vég. Entomol. Agric. France 18: 228. 1931.

Basionym: *Zythia rabiei* Pass., Comment. Soc. Crittog. Ital. 2: 437. 1867.

≡ *Phoma rabiei* (Pass.) Khune ex Gruyter, Persoonia 18: 89. 2002.

= *Mycosphaerella rabiei* Kovatsch. The blight of chick pea: 70. 1936.

≡ *Didymella rabiei* (Kovatsch.) Arx, Beitr. Kryptogamenfl. Schweiz 11: 364. 1962.

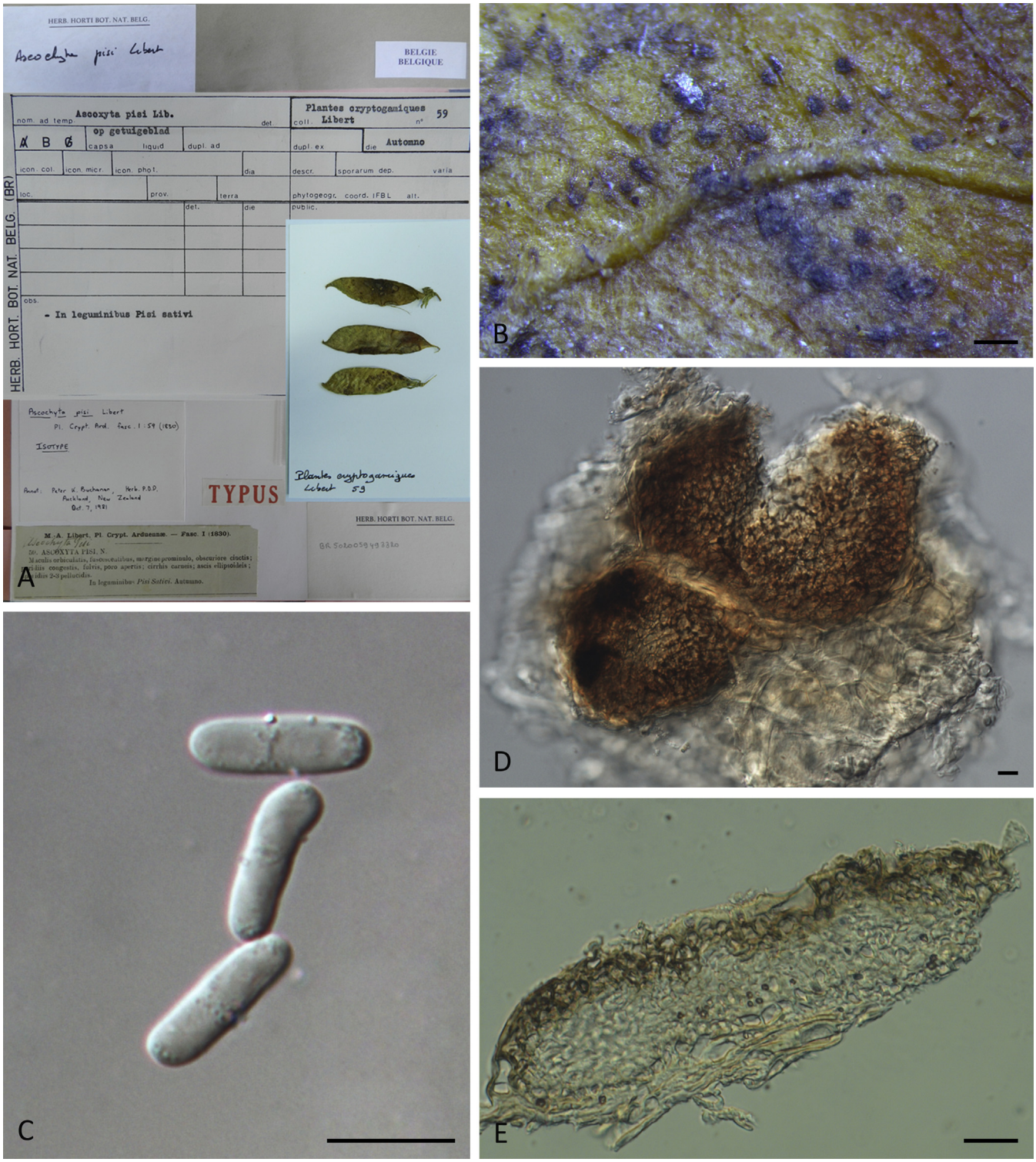

Fig. 22. *Ascochyta pisi* (BR 5020059493320). A. Type collection packet. B. Pycnidia on host substrate. C. Conidia. D. Pycnidia. E. Section of pycnidium. Scale bars: B = 100 µm; C–D = 10 µm; E = 20 µm.

Specimens examined: **Bulgaria**, from *Cicer arietinum*, deposited in CBS Feb. 1937, I.C. Kovachevsky, **ex-holotype** CBS 237.37. **India**, from the seeds of *Cicer arietinum*, deposited in CBS Jun. 1965, S. Sinha, CBS 534.65. **Unknown origin**, from an unknown substrate, deposited in CBS Feb. 1930, F. Labrousse, CBS 206.30.

Ascochyta sp. 1

Specimens examined: **Australia**, from a leaf of *Pisum sativum*, deposited in CBS Sep. 1984, G.H. Boerema, CBS 372.84 = PD 80/1246; from a leaf of *Pisum sativum*, deposited in CBS Sep. 1984, G.H. Boerema, CBS H-9078, culture CBS 373.84 = PD 80/1247.

Notes: These two strains were deposited as "*Ascochyta fabae*", but phylogenetically they are distinct from the authentic cultures of *As. fabae* (CBS 524.77, CBS 649.71 and PD 83/492). This species is probably a novel species, and will be described after further study.

Ascochyta sp. 2

Specimens examined: **Sweden**, Uppland, from *Lathyrus vernus*, May 1987, K. & L. Holm, CBS 113797 = UPSC 2222.

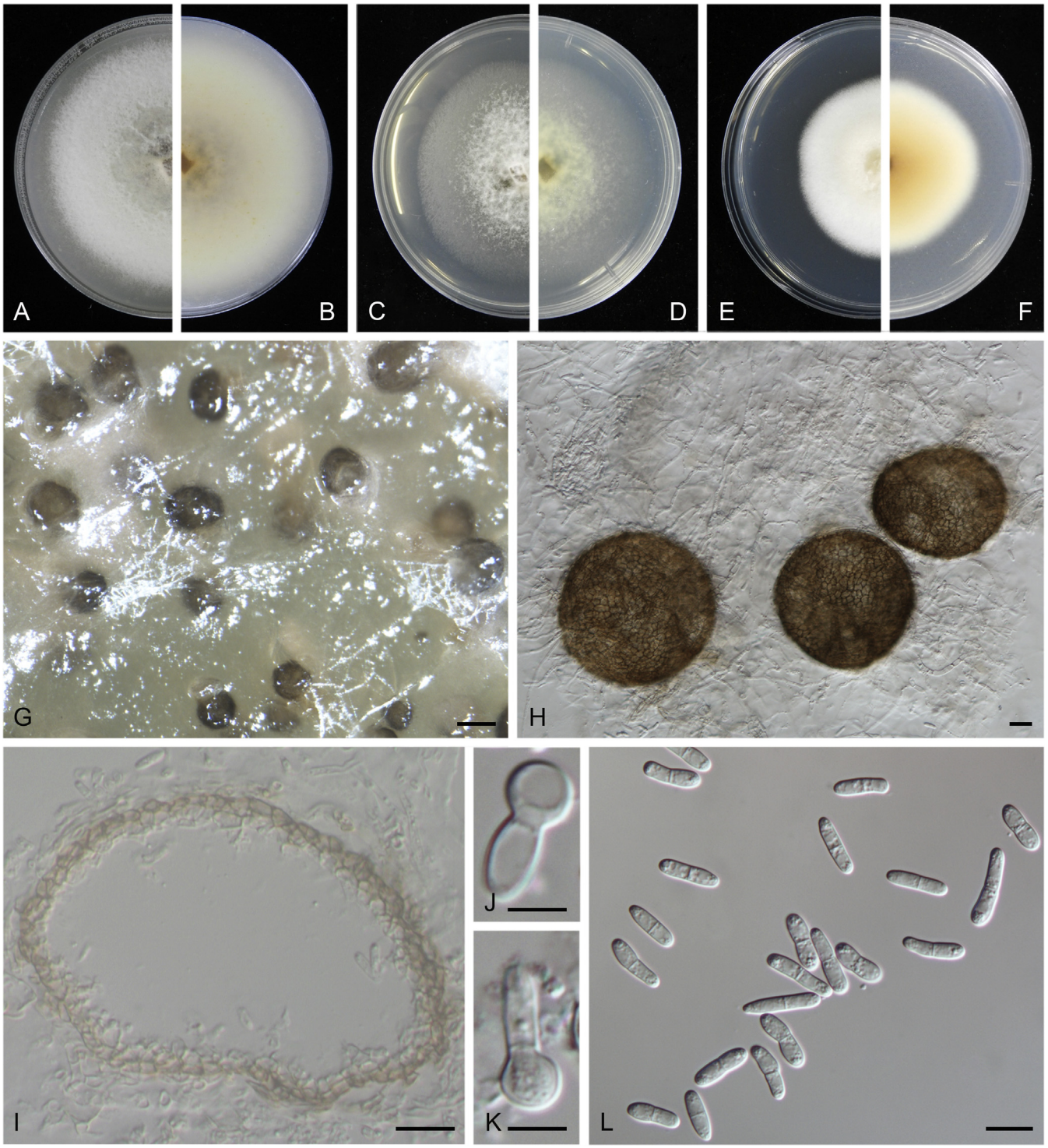

Fig. 23. *Ascochyta pisi* (CBS 122785). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidia. I. Section of pycnidium. J–K. Conidiogenous cells. L. Conidia. Scale bars: G = 200 µm; H–I = 20 µm; J–K = 5 µm; L = 10 µm.

Notes: Isolate CBS 113797 was received as "*Didymella astragalina*". However, it was distant from other *Didymella* species in the multi-locus phylogenetic tree, and clustered in the *Ascochyta* clade. The original host of *D. astragalina* is *Astragalus cicer*. Since the type of *D. astragalina* was unavailable for examination, it still needs to be confirmed if CBS 113797 represents a new species or is conspecific to *D. astragalina*.

Ascochyta syringae Bres., Hedwigia 33: 207. 1894.

Specimen examined: **The Netherlands**, from seed capsule of *Syringa vulgaris*, P.D. Wageningen, deposited in CBS Jul. 1972, G.H. Boerema, CBS 545.72.

Ascochyta versabilis (Boerema *et al.*) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814132.

Basionym: *Phoma versabilis* Boerema *et al.*, Persoonia 16: 154. 1996.

Description (Boerema & de Gruyter 1998).

Specimens examined: **Germany**, Westfalen, Oberdresselendorf, from stems of *Cardamine impatiens*, Oct. 1925, A. Ludwig (**holotype** L 995.229.369). **The Netherlands**, Wageningen, from a stem of *Silene* sp., deposited in CBS Jun. 1997, CBS 876.97 = PD 82/1008.

Notes: An authentic isolate of *Phoma versabilis* (CBS 876.97), which morphologically agrees well with the original description of this species (Boerema *et al.* 2004), grouped in the *Ascochyta* clade. Thus, *Ascochyta versabilis* was introduced as a new combination.

Ascochyta viciae Lib., Pl. crypt. Arduenna, fasc. 4: no. 356. 1837.

≡ *Septoria viciae* (Lib.) Westend., Herb. crypt. Belg.: no. 1151. 1857.
≡ *Phyllosticta viciae* (Lib.) Cooke, Handb., Brit. Fungi 1: 452. 1871.

Specimen examined: **The Netherlands**, Baarn, Praamgracht, from a leaf of *Vicia sepium*, Jun. 1968, H.A. van der Aa, CBS H-9121, culture CBS 451.68.

Ascochyta viciae-pannonicae Odřej, Biológia (Bratislava) 25: 685. 1970.

Specimen examined: **Czech Republic**, from a leaf of *Vicia pannonica*, deposited in CBS May 1992, CBS 254.92 = CCM F-241.

Clade 10: *Phomatodes*

Phomatodes Q. Chen & L. Cai, **gen. nov.** MycoBank MB814062.

Etymology: Name after its phoma-like conidia.

Conidiomata pycnidial, globose to subglobose, on agar surface or immersed, solitary or confluent, ostiolate. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, outer wall pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform. *Conidia* cylindrical to allantoid, hyaline, thin-walled, smooth, aseptate, guttulate.

Type species: *Phomatodes aubrietiae* (Moesz) Q. Chen & L. Cai.

Phomatodes aubrietiae (Moesz) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814133. Fig. 24.
Basionym: *Sclerophomella aubrietiae* Moesz, Choroby Szkodn. Rosl. 3: 144. 1926.
= *Phoma aubrietiae* (Moesz) Boerema, Gewasbescherming 1: 66. 1970.

Description from ex-epitype culture (CBS 627.97): *Conidiomata* pycnidial, solitary, globose to subglobose, glabrous, semi-immersed or immersed, 110–255(–290) × 90–215(–245) µm. *Ostiole* single, slightly papillate. *Pycnidial wall* pseudoparenchymatous, 4–6 layered, 18–24.5 µm thick, composed of isodiametric cells, *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to dolliform, 4.5–6.5 × 3.5–5 µm. *Conidia* ellipsoidal to cylindrical, smooth- and thin-walled, aseptate, 6–8.5 × 2.5–3 µm, with 2(–4) large polar guttules. *Conidial matrix* white.

Culture characteristics: Colonies on OA, 25–30 mm diam after 7 d, margin regular, with concentric rings, woolly, grey to pale olivaceous; reverse olivaceous. Colonies on MEA 15–20 mm diam after 7 d, margin regular, fluffy, greenish olivaceous to olivaceous; reverse concolourous. Colonies on PDA, 35–40 mm diam after 7 d, margin regular, floccose, smoke-grey; reverse dark olivaceous. NaOH test negative.

Specimens examined: **Albania**, from dead stalks of *Aubrietia gracilis* (**holotype** BP 12773). **The Netherlands**, Bodegraven, from seed of *Aubrietia hybrida* cv. Superbissima, deposited in CBS Aug. 1967, G.H. Boerema, CBS H-16154, culture CBS 383.67 = PD 65/223; from a stem of *Aubrietia* sp., Mar. 1997, J. de Gruyter (**epitype designated here** CBS H-16155, MBT202503, culture ex-epitype CBS 627.97 = PD 70/714).

Notes: The holotype of *Sclerophomella aubrietiae* was collected from *Aubrietia gracilis* in Albania, with conidia measuring 5–10 × 2–3 µm (Boerema & Valckx 1970). The conidial dimensions of our selected epitype (CBS H-16155, ex-epitype culture CBS 627.97) agree well with that of the original description.

Phomatodes nebulosa (Pers.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814134. Fig. 25.
Basionym: *Sphaeria nebulosa* Pers., Observ. Disp. Mycol. 2: 69. 1800.
≡ *Phoma nebulosa* (Pers.) Berk., Outl. Brit. Fung. (London): 314. 1860.

Description from culture (CBS 100191): *Conidiomata* pycnidial, solitary or aggregated, globose to subglobose, glabrous, produced on the agar surface or immersed, 125–185 × 105–135 µm. *Ostiole* single, conspicuously papillate. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, 20–37 µm thick, brown, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 7–9 × 4.5–8(–9.5) µm. *Conidia* cylindrical, smooth- and thin-walled, aseptate, 5–7 × 1.5–2.5 µm, with (1–)2–6(–8) large polar guttules. Conidial exudates not recorded.

Culture characteristics: Colonies on OA, 45–50 mm diam after 7 d, margin regular, floccose, greenish olivaceous, abundant pycnidia visible near the centre of colony; reverse dark olivaceous, pale greenish olivaceous near the margin. Colonies on MEA 40–45 mm diam after 7 d, margin regular, white with a greenish olivaceous concentric ring; reverse concolourous. Colonies on PDA, 40–45 mm diam after 7 d, margin regular, floccose, white, abundant pycnidia near the centre; reverse white in outer ring, darkening towards the centre of the colony via buff, hazel to black. NaOH test negative.

Specimens examined: **Poland**, near Gryfice, from *Thlaspi arvense*, deposited in CBS Dec. 1997, collected by J. Marcinkowska, CBS 100191. **The Netherlands**, from a stem of *Mercurialis perennis*, deposited in CBS Jan 1993, J, de Gruyter, CBS 117.93 = PD 83/90; from a leaf of *Armoracia rusticana*, deposited in CBS Jul. 1996, collected by H.A. van der Aa, CBS 740.96.

Notes: Isolates CBS 100190 and CBS 100191 were identified as "*Didymella macropodii*" in Boerema *et al.* (2004), and two other isolates obtained in this study (CBS 740.96, PD 84/512) were also received as "*D. macropodii*". In the phylogenetic analyses, CBS 100191 and CBS 740.96 clustered with the reference culture of *Phomatodes nebulosa* (CBS 117.93), but are distant from reference culture of *D. macropodii* (CBS 100190, data not shown). In addition, the morphological features of this isolate (CBS 100191) are essentially similar to that of *Phomat. nebulosa* (de Gruyter *et al.* 1993, Boerema *et al.* 2004), and different from *D. macropodii* (Boerema & de Gruyter 1998, Boerema *et al.* 2004), thus we concluded that cultures CBS 100191 and CBS 740.96 were more appropriately classified as *Phomat. nebulosa*.

Clade 11: *Calophoma*

Calophoma Q. Chen & L. Cai, **gen. nov.** MycoBank MB814063.

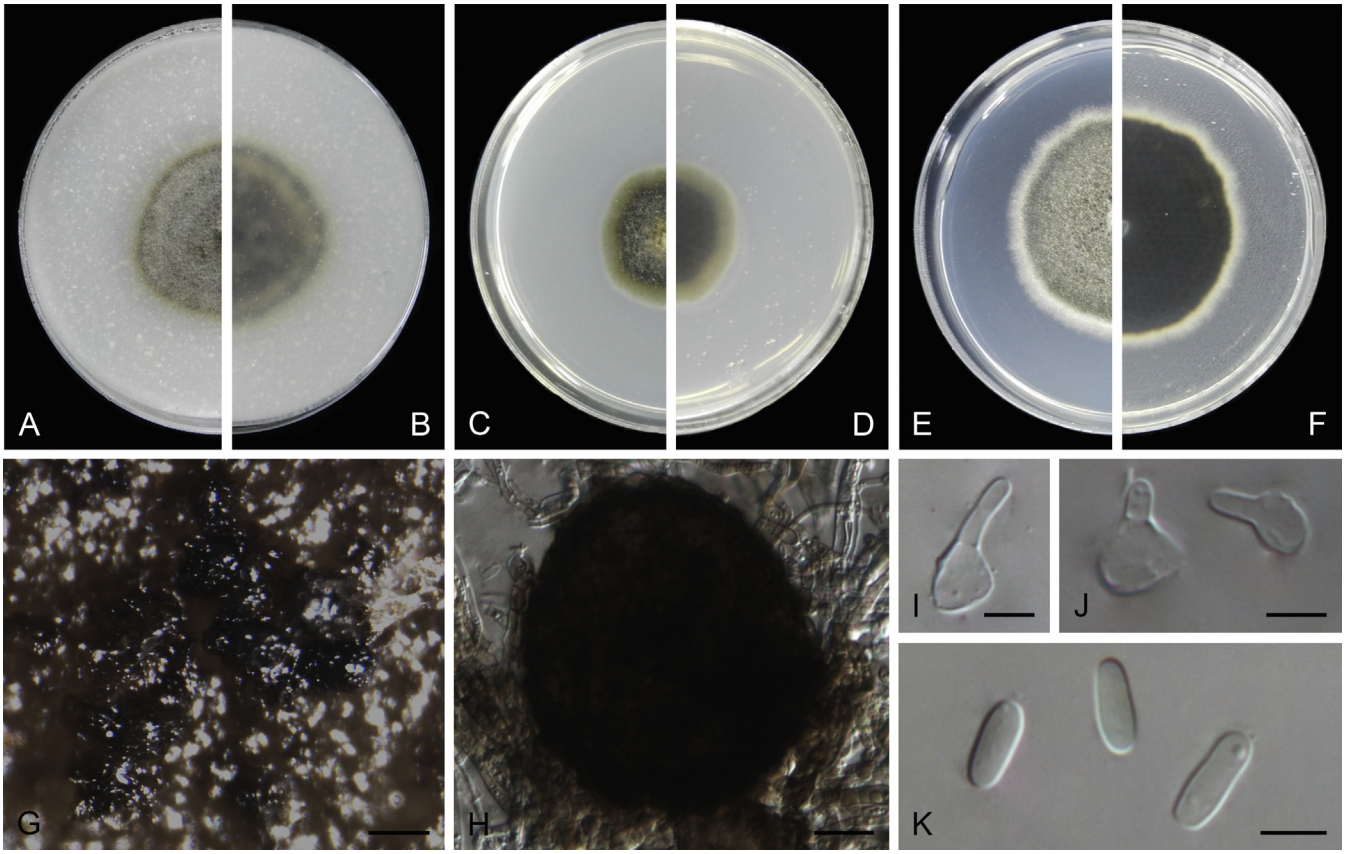

Fig. 24. *Phomatodes aubrietiae* (CBS 627.97). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidium. I–J. Conidiogenous cells. K. Conidia. Scale bars: G = 100 µm; H = 20 µm; I–K = 5 µm.

Etymology: Calo = κάλλος in Greek, beauty kalos (Greek), beautiful, good; *phoma* = phoma-like morphology.

Conidiomata pycnidial, subglobose to irregular, on agar surface or immersed, solitary or confluent, ostiolate, or with an elongate neck in older cultures. *Micropycnidia* present. *Pycnidial wall* pseudoparenchymatous, 2–6-layered, outer wall pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, globose to flask-shaped, ampulliform to doliiform. *Conidia* variable in size and shape, *i.e.* subglobose, subcylindrical, ellipsoidal, somewhat obclavate-fusiform, hyaline or becoming slightly brown, smooth- and thin-walled, aseptate, occasionally large 1-septate conidia occur that are eguttulate or guttulate. *Chlamydospores* only occur in one species, uni- or multicellular, unicellular intercalary, guttulate, thick-walled, multicellular irregular dictyo/phragmosporous, somewhat botryoid and in combination with unicellular chlamydospores.

Type species: *Calophoma clematidina* (Thüm.) Q. Chen & L. Cai.

Calophoma aquilegiicola (M. Petrov) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814135.
Basionym: *Phoma aquilegiicola* M. Petrov, Trudy Bot. Inst. Akad. Nauk S.S.S.R, Ser. 1, Fl. Sist. Vyssh. Rast : 281. 1933.
Description (Boerema *et al.* 1997).

Specimens examined: **New Zealand**, Auckland, from fading leaves of *Thalictrum dipterocarpum*, Jul. 2004, C.F. Hill, CBS 116402. **The Netherlands**, from a stem of *Aconitum pyramidale*, deposited in CBS Jan 1996, CBS 107.96 = PD 73/598; from a stem of *Aquilegia* sp., deposited in CBS Jan 1996, CBS 108.96 = PD 79/611; from a stem of *Aquilegia* sp., deposited in CBS Jan 1996, CBS 109.96 = PD 83/832. **Unknown origin**, from *Aquilegia* sp., deposited in CBS Jul. 1931, R. Laubert, CBS 107.31.

Notes: The holotype of *Phoma aquilegiicola* was from dry stalks of *Aquilegia vulgaris* collected in Russia. Isolate CBS 107.31 was originally identified as *Ascochyta aquilegiae*, but in the phylogenetic analysis it appears indistinguishable from four representative cultures of *Calophoma aquilegiicola*. This species is morphologically and phylogenetically closely related to *Ca. glaucii*. Clarification of their relationship awaits future studies.

Calophoma clematidina (Thüm.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814136. Fig. 26.
Basionym: *Ascochyta clematidina* Thüm., Bull. Soc. Imp. Naturalistes Moscou 55: 98. 1880.
≡ *Phoma clematidina* (Thüm.) Boerema, Verslagen Meded. Plantenziektenk. Dienst Wageningen (Jaarboek 1978) 153: 17. 1979.

Description from ex-epitype culture (CBS 108.79): *Conidiomata* pycnidial, solitary, globose to subglobose, mostly with some hyphal outgrows, produced on the agar surface or immersed, (120–)135–165 × 85–130 µm. *Ostioles* 1(–3), conspicuously papillate. *Pycnidial wall* pseudoparenchymatous, 2–4-layered, 13–21 µm thick, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 5.5–7.5 × 4–7 µm. *Conidia* ellipsoidal to cylindrical, smooth- and thin-walled, aseptate or occasionally 1-septate, 4.5–7 × 2–3 µm, with (0–)2–4(–8) polar guttules. *Conidial matrix* pale pink. *Chlamydospores* usually scanty, uni- or multicellular, unicellular intercalary, guttulate, thick-walled, green-brown, 8–10 µm diam, multicellular irregular dictyo/phragmosporous, somewhat botryoid and in combination with unicellular chlamydospores, tan to dark brown, 3–50 × 12–25 µm (Woudenberg *et al.* 2009).

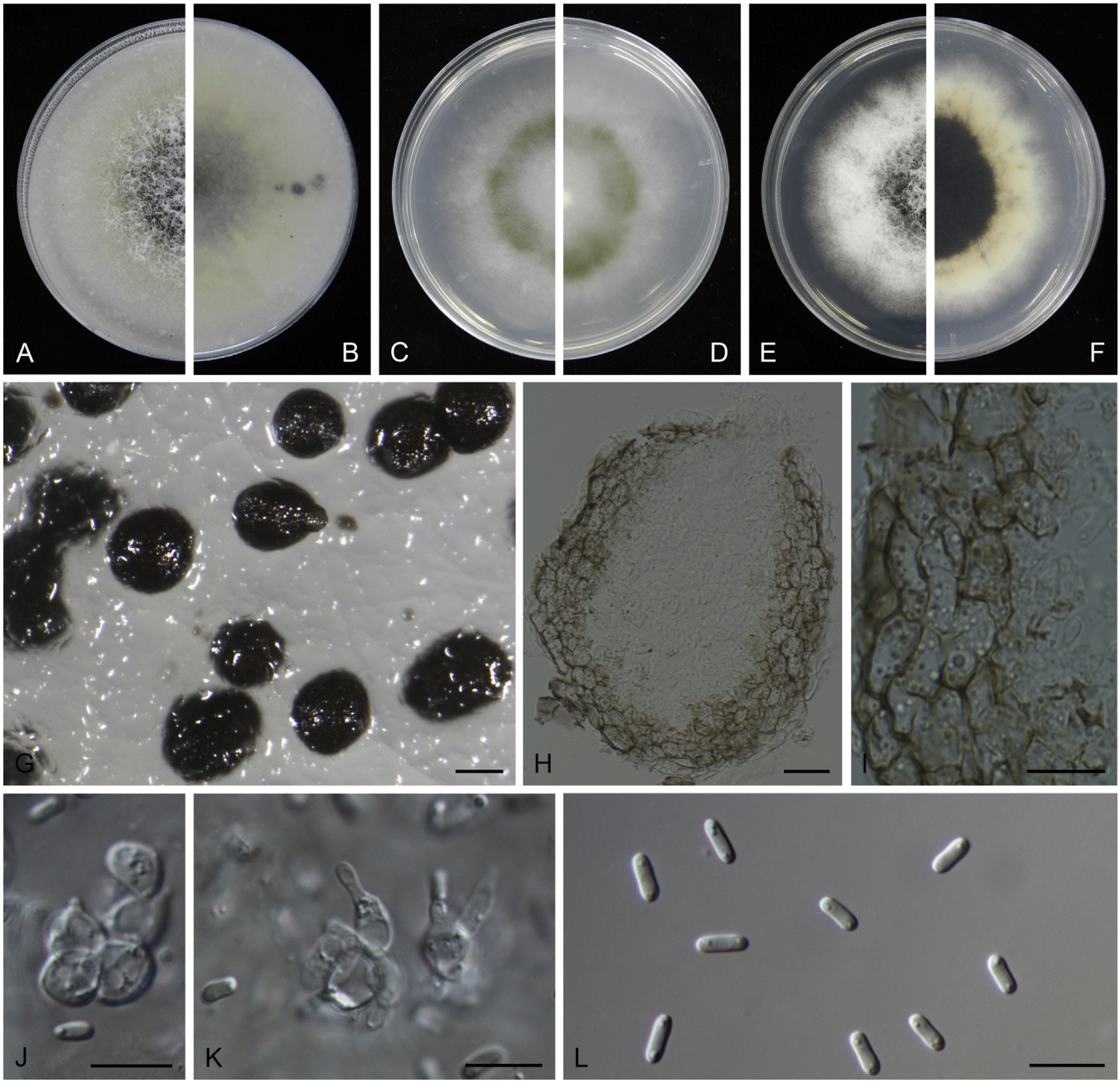

Fig. 25. *Phomatodes nebulosa* (CBS 100191). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidial section. I. Section of pycnidial wall. J–K. Conidiogenous cells. L. Conidia. Scale bars: G = 200 µm; H = 20 µm; I–L = 10 µm.

Culture characteristics: Colonies on OA, 25–30 mm diam after 7 d, margin regular, felty, white, pale brown grey towards the centre; reverse buff with a hazel centric ring in the middle. Colonies on MEA 30–35 mm diam after 7 d, margin regular, wooly, white, olivaceous near the centre; reverse concolourous. Colonies on PDA, 20–25 mm diam after 7 d, margin regular, felty; white reverse buff in outer ring, darkening towards the centre of the colony via hazel to brown olivaceous. NaOH test negative.

Specimens examined: **The Netherlands**, Spaubeek, from the stem of *Clematis* sp., deposited in CBS Jan 1979, G.H. Boerema (**epitype** CBS H-16193, culture ex-epitype CBS 108.79 = PD 78/522). **UK**, England, from *Clematis* sp., deposited in CBS Jan. 1966, F.T. Last, CBS 102.66.

Notes: Woudenberg *et al.* (2009) designated an epitype (CBS H-16193 with culture CBS 108.79) for *Phoma clematidina*. *Clematis* spp. are susceptible to different *Phoma s. lat.* species. *Calophoma clematidina* (syn. *Phoma clematidina*) has shown host specificity to *Clematis* hybrids, while *Didymella vitalbina* was isolated exclusively from *Cl. vitalba*, and such isolates were initially misidentified as *Phoma clematidina* (Woudenberg *et al.* 2009).

Calophoma clematidis-rectae (Petr.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814137. Fig. 27.

Basionym: *Coniothyrium clematidis-rectae* Petr., Feddes Repert Spec. Nov. Regni Veg. Beih. 42: 356. 1927.

≡ *Phoma clematidis-rectae* (Petr.) Aveskamp *et al.*, Stud. Mycol. 65: 25. 2010.

Description (Aveskamp *et al.* 2010).

Specimen examined: **The Netherlands**, Boskoop, from *Clematis* sp., deposited in CBS Nov.1963, collected by G.H. Boerema, CBS H-20275, culture CBS 507.63 = PD 07/03486747 = MUCL 9574.

Note: Aveskamp *et al.* (2010) recombined *Coniothyrium clematidis-rectae* into *Phoma*, and we propose a new combination for this species here, *Calophoma clematidis-rectae*.

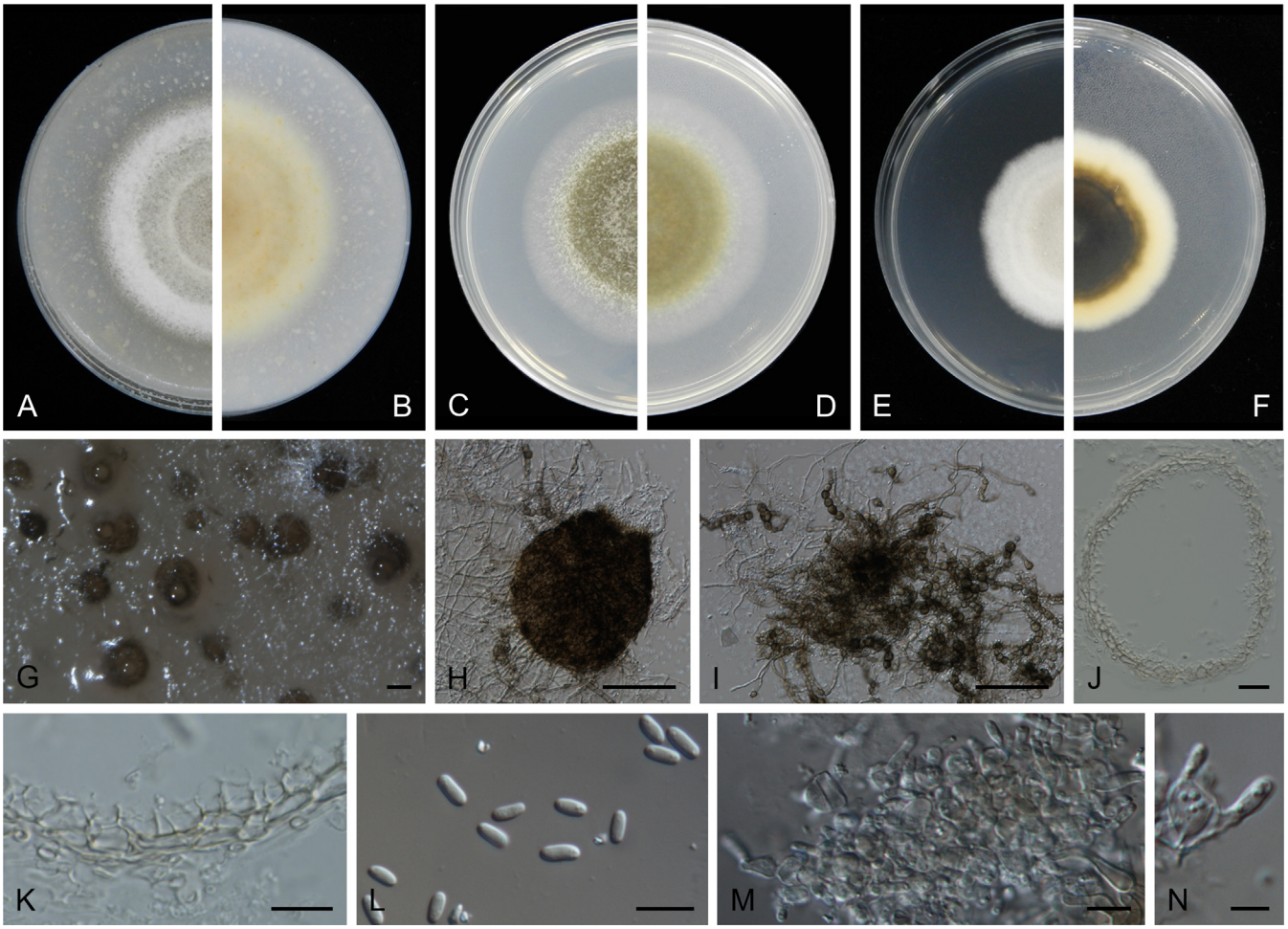

Fig. 26. *Calophoma clematidina* (CBS 108.79). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia sporulating on OA. H. Pycnidium. I. Swollen cells. J. Vertical section of pycnidium. K. Section of pycnidial wall. L. Conidia. M–N. Conidiogenous cells. Scale bars: G = 200 µm; H–I = 100 µm; J = 20 µm; K–M = 10 µm; N = 5 µm.

Calophoma complanata (Tode) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814138.
Basionym: *Sphaeria complanata* Tode, Fung. Mecklenb. Sel. (Lüneburg) 2: 21. 1791.
≡ *Phoma complanata* (Tode) Desm., Ann. Sci. Nat. Bot. 16: 299. 1851.
Description (Boerema & de Gruyter 1998).

Specimens examined: **The Netherlands**, Tilburg, from a stem of *Heracleum sphondylium*, Nov. 1997, H.A. van der Aa, CBS H-16194, culture CBS 100311; from a stem of *Angelica sylvestris*, deposited in CBS Jun. 1992 J. de Gruyter, CBS 268.92 = PD 75/3.

Calophoma glaucii (Brunaud) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814139.
Basionym: *Phoma glaucii* Brunaud, "*glauci*", Ann. Soc. Sci. Nat. La Rochelle 1892: 97. 1892.
Description (Boerema *et al.* 1997).

Specimens examined: **The Netherlands**, near Lisse, from *Dicentra* sp., deposited in CBS Jan 1996, CBS 112.96 = PD 79/765; Wageningen, from a leaf of *Chelidonium majus*, deposited in CBS Jan 1996, CBS 114.96 = PD 94/888.

Calophoma sp. 1

Specimen examined: **Switzerland**, Gabi am Simplon, from *Vincetoxicum officinale*, deposited in CBS May 1955, E. Müller, CBS 186.55.

Notes: This isolate resided in a single lineage, which is phylogenetically distinct from other species, and was originally identified as "*Didymella vincetoxici*". Since the type of *D. vincetoxici* was unavailable for study, we are unsure if CBS 186.55 represents a new species or is conspecific to *D. vincetoxici*.

Calophoma vodakii (E. Müll.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814140.
Basionym: *Didymella vodakii* E. Müll., Sydowia 7: 332. 1953.

Specimen examined: **Switzerland**, Kt. Wallis, Brig, from *Hepatica triloba*, deposited in CBS Jun. 1953, E. Müller (**holotype** ZT Myc 54939, culture ex-holotype CBS 173.53).

Notes: The specimen information of CBS 173.53, such as host, locality, collection date and collector are the same as those given in the original description of *Didymella vodakii* when it was published as a novel species (Müller 1953). It is therefore concluded that isolate CBS 173.53 represents the ex-holotype culture of *D. vodakii*.

Clade 12: *Phoma*

Phoma Sacc., Michelia 2: 4. 1880. **emend.** Q. Chen & L. Cai.
= *Atradidymella* M.L. Davey & Currah, Amer. J. Bot. 96: 1283. 2009.

Conidiomata pycnidial, sub-globose to elongated, superficial on or immersed into the agar, solitary or confluent, ostiolate. *Pycnidial wall* pseudoparenchymatous, 3–7-layered, outer wall pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform. *Conidia* oblong to cylindrical, ellipsoidal, sometimes

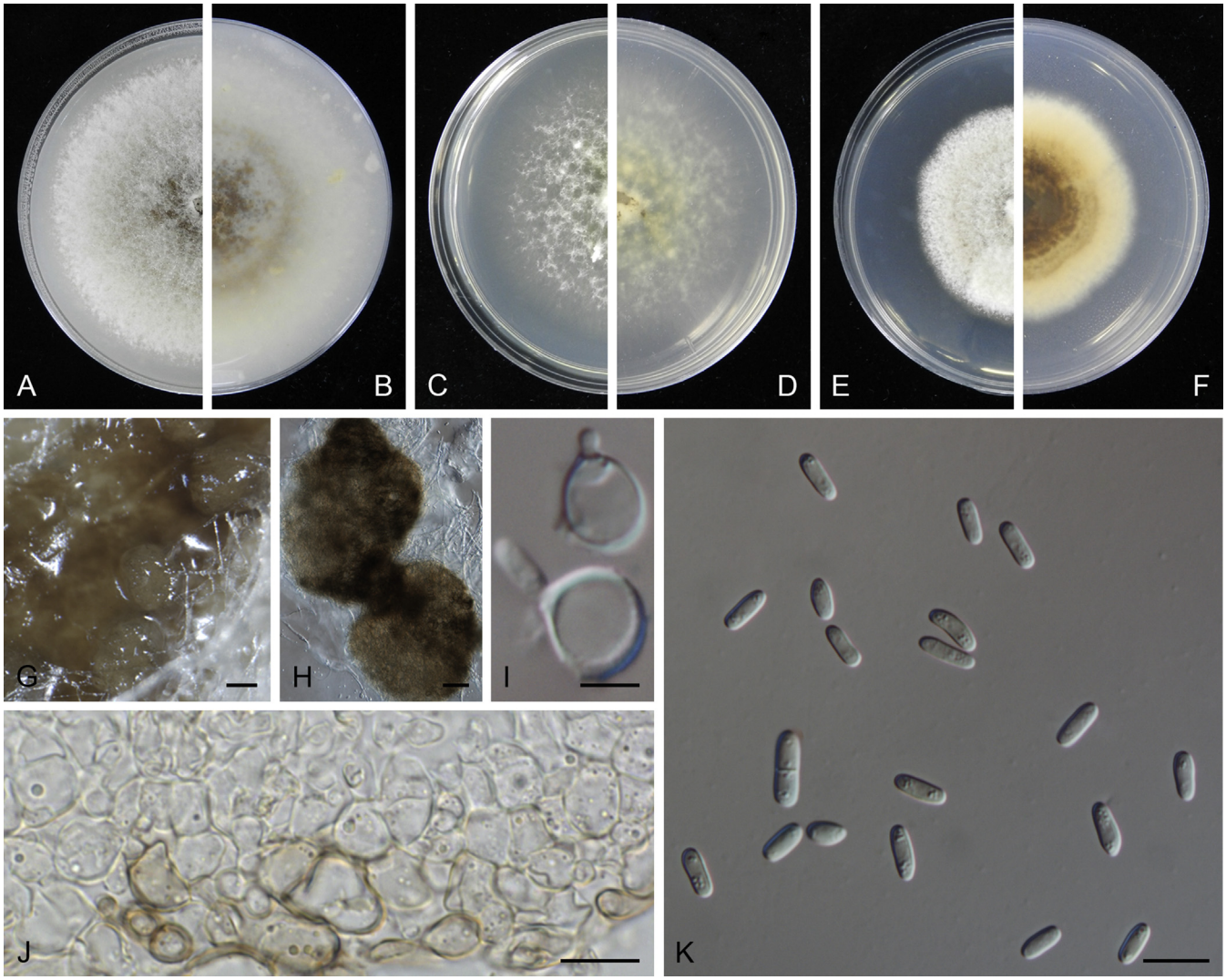

Fig. 27. *Calophoma clematidis-rectae* (CBS 507.63). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia sporulating on OA. H. Pycnidia. I. Conidiogenous cells. J. Section of pycnidial wall. K. Conidia. Scale bars: G = 200 µm; H = 40 µm; I = 5 µm; J–K = 10 µm.

fusiform, hyaline, smooth- and thin-walled, aseptate, guttulate. *Ascomata* pseudothecial, erumpent, subglobose to pyriform, solitary, setose around ostiole, with a short neck. *Hamathecium* pseudoparenchymatous in young ascomata, persisting as septate filamentous remnants in mature ascomata. *Asci* cylindrical to clavate, 8-spored, bitunicate. *Ascospores* fusiform, brown, 1-septate, smooth, slightly constricted at the septum, biseriate or triseriate (Davey & Currah, 2009).

Type species: *Phoma herbarum* Westend., Bull. Acad. Roy. Sci. Belgique, Cl. Sci. 19: 118. 1852.

Notes: As the sexual morph (*Atradidymella*) of *Phoma herbarum*, type species of the genus *Phoma*, was linked here, the generic features were emended and supplemented with the characters of sexual morph.

Phoma herbarum Westend., Bull. Acad. Roy. Sci. Belgique, Cl. Sci. 19: 118. 1852. **emend.** Q. Chen & L. Cai. Figs 29–30.

= *Atradidymella muscivora* M.L. Davey & Currah, Amer. J. Bot. 96: 1283. 2009.
= *Phoma muscivora* M.L. Davey & Currah, Amer. J. Bot. 96: 1283. 2009.
= *Phoma cruris-hominis* Punith., Nova Hedwigia 31: 135. 1979.

Description from isotype (BR 5020153305384): *Leaf spots* elliptical to circular, black. *Conidiomata* pycnidial, solitary, subglobose, 130–220 × 55–170 µm. *Ostiole* single. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, 10–30 µm thick, composed of isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, doliiform. *Conidia* oblong to ellipsoidal, smooth- and thin-walled, hyaline, sometimes 1-septate, 5–7.5 × 2.5–3.5 µm.

Description of sexual morph: *Ascomata* pseudothecial, solitary, erumpent from underlying host cell, dark brown, uniloculate, subglobose to ellipsoidal or pyriform, (75–115 × 58–95 µm) with short concolourous, occasionally septate setae around ostiole. *Peridium* wall pseudoparenchymatous, 3-layered, 10 µm thick. *Hamathecium* pseudoparenchymatous in young ascomata, persisting as septate filamentous remnants (1–3 µm) in mature ascomata. *Asci* cylindrical to clavate, 8-spored, bitunicate, 6–13 µm, grouped in a small fascicle of 10–20 at base of pseudothecium. *Ascospores* broadly fusiform, golden brown to dark brown, smooth, straight to allantoid, 1-septate, 14–20 × 4–5.5 µm, slightly constricted at septum, the upper cell sometimes shorter and broader than the lower, biseriate or triseriate (from Davey & Currah 2009).

Description from culture (CBS 615.75): *Conidiomata* pycnidial, solitary, globose to subglobose, glabrous, semi-immersed or immersed, 130–265 × 120–240 µm. *Ostioles* 1–2, slightly papillate. *Pycnidial wall* pseudoparenchymatous, 3–5-layered,

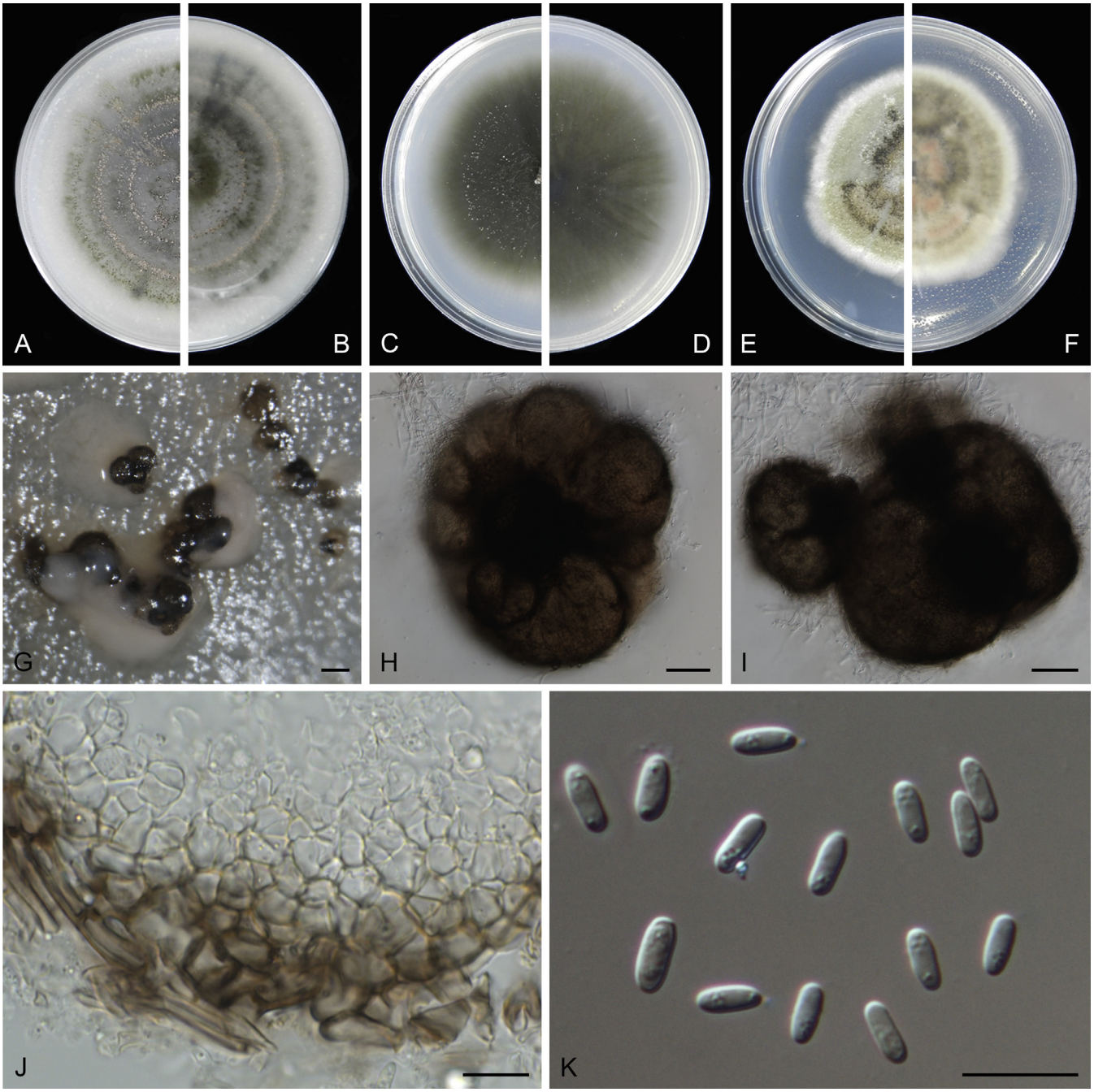

Fig. 28. *Phoma neerlandica* (CBS 134.96). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H–I. Pycnidia. J. Section of pycnidial wall. K. Conidia. Scale bars: G = 200 µm; H–I = 50 µm; J–K = 10 µm.

14–22 µm thick, composed of isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, dolliform, 5–6.5 × 4–5.5 µm. *Conidia* ellipsoidal to ovoid, smooth- and thin-walled, aseptate, 4.5–6 × 2–3 µm, with 1–2 guttules. *Conidial matrix* white.

Culture characteristics: Colonies on OA, 30–35 mm diam after 7 d, margin regular, abundant pycnidia in concentric rings, giving a salmon colour to the colonies, pale brown near the centre; reverse pale greenish olivaceous in outer ring, towards the centre of the colony via buff to olivaceous. Colonies on MEA 35–40 mm diam after 7 d, margin irregular, flattened, white to greenish olivaceous; reverse greenish olivaceous, white near the margin. Colonies on PDA, 35–40 mm diam after 7 d, margin regular, felty, white near the margin, darkening towards the centre, via hazel to grey-brown; reverse hazel to brown. NaOH test negative.

Specimens examined: **Belgium**, Vlaams-Brabant, Tervuren, from a stem of *Solanum lycopersicum* (**isotype** of *Phoma herbarum* BR 5020153305384). **Switzerland**, Kt. Graubünden, from *Achillea millefolium*, deposited in CBS Mar. 1951, E. Müller, CBS 304.51. **The Netherlands**, Emmeloord, from the stem of *Rosa multiflora* cv. Cathayensis, deposited in CBS Dec. 1975, G.H. Boerema, CBS 615.75 = PD 73/665 = IMI 199779; Naaldwijk, from a stem base of *Nerium* sp., deposited in CBS Sep. 1991, J. de Gruyter, CBS 502.91 = PD 82/276. **UK**, from a leg of woman, Apr. 1977, Y.M. Clayton, **holotype** of "*Phoma cruris-hominis*" IMI 213845, culture ex-holotype of "*Phoma cruris-hominis*" CBS 377.92 = IMI 213845; near Dumfries, from die-back of *Picea excelsa*, deposited in CBS Oct. 1937, T.R. Peace, CBS 274.37. **USA**, Michigan, Wolf Lake, from dried gametophytes of *Funaria hygrometrica*, 2008, M.L. Davey, culture **ex-holotype** of "*Atradidymella muscivora*" UAMH 10909 = CBS 127589; from gametophytes of *Polytrichum juniperinum* growing on the base of an uprooted *Picea mariana* tree, 2008, M.L. Davey, culture ex-holotype of "*Atradidymella muscivora*" UAMH 10909 = CBS 127589 = Pj8-D.

Notes: *Atradidymella muscivora* was introduced as the sexual morph of a new species "*Phoma muscivora*", which is

morphologically similar to *P. herbarum* (Davey & Currah 2009). However, based on the description of *P. muscivora*, there are no significant morphological differences from *P. herbarum*, thus we conclude that they are conspecific. *Phoma muscivora* and *At. muscivora* are treated as synonyms of *Phoma herbarum* here, which by default makes it the first report of a sexual morph of the type species of the genus *Phoma*. The culture ex-holotype of *Phoma cruris-hominis* (CBS 377.92), isolated from a lesion on the leg of a woman in London (Punithalingam 1979b), was shown to be genetically identical to the ex-type species of *P. herbarum*. Two isolates deposited as *Phoma acuum* (CBS 274.37) and *Leptosphaeria millefolii* (CBS 304.51) clustered with *P. herbarum* in the phylogenetic tree, with only two bp differences in *tub2* from the authentic strains of *P. herbarum* (CBS 502.91, CBS 615.75). Due to the similarity based on their DNA sequences, we re-identified these isolates as *P. herbarum*.

Phoma neerlandica Q. Chen & L. Cai, **sp. nov.** MycoBank MB814141. Fig. 28.

Etymology: Epithet derived from the country of origin, the Netherlands.

Description from ex-holotype culture (CBS 134.96): *Conidiomata* pycnidial, solitary or aggregated, globose to subglobose, glabrous, produced on the agar surface or immersed, 95–350(–430) × 80–300 µm. *Ostioles* 1–2(–3), papillate. *Pycnidial wall* pseudoparenchymatous, 5–7-layered, 20–35 µm thick, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, 4–7 × 3–6.5 µm. *Conidia* ellipsoidal to cylindrical, sometimes fusiform, smooth- and thin-walled, aseptate, occasionally 1-septate, 4.5–8.5(–12) × 2–3.5 µm, with 1–6 minute guttules. *Conidial matrix* rosy-buff to pale salmon.

Culture characteristics: Colonies on OA, 40–45 mm diam after 7 d, margin regular, flattened, olivaceous to grey, abundant pycnidia produced in concentric rings; reverse alternate olivaceous and salmon concentric rings. Colonies on MEA 40–45 mm diam after 7 d, margin regular, wooly, dull green; reverse concolourous. Colonies on PDA, 35–40 mm diam after 7 d, margin regular, wooly, pale olivaceous to hazel, white near the margin, black pycnidia produced in some sectors; reverse pale brown olivaceous with salmon patches, white near the margin. NaOH test negative.

Specimen examined: **The Netherlands**, Emmeloord, from a leaf of *Delphinium* sp., deposited in CBS Feb. 1996 (**holotype** HMAS 246691, culture ex-holotype CBS 134.96 = PD 84/676).

Notes: Isolate CBS 134.96 was initially identified as "*Phoma delphinii*". However, we have been unable to trace the type material. In the original description, conidial dimensions of *Phoma delphinii* were given as 3–4 × 2 µm, while Boerema *et al.* (1997) indicated that conidia of CBS 134.96 were notably variable in shape and size, mostly 4–15 × 1.5–5 µm, and including some 1-septate large conidia (15.5–22 × 4–5 µm). In our observations, the conidial size of CBS 134.96 agrees with that reported by Boerema *et al.* (1997). Since the conidial dimensions of CBS 134.96 and *Phoma delphinii* differ markedly, we prefer to describe this isolate as a new species, *Phoma neerlandica*.

Phoma neerlandica is phylogenetically most closely related to the type species of *Phoma*, *P. herbarum*. They can be morphologically distinguished from each other by the longer, uniseptate conidia in *P. neerlandica* [4.5–8.5(–12) × 2–3.5 µm] compared to the aseptate conidia in *P. herbarum* (4.5–6 × 2–3 µm).

Clade 13: *Leptosphaerulina*

Leptosphaerulina McAlpine, Fungus Diseases of stone-fruit trees in Australia: 103. 1902.

Ascomata pseudothecial, immersed or erumpent, obpyriform to subglobose, ostiolate. *Asci* clavate to ovoid, or obovoid, saccate, oblong, bitunicate, 8-spored. *Ascospores* muriform, oblong, ellipsoidal to obovoid, subfusoid, hyaline to brown, 1(–6)-septate, slightly constricted at the septum, biseriate or triseriate (Saccardo 1905, Inderbitzin *et al.* 2000, Abler 2003, Crous *et al.* 2011).

Type species: *Leptosphaerulina australis* McAlpine, Fungus Diseases of stone-fruit trees in Australia: 103. 1902.

Notes: The genus *Leptosphaerulina* was introduced to accommodate the type species *L. australis* (McAlpine 1902), which was isolated from *Prunus armeniaca* (Saccardo 1905). The genus currently comprises about 25 species (McAlpine 1902, Graham & Luttrell 1961, Irwin & Davis 1985, Roux 1986, Inderbitzin *et al.* 2000). *Leptosphaerulina* was first accommodated in the *Pleosporaceae* (Inderbitzin *et al.* 2000, Kodsueb *et al.* 2006), but later found to be related to *Didymella* (Kodsueb *et al.* 2006). Our analysis showed that *Leptosphaerulina* grouped in a distinct clade in the *Didymellaceae*, but that it is distant from *Didymella*.

Leptosphaerulina americana (Ellis & Everh.) J.H. Graham & Luttr., Phytopathology 51: 686. 1961.
Basionym: *Pleospora americana* Ellis & Everh., N. Amer. Pyren. (Newfield): 336. 1892.

Specimen examined: **USA**, Georgia, from *Trifolium pratense*, deposited in CBS May 1955, E.S. Luttrell, CBS 213.55.

Leptosphaerulina arachidicola W.Y. Yen *et al.*, J. Agric. Forest. 10: 167. 1956.

Specimen examined: **China**, Taiwan, from a leaf of *Arachis hypogaea*, deposited in CBS May 1959, K.T. Huang, CBS 275.59 = ATCC 13446.

Leptosphaerulina australis McAlpine, Fungus Diseases of stone-fruit trees in Australia: 103. 1902.

On synthetic nutrient-poor agar: *Ascomata* pseudothecial, solitary to aggregated in clusters, brown, superficial on agar medium, obpyriform to subglobose, 100–150 × 150–200 µm; ostiole central, up to 30 µm diam; outer wall covered with short, brown hyphal setae, 5–15 × 3–5 µm, with obtuse ends. *Asci* 100–120 × 35–45 µm, 8-spored, hyaline, obovoid, bitunicate with strongly developed apical chamber, 5–7 × 2–3 µm. *Ascospores* multiseriate in asci, hyaline, smooth, with mucoid sheath, 4 transverse septa, and 2–3 vertical, and 1–2 oblique septa, constricted at second vertical septum from apex, ellipsoidal to obovoid,

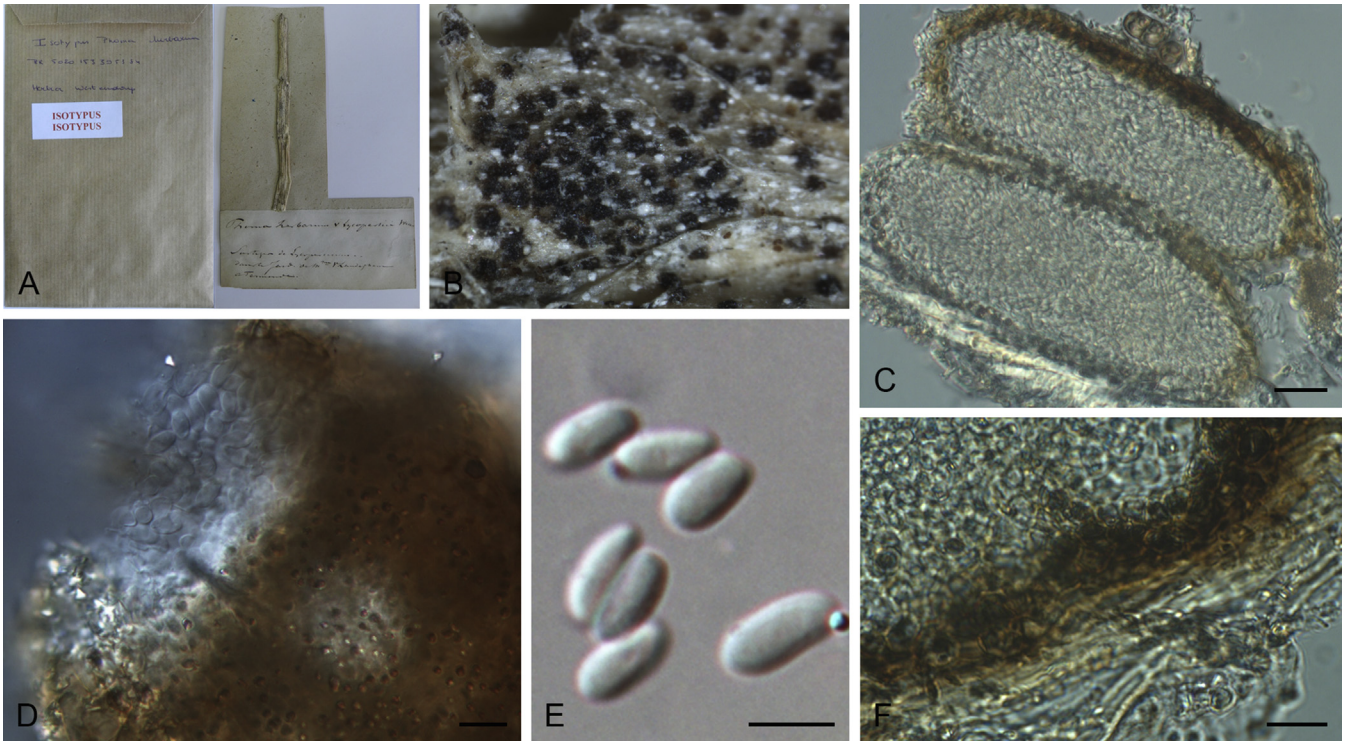

Fig. 29. *Phoma herbarum* (BR 5020153305384). A. Type collection packet. B. Pycnidia on host substrate. C. Section of pycnidia. D. Pycnidium with conidia. E. Conidia. F. Section of pycnidial wall. Scale bars: C = 20 µm; D, F = 10 µm; E = 5 µm.

tapering from middle of upper part of ascospore (widest point) to an acutely rounded apex, base obtusely rounded; hamathecial tissue dissolving among asci, and pseudoparaphyses not observed, (32–)33–27(–40) × (12–)13–14(–15) µm.

Culture characteristics: Colonies on OA, 20–25 mm diam after 7 d, lobate margins, dirty white near the centre, olivaceous grey to iron-grey near the margin. Colonies on MEA, 20–25 mm diam after 7 d, lobate margins, dirty white near the centre, sienna near the margin; reverse sienna. Colonies on PDA, 20–25 mm diam after 7 d, lobate margins, dirty white near the centre, olivaceous grey near the margin; reverse iron-grey (from Crous *et al.* 2011).

Specimen examined: **Kenya**, on leaves of *Protea* sp., 1999, culture CBS 116307 = CPC 3712. **Indonesia**, Lampung, from *Eugenia aromatica*, Dec. 1982, H. Vermeulen, CBS 317.83.

Notes: *Leptosphaerulina australis* was originally isolated from *Prunus armeniaca* in Australia (Saccardo 1905). The culture collected from Kenya is the first record from *Proteaceae* (Crous *et al.* 2011).

Leptosphaerulina trifolii (Rostr.) Petr., Sydowia 13: 76. 1959.
Basionym: *Sphaerulina trifolii* Rostr., Bot. Tidsskr. 22: 265. 1899.

Specimen examined: **The Netherlands**, from *Trifolium* sp., deposited in CBS Jul. 1958, CBS 235.58.

Clade 14: *Neoascochyta*

Neoascochyta Q. Chen & L. Cai, **gen. nov.** MycoBank MB814064.

Etymology: Morphologically resembling the genus *Ascochyta*, but phylogenetically distinct.

Conidiomata pycnidial, globose to subglobose, or irregularly shaped, superficial on or immersed into the agar, solitary or confluent, ostiolate, sometimes with a short neck. *Pycnidial wall* pseudoparenchymatous, 2–7-layered, outer wall pigmented, thick. *Conidiogenous cells* phialidic, hyaline, smooth, globose to flask-shaped, short obpyriform, or ampulliform to doliiform. *Conidia* variable in shape, hyaline, smooth- and thin-walled, *i.e.* fusoid to cylindrical, obclavate-ovoid to ellipsoidal, incidentally slight curved, uniseptate or aseptate, eguttulate or guttulate. *Ascomata* pseudothecial immersed or erumpent, solitary or confluent, globose to subglobose, ostiolate. *Asci* cylindrical to subclavate, slightly curved, short pedicellate or sessile, 8-spored, bitunicate. *Ascospores* cylindrical to ovoid, ellipsoidal, hyaline, 1-septate, symmetrical or asymmetrical, constricted at the septum, biseriate or irregular uniseriate.

Type species: *Neoascochyta exitialis* (Morini) Q. Chen & L. Cai.

Neoascochyta desmazieri (Cavara) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814142. Fig. 31.
Basionym: *Ascochyta desmazieri* Cav., Z. Pflanzenkrankh 3: 21. 1893. (as "*desmazieresii*").

Description from ex-neotype culture (CBS 297.69): *Conidiomata* pycnidial, solitary or sometimes aggregated, globose to subglobose, mostly with some hyphal outgrows, immersed, 115–280 × 95–165(–235) µm. *Ostiole* single, papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 2–4(–5)-layered, 15–28 µm thick, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 6–8.5 × 7.5–11 µm. *Conidia* cylindrical, hyaline, smooth- and thin-walled, mostly 1-septate, 8.5–18 × 2.5–4 µm, with 4–10(–13) guttules per cell. Conidial exudates not recorded.

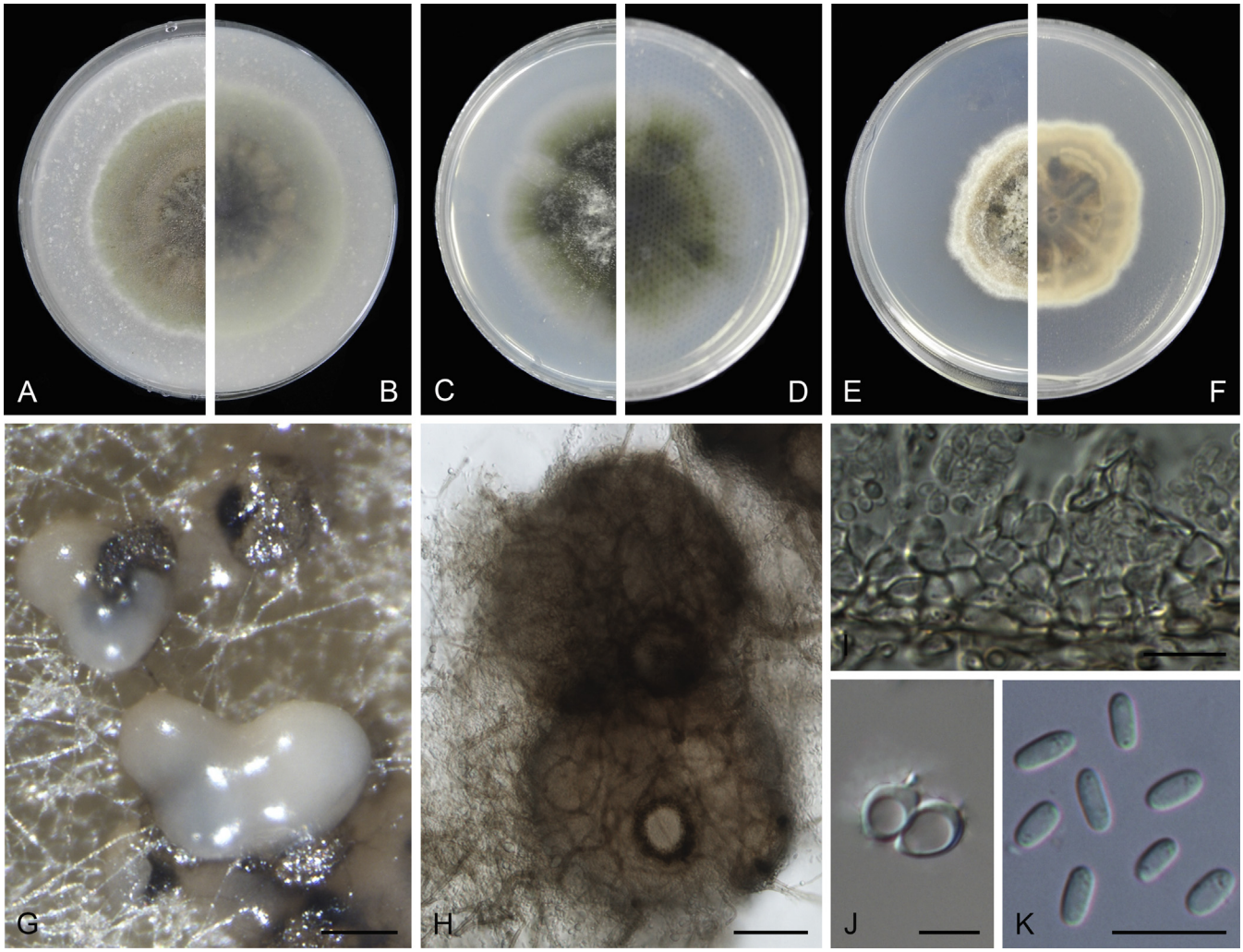

Fig. 30. *Phoma herbarum* (CBS 615.75). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidia. I. Section of pycnidial wall. J. Conidiogenous cells. K. Conidia. Scale bars: G = 100 µm; H = 50 µm; I, K = 10 µm; J = 5 µm.

Culture characteristics: Colonies on OA, 20–25 mm diam after 7 d, margin regular, felty, with concentric rings, white, pale greenish olivaceous near the centre; reverse white in outer ring, darkening towards the centre of the colony via pale salmon, buff to hazel. Colonies on MEA 35–40 mm diam after 7 d, margin regular, felty, whitish, grey greenish olivaceous near the centre; reverse white in outer ring, darkening towards the centre of the colony via buff, hazel to olivaceous. Colonies on PDA, 35–40 mm diam after 7 d, margin regular, similar as on MEA. NaOH test negative.

Specimens examined: **Austria**, Landwirtschaftl, from *Poaceae*, Mar. 1979, E. Lengauer, CBS H-8993, culture CBS 247.79. **Germany**, Hohenlieth, from *Lolium perenne*, deposited in CBS Apr. 1969, U.G. Schlösser (**neotype designated here** HMAS 246690, MBT202505, culture ex-neotype CBS 297.69). **Norway**, Oclo, from hay, Feb. 1997, M. Torp, CBS H-8935, culture CBS 758.97.

Notes: Attempts to locate the type specimen of *Ascochyta desmazieri* were unsuccessful. This species was first published as *Septoria graminium* var. *lolii* based on the examination of Pl. crypt. No. 1919 of Desmazières, and later was placed in *Ascochyta* by Cavara (1893) as *As. desmazieri*, with conidia measuring 20–30 × 2 µm. Sprague (1944) emended the conidial range of *As. desmazieri* as 15–20 × 2.8–3.5 µm after examining Desmazières's exsiccatum No. 2169 (Punithalingam 1979a). Punithalingam (1979a) clarified the confusion surrounding *As. desmazieri*, *Septoria* sp. and *Phoma lolii*, and suggested to retain *As. desmazieri* as a single species. The morphology of the neotype (HMAS 246690; 8.5–18 × 2.5–4 µm), which we designated here, agrees with the description of *As. desmazieri* by Sprague (1944).

The sole isolate deposited in CBS as "*Ascochyta agrostidis*" (CBS 758.97) was genetically identical to the culture ex-neotype of *Neoascochyta desmazieri* (CBS 297.69). Therefore, we reclassify isolate CBS 758.97 as *Neoa. desmazieri*.

Neoascochyta exitialis (Morini) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814143. Fig. 32.

Basionym: *Sphaerella exitialis* Morini, Nuovo Giorn. Bot. Ital. 18: 37. 1886.

≡ *Didymella exitialis* (Morini) E. Müll., Phytopathol. Z. 19: 407. 1952.

Description from culture (CBS 389.86): *Conidiomata* pycnidial, solitary, globose to subglobose, mostly with some hyphal outgrows, superficial on or immersed into the agar, 95–150 × 75–120 µm. *Ostiole* single, papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, 22–40 µm thick, composed of isodiametric or sometimes irregular cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, 6–8 × 6–9.5 µm. *Conidia* broadly fusoid to cylindrical, incidentally slightly curved, smooth- and thin-walled, hyaline, uniseptate,

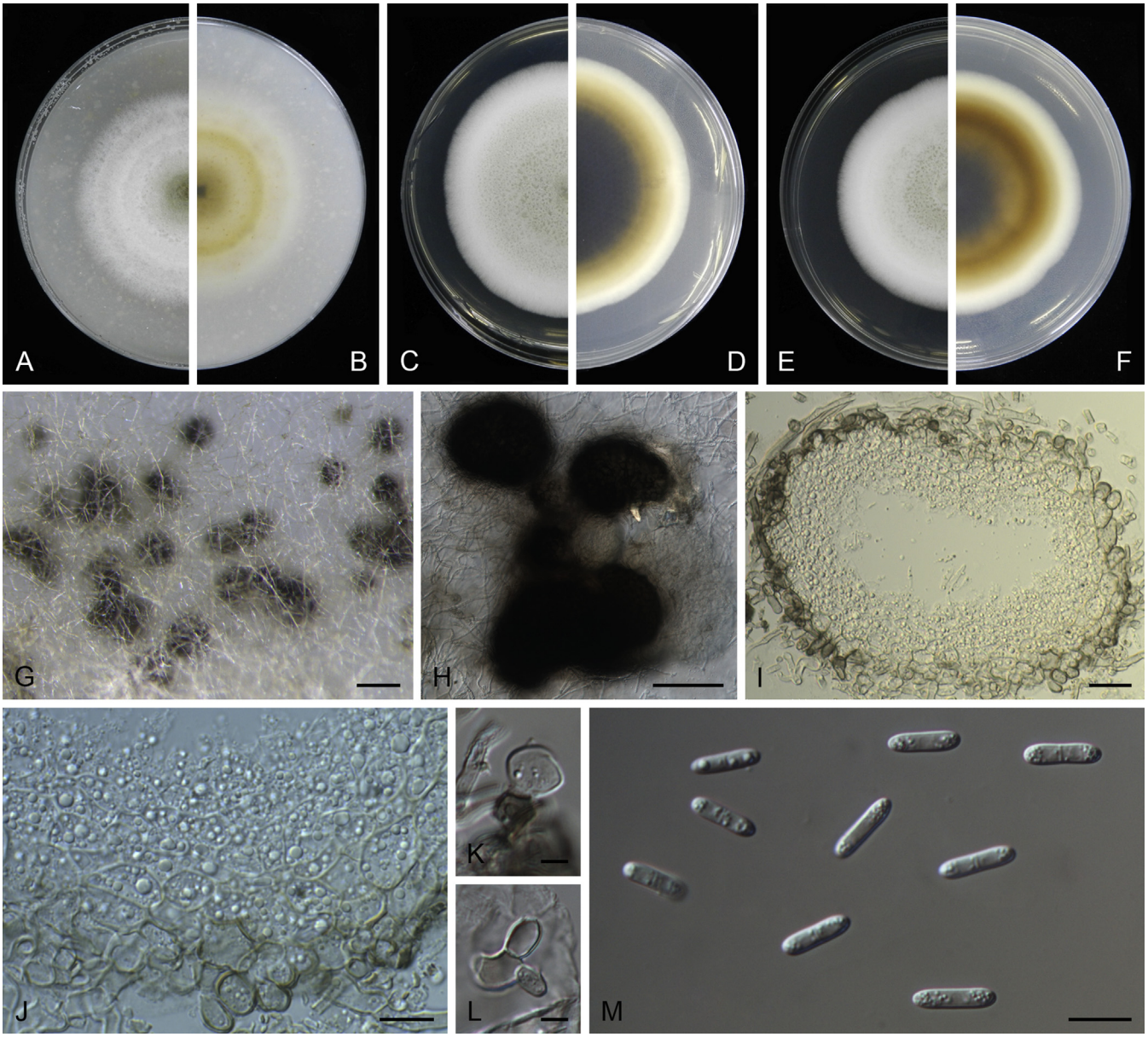

Fig. 31. *Neoascochyta desmazieri* (CBS 297.69). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidia. I. Section of pycnidium. J. Section of pycnidial wall. K–L. Conidiogenous cells. M. Conidia. Scale bars: G = 200 µm; H = 100 µm; I = 20 µm; J, M = 10 µm; K–L = 5 µm.

15.5–25 × 4–7 µm, with many minute guttules, *ca.* 15–30 guttules per cell. Conidial exudates not recorded.

Culture characteristics: Colonies on OA, 20–25 mm diam after 7 d, margin regular, floccose, white, grey olivaceous near the margin; reverse white in outer ring, olivaceous near the centre. Colonies on MEA 35–40 mm diam after 7 d, margin regular, wooly, pale greenish olivaceous, olivaceous near the centre; reverse concolourous. Colonies on PDA, 30–35 mm diam after 7 d, margin regular, wooly, whitish, hazel near the centre; reverse dull green. NaOH test negative.

Specimens examined: **Germany**, Monheim, from a leaf of *Secale cereale*, May 1984, M. Hossfeld, CBS 811.84; from a leaf of *Hordeum vulgare*, deposited in CBS Dec. 1984, CBS H-8939, culture CBS 812.84. **Sweden**, Uppland, from *Allium* sp., Sep. 1986, O. Constantinescu, CBS 113693 = UPSC 1929. **Switzerland**, Utzenstorf, from *Triticum aestivum*, deposited in CBS Sep. 1986, CBS 389.86 = INIFAT C86 = MW I 1343. **The Netherlands**, Gelderland, Laren, from *Triticum* sp. variety Tower, deposited in CBS Mar. 2002, I. de Vires, CBS 110124. **Unknown origin,** unknown substrate, deposited in CBS Aug. 1940, K. Röder, CBS 118.40.

Notes: Isolate CBS 118.40 was initially identified as "*D. arcuata*", CBS 811.84 and CBS 812.84 as "*As. avenae*", CBS 110124 as "*As. skagwayensis*", and CBS 113693 as "*As. allii*". The multilocus analysis revealed no phylogenetic differences among these isolates. Genetically there was nearly no difference among these strains, except a single bp difference of CBS 113693 in *tub2*. Here we reclassified all these isolates as *Neoascochyta exitialis*.

Neoascochyta graminicola (Punith.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814144. Fig. 33.
Basionym: *Didymella graminicola* Punith., Mycol. Pap. 119: 2. 1970.

Description from culture (CBS 102789): *Conidiomata* pycnidial, solitary, subglobose, glabrous, superficial on or immersed into the agar, 195–325 × 145–270(–300) µm. *Ostioles* 1–2, slightly

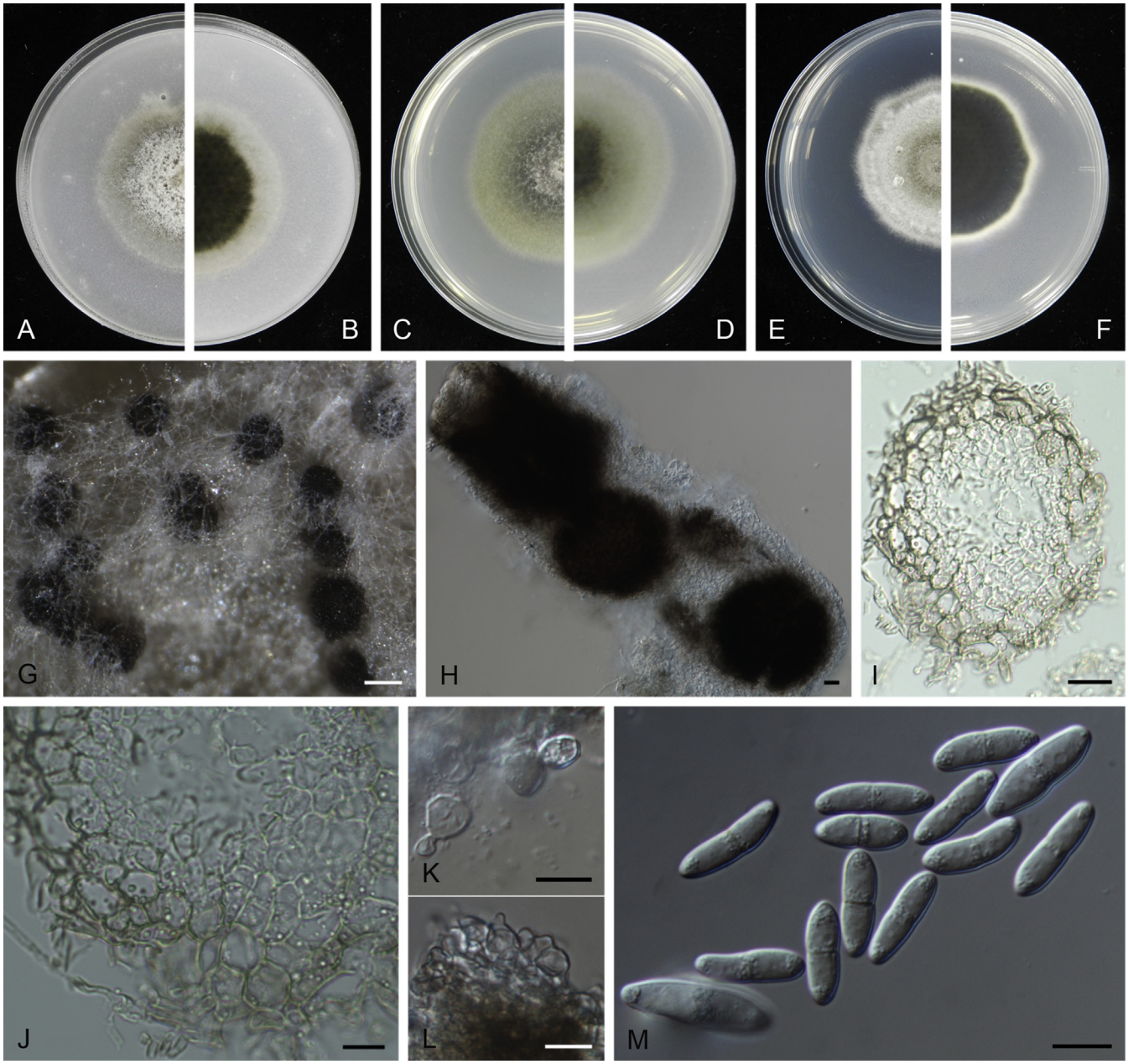

Fig. 32. *Neoascochyta exitialis* (CBS 389.86). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidia. I. Pycnidial section. J. Section of pycnidial wall. K–L. Conidiogenous cells. M. Conidia. Scale bars: G = 200 µm; H–I = 20 µm; J–M = 10 µm.

papillate. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, 17–24 µm thick, composed of isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to dolliform, 8.5–10.5 × 6.5–9.5 µm. *Conidia* cylindrical, smooth- and thin-walled, 1-septate, 12.5–17.5 × 4.5–6.5 µm, with 4–8 guttules. *Conidia matrix* white.

Culture characteristics: Colonies on OA, 15–20 mm diam after 7 d, margin regular, floccose, white to hazel, pale olivaceous near the centre; reverse pale olivaceous, white near the margin. Colonies on MEA 15–20 mm diam after 7 d, margin crenate, flattened, pale greenish olivaceous; reverse concolourous. Colonies on PDA, 35–40 mm diam after 7 d, margin dendritic, floccose, white to pale greenish olivaceous; reverse olivaceous. NaOH test negative.

Specimens examined: **Belgium**, Gembloux, from *Hordeum vulgare*, deposited in CBS Sep. 1979, J. Fraselle, CBS H-9007, culture CBS 586.79. **Germany**, Kiel-Kitzeberg, Schlosskoppelweg, from seeds of *Lolium perenne* or *L. multiflorum*, 1968, U.G. Schlösser (**holotype** IMI 136404); from seed of *Lolium multiflorum*, deposited in CBS Apr. 1969, U.G. Schlösser, CBS 301.69; from *Triticum aestivum*, Apr. 1982, G.M. Hoffmann, CBS H-1614, culture CBS 447.82; Eschweiler, from a leaf of *Hordeum vulgare*, May 1984, M. Hossfeld, CBS H-9017, culture CBS 815.84; Monheim, from a leaf of *Hordeum vulgare*, May 1984, M. Hossfeld, CBS H-9016, culture CBS 816.84. **New Zealand**, Canterbury Province, from a leaf of *Lolium perenne*, Dec. 1999, S. Ganev, culture CBS 102789.

Notes: According to the original literature (Punithalingam 1969), the holotype of *Didymella graminicola* was collected from *Lolium perenne* or *L. multiflorum* in Germany. The culture CBS 301.69 was previously deposited as "*Ascochyta sorghi*", CBS 447.82 as "*D. exitialis*", CBS 586.79 as "*As. graminea*", CBS 815.84 and CBS 816.84 as "*As. hordei* var. *americana*". In the phylogenetic analysis, these cultures clustered together in a well-supported clade and their sequences of four loci are genetically identical to the authentic culture of *Neoascochyta graminicola* (CBS 102789). As *As. sorghi* was reported to be restricted to sorghum

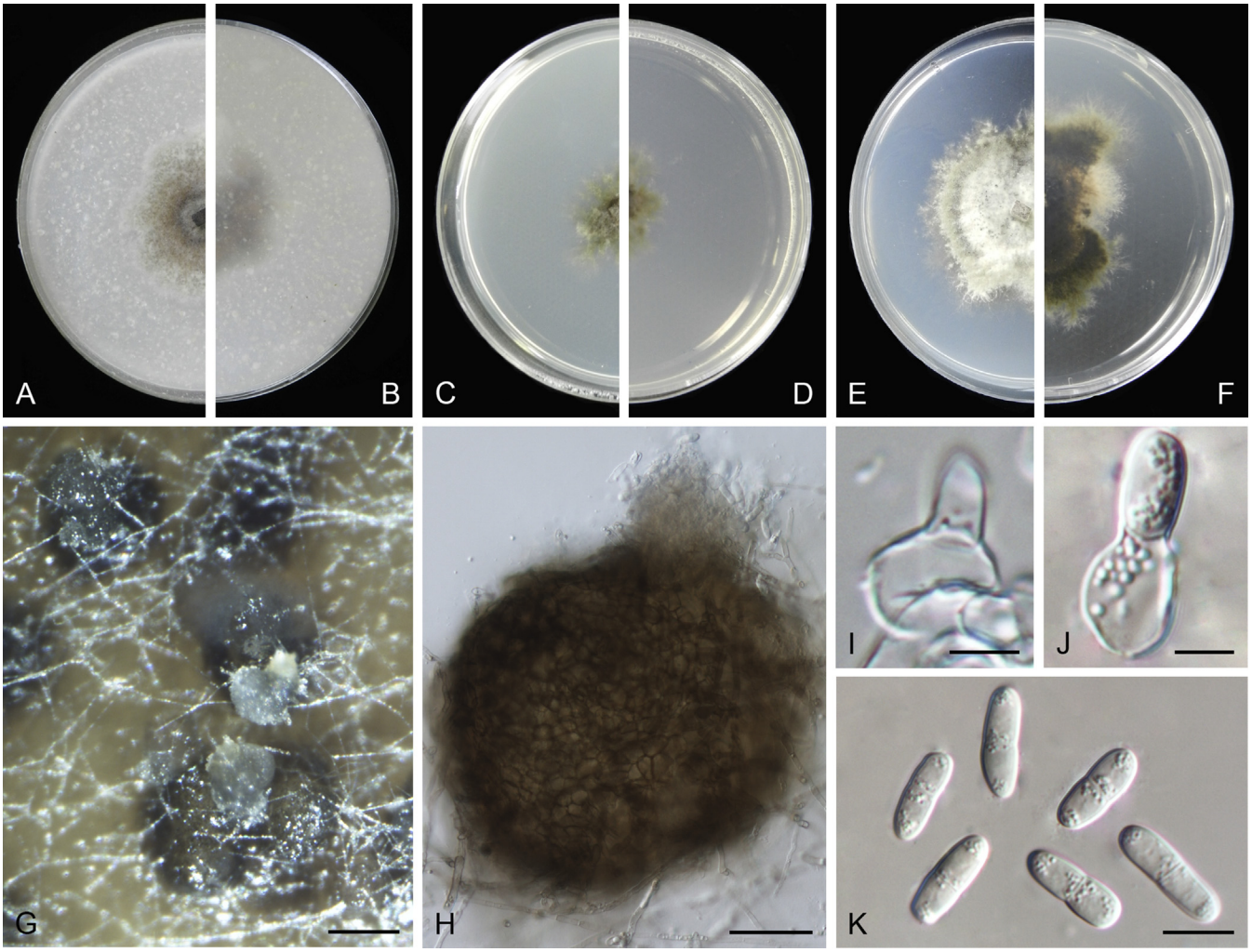

Fig. 33. *Neoascochyta graminicola* (CBS 102789). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidium. I–J. Conidiogenous cells. K. Conidia. Scale bars: G = 100 µm; H = 50 µm; I–J = 5 µm; K = 10 µm.

(Punithalingam 1979a), isolate CBS 301.69 from *Lolium multiflorum* was misidentified. Isolate CBS 447.82 clustered distantly from the ex-type of *D. exitialis* (CBS 389.86). *Ascochyta graminea* was originally reported from *Cynodon dactylon* in Italy (Punithalingam 1979a), whereas the isolate CBS 586.79 was from a different host, *Hordeum vulgare*, which belongs to the same host family as *Neoa. graminicola* (syn. *D. graminicola*). According to the original description of *As. hordei* var. *americana*, its conidia (15–20 × 4–5(–5.5) µm; Punithalingam 1979a) are hyaline to yellowish brown, wider than those of *Neoa. graminicola* (hyaline, 14–18(–20) × 3–4 µm; Punithalingam 1969), which suggests that they are two distinct species. Although isolates CBS 815.84 and CBS 816.84 were both isolated from *Hordeum vulgare*, the same host of *As. hordei* var. *americana*, they were phylogenetically identical to *Neoa. graminicola*, and re-identified as such.

Neoascochyta europaea (Punith.) Q. Chen & L. Cai, **comb. et stat. nov.** MycoBank MB814145. Figs 34–35.
Basionym: *Ascochyta hordei* var. *europaea* Punith., Mycol. Pap. 142: 95. 1979.

Description from holotype (IMI 164252): *Leaf spots* elliptical to circular, rosy buff with brown border. *Pycnidia* immersed in leaf surface of *Hordeum vulgaris*, solitary or confluent, subglobose, 50–290 × 40–250 µm. *Ostioles* 1(–2) on a short neck. *Pycnidial wall* pseudoparenchymatous, 2-layered, composed of isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, doliiform. *Conidia* fusoid to cylindrical, sometimes ellipsoidal, smooth- and thin-walled, hyaline to pale brown, 1-septate, 12.5–19.5 × 3–5 µm, with 2–10 guttules per cell.

Description from ex-epitype culture (CBS 820.84): *Pycnidia* mostly solitary or sometimes confluent, globose to subglobose, with some hyphal outgrows, produced on the agar surface or immersed, (190–)215–450(–565) × (150–)200–350(–420) µm. *Ostioles* 1–4 on a short neck. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, 27–50 µm thick, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 7.5–11.5 × 6–9 µm. *Conidia* fusoid to cylindrical, incidentally slight curved, smooth- and thin-walled, hyaline to pale buff, 1-septate, 14.5–20.5 × 4–5 µm, with many minute guttules, *ca.* 10–20 guttules per cell. Conidial exudates not recorded.

Culture characteristics: Colonies on OA, 40–45 mm diam after 7 d, margin regular, floccose, dark grey, pycnidia semi-immersed in concentric rings near the margin, grey olivaceous; reverse concolourous. Colonies on MEA 35–40 mm diam after 7 d, margin regular, wooly, pale greenish, olivaceous near the centre,

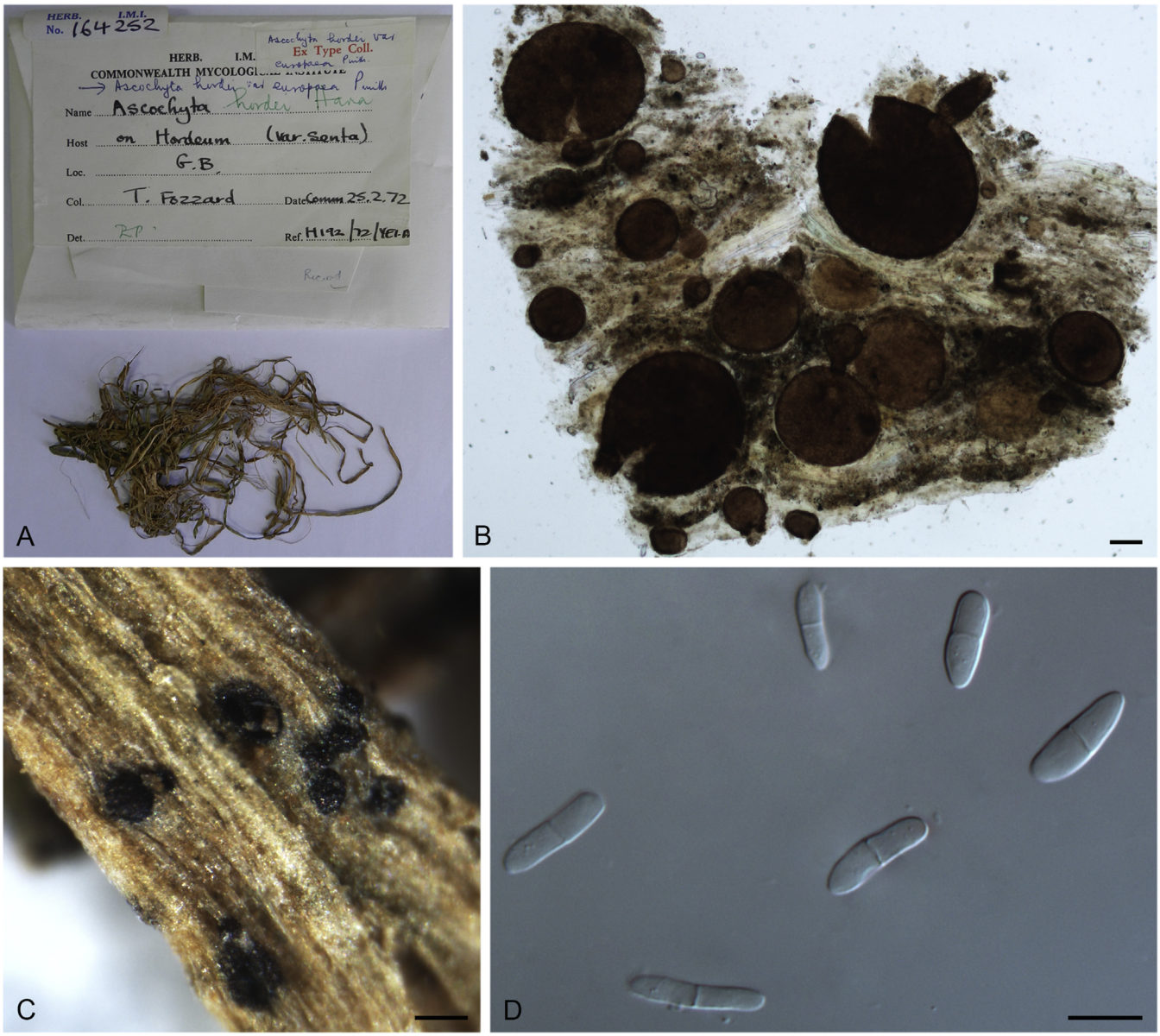

Fig. 34. *Neoascochyta europaea* (IMI 164252). A. Type collection packet. B. Pycnidia. C. Pycnidia on host substrate. D. Conidia. Scale bars: B = 50 µm; C = 200 µm; D = 10 µm.

white near the margin; reverse concolourous. Colonies on PDA, 40–45 mm diam after 7 d, margin regular, floccose, smoke-grey with a pale ring near the margin, black pycnidia produced near the centre and a concentric ring; reverse dull green. NaOH test negative.

Specimens examined: **Germany**, Eschweiler, from a leaf of *Hordeum vulgare*, May 1984, M. Hossfeld, CBS H-9024, culture CBS 819.84; from a leaf of *Hordeum vulgare*, May 1984, M. Hossfeld (**epitype designated here** CBS H-9025, MBT202506, culture ex-epitype CBS 820.84). **UK**, from leaves of *Hordeum vulare.*, Feb. 1972, T. Fozzard (**holotype** IMI 164252).

Notes: Conidia from the holotype are mostly 1-septate, 12.5–19.5 × 3–5 µm, hyaline to pale brown, which agrees well with the original description with conidia 14–16 × 3–4.5(–5) µm. The morphology of specimens selected in this study agrees with the type as well, and thus CBS H-9025 is chosen as epitype, with the living culture ex-epitype CBS 820.84. *Neoascochyta europaea* mainly occurs in Europe and especially in Great Britain on barley, rye and wheat (Punithalingam 1979a).

Neoascochyta paspali (P.R. Johnst.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814147.

Basionym: *Phoma paspali* P.R. Johnst., New Zealand J. Bot. 19: 181. 1981.

Description (de Gruyter *et al.* 1998).

Specimen examined: **New Zealand**, Auckland, Kaikohe, from a dead leaf of *Paspalum dilatatum*, Jan. 1979, P.K. Buchanan (**isotype** CBS H-7623, culture ex-isotype CBS 560.81 = PD 92/1569).

Neoascochyta sp. 1

Specimen examined: **Argentina**, Tandil, from a leaf of *Triticum aestivum*, Oct. 2002, CBS 112524.

Notes: CBS 112524 was initially identified as "*Ascochyta hordei*" and grouped in the same clade with CBS 516.81, another misidentified culture, in the phylogenetic tree. Since the type material of *As. hordei* could not be obtained, the identity of CBS 112524 remains uncertain, and requires further study.

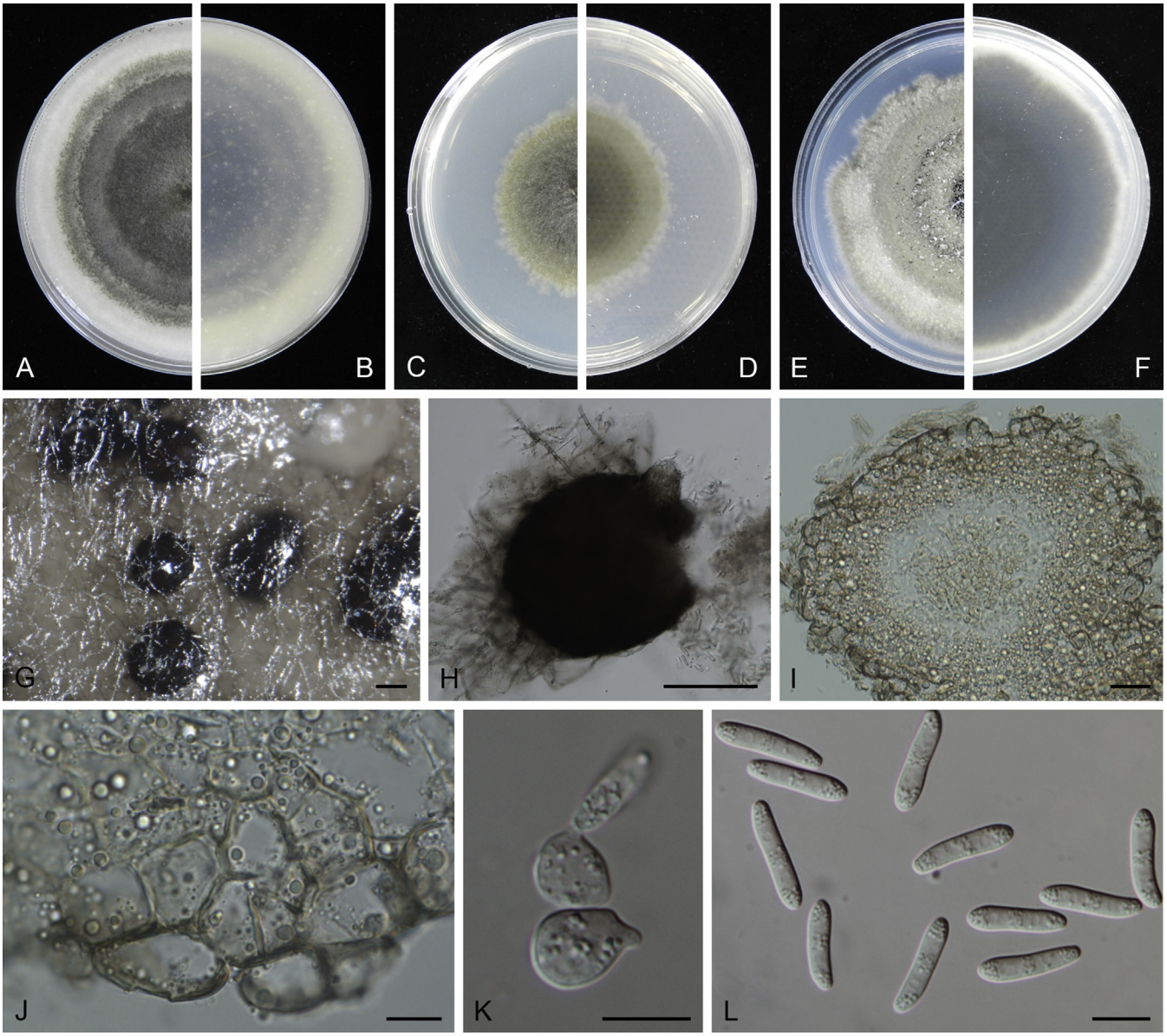

Fig. 35. *Neoascochyta europaea* (CBS 820.84). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidium. I. Pycnidial section. J. Section of pycnidial wall. K. Conidiogenous cells. L. Conidia. Scale bars: G = 200 µm; H = 100 µm; I = 20 µm; J–L = 10 µm.

Neoascochyta sp. 2

Specimen examined: **Italy**, Cenreo Richerche sul riso, Mortara, from *Oryza sativa*, Aug. 1981, CBS H-11964, culture CBS 516.81.

Notes: This isolate was incorrectly identified as "*Didymella graminicola*", and is phylogenetically distant from the authentic culture of this species (CBS 102789). This is a potential new species, and will be described elsewhere.

Neoascochyta sp. 3

Specimen examined: **Norway**, Oslo, from hay, deposited in CBS Apr. 1997, M. Torp, CBS H-9005, culture CBS 689.97.

Notes: Isolate CBS 689.97 was deposited as "*Ascochyta festucae*" and represents a single branch, which was distant from other species in the tree. Since the type of *As. festucae* is unavailable, we could not confirm if CBS 689.97 represents a new species, or is conspecific to *As. festucae*.

Neoascochyta sp. 4

Specimen examined: **South Africa**, Heilbron, from *Triticum aestivum*, deposited in CBS Sep. 1974, W.J. Jooste, CBS H-9008, culture CBS 544.74.

Notes: Isolate CBS 544.74, originally identified as "*Ascochyta hordei*", clustered sister to *Neoascochyta* sp. 5. This culture was collected from *Triticum aestivum*, while the type of *As. hordei* was from *Hordeum sativum* (Punithalingam 1979a). Since the type material of *As. hordei* was unavailable, the identity of this isolate remains uncertain.

Neoascochyta sp. 5

Specimen examined: **South Africa**, Potchefstroom, from straw, deposited in CBS Oct. 1972, M.C. Papendorf, CBS H-8974, culture CBS 876.72.

Notes: Isolate CBS 876.72, originally identified as "*Ascochyta brachypodii*", clustered sister to *Neoascochyta* sp. 4, which is distinct from other species in the phylogenetic tree. Since the

type material of *As. brachypodii* was unavailable, the identity of this isolate remains uncertain.

Clade 15: *Xenodidymella*

Xenodidymella Q. Chen & L. Cai, **gen. nov.** MycoBank MB814065.

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

Conidiomata pycnidial, globose to subglobose, on agar surface or immersed, solitary or confluent, ostiolate. *Pycnidial wall* pseudoparenchymatous, 3–9-layered, outer wall pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, globose to flask-shaped, ampulliform. *Conidia* variable in shape, hyaline, smooth- and thin-walled, *i.e.* ellipsoidal to allantoid, subcylindrical, oblong, pyriform, usually aseptate or occasionally 1-septate *in vivo*, mostly guttulate. *Chlamydospores* occasionally present, brown, intercalary, in spiral chains, unicellular, globose to subglobose. *Ascomata* pseudothecial, immersed or erumpent, globose to subglobose, solitary or confluent, ostiolate or poroid. *Asci* cylindrical to subclavate, 8-spored, bitunicate. *Ascospores* obovoid to oblong, clavate, ellipsoidal, sometimes slightly curved, hyaline, 1-septate, symmetrical or asymmetrical, constricted at the septum, biseriate.

Type species: *Xenodidymella applanata* (Niessl) Q. Chen & L. Cai.

Xenodidymella applanata (Niessl) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814148. Figs 36–37.

Basionym: *Didymosphaeria applanata* Niessl, Oesterr. Bot. Z. 25: 129. 1875.

≡ *Didymella applanata* (Niessl) Sacc., Syll. Fung. 1: 546. 1882.

= *Phyllosticta argillacea* Bres., Hedwigia 33: 206. 1894.

≡ *Phoma argillacea* (Bres.) Aa & Boerema, Persoonia 18: 17. 2002.

Description from holotype (M 0275818): *Leaf spots circular*, brown to black. *Pseudothecia* on leaf surface, solitary, globose to subglobose, 225–265 × 210–260 µm. *Ostioles* single. *Asci* cylindrical, 50–60 × 10.5–14.5 µm, 8-spored, biseriate. *Pseudothecia wall* pseudoparenchymatous, composed of isodiametric cells, 5–7-layered, 30–41 µm thick. *Ascospores* broadly fusiform, 11.5–15.5 × (4–)5.5–7.5 µm, smooth, straight or slightly curved, hyaline, 1-septate, slightly constricted at the septum, upper cells usually broader than the lower cells.

Description from ex-epitype culture (CBS 195.36): *Conidiomata* pycnidial, solitary, globose to subglobose, glabrous, produced on the agar surface or semi-immersed, 85–175 × 60–145 µm. *Ostiole* single, slightly papillate. *Pycnidial wall* pseudoparenchymatous, 5–7-layered, 20–25 µm thick, composed of isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to dolliform, 5.5–8 × 4.5–6 µm. *Conidia* ellipsoidal to ovoid, smooth- and thin-walled, aseptate, 5–7 × 2–3 µm, with several guttules. *Conidia matrix* white.

Culture characteristics: Colonies on OA, 20–25 mm diam after 7 d, margin regular, crenate, floccose, white, pale olivaceous near the centre; reverse buff to pale brown. Colonies on MEA, 15–20 mm diam after 7 d, margin regular, floccose, white, pale greenish olivaceous near the margin; reverse buff. Colonies on PDA, 15–20 mm diam after 7 d, margin regular, floccose, white; reverse pale brown olivaceous. Application of NaOH results in a pale reddish discolouration of the agar.

Specimens examined: **Germany**, near Köningstein, from leaves of *Rubus idaeus*, Aug. 1893, W. Krieger (**holotype** of "*Phyllosticta argillacea*" Fungi saxon. 1187, S). **Sweden**, Umeå, Västerhiske, from a shoot of *Rubus idaeus*, Jan. 2000, S. Hellqvist, CBS 115577; from *Rubus arcticus* subsp. × *stellarcticus*, Jan. 2000, S. Hellqvist, CBS 115578. **The Netherlands**, Baarn, from *Rubus idaeus* cv. 'Rode Radbout', deposited in CBS Apr. 1963, J.A. von Arx, CBS H-11941, culture CBS 205.63; Breda, from stem of *Rubus idaeus*, 1936, Rietsema (**epitype** of *Didymosphaeria applanata* **designated here** HMAS 246688, MBT202507, culture ex-epitype CBS 195.36). **UK**, Shrewsbury, from *Rubus idaeus*, 1875, Plowright (**holotype** of *Didymosphaeria applanata* M 0275818).

Notes: A phoma-like asexual morph of *Didymella applanata* has been described by Corbaz (1957) and Corlett (1981), and later identified by de Gruyter *et al.* (2002) as *Phoma argillacea*. The original description of the asexual morph reported a conidial size of 6–9 × 2–3 µm, which agrees with the epitype (5–7 × 2–2.8 µm) designated in the present study. *Xenodidymella applanata* is a pathogen of raspberry (*Rubus idaeus*) that was in the past commonly recorded as a sexual morph on this host. Furthermore, it also occasionally occurred on other species of *Rubus* (de Gruyter *et al.* 2002). Strain CBS 115578 showed certain distance from the other three representative strains of *Xenodidymella applanata*, with two bp differences in four sequenced loci.

Xenodidymella asphodeli (E. Müll.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814149. Figs 38–39.

Basionym: *Didymella asphodeli* E. Müll., Sydowia 12: 245. 1958 (1959).

= *Ascospora solieri* Mont., Ann. Sci. Nat. Bot., sér. 3, 11: 48. 1849.

≡ *Phoma solieri* (Mont.) Sacc., Michelia 1: 525. 1879.

Description from holotype (ZT Myc 56445): *Leaf spots* elliptical, pale brown to black. *Pycnidia* abundant, on leaf surface of *Asphodelus albus*, solitary, globose, (85–)180–280(–360) × (70–)150–320 µm. *Ostiole* single, distinctly papillate. *Pycnidial wall* pseudoparenchymatous, 3–4-layered, 15–30 µm thick, composed of oblong to isodiametric cells, outer wall 2–3-layered, brown. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform. *Conidia* broad cylindrical, smooth- and thin-walled, aseptate, 16.5–26 × 5.5–8 µm, guttulate.

Description from ex-epitype culture (CBS 375.62): *Conidiomata* pycnidial, solitary, globose, with some hyphal outgrows, superficila on or immersed into the agar, 160–385(–445) × 135–350(–400) µm. *Ostiole* single, distinct papillate. *Pycnidial wall* pseudoparenchymatous, 3–7-layered, 30–65 µm thick, composed of oblong to isodiametric cells, outer wall two-layered, brown. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, 8.5–12 × 6.5–11 µm. *Conidia* variable in shape and size, broadly obovoid, pyriform to cylindrical, smooth- and thin-walled, aseptate, 14–27(–34) × 4.5–11(–15) µm, with 20–40 large guttules. *Conidial matrix* pale pink. *Chlamydospores* unicellular, produced in and on the agar, brown, intercalary, in spiral chains, globose to subglobose, 14.5–41.5 × 10–37 µm, thick-walled.

Culture characteristics: Colonies on OA, 40–45 mm diam after 7 d, margin regular, flattened, olivaceous, black pycnidia

Fig. 36. *Xenodidymella applanata* (M 0275818). A. Type collection packet. B. Pseudothecia on host substrate. C. Pseudothecium. D. Section of pseudothecial wall. E. Asci. F. Ascospores. Scale bars: B = 100 µm; C, D = 50 µm; E–F = 5 µm.

produced in concentric rings; reverse iron-grey to olivaceous in concentric rings. Colonies on MEA 35–40 mm diam after 7 d, margin regular, floccose, greenish olivaceous to dark leaden-black, white tufts near the centre; reverse greenish olivaceous to dark leaden-black, hazel near the centre. Colonies on PDA, 40–45 mm diam after 7 d, margin regular, floccose, white to iron-black; reverse hazel to iron-black in concentric rings. NaOH test negative.

Specimens examined: **France**, Aples Maritimes, Tende, from *Asphodelus albus*, deposited in CBS Jan. 1962, E. Müller (**epitype of *Didymella asphodeli* designated here** HMAS 246689, MBT202508, culture ex-epitype CBS 375.62). **Italy**, Sardinie, from a wilting leaf of *Asphodelus ramosus*, May 1974, W. Gams & J. Stalpers, CBS 499.72. **Switzerland**, Monte Generoso, Bella Vista, from dead stems of *Asphodelus albus*, May 1956, Kt. Tessin (**holotype** of *Didymella asphodeli* ZT Myc 56445).

Notes: When *Didymella asphodeli* was introduced, a description of a sexual morph was provided (Müller 1958). However, in the examination of the holotype, we only observed the asexual morph with large conidia, 16.5–26 × 5.5–8 µm, which agrees with the conidial morphology of the epitype designated here, 14–27(–34) × 4.5–11(–15) µm. Müller (1958) also reported a connection between *D. asphodeli* and a pycnidial fungus which was identified as *Phyllostictina solieri* (currently *Phoma solieri*). However, this sexual-asexual link requires molecular verification. The two isolates (CBS 375.62 and CBS 499.72) showed certain

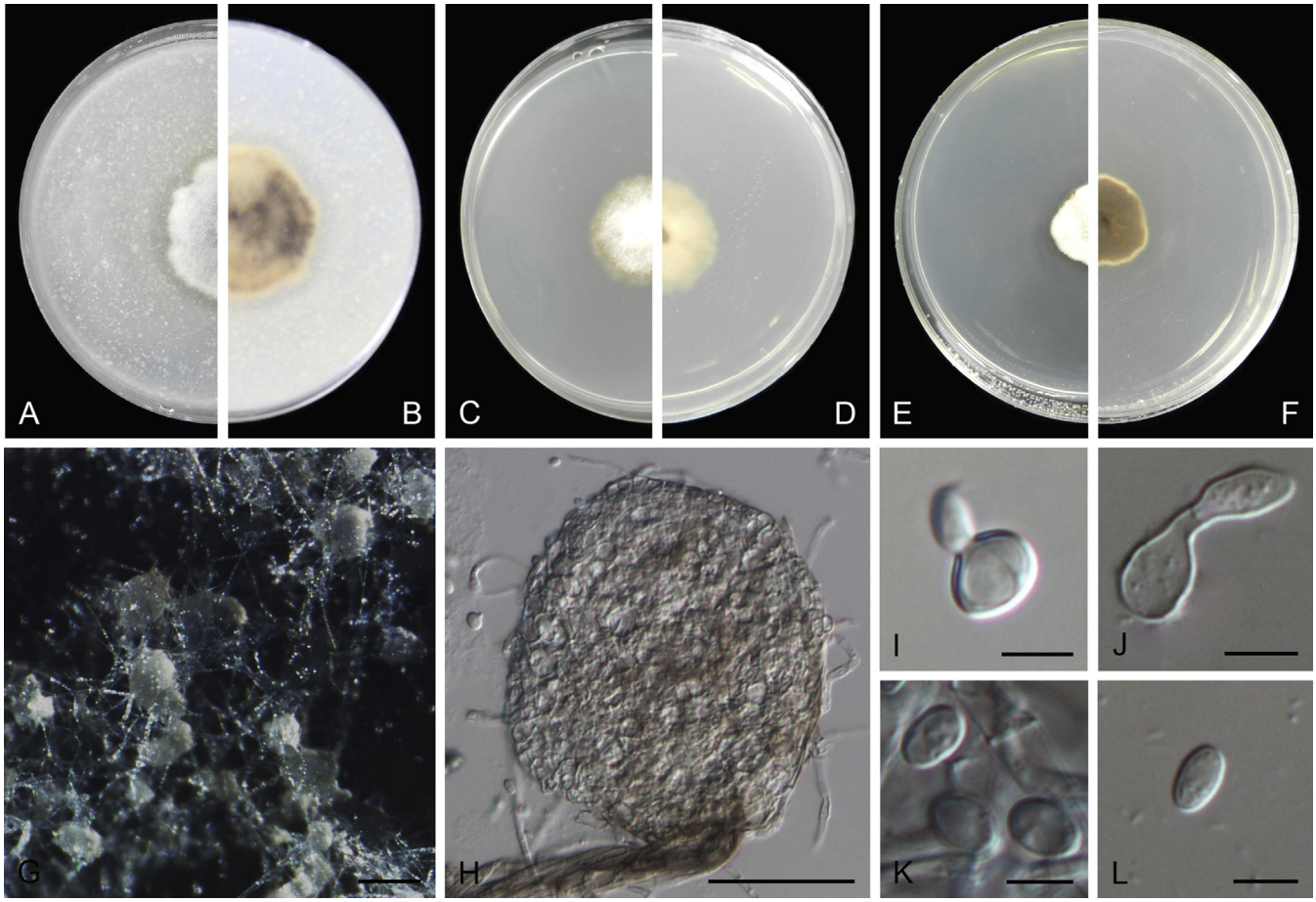

Fig. 37. *Xenodidymella applanata* (CBS 195.36). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidium. I–J. Conidiogenous cells. K–L. Conidia. Scale bars: G = 100 µm; H = 50 µm; I–L = 5 µm.

distance in phylogeny, and further study is needed to confirm if the two strains represent different species.

Xenodidymella catariae (Cooke & Ellis) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814150.
Basionym: *Sphaeria catariae* Cooke & Ellis, Grevillea 5: 95. 1877.
≡ *Didymella catariae* (Cooke & Ellis) Sacc., Syll. Fung. (Abellini) 1: 557. 1882.
= *Ascochyta nepeticola* Melnik, Novosti Sist. Nizsh. Rast. 5: 178. 1968.
≡ *Phoma nepeticola* (Melnik) Dorenb. & Gruyter, Persoonia 18: 18. 2002.
Description (de Gruyter *et al.* 2002).

Specimen examined: **The Netherlands**, from the stem of *Nepeta catenaria*, deposited in CBS Mar. 2000, CBS 102635 = PD 77/1131.

Notes: This species was first reported from *Nepeta catenaria* in New Jersey, with ascospores described as biseriate, ellipsoidal, uniseptate, 20 × 8 µm (Cooke & Ellis 1877). The asexual and the sexual morphs were reported from the same host, with conidia (4–)5–7(–11.5) × 2.5–5 µm *in vitro*, and 8–15(–17) × (2.5–)3–(4.5–)5 µm *in vivo* (de Gruyter *et al.* 2002).

Xenodidymella humicola (J.C. Gilman & E.V. Abbott) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814151.
Basionym: *Phoma humicola* J.C. Gilman & E.V. Abbott, Iowa State Coll. J. Sci. 1: 266. 1927.
Description (de Gruyter *et al.* 1998).

Specimen examined: **USA**, Nevada, Death Valley, from a dead leaf of *Franseria* sp., deposited in CBS Apr. 1985, G.H. Boerema, CBS H-16390, culture CBS 220.85 = PD 71/1030.

Clade 16: *Neodidymelliopsis*

Neodidymelliopsis Q. Chen & L. Cai, **gen. nov.** MycoBank MB814066.

Etymology: Neo = νέο in Greek, new; in reference to the morphologically similarity with the genus *Didymella*.

Conidiomata pycnidial, globose to subglobose, ellipsoidal, later irregular, superficial on or immersed into the agar, solitary or confluent, ostiolate, or with an elongated neck. *Pycnidial wall* pseudoparenchymatous, 2–7-layered, outer wall pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, flask-shaped, ampulliform to short cylindrical. *Conidia* variable in shape, smooth- and thin-walled, *i.e.* ovoid to ellipsoidal, cylindrical, allantoid, hyaline to pale brown, or pale yellowish, usually aseptate or occasionally 1-septate *in vivo*, mostly guttulate. *Chlamydospores* observed in some species, intercalary or terminal, globose to oval, single or in chains, brown, smooth, sometimes dictyochlamydospores. *Ascomata* pseudothecial, immersed or erumpent, subglobose to pyriform, solitary or confluent, ostiolate. *Asci* cylindrical to clavate, sessile or stipitate, 8-spored, bitunicate. *Pseudoparaphyses* filamentous, 0(–3)-septate. *Ascospores* subovoid to oblong, ellipsoidal, hyaline, smooth, 1(–3)-septate, symmetrical or asymmetrical, constricted at the septum, bi- to triseriate.

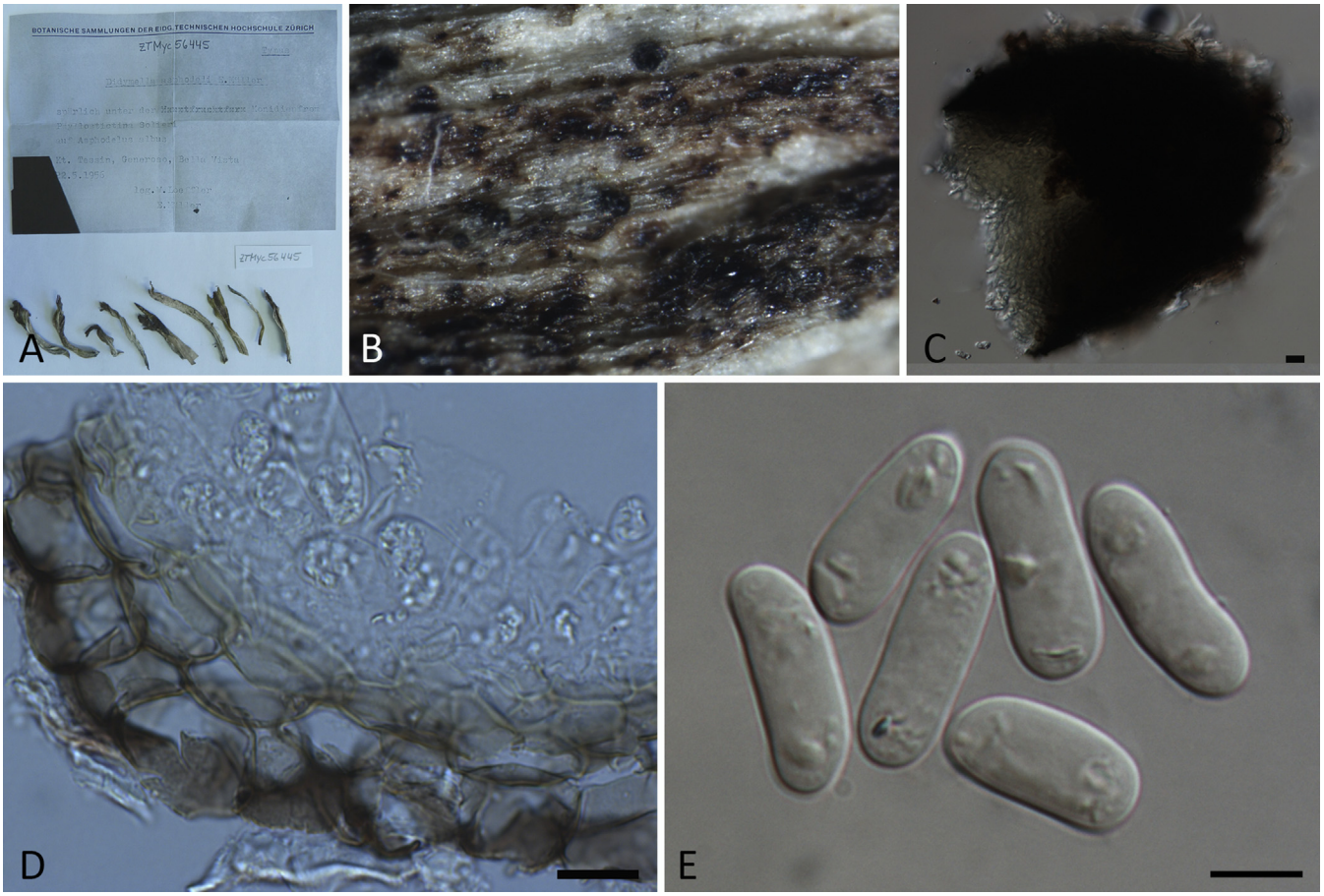

Fig. 38. *Xenodidymella asphodeli* (ZT Myc 56445). A. Type collection packet. B. Pycnidia on host substrate. C. Pycnidium. D. Section of pycnidial wall. E. Conidia. Scale bars: C = 20 µm; D–E = 10 µm.

Type species: *Neodidymelliopsis cannabis* (G. Winter) Q. Chen & L. Cai.

Neodidymelliopsis cannabis (G. Winter) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814152.

Basionym: *Sphaerella cannabis* G. Winter, Hedwigia 11: 145. 1872.
≡ *Didymella cannabis* (G. Winter) Arx, Beitr. Kryptogamenfl. Schweiz 11: 365. 1962.
= *Depazea cannabis* L.A. Kirchn., Lotos 6: 183. 1856.
≡ *Phoma cannabis* (L.A. Kirchn.) McPartl., Mycologia 86: 871. 1994.
= *Didymella urticicola* Aa & Boerema, Trans. Brit. Mycol. Soc. 67: 303. 1976.
= *Phoma urticicola* Aa & Boerema, Trans. Brit. Mycol. Soc. 67: 303. 1976.
Description and illustrations (McPartland 1994).

Specimens examined: **The Netherlands**, Baarn, from a leaf of *Urtica dioica*, Dec. 1967, H.A. van der Aa, CBS H-11956, culture CBS 591.67; Wageningen, from a dead stem tip of *Urtica dioica*, Mar. 1973, G.H. Boerema (**holotype** of "*Didymella urticicola*" CBS H-11971, culture ex-holotype CBS 121.75 = ATCC 32164 = IHEM 3403 = IMI 194767 = PD 73/584); Zeist, from packing material, Nov. 1976, G.A. Harrewijn, CBS H-11959, culture CBS 629.76. **Unknown origin**, from *Cannabis sativa*, deposited in CBS Oct. 1937, K. Röder, CBS 234.37.

Notes: *Cannabis* is the only known host of *Neod. cannabis*, and records of this species are mainly from countries in Eurasia and North America (McPartland 1994). Initially isolates CBS 121.75 and CBS 591.67 were respectively identified as "*Didymella urticicola*" and "*D. eupyrena*". Sequences of all four loci were identical to that of the authentic cultures of *Neod. cannabis* (CBS 629.76 and CBS 234.37). Furthermore, morphologically there were no significant differences between *D. urticicola* [conidia (3–)4–6.5(–8.5) × (1.5–)2–3(–3.5) µm; Boerema 1976] and *D. cannabis* (conidia 3–8 × 2–3 µm; McPartland 1994). We re-identified CBS 121.75 and CBS 591.67 as *Neod. cannabis*, and treated *Didymella urticicola* and its asexual morph *Phoma urticicola* as synonyms of *Neod. cannabis*. This new combination was proposed based on the sexual morph of the taxon, and the sexual-asexual connection should be further confirmed. A neotype of the asexual morph of *Neod. cannabis* was designated by McPartland (1994), which was from Germany and deposited in BPI. The asexual stage of *Neod. cannabis* often produces septate conidia *in vivo*, which was considered as a "pseudo-ascochyta" form. Although the oldest epithet for this species is that of *Depazea cannabis* L.A. Kirchn. 1856, we have been unable to confirm this synonymy.

Neodidymelliopsis polemonii (Cooke) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814153. Figs 40–41.

Basionym: *Phoma polemonii* Cooke, Grevillea 13: 94. 1885.

Description from isotype (K 197453): Caulicolous, associated with stem lesions. *Conidiomata* pycnidial, ellipsoidal to subglobose, on the surface of stems, 148–388 × 120–287 µm. *Ostiole* single, papillate. *Pycnidial wall* pseudoparenchymatous, 3–5-layered, 14.5–30.5 µm thick, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, 3.5–5.5 × 3.5–5 µm. *Conidia* ellipsoidal to cylindrical, thin-walled, smooth, hyaline, 4.5–7 × 2–3 µm, eguttulate.

Description from ex-epitype culture (CBS 109181): *Conidiomata* pycnidial, solitary or confluent, globose to subglobose, or irregular, covered with hyphal outgrowths, semi-immersed or immersed, 100–340 × 75–235 µm. *Ostioles*

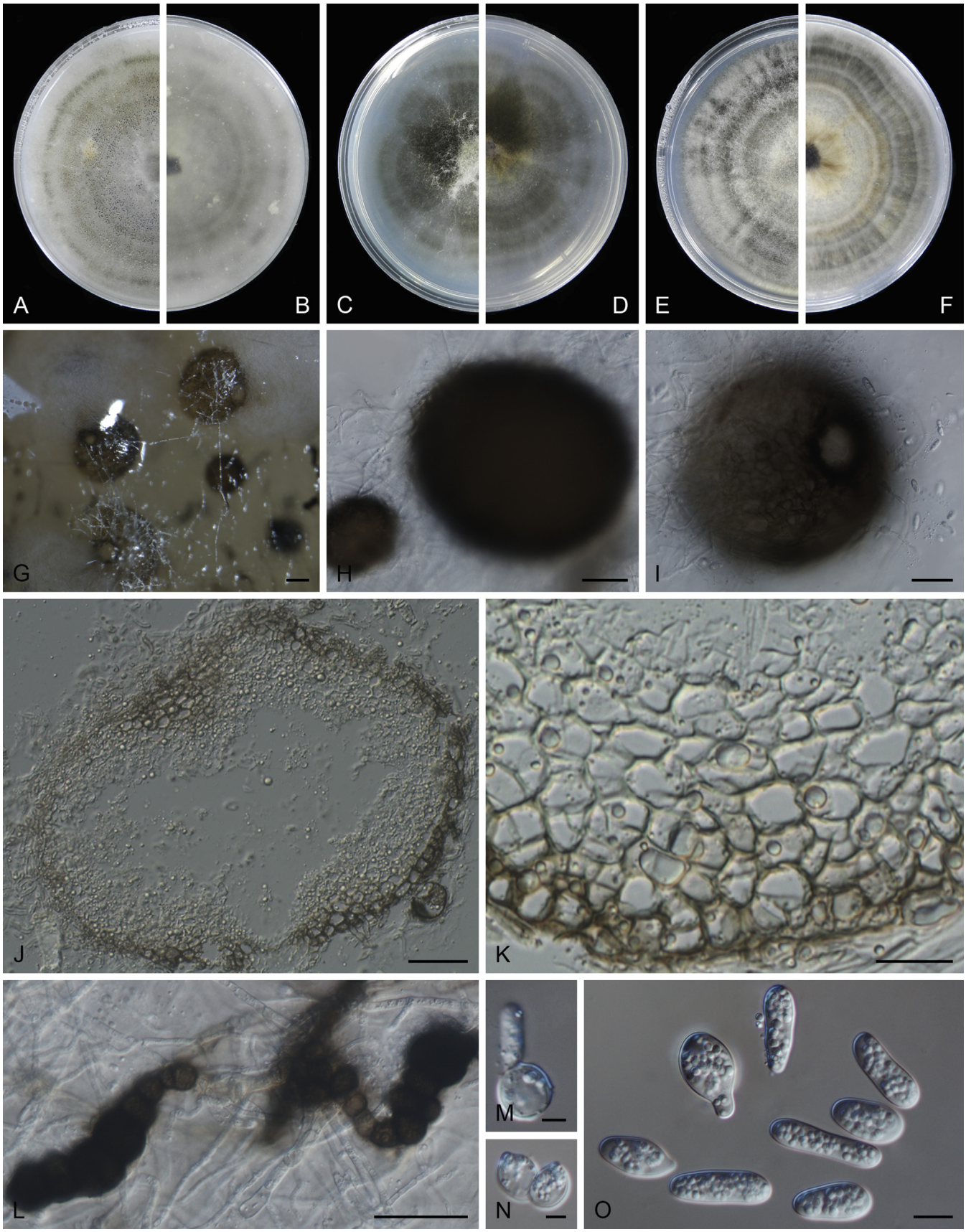

Fig. 39. *Xenodidymella asphodeli* (CBS 375.62). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H–I. Pycnidia. J. Pycnidial section. K. Section of pycnidial wall. L. Chlamydospores in chains. M–N. Conidiogenous cells. O. Conidia. Scale bars: G = 200 µm; H–J, L = 50 µm; K = 20 µm; M–N = 5 µm; O = 10 µm.

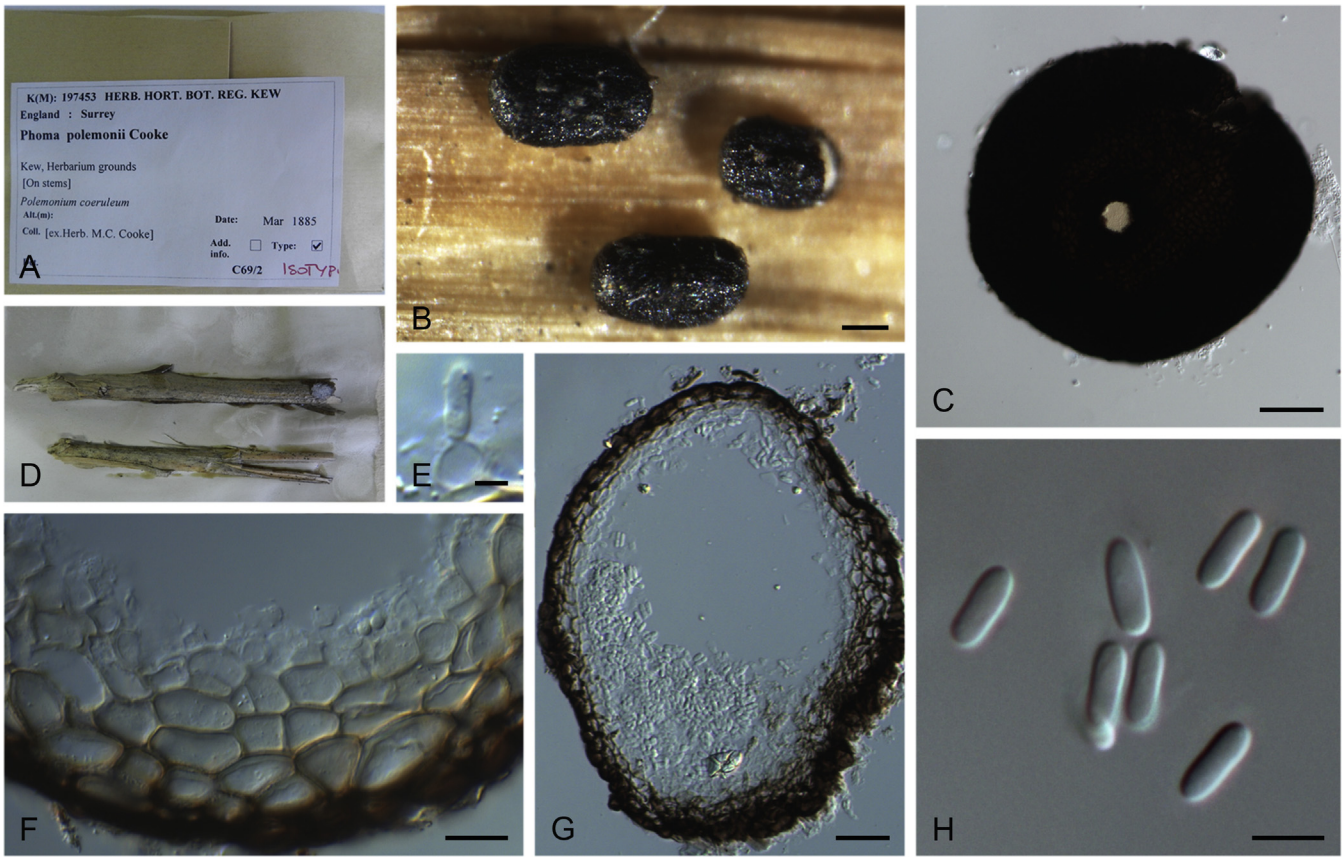

Fig. 40. *Neodidymelliopsis polemonii* (K 197453). A, D. Type collection packet. B. Pycnidia on host substrate. C. Pycnidium. E. Conidiogenous cells. F. Section of pycnidial wall. G. Section of pycnidium. H. Conidia. Scale bars: B = 200 µm; C = 50 µm; E = 2.5 µm; F–G = 10 µm; H = 5 µm.

1–3, with wide openings or developing to elongated necks, slightly papillate or non-papillate. *Pycnidial wall* pseudoparenchymatous, 2–7-layered, 14–19 µm thick, composed of oblong to isodiametric cells, outer layers pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 3.5–7 × 2.5–6 µm. *Conidia* ellipsoidal to cylindrical, sometimes allantoid, hyaline, smooth- and thin-walled, aseptate, 5.5–7(–7.5) × 1.5–3 µm, with 2(–4) small polar guttules. *Conidial matrix* whitish.

Culture characteristics: Colonies on OA, 30–35 mm diam after 7 d, margin regular, floccose, white, hazel near the colony margin; reverse buff, pale brown near the margin. Colonies on MEA 25–30 mm diam after 7 d, margin regular, floccose, white to pale olivaceous; reverse olivaceous. Colonies on PDA, 20–25 mm diam after 7 d, margin regular, floccose, white to pale greenish olivaceous; reverse dull green. NaOH test negative.

Specimens examined: **The Netherlands**, from *Polemonium caeruleum*, deposited in CBS Jan. 2001, H. de Gruyter, (**epitype designated here** HMAS 246687, MBT202509, culture ex-epitype CBS 109181 = PD 83/757); Valkenswaard, from *Polemonium caeruleum*, Oct. 1967, H.A. van der Aa, CBS H-9081, culture CBS 375.67. **UK**, Surrey, from stems of *Polemonium coeruleum*, Mar. 1885, M.C. Cooke (**isotype** K 197453).

Notes: According to the original literature, *Phoma polemonii* was described from the stems of *Polemonium caeruleum* in the UK, with ellipsoidal conidia, 10 × 3 µm. The conidial dimensions observed in the type specimen in K are 4.5–7 × 2–3 µm, which is quite different from the original description. We have repeated the measurement several times using 90 conidia in total, and confirmed the conidial dimensions of the isotype as 4.5–7 × 2–3 µm. Morphological characters of our selected epitype (HMAS 246687, ex-epitype CBS 109181) from *Polemonium caeruleum* are consistent with the isotype specimen, although 1-septate, larger conidia occasionally occur. Isolate CBS 375.67 was initially identified as "*Ascochyta polemonii*", but phylogenetically it clustered with *Neodidymelliopsis polemonii*, and was morphologically similar and from the same host, *Polemonium caeruleum*. Therefore, we re-identified this isolate as *Neod. polemonii*.

Neodidymelliopsis sp. 1

Specimen examined: **Canada**, British Columbia, from a leaf of *Achlys triphylla*, Jun. 1976, J. Gremmen, CBS 256.77.

Notes: Isolate CBS 256.77, originally identified as "*Ascochyta achlydis*", was phylogenetically distinct from other species in the genus *Neodidymelliopsis*. This isolate occurred on *Achlys triphylla*, which is the same original host of *Ascochyta achlydis*. Since the type of *Ascochyta achlydis* was unavailable, it was unclear if CBS 256.77 represented a new species, or was conspecific to *As. achlydis*.

Neodidymelliopsis sp. 2

Specimen examined: **Israel**, En Avdat, Negev desert, from soil in desert, Feb. 1996, A. van Iperen, CBS 382.96.

Notes: Isolate CBS 382.96, deposited as "*Ascochyta scotinospora*", represented a distinct lineage in the phylogenetic tree. Since the type of *As. scotinospora* was unavailable, it was

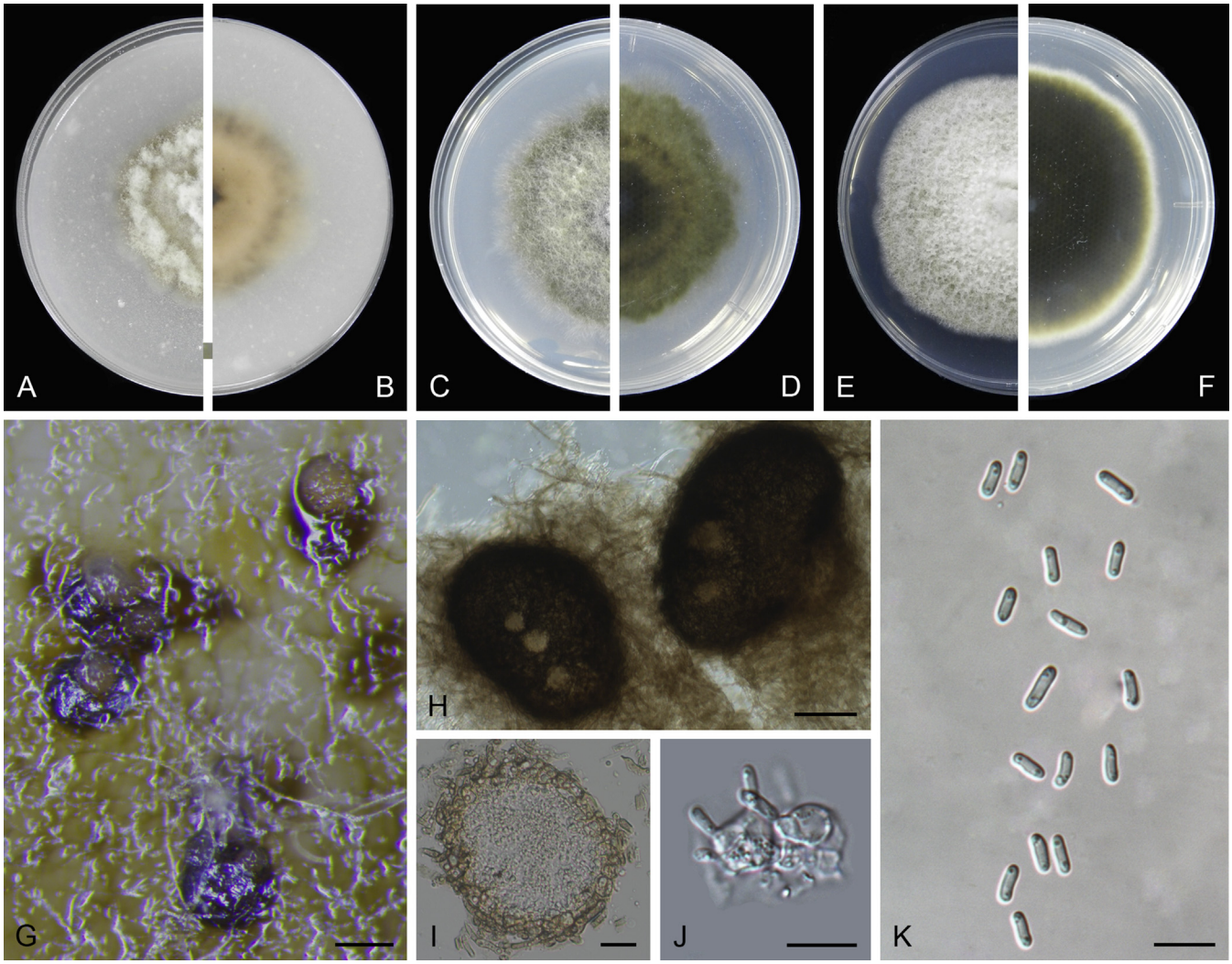

Fig. 41. *Neodidymelliopsis polemonii* (CBS 109181). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidia. I. Section of pycnidium. J. Conidiogenous cells. K. Conidia. Scale bars: G = 200 µm; H = 100 µm; I = 20 µm; J–K = 10 µm.

unclear if CBS 382.96 represented a new species, or was conspecific to *As. scotinospora*.

Neodidymelliopsis xanthina (Sacc.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814154. Fig. 42.

Basionym: *Phoma xanthina* Sacc., Michelia 1: 359. 1878.

≡ *Macrophoma xanthina* (Sacc.) Berl. & Voglino, Atti Soc. Veneto-Trentino. Sci. Nat. Padova 10: 181. 1887.

≡ *Ascochyta xanthina* (Sacc.) Petr. & P. Syd., Ann. Mycol. 22: 347. 1924.

Description from ex-neotype culture (CBS 383.68): *Conidiomata* pycnidial, solitary or confluent, globose to subglobose, glabrous, superficial on or immersed into the agar, (310–) 345–535(–600) × 285–530(–565) µm. *Ostioles* single, papillate. *Pycnidial wall* pseudoparenchymatous, 2–3-layered, 13–31 µm thick, composed of oblong to isodiametric cells. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform, 7–12.5 × 5.5–12.5 µm. *Conidia* ellipsoidal to allantoid, incidentally slight curved, smooth- and thin-walled, hyaline to pale yellowish, mainly aseptate, (5–)6.5–11.5 × 2–4.5 µm, with (0–) 2–12(–15) minute polar guttules, occasionally with larger 1-septate conidia. *Conidial matrix* pale brown.

Culture characteristics: Colonies on OA, 45–50 mm diam after 7 d, margin regular, floccose, white, pale grey to olivaceous near the centre; reverse grey-brown to hazel, white near the margin. Colonies on MEA 40–45 mm diam after 7 d, margin regular, floccose, white, pale greenish olivaceous near the centre; reverse concolourous. Colonies on PDA, 35–40 mm diam after 7 d, margin regular, floccose, whitish, black pycnidia visible near the centre and concentric rings; reverse buff in outer ring, darkening towards the centre of the colony via amber, hazel to brown zones. Application of NaOH resulted in a slight greenish to reddish discolouration.

Specimens examined: **The Netherlands**, Baarn, from leaves of *Delphinium* sp., May 1968, H.A. van der Aa (**neotype designated here** CBS H-8938, MBT202512, culture ex-neotype CBS 383.68); from a leaf of *Delphinium* sp., Jun. 1969, H.A. van der Aa, CBS H-8939, culture CBS 168.70.

Notes: The type of *Phoma xanthina* was from *Delphinium* sp. in France. Loan requests for the type specimen were unsuccessful, and we assume that it has been lost. De Gruyter (2002) provided a description of a representative culture of *P. xanthina* (CBS 383.68 from *Delphinium* sp. in the Netherlands), which was also examined in the present study. CBS 383.68 is chosen as neotype due to its morphological congruence with the original description of this species.

Isolate CBS 168.70 was previously identified as "*Ascochyta aquilegiae*", and found to cluster with *Neod. xanthina* in the

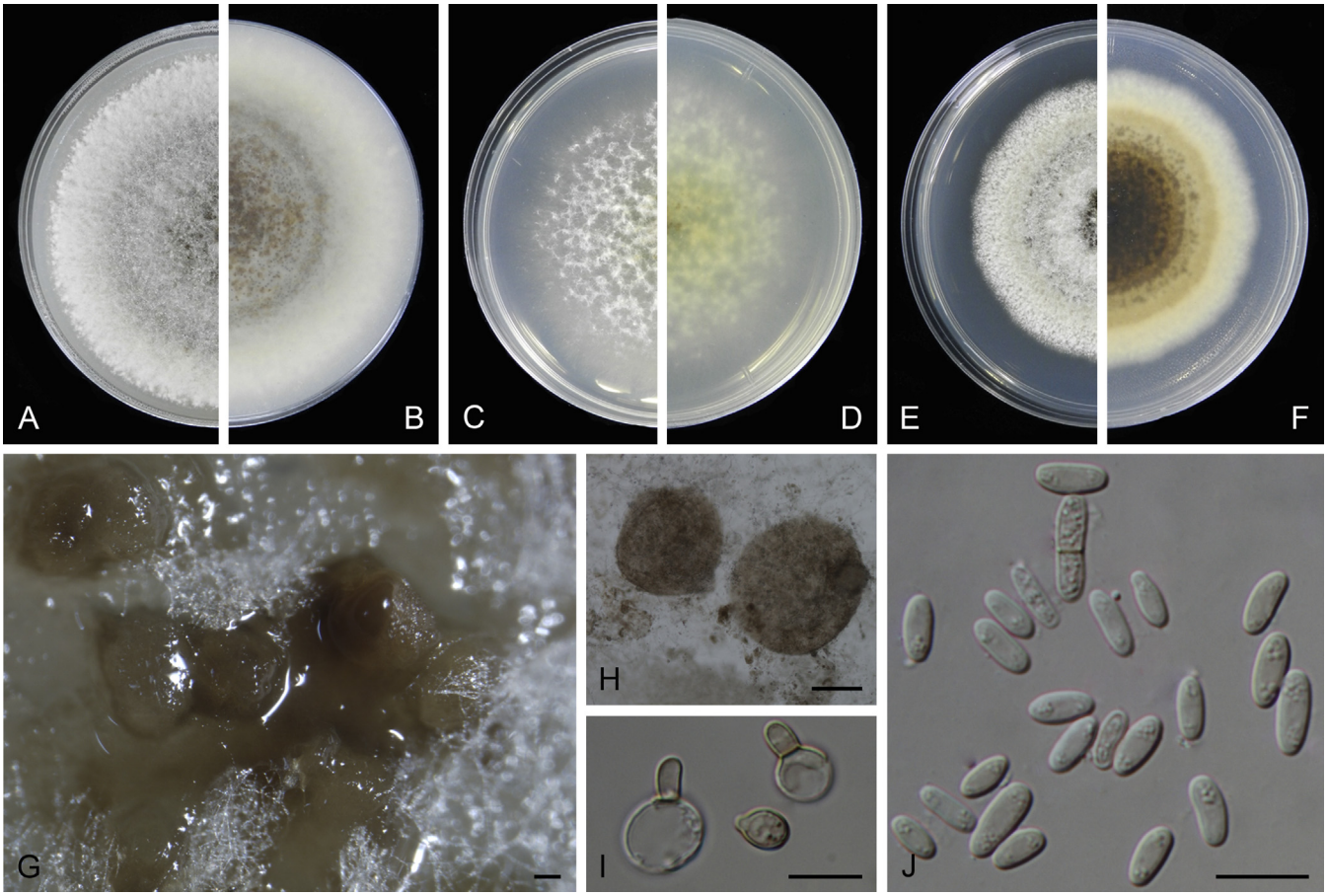

Fig. 42. *Neodidymelliopsis xanthina* (CBS 383.68). A–B. Colony on OA (front and reverse). C–D. Colony on MEA (front and reverse). E–F. Colony on PDA (front and reverse). G. Pycnidia forming on OA. H. Pycnidia. I. Conidiogenous cells. J. Conidia. Scale bars: G = 200 µm; H = 100 µm; I–J = 10 µm.

present phylogenetic study. Hence, it is considered as conspecific to *Neod. xanthina*.

Clade 17: *Nothophoma*

Nothophoma Q. Chen & L. Cai, **gen. nov.** MycoBank MB814060.

Etymology: *Notho* = nothus in Greek, fake, close but different; *phoma* = phoma-like morphology.

Conidiomata pycnidial, globose to elongated, or irregular, superficial on or immersed into the agar, solitary or confluent, ostiolate, sometimes with a short neck. *Pycnidial wall* pseudoparenchymatous, 2–9-layered, outer wall pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, sometimes flask-shaped. *Conidia* variable in shape, hyaline but incidentally brown, smooth- and thin-walled, aseptate, *i.e.* ovoid, oblong to ellipsoidal, eguttulate or guttulate.

Type species: *Nothophoma infossa* (Ellis & Everh.) Q. Chen & L. Cai.

Nothophoma anigozanthi (Tassi) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814084. Figs 11–12.

Basionym: *Phoma anigozanthi* Tassi, Bull. Labor. Ort. Bot. Siena 2: 148. 1899.

≡ *Phyllosticta anigozanthi* (Tassi) Allesch, Rabenh. Krypt.-Fl. [ed. 2], Pilze 7: 754. 1903.

Description from holotype (N 3622): *Leaf spots* elliptical to circular, black. *Pseudothecia* solitary, on the surface of leaves, brown, uniloculate, subglobose to globose, 85–125 × 70–100 µm, ostiolate. *Asci* obpyriform to fusiform, 55–73 × 17–26 µm, 8-spored, irregular uniseriate. *Ascospores* broadly fusiform to ellipsoidal, 14–20 × 3.5–5.5 µm, smooth, straight or slightly curved, hyaline, uniseptate, slightly constricted at the septum, guttulate, upper cells usually broader and longer than the lower cells.

Description from ex-epitype culture (CBS 381.91): *Conidiomata* pycnidial, solitary or aggregated, globose to subglobose, glabrous, olivaceous buff, superficial on or semi-immersed in the agar, (65–)70–130 µm diam; conidiomata with age becoming black, broadly globose to irregular, with some white hyphal outgrows and with a clear elongated neck around the ostioles, (145–)155–280(–300) × (120–)140–230(–250) µm. *Ostioles* 1–4(–6), on a distinctly elongated neck (up to 170 µm). *Pycnidial wall* pseudoparenchymatous, 3–6-layered, 16–41 µm thick, composed of isodiametric cells, outer wall 2–3-layered, pigmented. *Conidiogenous cells* phialidic, hyaline, smooth, ampulliform to doliiform, 5–9 × 4.5–7.5 µm. *Conidia* ellipsoidal, smooth- and thin-walled, aseptate, 3.5–5 × 1.5–2.5 µm, sometimes with several very small guttules. *Conidial matrix* creamy white.

Culture characteristics: Colonies on OA, 40–45 mm diam after 7 d, margin regular, powdery due to the abundant pycnidia produced in concentric rings, olivaceous to grey olivaceous; reverse concolourous. Colonies on MEA 40–45 mm diam after

7 d, margin regular, flattened, greenish olivaceous, pale salmon near the margin; reverse concolourous. Colonies on PDA, similar as on OA, but somewhat slower growing, 30–35 mm diam after 7 d, hazel to olivaceous. NaOH spot test: a luteous discolouration on MEA, later changing to dull green to vinaceous-black, from the centre to outer ring.

Specimen examined: **Italy**, on leaves of *Anigozanthos flavidus*, Feb. 1862 (**holotype** N 3622 in SIENA). **The Netherlands**, from a leaf of *Anigozanthus maugleisii*, deposited in CBS Jun. 1991, H. Cevat (**epitype designated here** CBS H-5199, MBT202498, culture ex-epitype CBS 381.91 = PD 79/1110).

Notes: The original description of *Phoma anigozanthi* indicated that this fungus produces aseptate conidia, 4–4.5 × 2 µm, which is in agreement with our observation of the specimen CBS H-5199 (3.5–5 × 1.5–2.5 µm). CBS H-5199 is therefore designated as epitype. *Sphaerella millepunctata* was recorded as the spermogonial state of *Nothophoma anigozanthi* (syn. *Phoma anigozanthi*; Saccardo 1902), and we did observe the asci and ascospores from the holotype of "*Phoma anigozanthi*" from *Anigozanthos flavidus* preserved in herbarium SIENA in Italy. An emended description of the sexual morph of *P. anigozanthi* is therefore provided.

Nothophoma arachidis-hypogaeae (V.G. Rao) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814085.
Basionym: *Phyllosticta arachidis-hypogaeae* V.G. Rao, Sydowia 16: 275. 1962 (1963).
≡ *Phoma arachidis-hypogaeae* (V.G. Rao) Aa & Boerema, Persoonia 15: 388. 1993.
Description (de Gruyter *et al.* 1993).

Specimens examined: **India**, Poona, from leaves of *Arachis hypogaea*, Sep. 1962, V. Rao (**holotype** M.A.C.S. No. 134); Madras, from a leaf of *Arachis hypogaea*, deposited in CBS Jan 1993, J, de Gruyter, CBS 125.93 = PD 77/1029.

Notes: *Nothophoma arachidis-hypogaeae* clustered with *No. infossa* (CBS 123395), but they can be distinguished based on morphology and phylogeny. Conidia of *No. arachidis-hypogaeae* are narrower than that of *No. infossa* (3.2–5.2 × 1.8–2.4 µm *vs.* 4.5–6 × 2.5–3.5 µm) (de Gruyter *et al.* 1993, Aveskamp *et al.* 2009a). In the four sequenced loci, CBS 125.93 differs from CBS 123395 in 20 bp.

Nothophoma gossypiicola (Gruyter) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814087.
Basionym: *Phoma gossypiicola* Gruyter, Persoonia 18: 96. 2002.
Description (de Gruyter 2002).

Specimen examined: **USA**, Texas, from a leaf of *Gossypium* sp., deposited in CBS Aug. 1967, G.H. Boerema, CBS H-9006, culture CBS 377.67.

Notes: This species was first described as *Ascochyta gossypii* Woron. in 1914, the holotype of which was collected by N. Woronichin on leaves of *Gossypium* sp. near Abazinka, the former Soviet Union (de Gruyter 2002). However, this name was illegitimate and replaced by a *nomen novum*, *Phoma gossypiicola* (de Gruyter 2002). Here this species is transferred to the new genus *Nothophoma*.

Nothophoma infossa (Ellis & Everh.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814088.
Basionym: *Phoma infossa* Ellis & Everh., J. Mycol. 4: 102. 1888.
Description and illustrations (Aveskamp *et al.* 2009a).

Specimen examined: **Argentina**, Buenos Aires Province, La Plata, from leaves of *Fraxinus pennsylvanica*, 2008, A.E. Perello (**neotype** CBS H-20145, culture ex-neotype CBS 123395).

Nothophoma quercina (Syd.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814086.
Basionym: *Cicinobolus quercinus* Syd., Ann. Mycol. 13: 42. 1915.
≡ *Ampelomyces quercinus* (Syd.) Rudakov, Mikol. Fitopatol. 13: 109. 1979.
≡ *Phoma fungicola* Aveskamp *et al.*, Stud. Mycol. 65: 26. 2010.
Description (Aveskamp *et al.* 2010).

Specimen examined: **Ukraine**, Crimea, in the vicinity of Feodosiya, on *Microsphaera alphitoides* from *Quercus* sp., deposited in CBS Dec. 1992, CBS H-20276, culture CBS 633.92 = ATCC 36786 = VKM MF-325.

Notes: This species, originally published as *Cicinobolus quercinus*, was transferred to *Ampelomyces*, and later treated as a *nomen novum* in the genus *Phoma* by Aveskamp *et al.* (2010). According to the phylogenetic analysis in the present study, it clustered in the *Nothophoma* clade, and thus *Nothophoma quercina* was proposed as a new combination.

Microsphaeropsidaceae Q. Chen, L. Cai & Crous, **fam. nov.** MycoBank MB814155.

Conidiomata pycnidial, immersed or erumpent, subglobose, solitary or confluent, ostiolate. *Pycnidial wall* of *textura angularis*. *Conidiogenous cells* phialidic, hyaline, ampulliform to doliiform or subcylindrical, or somewhat irregular. *Conidia* thin-walled, smooth or (sometimes) with ornamentations, pale brown to yellowish or greenish brown, variable in shape, ovoid, globose, cylindrical to bacilliform, ellipsoidal to oblong, 0–1-septate.

Type genus: *Microsphaeropsis* Höhn., Hedwigia 59: 267. 1917.

Microsphaeropsis Höhn., Hedwigia 59: 267. 1917.

Conidiomata pycnidial, immersed or erumpent, subglobose, solitary or confluent, ostiolate. *Pycnidial wall* of *textura angularis*. *Conidiogenous cells* phialidic, hyaline, ampulliform to doliiform or subcylindrical, with a prominent apical periclinal thickening. *Conidia* thin-walled, smooth or finely roughened, hyaline when young, becoming pale brown to yellowish or greenish brown, variable in shape, ovoid, globose, cylindrical to bacilliform, ellipsoidal to oblong, straight to slightly curved, 0–1-septate.

Type species: *Microsphaeropsis olivacea* (Bonord.) Höhn., Hedwigia 59: 267. 1917.

Notes: *Microsphaeropsis* was established by von Höhnel, and was originally placed in the *Montagnulaceae* (von Höhnel 1917). Our phylogenetic analysis clearly indicated that *Microsphaeropsis* is basal to *Didymellaceae*, from which it appears to have a significant evolutionary distance. Conidia of *Microsphaeropsis* usually differ from those of *Didymellaceae* in surface ornamentation and darker colour. For this reason the

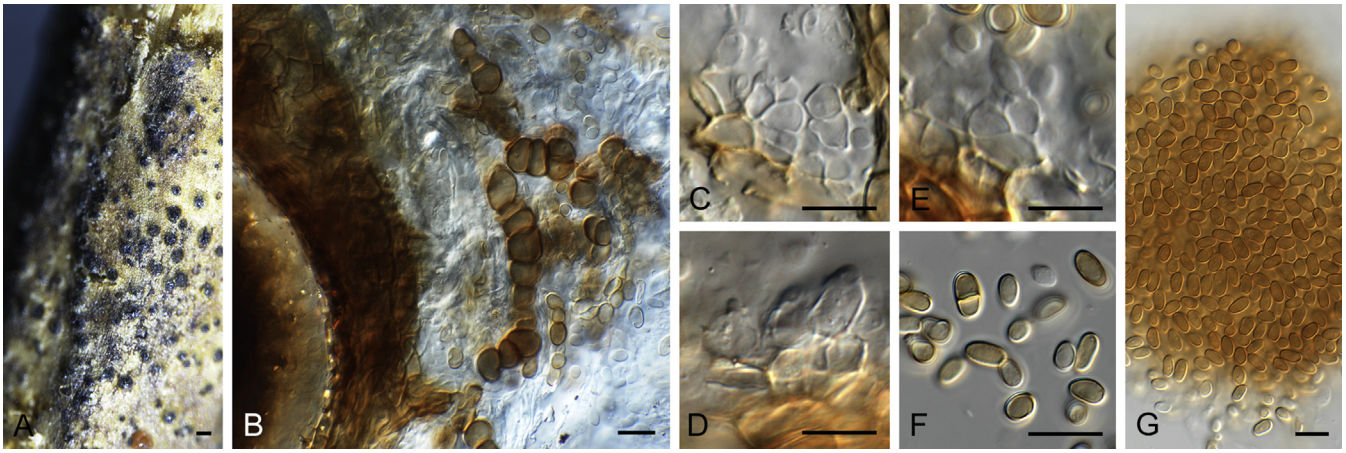

Fig. 43. *Microsphaeropsis olivacea* (BPI 797151). A. Conidiomata on host tissue. B. Section through conidiomatal wall, showing chains of chlamydospores. C–E. Conidiogenous cells. F. Brown, 0(–1)-septate conidia. G. Aseptate conidia. Scale bars: A = 200 µm; B–G = 10 µm.

Microsphaeropsidaceae is herewith introduced to accommodate *Microsphaeropsis*.

Microsphaeropsis olivacea (Bonord.) Höhn., Hedwigia 59: 267. 1917. Fig. 43.
Basionym: *Coniothyrium olivaceum* Bonord., Jahrb. Nassauischen Vereins Naturk. 23–24: 377. 1869.

Description from holotype (BPI 797151): *Conidiomata* pycnidial, up to 200 µm diam, solitary, dark brown, immersed, becoming erumpent and somewhat papillate at central ostiole, up to 80 µm diam. *Pycnidial* wall pseudoparenchymatous, 4–8-layered, of *textura angularis*, brown, giving rise to chains of brown chlamydospores extending into the host tissue, brown, smooth, thick-walled, ellipsoidal to globose, 6–10 µm diam. *Conidiophores* reduced to conidiogenous cells lining the inner cavity of conidioma. *Conidiogenous cells* hyaline, smooth, subcylindrical to doliiform, 5–7 × 4–7 µm; apex with prominent periclinal thickening. *Conidia* solitary, initially hyaline, smooth, becoming pale brown and finely roughened, 1–2-guttulate, ellipsoidal to subcylindrical with obtuse ends, straight to slightly curved, 0(–1) septate, (5–)6–7(–8.5) × (3–)3.5–4 µm.

Specimens examined: **Austria**, on stem of *Hedera helix* (**holotype** BPI 797151, ex herb. Fuckel, ex herb. Boiss). **France**, Nancy, from needles of *Pirus laricio*, deposited in CBS Apr. 1977, M. Morelet, CBS H-10854, culture CBS 233.77. **The Netherlands**, Valkenswaard, from dead twigs and pods of *Sarothamnus* sp., Feb 1971, H.A. van der Aa, CBS H-10870, culture CBS 432.71.

Notes: The two cultures studied here closely resemble *M. olivacea*, in having smooth to finely roughened, pale brown, ellipsoidal to subcylindrical, straight to slightly curved conidia, (5–)6–7 × 3–4 µm (*in vitro*). Because they occur on different hosts, however, we refrain from designating any one of these isolates as ex-epitype.

Microsphaeropsis proteae (Crous & Denman) Crous & Denman, Persoonia 27: 32. 2011.
Basionym: *Coniothyrium proteae* Crous & Denman, S. African J. Bot. 64: 139. 1998.
Description and illustrations (Crous *et al.* 2011).

Specimen examined: **South Africa**, Western Cape Province, from *Protea nitida*, Aug. 1996, S. Denman (culture **ex-type** CBS 111319 = CPC 1425).

DISCUSSION

This study was prompted by the question of how to delineate natural genera in the *Ascochyta-Didymella-Phoma* complex, which represents a dilemma to plant pathologists and mycologists alike (Chilvers *et al.* 2009, Aveskamp *et al.* 2010, Hyde *et al.* 2013). Based on the previous studies by Aveskamp *et al.* (2009a, b, 2010) and de Gruyter *et al.* (2009, 2012), we combined the multi-locus data of *rpb2* with LSU, ITS and *tub2* for phylogenetic analysis, and added more isolates of previously unstudied species. The topology of the single *rpb2* phylogeny is highly similar to the combined four loci tree. In this regard, the *rpb2* gene showed better resolution at the species and generic level than ITS, LSU or *tub2*. Unfortunately, the success rate of the amplification of *rpb2* was not satisfactory.

The family *Didymellaceae* was established to accommodate the majority of species in *Phoma s. lat.* and related genera by de Gruyter *et al.* (2009), based on its type genus *Didymella*. Aveskamp *et al.* (2010) revised the taxonomy of some monophyletic clades in *Didymellaceae*. An interesting result generated in the present study was that a well-supported clade comprising *Microsphaeropsis* species clustered outside the *Didymellaceae*. That was inconsistent with previous studies, which indicated that the type species of *Microsphaeropsis*, *Mi. olivacea*, grouped in *Didymellaceae* (de Gruyter *et al.* 2009, 2012, Aveskamp *et al.* 2010). This is not so surprising, as previous studies were mostly based on LSU / SSU (e.g. de Gruyter *et al.* 2009) which lacked necessary resolution at genus level and resulted in unresolved polytomies (e.g. Aveskamp *et al.* 2010). *Microsphaeropsis* is characterised by small, predominantly aseptate conidia, formed on pycnidial phialides, which are morphologically similar to some species of *Phoma* and *Coniothyrium* (Jones 1976, Carisse & Bernier 2002). However, *Microsphaeropsis* produces pale greenish brown, finely roughened conidia, that differ significantly from the mainly hyaline, smooth conidia observed in *Phoma* species, and the usually 0–1-septate, verrucose conidia produced from annellides in *Coniothyrium s. str.* (Morgan-Jones 1974, Carisse & Bernier 2002, Aveskamp *et al.* 2010, de Gruyter *et al.* 2012). Additionally, in the study of de Gruyter *et al.* (2012), *Coniothyrium s. str.* clustered with the type genus *Leptosphaeria* in *Leptosphaeriaceae*, which was in agreement with the results obtained in the present study. Since many species of *Microsphaeropsis* are still unknown from culture

or DNA sequence, further work is needed to resolve species boundaries in this genus.

The genera *Boeremia*, *Leptosphaerulina*, *Macroventuria* and *Stagonosporopsis* cluster in *Didymellaceae*, which agrees with the results of Aveskamp *et al.* (2010). Five *Phoma* species lacking of chlamydospores were also included in *Epicoccum*. Species in the former genus *Peyronellaea* and some that resided in several other lineages (named Groups G, H, I, J *sensu* Aveskamp *et al.* 2010) were recombined into *Didymella*. Furthermore, we demarcated the genera *Ascochyta*, *Didymella* and *Phoma* on the basis of their phylogeny of their respective generic type species, whilst we also introduced nine new genera, which were well-supported in the molecular phylogenetic analyses, *i.e. Allophoma*, *Calophoma*, *Heterophoma*, *Neoascochyta*, *Neodidymelliopsis*, *Nothophoma*, *Paraboeremia*, *Phomatodes* and *Xenodidymella*. Among the currently studied 17 genera in *Didymellaceae*, with the exception of *Didymella*, the sexual morph is only known from nine genera, *i.e. Ascochyta*, *Leptosphaerulina*, *Macroventuria*, *Neoascochyta*, *Neodidymelliopsis*, *Paraboeremia*, *Phoma*, *Stagonosporopsis* and *Xenodidymella*. Presently, all former *Didymella* species are known from their sexual morphs, although this will change as asexual taxa can now also be accommodated in this genus. The delimitation of *Ascochyta*, *Didymella* and *Phoma* is clarified by the present findings, in which the type species are separated into distinct monophyletic lineages, and all three genera were linked to sexual morphs.

The genera *Ampelomyces*, *Ascochyta* (de Gruyter *et al.* 2009, Aveskamp *et al.* 2010), *Boeremia* (Aveskamp *et al.* 2010), *Chaetasbolisia* (de Gruyter *et al.* 2009, Aveskamp *et al.* 2010, Wijayawardene *et al.* 2012, Zhang *et al.* 2012), *Dactuliochaeta* (Wijayawardene *et al.* 2012, Zhang *et al.* 2012), *Didymella*, *Epicoccum*, *Leptosphaerulina*, *Macroventuria*, *Microsphaeropsis*, *Peyronellaea*, *Phoma* (Aveskamp *et al.* 2010), *Piggotia*, *Pithoascus* (Wijayawardene *et al.* 2012, Zhang *et al.* 2012) and *Stagonosporopsis* (Aveskamp *et al.* 2010) were formerly placed in the family *Didymellaceae*. However, *Ampelomyces*, with the type species *Ampelomyces quisqualis*, was accommodated in *Phaeosphaeriaceae* (de Gruyter *et al.* 2009); *Chaetasbolisia* needs to be restudied including more taxa (Aveskamp *et al.* 2010); *Microsphaeropsis* grouped sister to the *Didymellaceae* in the *Microsphaeropsidaceae* in the present study; *Pithoascus* was recently placed in *Microascaceae* (Sandoval-Denis *et al.* 2016); while *Dactuliochaeta* and *Piggotia* require more molecular data to validate their taxonomic placements (Hyde *et al.* 2013). Hence, it was not possible to presently accept these three doubtful genera (*Chaetasbolisia*, *Dactuliochaeta* and *Piggotia*) in *Didymellaceae*. Moreover, *Platychora* was previously assigned to *Venturiaceae* (Barr 1968), but in a later study by Winton *et al.* (2007) and Zhang *et al.* (2012), the generic type *Platychora ulmi* was shown to cluster in *Didymellaceae*. This genus and the type species should also be re-evaluated based on new collections and epitypification (Zhang *et al.* 2012). We concluded that 17 genera *viz*. *Allophoma*, *Ascochyta*, *Boeremia*, *Calophoma*, *Didymella*, *Epicoccum*, *Heterophoma*, *Leptosphaerulina*, *Macroventuria*, *Neoascochyta*, *Neodidymelliopsis*, *Nothophoma*, *Paraboeremia*, *Phoma*, *Phomatodes*, *Stagonosporopsis* and *Xenodidymella* can presently be supported as members of *Didymellaceae*.

Morphological characteristics have proven to be relatively conserved in *Phoma s. lat.*, including features such as shape and dimensions of pycnidia, conidiogenous cells and conidia. The relatively simple asexual morphological features of these species could not provide sufficient distinctions for species delimitation. Although these species clustered in different phylogenetic lineages, they share some overlapping morphological features (Table 2), which is similar to the situation in the genus *Septoria* for which it was concluded that reliable identification in future should be based on DNA sequence data linked to morphology and ecology (Quaedvlieg *et al.* 2013, Verkley *et al.* 2013).

In previous years, conidiogenesis and conidial septation used to be regarded as the most important criteria to discriminate species of *Phoma* and allied genera, especially between *Ascochyta* and *Phoma* (Morgan-Jones 1974, Boerema & Bollen 1975, Jones 1976, Punithalingam 1979a, de Gruyter *et al.* 2009, 2012, Aveskamp *et al.* 2010). However, conidiogenesis of species in the same genus was later found to differ, such as the annellidic conidiogenous cells in *As. pisi* (Boerema & Bollen 1975), versus the phialidic conidiogenous cells in *As. fabae* (Punithalingam 1975). Punithalingam (1979a) elucidated that the annellidic state was the initial stage during pycnidial development in *Ascochyta*, and that the phialidic state was the final stage that could be observed once pycnidia matured. Under the conditions employed in the present study, we observed all species accommodated in the *Didymellaceae* to exhibit phialidic conidiogenesis.

Several species belonging to phoma-related genera are known to exhibit some level of host-specificity. For instance, *Ascochyta fabae* showed pathogenic specialisation for faba bean (*Vicia faba*), while *As. lentis* is specific to lentil (*Lens culinaris*) (Kaiser *et al.* 1997), *Nothophoma infossa* (syn. *Phoma infossa*) is often associated with ash trees (*Fraxinus* sp.) and *No. gossypiicola* (syn. *Phoma gossypiicola*) is reported only on cotton plants (*Gossypium* spp.) (Aveskamp *et al.* 2010). However, not all fungal-host associations in *Didymellaceae* are clearly defined. Although the strains used in the present study were collected globally, cultures for each species are still limited in number and mainly arise from collections made in Europe and the USA. Generally, Asia, Africa and Latin America have been rather poorly represented in previous studies. For many old names, ex-type cultures are lacking, and holotype specimens could not be traced. To truly elucidate the taxonomy of phoma-like genera, therefore, a conserted global effort is called for not only to recollect previously described species, but also to add isolates from continents that have been largely neglected or under-sampled by mycologists and plant pathologists in the past.

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