Resolving the *Phoma* enigma

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**Abstract:** The Didymellaceae was established in 2009 to accommodate Ascoscytha, 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. Ascoscytha 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-focus 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 neotype were designated to help stabilise the taxonomy and use of names. As a result of these data, Ascoscytha, Didymella and Phoma were delineated as three distinct genera, and the generic circumscripts of Ascoscytha, 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 Microsphaeropodaceae was introduced.

**Key words:** Ascoscytha, Didymella, Multi-focus phylogeny, Phoma, Taxonomy.

**Taxonomic novelties:** New family: Microsphaeropodaceae Q. Chen, L. Cai & Crous; New genera: Allophoma Q. Chen & L. Cai, Calophoma Q. Chen & L. Cai, Heterophoma Q. Chen & L. Cai, Neosacrophora Q. Chen & L. Cai, Neodidymella Q. Chen & L. Cai, Paraboeremia Q. Chen & L. Cai, Phoma Q. Chen & L. Cai, Phomatoses Q. Chen & L. Cai, Xerodidymella Q. Chen & L. Cai; New species: Allophoma micragaenum Q. Chen & L. Cai, Phoma neerlandica Q. Chen & L. Cai, Stagonosporopsis helianthi Q. Chen & L. Cai; New combinations: Allophoma labalis (Sacc.) Q. Chen & L. Cai, All. minor (Aveskamp et al.) Q. Chen & L. Cai, All. piperis (Tassi) Q. Chen & L. Cai, All. tropica (R. Schnide & Boerema) Q. Chen & L. Cai, Allophoma herbicola (Wehm.) Q. Chen & L. Cai, As. medicaginica var. macrospora (Boerema et al.) Q. Chen & L. Cai, Calophoma alaquigecilica (M. Petrov) Q. Chen & L. Cai, Ca. clermatidina (Thüm.) Q. Chen & L. Cai, Ca. clermatidis-recta (Petr.) Q. Chen & L. Cai, Ca. complanata (Tode) Q. Chen & L. Cai, Ca. glauci (Brunaud) Q. Chen & L. Cai, Ca. vladai (E. Mull.) Q. Chen & L. Cai, Didymella acerosellae (A.L. Sm. & Rams.) Q. Chen & L. Cai, D. aliena (Fr.) Q. Chen & L. Cai, D. americana (Moran-Jones & J.F. White) Q. Chen & L. Cai, D. anserina (Marchal.) Q. Chen & L. Cai, D. aurea (Gryter et al.) Q. Chen & L. Cai, D. bellidis (Neerg.) Q. Chen & L. Cai, D. boeremae (Gryter) Q. Chen & L. Cai, D. calidophila (Aveskamp et al.) Q. Chen & L. Cai, D. chenopodi (P. Karst. & Har.) Q. Chen & L. Cai, D. coffeeae-arabicae (Aveskamp et al.) Q. Chen & L. Cai, D. curtisi (Ber.) Q. Chen & L. Cai, D. dactylidys (Aveskamp et al.) Q. Chen & L. Cai, D. dimerph (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. longicola (Aveskamp et al.) Q. Chen & L. Cai, D. maccrostoma (Mont.) Q. Chen & L. Cai, D. maedus (Army & R.R. Nelson) Q. Chen & L. Cai, D. microchlamydospora (Aveskamp & Verkley) Q. Chen & L. Cai, D. molleri (G. Winter) Q. Chen & L. Cai, D. musae (P. Joly) Q. Chen & L. Cai, D. neugallia (Thüm.) Q. Chen & L. Cai, D. nigricans (P.R. Johnst. & Boerema) Q. Chen & L. Cai, D. pedeidea (Aveskamp et al.) Q. Chen & L. Cai, D. pinodella (L.K. Jones) Q. Chen & L. Cai, D. poromor (Thüm.) Q. Chen & L. Cai, D. protuberans (Lév.) Q. Chen & L. Cai, D. rhei (Ellis & Everh.) Q. Chen & L. Cai, D. rubricula (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. subharbarum (Gryter et al.) Q. Chen & L. Cai, D. vibricola (Oudem.) Q. Chen & L. Cai, Epicoccum brasiliense (Aveskamp et al.) Q. Chen & L. Cai, E. draconis (Berkin & Cocks) Q. Chen & L. Cai, E. henningisi (Sacc.) Q. Chen & L. Cai, E. huayucayense (Turk.) Q. Chen & L. Cai, E. plurinorum (P.R. Johnst.) Q. Chen & L. Cai, Heterophoma adonis (Moesz) Q. Chen & L. Cai, H. nobilis (Kabat & Bubaki) Q. Chen & L. Cai, H. novae-verbascicae (Aveskamp et al.) Q. Chen & L. Cai, H. pollenis (Taubenh.) Q. Chen & L. Cai, H. sylvatica (Sacc.) Q. Chen & L. Cai, Neoascoscytha desmazeria (Cavara) Q. Chen & L. Cai, Neoacaeae (Punith) Q. Chen & L. Cai, Neoacaeae (Morini) Q. Chen & L. Cai, Neoa. gramicinica (Punith) Q. Chen & L. Cai, Neoacaeae (Punith) Q. Chen & L. Cai, Neodidymella cannavisa (As & Boerema) Q. Chen & L. Cai, Neod. poloneml (Cooke) Q. Chen & L. Cai, Neod. xanthina (Sacc.) Q. Chen & L. Cai, Notophoma angiosanthis (Tassi) Q. Chen & L. Cai, No. arachidis-hyposgiae (V.G. Rao) Q. Chen & L. Cai, No. gossypicola (Gryter) Q. Chen & L. Cai, No. infossa (Ellis & Everh.) Q. Chen & L. Cai, No. quaerincia (Syd.) Q. Chen & L. Cai, Paraboeremia adianticola (As & Boerema) Q. Chen & L. Cai, Pa. putaminum (Speng.) Q. Chen & L. Cai, Pa. salaginellae (Sacc.) Q. Chen & L. Cai, Phomatoses (Moese) Q. Chen & L. Cai, Phom. nebulosa (Pers.) Q. Chen & L. Cai, Xerodidymella applanata (Nessl) Q. Chen & L. Cai, X. asphodeli (E. Mull) Q. Chen & L. Cai, X. catarrinae (Cooke & Ellis) Q. Chen & L. Cai, N. humicica (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 1880), 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).
Although Boerema et al. (2004) subdivided the genus Phoma into nine sections (i.e. Phoma, Heterospora, Paraphoma, Peyronellaea, Phylllostictoides, 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, Phylllostictoides 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, Phylllostictoides and Sclerophomella were further assessed, resulting in many species being reclassified in existing genera (e.g. Didymella, Stagonosporopsis, or transferred to Boeremia, Epiconicum 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, Selenophoma (Phaeosphaeriaceae), Pyrenoacheta and Pyrenoachetopsis (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 Chaetosphaeronomia (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 Pleosporales (Aveskamp et al. 2010, de Gruyter et al. 2012).

The genus Ascochyta was established by Libert in 1830, and typified by As. psii (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 conidigenesis 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 pericinclus 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 mycologists, 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 M ycosphe rae llae, and then placed in the Pleosporaceae, Phaeosphaer iaceae, or 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 assexual 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 (Chivers 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.
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).

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 conidigenous cells, measurements were taken from 5–10 samples. Observations were conducted with a Leica M125 dissecting microscope and with a Zeiss Axioskope 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 conidigenous 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 μL 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 LRS (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 | Status | Host, substrate | Country        | GenBank accession numbers |
|--------------------------|------------------------|---------------|--------|-----------------|-----------------|----------------------------|
| **All. minor**           | Phoma minor            | CBS 325.82    | T      | **S. lycopersicum** | Indonesia       | GU238107 GU237831 KT389553 GU237632 |
|                          |                        | 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      | **P. pereskiiifolia** | The Netherlands | GU238129 GU237816 KT389554 GU237644 |
| **All. tropica**         | Phoma tropica          | CBS 108.93; PD 90/2011 | T      | Peperomia sp. | The Netherlands | GU238130 GU237921 KT389555 GU237645 |
| **All. zantedeschiae**   | Phoma zantedeschiae    | CBS 131.93; PD 69/140 | T      | **C. ionantha** | Germany         | GU238149 GU237864 KT389556 GU237663 |
| **All. nigripycnidia**   | Phoma nigripycnidia    | CBS 116.96; PD 95/7930 | T      | Vicia cracca | Russia          | GU238118 GU237756 — GU237637 |
| **As. fabae**            | Ascochyta fabae        | CBS 404.65; IMI 116999 | R      | Medicago sativa | Canada          | GU238102 GU237859 KP300423 GU237629 |
| **As. phaceae**          | Didymella phacae       | CBS 184.55    | T      | Phaca alpina | Switzerland     | KT389692 KT389475 — KT389769 |
| **As. pisi**             | Ascochyta pisi         | CBS 122750; ATCC 201619 | T      | Pismum sativum | USA             | KT389694 KT389477 — KT389771 |
|                          |                        | CBS 122751; ATCC 201620 | T      | Pismum sativum | Canada          | KP300444 KP300432 EU846867 KP300388 |
|                          |                        | CBS 122785; PD 78/517 | T      | Pismum sativum | The Netherlands | GU237969 GU237763 — GU237532 |
| **As. juglandis**        |                        | CBS 108.49    | T      | Juglans regia  | The Netherlands | KT389693 KT389476 — KT389770 |
| **As. rabiei**           |                        | CBS 206.30    | —      | —               | —               | KT389695 KT389478 KT389559 KT389772 |
|                         | As. rabiei             | CBS 237.37    | T      | Cicer arctinum | Bulgaria        | KT389696 KT389479 — KT389773 |
|                         | CBS 534.65             | Cicer arctinum | —      | —               | India           | GU237970 GU237866 KP300405 GU237533 |
| **As. fabae**            |                        | CBS 372.84; PD 80/1246 | T      | Pismum sativum | Australia       | KT389697 KT389480 — KT389774 |
|                          | CBS 373.84; PD 80/1247 | Pismum sativum | —      | —               | Australia       | KT389698 KT389481 KT389560 KT389775 |
| Species | Old name | Strain number | Status | Host, substrate | Country | GenBank accession numbers |
|---------|----------|---------------|--------|----------------|---------|--------------------------|
| 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 powelli | 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 KT389563 KT389784 |
| As. abelmoschi | | CBS 107.21 | | Abelmoschus esculentus | — | KT389708 KT389491 — KT389785 |
| 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 |
| | | CBS 248.38 | | Phoma nemophilae | — | 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)
| Species                          | Old name                                | Strain number | Status | Host, substrate     | Country     | GenBank accession numbers |
|---------------------------------|-----------------------------------------|---------------|--------|---------------------|-------------|--------------------------|
| **B. exigua**                   | var. pseudolilacis                       | CBS 101207; PD 94/614 | T      | Syringa vulgaris    | The Netherlands | GU237941 GU237721 — GU237503 |
| **Ascochyta lamiorum**          |                                         | CBS 462.67     |        | Lamiun maculatum    | The Netherlands | KT389705 KT389488 — KT389782 |
| **Boeremia exigua var. viburni**|                                         | CBS 100354; PD 83/448 | R      | Viburnum opulus     | The Netherlands | KT389704 KT389487 KT389576 KT389781 |
| **B. foveata**                  |                                         | CBS 109176; PD 94/1394 | R      | Solanum tuberosum   | Bulgaria    | GU237946 GU237742 KT389578 GU237508 |
| **B. hedericola**               |                                         | CBS 367.91; PD 87/229 | R      | Hedera helix        | The Netherlands | GU237949 GU237842 KT389579 GU237511 |
| **B. lilacis**                  | var. lilacis                             | CBS 569.79; PD 72/741; IMI 331909 | R      | Syringa vulgaris    | The Netherlands | GU237936 GU237892 — GU237498 |
| **Ascochyta philadelphi**       |                                         | CBS 588.67     |        | Pheladelius 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**                | Boeremia noackiana                       | CBS 101203; PD 79/1114 | R      | Phaseolus vulgaris  | Colombia       | GU237953 GU237720 KT389581 GU237515 |
| **B. sambuci-nigrae**           | B. sambuci-nigrae                        | CBS 629.68; CECT 20048; IMI 331913; PD 67/55 | T      | Sambucus nigra      | The Netherlands | GU237955 GU237897 — GU237517 |
| **B. strasserii**               | B. strasserii                            | CBS 126.93; PD 73/842 |        | Mentha sp.          | The Netherlands | GU237956 GU237773 KT389584 GU237518 |
| **B. telephii**                 | B. telephii                             | CBS 760.73; PD 71/1616 | R      | Sedum telephium     | The Netherlands | GU237959 GU237805 — GU237521 |
| **Calophoma aquilegicola**      | Ascochyta aquilegicola                   | CBS 107.31     |        | Aquilegia sp.       | —            | KT389710 KT389493 — KT389787 |
| Phoma aquilegicola              |                                         | CBS 107.96; PD 73/598 | R      | Aconitum pyramidale | The Netherlands | GU238041 GU237735 KT389586 GU237581 |
| Phoma aquilegicola              |                                         | CBS 108.96; PD 79/611 | R      | Aquilegia sp.       | The Netherlands | GU238042 GU237736 — GU237582 |
| Phoma aquilegicola              |                                         | CBS 109.96; PD 83/832 | R      | Aquilegia sp.       | The Netherlands | KT389711 KT389494 — KT389788 |
| Phoma aquilegicola              |                                         | CBS 114042     |        | Thalictrum dipertocarpum | New Zealand | KT389712 KT389495 — KT389789 |
| **Ca. clematidina**             | Phoma clematidina                        | CBS 102.66     |        | Clematis sp.        | UK            | FJ515630 FJ426988 KT389587 FJ427099 |
| **Ca. clematidis-rectae**       | Phoma clematidis-rectae                 | CBS 108.79; PD 78/522 | T      | Clematis sp.        | The Netherlands | FJ515632 FJ426989 KT389588 FJ427100 |
| **Ca. complanata**              | Phoma complanata                        | CBS 507.63; PD 07/03486747; MUCL 9574 |        | Angelica sylvestris | The Netherlands | EY54180 FJ515608 GU371778 FJ516262 |
| **Ca. glauca**                  | Phoma glauca                            | CBS 112.96; PD 79/765 |        | Heracleum sphondylium | The Netherlands | EY54181 GU237870 KT389590 GU237594 |
| **Calophoma sp.**               | Didymella vincetoxicci                  | CBS 186.55     |        | Vincetoxicin officinale | Switzerland  | KT389713 KT389496 — KT389790 |
| Species                     | Old name       | Strain number | Status  | Host, substrate     | Country        | GenBank accession numbers |
|-----------------------------|----------------|---------------|---------|---------------------|----------------|--------------------------|
| Ca. vodakii                | D. vodakii     | CBS 173.53    | T       | Hepatica triloba    | Switzerland    | KT389714 KT389497 —       | KT389791 |
| Coniothyrium cartei        | Coniothyrium cartei | CBS 105.91    | T       | Quercus robur       | Germany        | KT389591                  | KT389792 |
| Co. glycinus               | C. glycinus    | CBS 12414     | T       | Glycine max         | Zimbabwe       | KT387596 KT389714 —       | KT382702 |
| Co. palmarum               | C. palmarum    | CBS 400.71    | R       | Chamaerops humilis  | Italy          | EU754153 AY720708 KT389592 | KT389792 |
| Co. telephi                | C. telephi     | CBS 188.71    | T       | Air                 | Finland        | KT387599 KT389716         | KT389793 |
| Cucurbitaria berberidis    | Cucurbitaria berberidis | CBS 363.93  | R       | Berberis vulgaris   | The Netherlands| KT387596 KT389717          | KT389794 |
| Didymella aceroselloides   | Phoma aceroselloides | CBS 179.97    | T       | Rumex hydrolapathum | The Netherlands| GU283034 GU283793 KP330415 GU237575 |
| D. aliena                  | Phoma aliena   | CBS 379.93; PD 82/945 | R       | Berberis sp.        | The Netherlands| GU238037 GU237851 KP330416 GU237578 |
| D. americana               | Peyronellae americana | CBS 185.85; PD 80/1191 | R       | Zea mays            | USA            | GU237990 FJ26972 KT389594 FJ247088 |
| D. anserina                | Phoma radicis-callunae | CBS 253.80    | —       | —                   | Germany        | KT389715 KT389498 KT389595 KT389795 |
| D. arachidicola            | Peyronellae arachidicola | CBS 333.75; ATCC 28333; IMI 386092; PREM 44869 | T       | Arachis hypogaea    | South Africa   | GU237996 GU237833 GU237988 GU237554 |
| D. aurata                  | Pe. aurata     | 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| GU283046 GU237904 KP330417 GU237586 |
| D. boeremae                | Phoma boeremae | CBS 109942; PD 84/402 | T       | Medicago litoralis cv. Harbinger | Australia | GU238048 FJ26982 KT389600 FJ247097 |
| D. calidophila             | Phoma calidophila | CBS 448.83    | T       | Soil                | Egypt          | GU238052 FJ247059         | FJ247168 |
| D. chenopodi               | Phoma chenopodi | CBS 128.93; PD 79/140 | R       | Chenopodium quinoa cv. Sajana | Peru     | GU238055 GU237775 KT389602 GU237591 |
| D. coffeae-arabicaceae     | Peyronellae coffeae-arabicaceae | CBS 123380; PD 84/1013 | T       | Coffea arabica      | Ethiopia       | GU238005 FJ26993 KT389603 FJ247104 |
| D. curtisii                | Pe. curtisii   | CBS 251.92; PD 86/1145 | R       | Nerine sp.          | The Netherlands| GU238013 FJ247038 —       | FJ247148 |
| 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             | Peyronellae eucalyptica | CBS 377.91; PD 79/210 | R       | Eucalyptus sp.      | Australia      | GU238007 GU237846 KT389605 GU237562 |
| D. exigua                  | Didymella exigua | CBS 183.55    | T       | Rumex anfillus      | France         | EU754155 GU237794 EU874850 GU237525 |

(continued on next page)
| Species                      | Old name                        | Strain number | Status | Host, substrate        | Country          | GenBank accession numbers |
|------------------------------|---------------------------------|---------------|--------|------------------------|------------------|----------------------------|
| D. gardeniae                | Peyronellaea gardeniae         | CBS 626.68; IMI 108771 | T      | Gardenia jasminoides   | India            | GQ387955 FJ427003 KT389606 FJ427114 |
| D. glomerata                | Pe. glomerata                   | CBS 133.72    | R      | Fresco in church       | Romania          | KT389718 FJ427004 — FJ427115 |
| D. heteroderae              | Pe. heteroderae                 | CBS 528.66; PD 63/590 | R      | Chrysanthemum sp.     | The Netherlands  | EU754184 FJ427013 GU371781 FJ427124 |
| D. lethalis                 | Pe. lethalis                    | CBS 109.92; PD 73/1405 | T      | Undefined food material | The Netherlands  | GU238002 FJ426983 KT389601 FJ427098 |
| D. longicolla               | Phoma longicolla               | CBS 103.25    | T      | —                      | —                | —                          |
| D. glomerata                | Pe. glomerata                   | CBS 133.72    | R      | Fresco in church       | Romania          | KT389718 FJ427004 — FJ427115 |
| D. heteroderae              | Pe. heteroderae                 | CBS 528.66; PD 63/590 | R      | Chrysanthemum sp.     | The Netherlands  | EU754184 FJ427013 GU371781 FJ427124 |
| D. lethalis                 | Pe. lethalis                    | CBS 109.92; PD 73/1405 | T      | Undefined food material | The Netherlands  | GU238002 FJ426983 KT389601 FJ427098 |
| D. longicolla               | Phoma longicolla               | CBS 124514; PD 80/1189 | T      | Opuntia sp.            | Spain            | GU238095 GU237767 — GU237622 |
| D. glomerata                | Pe. glomerata                   | CBS 133.72    | R      | Fresco in church       | Romania          | KT389718 FJ427004 — FJ427115 |
| D. heteroderae              | Pe. heteroderae                 | CBS 528.66; PD 63/590 | R      | Chrysanthemum sp.     | The Netherlands  | EU754184 FJ427013 GU371781 FJ427124 |
| D. lethalis                 | Pe. lethalis                    | CBS 109.92; PD 73/1405 | T      | Undefined food material | The Netherlands  | GU238002 FJ426983 KT389601 FJ427098 |
| D. longicolla               | Phoma longicolla               | CBS 124514; PD 80/1189 | T      | Opuntia sp.            | Spain            | GU238095 GU237767 — GU237622 |
| D. masticolata              | Phoma masticolata var. incolorata | CBS 223.69     | R      | Acer pseudoplatanus    | Switzerland      | GU238096 GU237801 KT389608 GU237623 |
| Phoma masticolata           | CBS 247.38                      | Pinus nigra var. asiatica | —      | —                      | —                | —                          |
| 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. molteniana               | Phoma digitalis                 | CBS 229.79; LEV 7660 | R      | Digitalis purpurea     | New Zealand      | GU238067 GU237802 KP330418 GU237605 |
| D. musae                    | Peyronellaea musae              | CBS 109.79; PD 90/835-1 | R      | Digitalis sp.          | The Netherlands  | GU238066 GU237744 — GU237604 |
| D. negriana                 | Phoma negriana                  | CBS 358.71    | R      | Vitis vinifera         | Germany          | GU238116 GU237838 KT389610 GU237635 |
| D. nigritans                | Peyronellaea australis          | CBS 444.81; PDCC 6546 | T      | Actinidia chinensis    | New Zealand      | GU238000 GU237867 GU237558 |
| D. pedeae                   | Phoma pedeae                    | CBS 124517; PD 92/612A | T      | Schefflera eleganssima | The Netherlands  | GU238127 GU237770 KT389612 KT389613 |
| D. pinodella                | Peyronellaea pinodella           | CBS 318.90; PD 81/729 | T      | Pisum sativum          | The Netherlands  | GU238016 FJ427051 FJ427161 |
| 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 | T      | Heracleum dissection   | Russia           | GU238025 FJ427053 KT389615 FJ427163 |
| D. pomorum var. cyannea    | CBS 388.80                      | Tinticum sp.   | South Africa | Tinticum sp.            | Switzerland      | KT389720 KT389502 KT389616 KT389799 |
| D. protuberans              | Peyronellaea alectorolophi      | CBS 354.52    | T      | Tinticum sp.           | Switzerland      | KT389720 KT389502 KT389616 KT389799 |
| D. obtusa                   | CBS 377.93; PD 80/976           | Tinticum sp.   | South Africa | Tinticum sp.            | Switzerland      | KT389720 KT389502 KT389616 KT389799 |
| D. pomorum var. pomorum    | CBS 391.93; PD 80/87            | Tinticum sp.   | South Africa | Tinticum sp.            | Switzerland      | KT389720 KT389502 KT389616 KT389799 |

**Notes:**
- Status codes: T (type), R (reference), and— (not recorded).
- Accession numbers for LSU, ITS, rpb2, and tub2.
Table 1. (Continued).

| Species                          | Old name          | Strain number | Status² | Host, substrate | Country     | GenBank accession numbers³ |
|----------------------------------|-------------------|---------------|---------|-----------------|-------------|---------------------------|
|                                  |                   |               |         |                 |             | LSU | ITS | rpb2 | tub2 |
| Pe. protuberans                  | CBS 381.96; PD 71/706 | T             | Lycium halifolium | The Netherlands | GU238029 | GU237853 | KT389620 | GU237574 |
|                                | CBS 109177; LEV 15165; PD 2000/9941 | R             | Rheum rhaponticum | New Zealand | GU238139 | GU237743 | KP330428 | GU237653 |
|                                | CBS 683.79; LEV 15094 | T             | Rumex obtafolius | New Zealand | KT389721 | KT389503 | KT389622 | KT389800 |
|                                | CBS 281.83 | T             | Alcianthus altissima | South Africa | GU238030 | FJ427063 | KT389623 | FJ427170 |
|                                | CBS 160.78; LEV 11451 | R             | Senecio jacobaea | New Zealand | GU238143 | GU237787 | — | GU237657 |
|                                | CBS 379.96 |             | Pteris sp. | The Netherlands | KT389722 | KT389504 | KT389622 | KT389626 |
|                                | CBS 115.58; DSM 62044 |             | Chrysanthemum roseum | Germany | KT389723 | KT389505 | KT389625 | KT389802 |
|                                | CBS 110.92; PD 76/1010 | R             | Triticum sp. | USA | GU238032 | FJ427080 | KT389626 | FJ427186 |
|                                | CBS 249.92; PD 78/1088 | T             | Zea mays | Canada | GU238145 | GU237808 | — | GU237658 |
|                                | CBS 250.92; DAOM 171914; PD 92/371 | T             | Zea mays | Canada | GU238145 | GU237808 | — | GU237659 |
| D. rhei                         | Phoma rhei        | CBS 381.96; PD 71/706 | T             | Lycium halifolium | The Netherlands | GU238029 | GU237853 | KT389620 | GU237574 |
|                                | CBS 109177; LEV 15165; PD 2000/9941 | R             | Rheum rhaponticum | New Zealand | GU238139 | GU237743 | KP330428 | GU237653 |
|                                | CBS 683.79; LEV 15094 | T             | Rumex obtafolius | New Zealand | KT389721 | KT389503 | KT389622 | KT389800 |
|                                | CBS 281.83 | T             | Alcianthus altissima | South Africa | GU238030 | FJ427063 | KT389623 | FJ427170 |
|                                | CBS 160.78; LEV 11451 | R             | Senecio jacobaea | New Zealand | GU238143 | GU237787 | — | GU237657 |
|                                | CBS 379.96 |             | Pteris sp. | The Netherlands | KT389722 | KT389504 | KT389622 | KT389626 |
|                                | CBS 115.58; DSM 62044 |             | Chrysanthemum roseum | Germany | KT389723 | KT389505 | KT389625 | KT389802 |
|                                | CBS 110.92; PD 76/1010 | R             | Triticum sp. | USA | GU238032 | FJ427080 | KT389626 | FJ427186 |
|                                | CBS 249.92; PD 78/1088 | T             | Zea mays | Canada | GU238145 | GU237808 | — | GU237658 |
|                                | CBS 250.92; DAOM 171914; PD 92/371 | T             | Zee mays | Canada | GU238145 | GU237808 | — | GU237659 |
|                                | CBS 523.73; PD 69/800 | R             | Viburnum cassinoides | The Netherlands | GU238155 | GU237879 | KP330430 | GU237667 |
|                                | CBS 120/105 |             | Amaranthus sp. | Brazil | GU238049 | GU237760 | KT389627 | GU237588 |
|                                | CBS 186.83; PD 82/47 | R             | Dracaena sp. | Rwanda | GU238070 | GU237795 | KT389628 | GU237607 |
|                                | CBS 104.80; PD 74/1017 | R             | Acacia mearnsii | Kenya | GU238081 | GU237731 | KT389629 | GU237612 |
|                                | CBS 105.80; PD 75/908 | T             | Solarium sp. | Peru | GU238084 | GU237732 | KT389630 | GU237615 |
|                                | CBS 125.82; IMI 331914; CECT 20044 | T             | Human toenail | The Netherlands | GU237974 | FJ426995 | KT389631 | FJ427106 |
|                                | CBS 173.73; ATCC 24428; IMI 164070 | T             | Dactylis glomerata | USA | GU237975 | FJ426996 | KT389632 | FJ427107 |
|                                | CBS 246.60; ATCC 22237; ATCC 16652; IMI 81601 | T             | Soil | India | GU237976 | FJ427049 | — | FJ427159 |
|                                | CBS 558.81; PDCC 6873 | T             | Soil | India | GU237977 | FJ427050 | KT389633 | FJ427160 |
|                                | CBS 179.80; PD 76/1018 | T             | Soil | India | GU237977 | FJ427050 | KT389633 | FJ427160 |
|                                | CBS 627.68; PD 66/926 | T             | Soil | India | GU237977 | FJ427050 | KT389633 | FJ427160 |
|                                | CBS 1114309; UPSC 2982 | T             | Soil | India | GU237977 | FJ427050 | KT389633 | FJ427160 |
|                                | CBS 507.91; PD 74/148 | T             | Soil | India | GU237977 | FJ427050 | KT389633 | FJ427160 |
|                                | CBS 113.20; PD 92/774 | T             | Soil | India | GU237977 | FJ427050 | KT389633 | FJ427160 |
|                                | CBS 116.93; PD 71/884 | T             | Soil | India | GU237977 | FJ427050 | KT389633 | FJ427160 |
|                                | CBS 874.97; PD 93/764 | T             | Soil | India | GU237977 | FJ427050 | KT389633 | FJ427160 |

(continued on next page)
| Species            | Old name              | Strain number | Status | Host, substrate          | Country        | GenBank accession numbers |
|--------------------|-----------------------|---------------|--------|--------------------------|----------------|--------------------------|
| L. conoidea        | Leptosphaeria conoidea| CBS 616.75; ATCC 32813; IMI 199777; PD 74/56 |        | Lunaria annua              | The Netherlands | JF740279 JF740201 KT389639 KT389804 |
| L. doliolum        | Leptosphaeria doliolum| CBS 505.75    | T      | Urtica dioica             | The Netherlands | QG338756 JF740205 KT389640 JF740144 |
| L. arachidicola    | L. arachidicola       | CBS 275.59; ATCC 13446 |        | Tricholium pratense       | USA            | GU237981 GU237799 KT389641 GU237539 |
| L. australis       | L. australis          | CBS 317.83    |        | Eugenia aromatica         | Indonesia      | EU751466 GU237829 GU371790 GU375450 |
| L. trifolii        | L. trifolii           | CBS 235.58    |        | Tricholium sp.            | The Netherlands | GU237982 GU237806 — GU237542 |
| M. anomochaeta     | Macroventuria anomochaeta | CBS 302.72 |        | Medicago sativa           | South Africa   | GU237985 GU237873 — GU237545 |
| M. wentii          | Ma. wentii            | CBS 526.71    | T      | Decayed canvas            | South Africa   | GU237984 GU237881 GU456346 GU237544 |
| M. proteae         | Mi. proteae           | CBS 111319; CPC 1425 |        | Plant litter               | USA            | GU237986 GU237884 KT389642 GU237546 |
| M. graminicola     | Neoascocysta          | CBS 247.79    |        | Gramineae                 | Austria        | KT389725 KT389507 — KT389805 |
| L. arachidicola    | As. desmazieri        | CBS 297.69    | T      | Lolium perenne             | Germany        | KT389726 KT389508 KT389644 KT389806 |
| L. arachidicola    | As. agrostidis        | CBS 758.97    |        | Hay                        | Norway         | KT389727 KT389509 — KT389807 |
| M. graminicola     | As. hordei var.      | CBS 819.84    |        | Hordeum vulgare            | Germany        | KT389728 KT389510 KT389645 KT389808 |
| M. graminicola     | As. hordei var.      | CBS 820.84    | T      | Hordeum vulgare            | Germany        | KT389729 KT389511 KT389646 KT389809 |
| M. graminicola     | As. skagwayensis     | CBS 110124    |        | Triticum sp.              | The Netherlands | KT389730 KT389512 — KT389810 |
| M. graminicola     | As. alii              | CBS 113693; UPSC 1929 |        | Allium sp.                | Sweden         | KT389731 KT389513 — KT389811 |
| M. graminicola     | As. sorghii           | CBS 301.69    |        | Lolium multiflorum        | Germany        | KT389737 KT389519 KT389650 KT389817 |
| M. graminicola     | D. exitialis          | CBS 389.86    |        | Triticum aestivum         | Switzerland    | KT389733 KT389515 KT389648 KT389813 |
| M. graminicola     | D. exitialis          | CBS 811.84    |        | Secale cereale            | Germany        | KT389734 KT389516 — KT389814 |
| M. graminicola     | As. hordei var.      | CBS 812.84    |        | Hordeum vulgare            | Germany        | KT389735 KT389517 — KT389815 |
| M. graminicola     | As. skagwayensis     | CBS 110124    |        | Triticum sp.              | The Netherlands | KT389730 KT389512 — KT389810 |
| M. graminicola     | As. alii              | CBS 113693; UPSC 1929 |        | Allium sp.                | Sweden         | KT389731 KT389513 — KT389811 |
| M. graminicola     | As. sorghii           | CBS 301.69    |        | Lolium multiflorum        | Germany        | KT389737 KT389519 KT389650 KT389817 |
| M. graminicola     | D. exitialis          | CBS 389.86    |        | Triticum aestivum         | Switzerland    | KT389733 KT389515 KT389648 KT389813 |
| M. graminicola     | As. hordei var.      | CBS 811.84    |        | Secale cereale            | Germany        | KT389734 KT389516 — KT389814 |
| M. graminicola     | As. hordei var.      | CBS 812.84    |        | Hordeum vulgare            | Germany        | KT389735 KT389517 — KT389815 |
| M. graminicola     | As. skagwayensis     | CBS 110124    |        | Triticum sp.              | The Netherlands | KT389730 KT389512 — KT389810 |
| M. graminicola     | As. alii              | CBS 113693; UPSC 1929 |        | Allium sp.                | Sweden         | KT389731 KT389513 — KT389811 |
| M. graminicola     | As. sorghii           | CBS 301.69    |        | Lolium multiflorum        | Germany        | KT389737 KT389519 KT389650 KT389817 |
| Species                          | Old name                          | Strain number | Status | Host, substrate | Country       | GenBank accession numbers                                                                 |
|---------------------------------|-----------------------------------|---------------|--------|----------------|---------------|------------------------------------------------------------------------------------------|
| **Table 1. (Continued).**       |                                   |               |        |                |               |                                                                                          |
| Neoa. paspali Phoma paspali     | CBS 560.81; PD 92/1569 T          | T             |        | Paspalum dilatatum | New Zealand   | GU238124 FJ427048 KP330426 FJ427158                                                     |
| Neoascochyta sp. 1 Ascochyta hordei | CBS 112524 T                       | T             |        | Triticum aestivum | Argentina     | KT389742 KT389524 — KT389822                                                           |
| Neoascochyta sp. 2 Diodymella graminicola | CBS 516.81 T                    | T             |        | Oryza sativa     | Italy         | KT389743 KT389525 KT389653 KT389823                                                     |
| Neoascochyta sp. 3 Ascochyta festueae | CBS 689.97 T                      | T             |        | Hay             | Norway        | KT389744 KT389526 KT389654 KT389824                                                     |
| Neoascochyta sp. 4 As. hordei var. hordei | CBS 544.74 T                    | T             |        | Triticum aestivum | South Africa  | EU754134 GU237887 KT389652 GU237488                                                    |
| Neoascochyta sp. 5 As. brachypodii | CBS 876.72 T                      | T             |        | Straw            | South Africa  | KT389745 KT389527 — KT389825                                                           |
| Neodidymelliosis cannabis Diodymella urticicola | CBS 121.75; ATCC 32164; IMI 194767; PD 73/584 T | T             |        | Urtica dioica    | The Netherlands | GU237972 GU237761 — GU237535                                                           |
| Neodidoymelliosis sp. 1 Ascochyta achlydis | CBS 256.77 T                      | T             |        | Achlys triphylla | Canada        | KT389749 KT389531 — KT389829                                                           |
| Neodidoymelliosis sp. 2 As. scotinospora | CBS 382.96 T                      | T             |        | Sol in desert    | Israel        | KT389750 KT389532 — KT389830                                                           |
| Neod. xanthina As. aquilegiae Phoma xanthina | CBS 168.70 T                      | T             |        | Delphinium sp.   | The Netherlands | KT389751 KT389533 — KT389831                                                           |
| Neothophoma anigozanthi Phoma anigozanthi | CBS 381.91; PD 79/1110 T          | T             |        | Anigozanthus maugleis | The Netherlands | GU238039 GU237852 — KT389855 GU237580                                                  |
| No. arachidis-hypogaeae Phoma arachidis-hypogaeae | CBS 125.93; PD 77/1029 R          | R             |        | Arachis hypogaea | India         | GU238043 GU237771 KT389856 GU237583                                                    |
| No. gossypicola Phoma gossypicola | CBS 377.67 T                      | T             |        | Gossypium sp.    | USA           | GU238079 GU237845 KT389858 GU237611                                                    |
| No. infossa Phoma infossa       | CBS 123395 T                      | T             |        | Fraxinus pennsylvanica | Argentina   | GU238089 FJ427025 KT389859 FJ427135                                                    |
| No. quercina Phoma fungicola CBS 633.92; ATCC 36786; VKM MF-325 | T                                  |              |        | Microsphaera alphioides from Quercus sp. | Ukraine | EU754127 GU237900 KT389867 GU237609                                                  |
| Ophiosphaerella herpotricha Ophiopsphaerella herpotricha | CBS 620.86 T                      | T             |        | Bromus erectus   | Switzerland   | DQ678062 KF498728 DG677958 —                                                           |
| Paraboeremia adianticola Diodymella adianticola | CBS 187.83; PD 82/128 T           | T             |        | Polystichum adiantiforme | USA          | GU238035 GU237796 KP330421 GU237576                                                    |
| Pa. putaminum Phoma putaminum CBS 130.69; CECT 20054; IMI 331916 | R                                  |              |        | Pteris ensiformis | —            | KT389752 KT389534 — KT389832                                                           |
| Pa. putaminum Phoma putaminum CBS 372.91; PD 75/960 R | Ulmus sp. | The Netherlands | GU238137 GU237843 — GU237651|
| Pa. selaginellae Phoma selaginellae | CBS 122.93; PD 77/1049 T          | T             |        | Selaginella sp.  | The Netherlands | GU238142 GU237762 GU237656                                                            |
| Paraleptosphaeria nitschkei Paraleptosphaeria nitschkei | CBS 306.51 T                      | T             |        | Cirisium spinosissimum | Switzerland | JF740308 JF740239 KT389660 KT389833                                                      |

(continued on next page)
| Species                  | Old name             | Strain number | Status | Host, substrate       | Country   | GenBank accession numbers |
|--------------------------|----------------------|---------------|--------|-----------------------|-----------|--------------------------|
| Phaeosphaeria ammophilae | Phaeosphaeria ammophilae | CBS 114595   |        | Ammophila arenaria    | Sweden    | GU301859 KF766146 GU371724 — |
| Phaeosphaeriopsis triseptata | Phaeosphaeriopsis triseptata | MFLUCC 13-0347 |        | Rhus aculeatus        | Italy     | KJ522480 KJ522476 KJ522486 — |
| Phoma neerlandica        | Phoma neerlandica    | CBS 134.96; PD 84/676 | T      | Delphinium sp.        | The Netherlands | KT389753 KT389535 KT389661 KT389834 |
| Phoma herbarum           | Phoma herbarum       | CBS 377.92; IMI 213845 |        | Human leg             | The Netherlands | KT389756 KT389536 KT389663 KT389837 |
| Phoma herbarum           | Phoma herbarum       | CBS 502.91; PD 82/276 |        | Nerium sp.            | The Netherlands | GU382082 GU237674 KP330419 GU237613 |
| Phoma herbarum           | Phoma herbarum       | CBS 615.75; PD 73/665; IMI 199779 | R      | Rosa multiflora cv. Cathayensis | The Netherlands | EU754186 FJ427022 KP330420 FJ427133 |
| Atradidymella muscivorata | Atradidymella muscivorata | CBS 127589; UAMH 10909 |        | Polystichum juniperinum | USA | KT389757 KT389539 KT389664 KT389838 |
| Phoma acuminata          | Phoma acuminata      | CBS 274.37    |        | Picea excelsa         | UK        | KT389754 KT389537 KT389662 KT389835 |
| Leptosphaeria millefolii | Leptosphaeria millefolii | CBS 304.51    |        | Achillea millefolium  | Switzerland | KT389755 KT389538 — KT389836 |
| Phomatos aubrietiæ       | Phomatos aubrietiæ   | CBS 383.67; PD 65/223 | R      | Aurelietia hybrida cv. Superbissima | The Netherlands | GU238044 GU237684 — GU237584 |
| Phomatos aubrietiæ       | Phomatos aubrietiæ   | CBS 627.97; PD 70/714 | T      | Aurelietia sp.        | The Netherlands | GU238045 GU237695 KT389665 GU237585 |
| Phomatos aubrietiæ       | Phomatos aubrietiæ   | CBS 117.93; PD 83/90 |        | Mercurialis perennis  | The Netherlands | GU238114 GU237757 KP330425 GU237633 |
| Phomatos aubrietiæ       | Phomatos aubrietiæ   | CBS 100191    |        | Thlaspi arvense       | Poland     | KP330446 KP330434 KT389666 KP330390 |
| Phomatos aubrietiæ       | Phomatos aubrietiæ   | CBS 740.96    |        | Armoracia rusticana    | The Netherlands | KT389758 KT389540 KT389667 KT389839 |
| Plenodomus biglauusus    | Plenodomus biglauusus | CBS 532.66; PD 65/911 |        | Brassica sp.          | The Netherlands | KT389759 KT389541 KT389668 KT389840 |
| Plen. lingam             | Plen. lingam         | CBS 275.63    |        | Brassica sp.          | UK         | KT389750 KT389566 KT389699 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      | GU382160 KC854239 KC854471 — |
| Pleo. typhicola          | Pleo. typhicola      | CBS 132.69    |        | Typha angustifolia     | The Netherlands | KT389759 KT389541 KT389668 KT389840 |
| Pyrenochaeta cava        | Pyrenochaeta cava    | CBS 257.68; CECT 20043; IMI 331911 |        | Soil from wheat-field  | Germany    | EU754199 KT389620 — KT389844 |
| Pyrenochaeta nobilis     | Pyrenochaeta nobilis | CBS 407.76    | T       | Laurus nobilis        | Italy      | EU754206 NR_103598 DK677991 KT389845 |
| Pyrenochaetopsis pratorum| Pyrenochaetopsis pratorum | CBS 445.81    |        | Lolium perenne         | New Zealand | GU238136 NR_111623 KT389671 KT389846 |
| Pyrenophora phaeocomes   | Pyrenophora phaeocomes | DAO7 222769 |        | Calamagrostis villosa | Switzerland | JN400093 JN403649 DK487614 — |
| Setomelanoma holmii      | Setomelanoma holmii  | CBS 110217    |        | Picea pungens         | USA        | KT389783 KT389542 GU371800 — |
| Sporomielia minima       | Sporomielia minima   | CBS 524.50    |        | Dung of goat          | Panama     | DK678056 KT389543 DK677990 — |
| 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 | Status | Host, substrate | Country   | GenBank accession numbers |
|-------------------------|-----------|---------------|--------|-----------------|-----------|--------------------------|
|                         |           |               |        |                 |           | LSU IT S rpb2 tub2       |
| **Species**             | **Old name** | **Strain number** | **Status** | **Host, substrate** | **Country** | **GenBank accession numbers** |
| *Didymella hellebori*   | CBS 114303; UPSC 2962 | T | 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 75/814 | | Solarium sp. | Peru | GU238170 GU237817 — | GU237675 |
| **S. artemisicola**    | S. artemisicola | 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 |
| **S. crystalliniformis** | S. crystalliniformis | CBS 713.85; ATCC 76027; PD 83/826 | T | Solarium lycopersicum | Colombia | GU238178 GU237803 KT389675 | GU237683 |
| **S. cucurbitacearum** | S. cucurbitacearum | CBS 133.96; PD 79/127 | R | Cucumis sp. | New Zealand | GU238181 GU237780 KT389676 | GU237686 |
| **S. dennisi**         | S. dennisi | CBS 631.68; PD 68/147 | T | Solidago floribunda | The Netherlands | GU238182 GU237699 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. heliosidis**      | S. heliosidis | CBS 109182; PD 74/231 | R | Heliospiza 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 GU237693 KT389681 | GU237704 |
| **S. inoxydabilis**    | S. inoxydabilis | CBS 425.90; PD 81/520 | T | Chrysanthemum parthenium | The Netherlands | GU238188 GU237691 KT389682 | GU237693 |
| **S. laticola**        | S. laticola | CBS 562.81; PDCC 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 | JQ97461 NR_111724 — | JQ97496 |
| **S. tracheli**        | S. tracheli | 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 | T | 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)
| Species                | Old name                  | Strain number¹ | Status²       | Host, substrate         | Country               | GenBank accession numbers³ |
|-----------------------|---------------------------|----------------|---------------|-------------------------|------------------------|----------------------------|
| Subplenodomus violicola | Subplenodomus violicola   | CBS 306.68     | Viola tricolor | The Netherlands         | GU238156 FJ427083     | KT389849                   |
| Xenodidymella applanata | Didymella applanata       | CBS 195.36     | T             | Rubus idaeus            | KT389764 KT389548     | KT389852                   |
|                       |                           | CBS 205.63     |               | Rubus idaeus            | GU237998 GU237778      | KT389764 GU237556          |
|                       |                           | CBS 115577     |               | Rubus idaeus            | KT389756 KT389546      | KT389850                   |
|                       |                           | CBS 115578     |               | Rubus arcticus          | KT389763 KT389547      | KT389851                   |
|                       |                           | CBS 115577     |               | Rubus arcticus          | KT389763 KT389547      | KT389851                   |
|                       |                           | CBS 205.63     |               | Rubus arcticus          | KT389764 KT389548      | KT389852                   |
|                       |                           | CBS 115577     |               | Rubus arcticus          | KT389756 KT389546      | KT389850                   |
|                       |                           | CBS 115578     |               | Rubus arcticus          | KT389763 KT389547      | KT389851                   |
| X. asphodeli          | D. asphodeli              | CBS 375.62     | T             | Asphodelus albus        | KT389765 KT389549      | KT389859                   |
|                       |                           | CBS 499.72     |               | Asphodelus ramosus      | KT389766 KT389550      | KT389853                   |
| X. catariae           | D. catariae               | CBS 102635     |               | Nepeta catarinaria      | GU237962 GU237727      | KT389689                   |
| X. humicola           | Phoma humicola            | CBS 220.85     | R             | Franseria sp.           | GU238086 GU237800      | KT389617                   |

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: Mycothèque de l’Université 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; rp2: 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 rp2) of which 883 were unique site patterns (45 for LSU, 270 for ITS, 216 for tub2 and 352 for rp2), and Spororiellmi 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 rp2 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 Neo-didymellisopis 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, Nophophoma 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 12,856 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 Spororiellmi 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 conoida, Leptosphaeria doliolium, Paraleptosphaeria nitschkei, Plenodomus biglobusos, Plen. lingam and Subplenodomus vio- licola; Cucurbitariaceae (BPP = 1; MLBS = 50 %) comprising four species, Cucurbitaria berberidis, Pyrenochaeta cava, Pyrenochaeta nobilis and Pyrenochaetopsis pratrum; Pleospo- raceae (BPP = 1; MLBS = 93 %) comprising six species, Alternaria japonica, Bipolaris maydis, three Pleospora species, viz. Pleospora betae, Pleo. herbarum and Pleo. typhicola, and Pyrenophora phaeocornes; and Paeosphaeriaceae (BPP = 1; MLBS = 100 %) comprising four species, Ophiopsphaeria her- potricha, Paeosphaeria ammophila, Paeosphaeriopsis tri- septata and Setomelanoma holmi. The remaining ingroup could be divided into a basal Micro- sphaeropsis 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. labili (syn. Phoma labili), All. minor (syn. Phoma minor), All. piperis (syn. Phoma piperis), All. tropica (syn. Phoma tropica), and All. zantedeschiae (syn. Phoma zantede- schiae). Clade 3 (BPP = 1; MLBS = 97 %, six isolates) comprised five species accommodated in a novel genus Heterophoma, i.e. H. adonis (syn. Didymella adonis), H. nobilis (syn. Ascochyta nobilis), H. novae-verbascioca (syn. Phoma novae-verbascioca), 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. brasiliensi (syn. Phoma brasiliensi), E. draconis (syn. Phoma draconis), E. henningsii (syn. Phoma henningsii), E. huancayense (syn. Phoma huancayensis) and E. plurvorum

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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).
versabilis phoma-like conidia were embedded in 372.84, CBS 373.84, CBS 113797). Two species that produced medicaginis var.

As. medicaginicola including the generic type, Ma. anomochaeta (syn. As. clematidis-rectae, Phoma clematidina, Clade 13

As. pisi (syn. As. nigripycnidia, two new names for these taxa. These included Neoa. desmazerii (syn. Ascochyta desma-

zelier), Neoa. exitialis (syn. Didymella exitialis), Neoa. graminicola (syn. Didymella graminicola), Neoa. europaea (syn. As. herbi-

dae var. europaeae), 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. planata (syn. Didymella planata), X. asphodeli (syn. D. asphodeli), X. catariae (syn. D. catariae) and X. humicola (syn. Phoma humicola). Clade 16

(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 Neodidymellliopsis is proposed below, including six species, Neod. cannabis (syn. D. cannabis), Neod. polononi (syn. Phoma polononi), Neod. xanthina (syn. Phoma xanthina) and two insufficiently known isolates (CBS 256.77, CBS 382.96). Clade 17

(MLBS = 85 %, five isolates) contained five species that were accommodated in a new genus proposed below, Notho-

phoma, namely Neoa. anigozanthi (syn. Phoma anigozanthi), Neoa. arachidis-hypogaeae (syn. Phoma arachidis-hypogaeae), Neoa. quercina (syn. Phoma fungica), Neoa. gossypica (syn. Phoma gossypica) and Neoa. infossa (syn. Phoma infossa). Taxonomy

Phylogenetic analyses based on the combined LSU, ITS, tub2 and rp2 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 charac-

ters 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., Mycol. Mycol. 65: 44. 2010.

Conidiomata pycnidal, 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. Conidigenous cells phialidic, hyaline, smooth, amphiulliform or doliform. 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 pseuodothecial, if present, occurring only in vivo, globose to subglobose, sometimes with a somewhat conical neck. Asci cylindrical or subclavate, 8-

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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 multisepate |
| Epicoccum       | ovoid, ellipsoidal to oblong, (sub-)cylindrical, epicocoid conidia: multicellular-phragmosporous, subglobose-yliform | 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| – | – | – | multiniform, oblong, ellipsoidal to ovoid, subfusoid | 1(–6) |
| Macroventuria   | – | – | – | ellipsoidal | 1 |
| Neoascochyta    | fusoid to cylindrical, obclavate-ovoid to ellipsoidal | 0–1 | – | cylindrical to ovoid, ellipsoidal | 1 |
| Neodidymelliiopsis| 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 |
| Phomatoites     | cylindrical to allantoid | aseptate | – | – | – |
| Stagonosporopsis| ellipsoidal to subglobose | 0–3 | – | ellipsoidal, fusiform or obvoid | 1 |
| Xenodidymella   | ellipsoidal to allantoid, subcylindrical, oblong, pyriform | 0–1 | unicellular | obvoid 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 = IPSC 2962. The Netherlands, Limburg, Schaerenbergbos, 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 90/1318).

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 artemisicola (Hollós) Aveskamp et al., Stud. Mycol. 65: 44. 2010.

Basionym: Phoma artemisicola 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 731409.

**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: 384. 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 9915.

**Stagonosporopsis crystalliniformis** (Loer. et al.) Aveskamp et al., Stud. Mycol. 65: 45. 2010.

**Basionym**: *Phoma andina var. crystalliniformis* Loer. et al., Fitopatologia 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 838226).

**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. Nassauschen 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 79127.

**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): *Conidiotrama pyriformis* pyriform, 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, amputiform to doliform, 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, eguttulate 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 discoulouration on MEA.

Specimens examined: **The Netherlands**, Arnhem, from a stem of *Solidago florporum*, deposited in CBS Sep. 1968 (**epitype designated here** HAAM 246703, MBT220490, culture ex-epitype CBS 631.68 = PD 88147); 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 florporum* 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 868561).

**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 19: 40. 2002.

Specimen examined: **The Netherlands**, from *Heliopsis patula*, deposited in CBS Jan. 2001, H. de Gruyter, CBS 109182 = PD 74231.

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

**Basionym**: *Hendersonia hortensis* Sacc. & Malbr., Michelia 2: 629. 1882.

≡ *Phoma subboulthoaweri* Boerema et al., Persoonia 16: 360. 1997.

≡ *Ascochyta bolthoaweri* Sacc. Z. Pflanzenkrankh. 1: 136. 1891.
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 & Verhoef 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.

Basionym: Didymella ligulicola var. inoxydabilis (Boerema) Aveskamp et al., Stud. Mycol. 65: 45. 2010.

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. 2. Stagonosporopsis dennisi (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.
Description from ex-holotype culture (CBS 200.87):

Conidiomata pycnidial, solitary or aggregated, subglobose, glabrous or covered with hyphal outgrowths, 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 mycelium sparse, wooly, white, pale olivaceous near the centre; reverse concolourous. Colonies on MEA, 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 discoloration 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...
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. heliopsidis 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 loticola P.R. Johnston, 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-101494 = 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 peniculatae Boerema et al., Persoonia 17: 282. 1999.

Specimen examined: UK, Cambridgeshire, Mepal, from Lupinus albus, Apr. 1998 (holotype of Phoma peniculatae 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 dennisi 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-20047, 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 777675.

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 CBS 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.

Conidiumata pycnidial, globose to flask-shaped, superficial on or immersed into the agar, solitary or confluent, ostiolate. Pycnial wall pseudoparenchymatous, 2–5-layered. Conidiogenous cells phialidic, hyaline, smooth, ampulliform to doliform, 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.
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, eguttulate 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. Allompha 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 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.

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.

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) As & 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.
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 *Zantedeschia* 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 = ἑτερος, in Greek, other; morphologically similar to but phylogenetically different from *Phoma*.

*Conidioma* pycnidial, globose to subglobose, superficial on or immersed into the agar, solitary or confluent and 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): *Conidioma* pycnidial, solitary or aggregated, (sub-)globose, glabrous or with some hyphal outgrowths, 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 discoloration on MEA, later changing to three colour layers, via dull green, dark brown to reddish, from the centre to outer ring.

**Specimen examined:** Sweden, Oland, Mörbylåga, 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 the 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 et al. 1993).

**Specimens 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, septe 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 outgrowths, superficial on and immersed into the agar, 110–330 μm diam. **Ostiole** mainly single, occasionally two ostiolar, 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 pycnidial 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.
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 doliform. 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,
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: Kenya, from a pod of *Phaseolus vulgaris*, 1979, G.H. Boerema, CBS H-16308, CBS 102.80 = CECT 20049 = IMI 331907 = PD 79/61.

**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; 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 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.

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

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

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.
**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 identified 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 from 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 tarsa** R.B. Stewart, Mycologia 49: 430. 1957.
≡ **Phoma tarsa** (R.B. Stewart) H. Verm., Coffee Berry Dis. Kenya: 14. 1979.

Specimens examined: **Brazil**, Patrocínio, from leaf of **Coffee arabica**, deposited in CBS by L.H. Pfennig, CBS 119730. **Cameroon**, Bamenda, from **Coffee 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.) Hohn., 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 = ATCC 920959; 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**, Baam, 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 79/116.

**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 196: 109. 1969.

Description from ex-neotype culture (CBS 443.94): Conidiomata pycnidal, solitary or aggregated, globose to subglobose, glabrous or with few hyphal outgrowths, superficial and immersed, later developing to irregular conidiospores and with a short broad elongated neck, 120–320 × 105–285 μm. Ostioles 1–4(–5), on a short elongated neck. **Pycnidal 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 doliform, 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, 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 discoloration 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 79/116, 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. populii** in the phylogenetic tree, but **B. exigua** var. heteromorpha occurred on **Nerium oleander**, while **B. exigua** var. **populii** 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**, Leiden, from a stem of **Linum usitatissimum**, deposited in CBS Feb. 1976, G.H. Boerema, CBS 116.76 = ATCC 32322 = 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 **Salix** spp. respectively.

**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. populii** (Gruyter & P. Scheer) Aveskamp et al., Stud. Mycol. 65: 39. 2010.

*Basionym:* **Phoma exigua var. populii** Gruyter & P. Scheer, J. Phytopathol. 146: 413. 1998.
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**.

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**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.).

Specimen 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 multi-focus phylogeny of the Boeremia exigua varieties (Berner et al. 2015). A single isolate deposited as “Ascochyta philadelphia” was re-identified as B. lilacis in this study. The name As. philadelphia 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 asperate, 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, Brasiliën, Campinas, from Phaseolus sp., Mar. 1997, F. Noack (=Holotype F52544), Colombia, from Phaseolus vulgaris, deposited in CBS Sep. 1998, J. de Gruyter (epitype designated here HMAS 246697, MBBT20496, culture ex-epitype CBS 101203 = PD 79/1114). Guatemala, from Phaseolus vulgaris, deposited in CBS Jan. 1998, IPO Wageningen, CBS 100353 = PD 67/718.

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., Syl. 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 hyphal, 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 phalidic, hyaline, smooth, ampulliform to doliform, 4–7 × (2.5–)3.5–5.5 μm. Conidia ellipsoidal to cylindrical, hyaline, thin-walled, smooth, asperate, 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.
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 Amaranthaceae (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 780.73 = 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 Entdecker Gesammten Naturk. Ges. Naturf. Freunde Berlin 7: 32. 1815, **emend.** Q. Chen & L. Cai.

Conidiomata pycnidal, 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, dicystosporous 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.

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**Fig. 9.** Boeremia roaakiana (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.
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 186.80 = PD 74/1017.

**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).  
**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 cannot 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).

Specimens examined: *New Zealand*, Auckland, Mt Albert, from a leaf of *Setaria sp.*, Feb. 1979, P.R. Johnst. (*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.

*Description* (Boerema 1993).

Specimens examined: *France*, Antibes, from a twig of *Citrus sp.*, deposited in CBS Sep. 1968, CBS 627.66 = PD 66/926. *Puerto Rico*, Mayaguez, from *Berberis sp.*, deposited in CBS Jul. 1993, J. de Gruyter, CBS 379.93 = PD 82/945.

**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. Microsporidia occur in some species. *Pycnidial wall* pseudoparenchymatous, 2–8-layered, with a pigmented outer wall. *Conidiogenous cells* phialidic, phialide, smooth, flask-shaped, ampulliform or doliform. *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 multisepate (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 produce 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.) As & Boerema, Persoonia 18: 16. 2002.

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

Specimens 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.) As & Boerema, Persoonia 16: 486. 1998.

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

Specimens examined: *France*, Vosges, from branches of *Euonymus europaeus*, B.D. Mougeot (*neotype* PAD Roum. F. galicii 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. 66: 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.
Didymella arachidicola (Khokhr.) Tomlin, Opredelitel' gribov roda Mycosphaerella Johans: 285. 1979.

Basionym: Mycosphaerella arachidicola Khokhr., Bolezni i vreminia R. Petrovi: 95. 1974.

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

Specimens examined: *South Africa*, Cape Province, Jan Kempdorp, Vaalharts Research Station, from a leaf of *Arachis hypogea*, deposited in CBS May 1975, W.F.O. Marasas (isotype of Phoma arachidicola CBS H-7601, culture ex-isotype CBS 333.175 = ATCC 28333 = IMI 386092).

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

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

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.

Notes: This species was treated as new combination (*Peyronellaea aurea*) by Aveskamp et al., Stud. Mycol. 65: 31. 2010.
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 curtisi* Berk., Nuovo Giorn. Bot. Ital. 10: 19. 1878.

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

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

≡ *Phyllosticta narcissi* Aderh., Centrabl. Bakteriol., 2 Abth. 6: 632. 1900.

≡ *Phoma narcissi* Aderh., 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 curtisi*, and herein we treat it as a new combination in *Didymella*. The two isolates have two and five bp differences in ITS and *tuf2* 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 *Dactilis glomerata*, 1973 (holotype CBS H-20237, culture ex-holotype CBS 124513 = PD 73/1405).

**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-isotype CBS 626.68 = IMI 108771).

**Didymella eucalyptica** (Sacc.) Q. Chen & L. Cai, comb. nov. MycoBank MB814102.

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

≡ *Peyronellaea eucalyptica* (Sacc.) Q. Chen & L. Cai, Stud. Mycol. 65: 32. 2010.

Description (de Gruyter & Boerema 1999).

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. curtisi*, 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) Kurtz, 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, subglobe 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. Ascii 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, medi- anly 1-septate, upper cell often wider than lower cell, slightly constricted at the septum.

Specimen examined: *France*, Menise sur Tholon, from *Rumex anitolius*, 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 bacil- liform, 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 626.88 = IMI 108771).

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

Basionym: *Coniothyrium glomeratum* Corda, Icon. Fung. (Pra- gue) 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 CBS 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).
**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:** Sivasenan (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.

≡ Polyopes purpureus var. incoloratus A.S. Home, J. Bot. 58: 240. 1920.

≡ Phoma macrostoma var. incolorata (A.S. Home) Boerema & Dorenb., Persoonia 6: 55. 1970. (as "macrostromum var. incolorata")

≡ Phoma zeae-maydis Punith., Mycopathologia 112: 50. 1990. (nom. nov. for Phyllosticta maydis in Phoma)

≡ Peyronellaea maydis (Amy & R.R. Nelson) Crous, Persoonia 32: 223. 2014.

≡ Mycosphaerella zeae-maydis Mukunya & Boothr., Phytopathology 63: 530. 1973.

**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 macrostoma._ 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.

Specimens examined: _Germany_, near München, from the bark of Larix decidua, deposited in CBS Jun. 1965, L. Pehl, CBS 482.95. _Switzerland_, Vienwaldstrasse, 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. ariatica, 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 macrostoma._ 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 exigua** (CBS 183.55). A. Ascomata on host. B. Surface view of ascoma. C–G. Asci with ascospores (arrow denotes pseudoparaphysae). H. Hyaline 1-septate ascospores. Scale bars: B–H = 10 μm.
Didymella zeae-maydis (Mukunya & Boothr.) Arny, Beih. Nova Hedwigia 87: 288. 1987.

Didymella australis (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. Army, culture ex-holotype of "Phylllosticta maydis" CBS 588.69.

Notes: Mukunya & Boothroyd (1973) established the sexual and asexual connection between Mycosphaerella zeae-maydis and Phylllosticta 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 92/812A.

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 Pirtz & Morgan-Jones, Trans. Brit. Mycol. Soc. 51: 200. 1968.

Description (Boerema 1993).

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

Didymella nigricans (P.R. Johnst. & Boerema) Q. Chen & L. Cai, comb. nov. MycoBank MB814112.

Basionym: Phoma nigricans P.R. Johnst. & Boerema, New Zealand J. Bot. 19: 394. 1982.

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 elegansissima, 1992, isolated by J. de Gruyter (holotype CBS H-20239, culture ex-holotype CBS 124517 = PD 92/812A).

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. 1966.
≡ 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. Ascii 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. Osti-oles 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.
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. Sommeryens (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 cinicina Kusnezowa, Novoste Sist. Nizsh. Rast. 8: 189. 1971.
≡ Phoma jolyana var. cinicina (Kusnezowa) Boerema & Kesteren, Kew Bull. 31: 535. 1977.
≡ Phoma pomorum var. cinicina (Kusnezowa) Aveskamp et al., Mycologia 101: 377. 2009.
≡ Peyronellaea pomorum var. cinicina (Kusnezowa) Aveskamp et al., Stud. Mycol. 65: 33. 2010.
≡ Phoma cyanæa Jooste & Papendorf, Mycotaxon 12: 444. 1981.
≡ Phoma pomorum var. cyanæa (Jooste & Papendorf) Aveskamp et al., Mycologia 101: 377. 2009.
≡ Peyronellaea pomorum var. cyanæa (Jooste & Papendorf) Aveskamp et al., Stud. Mycol. 65: 32. 2010.
≡ Phoma triticiæa 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. cinicina” 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 (ho- lotype of “Phoma pomorum var. cyanæa” PREM 45736, culture ex-holotype CBS 388.80). Switzerland, Zürich, Oerlikon, from Triticum speltæ, deposited in CBS Mar. 1952, E. Müller (culture ex-holotype of “Phoma triticiæa” 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 64914.

Notes: The isolates of the respective Phoma pomorum varieties, viz. vars. cinicina (CBS 285.76), cyanæa (CBS 388.80) and pomorum (CBS 354.56), and the species P. triticiæa (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
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. Nassauschen 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. *Conidigenous cells* phialidic, hyaline, smooth, ampulliform to doliform, 3.5–5(−6) × 3–4.5 μm. *Conidia* ellipsoidal, hyaline, thin-walled, smooth, aseptate, 4.5–7.5 × 3–5(−6.5) μm, eguttulate 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 discoloration 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.
(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 rumiocila (Boerema & Loer.) Q. Chen & L. Cai, comb. nov. MycoBank MB814118. Figs 17–18.

Basionym: Phoma rumiocila 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.
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, florccose, 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 unisepate 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.
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 & Noordeloos 1992).

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

**Notes:** Phoma viburnicola was first collected on Viburnum oxyccoccus 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** pseudoparenchymatous, small, grey, 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. Plantenziektken. 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, 5–6.5 × 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** white.

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 to buff, 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 discouloration of the agar.

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 (Spig.) Q. Chen & L. Cai, **comb. nov.** MycoBank MB814125.
**Basionym:** Phoma putaminum Spig., Atti Soc. Cittog. Ital. 3: 66. 1881.
**Description** (de Gruyter & Noordeloos 1992).

Specimens examined: **Unknown origin,** from Paris 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: 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.

Notes: The type specimen of *Phyllosticta selaginellae* could not be located, and is presumably lost. The strain CBS 122.93 from *Selaginella* sp. had ellipsoidial 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 gutulate, 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 perithelial, globose, ostiolate, erumpent on the agar surface, setose in the upper part. Asci ellipsoidial or saccate, bitunicate, 8-spored. Ascospores mostly hyaline, ellipsoidial, 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 Venticulaceae which produced relatively large, nearly hyaline, two-celled ascospores, differing from *Leptosphaerulina* (*van der Aa* 1971). Later *Macroventuria* was placed in *Pseudosphaeraceae* by *Barr* (1982) and then in *Pleosporaceae* by *Eriksson & Hawksworth* (1986) (*Kodiskeu 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.
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. anomalochaeta” 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. anomalochaeta (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,
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.

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.

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).
**Ascochyta medicagoe** var. *medicagoe* Q. Chen & L. Cai, **comb. nov.** MycoBank MB814129.

**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, culture CBS H-16581, culture CBS 629.97 = PD 76/1017; Wyoming, Jackson, Glory Mountain, from stems of *Synthisis 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 61/783.

**Ascochyta medicaginicola** var. *medicaginicola* Q. Chen & L. Cai, **nom. nov.** MycoBank MB814128.

≡ *Phoma medicaginis* var. *medicaginis* Malbr. & Roum., *Rev. Mycol.* 8: 91. 1888.

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

*Specimens examined:* Czech Republic, from *Medicago sativa*, deposited in CBS Jul. 1990, M.E. Noordeloos, CBS 316.90 = CCMF F-187. *France*, Rouen, from *Medicago sativa*, Oct. 1885, C. Roumegueire (*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 (4.5–)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. Kemkamp (*holotype* CBS H-16487, culture ex-holotype CBS 112.53).
Description from ex-epitype culture (CBS 122785): Conidiomata pycnidial, solitary, globose to subglobose, with some hyphal outgrowths, 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 502005943320). 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 Mar. 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; Chivers 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.
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.
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, Oberdresseilendorf, 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), was examined 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 Dörf. Biolog. (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: Phomatoses

Phomatoses 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 doliform. Conidia cylindrical to allantoid, hyaline, thin-walled, aseptate, guttulate.

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

Phomatoses 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 idioblastic cells. Conidiogenous cells phialidic, hyaline, smooth, ampulliform to doliform, 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; reverse concolourous. Colonies on MEA 15–20 mm diam after 7 d, margin regular, fluff, 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 hybridica cv. Superbissima, deposited in CBS Aug. 1987, 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.

Phomatoses 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. Fungi. (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 doliform, 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 Phomatoses 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 Phomatoses 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 Phomatoses nebulosa.

Clade 11: Calophoma

Calophoma Q. Chen & L. Cai, gen. nov. MycoBank MB814063.
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. Microconidia present. Ostioles 1–3, conspicuously papillate. Pycnidial wall pseudoparenchymatous, 2–4-layered, outer wall pigmented. Conidiogenous cells phialidic, hyaline, smooth, globose to flask-shaped, ampulliform to doliform. Conidia ellipsoidal to cylindrical, smooth- and thin-walled, 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 dicyo/phragmosporous, somewhat botryoid and in combination with unicellular chlamydospores.

Type species: Calophoma clematidina (Thüm.) Q. Chen & L. Cai, comb. nov. MycoBank MB814136.

Chlamydospores usually scanty, uni- or multicellular, unicellular intercalary, guttulate, thick-walled, multicellular irregular dicyo/phragmosporous, somewhat botryoid and in combination with unicellular chlamydospores.

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 MB814135. Basionym: Phoma clematidina (Thüm.) Boerema, Verslagen Meded. Plantenziekt. 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 outgrowths, 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 doliform, 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 dicyo/phragmosporous, somewhat botryoid and in combination with unicellular chlamydospores, tan to dark brown, 3–50 × 12–25 μm (Woudenberg et al. 2009).

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 109.96 = PD 83/832. Unknown origin, from Aquilegia sp., deposited in CBS Jul. 1931, R. Laubert, CBS 107.31.
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 clematidis-rectae (syn. Phoma clematidina) has shown host specificity to Clematis hybrids, while Didymella vitalbina was isolated exclusively from Cl. vitalba, and such isolates were initially mis-identified 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.
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 84/888.

Calophoma sp. 1
Specimen examined: Switzerland, Gabi am Simplon, from Vincetoxicum officinale, deposited in CBS May 1955, E. Müller, CBS 196.55.
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. Pyc-nidial wall pseudoparenchymatous, 3–7-layered, outer wall pigmented. Conidiogenous cells phialidic, hyaline, smooth, ampulliform. Conidia oblong to cylindrical, ellipsoidal, sometimes

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.

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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 musciwora M.L. Davey & Currah, Amer. J. Bot. 96: 1283. 2009. = Phoma musciwora 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,
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 in outer ring, towards the centre of the colony via buff to olivaceous. 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 502153305384). 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 73/65 = IMI 199779; Naaldwijk, from a stem base of Nertum 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...
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, pycnidial, solitary or aggregated, globose to subglobose, ostiolate. Asci clavate to ovoid, or obvoid, saccate, oblong, bitunicate, 8-spored. Ascospores muriform, oblong, ellipsoidal to obvoid, subfuscoid, 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, Kod sueb et al. 2006), but later found to be related to Didymella (Kod sueb 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. Lutrell, 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.

Notes: 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. Asc 100–120 × 35–45 μm, 8-spored, hyaline, obvoid, bitunicate with strongly developed apical chamber, 5–7 × 2–3 μm. Ascospores multiserial 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 obvoid,
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: Neosascochyta

Neosascochyta 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. Pycnidal wall pseudoparenchymatous, 2–7-layered, outer wall pigmented, thick. Conidiogenous cells phialidic, hyaline, smooth, globose to flask-shaped, short obpyriform, or ampulliform to doliform. Conidia variable in shape, hyaline, smooth- and thin-walled, i.e. fusoid to cylindrical, obclavate-ovoid to ellipsoidal, occasionally slight curved, uniseptate or aseptate, eguttulate or guttulate. Ascomata pseuothecial immersed or erumpent, solitary or confluent, globose to subglobose, ostiolate. Ascii cylindrical to subclavate, slightly curved, short pedicellate or sessile, 8-spored. Ascospores cylindrical to ovoid, ellipsoidal, hyaline, 1-septate, symmetrical or asymmetrical, constricted at the septum, biseriate or irregular uniseriate.

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

Neosascochyta 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 cbongl to isoladiometric cells. Conidiogenous cells phialidic, hyaline, smooth, ampulliform to doliform, 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.
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 outgrowths, 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 phalidic, hyaline, smooth, ampulliform, 6–8 × 6–9.5 µm. Conidia broadly fusoid to cylindrical, inadvertently slightly curved, smooth- and thin-walled, hyaline, uniseptate, 

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**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.
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, woolly, pale greenish olivaceous, olivaceous near the centre; reverse concolourous. Colonies on PDA, 30–35 mm diam after 7 d, margin regular, woolly, 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, Uppsland, 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 C66 = MW I 1343. The Netherlands, Gelderland, Laren, from Triticum sp. variety Tower, deposited in CBS Mar. 2002, I. de Vries, CBS 389.86. 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 extilalis*.

**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...
papillate. Pycnidal 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-Kitzeburg, Schlosskoppelweg, from seeds of Lolium perenne or L. multiflorum, 1968, U.G. Schlösser (holotype IMI 136404); from seed of L. 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...
(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. Pycnial 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,
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 vulgare, 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.
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 brachypodi”, 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; *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-thin-walled, 1-septate, slightly constricted at the septum, biseriate. Asci ellipsoidal to allantoid, subcylindrical, oblong, curved, hyaline, 1-septate, slightly constricted at the septum, 8-spored, bitunicate. Ascospores 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, Cesterr. Bot. Z. 25: 129. 1875.

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

≡ Phyllosticta argillacea Bres., Hedwigia 33: 206. 1894.

≡ Phoma argillacea (Niessl) Sacc., Syll. Fung. 1: 546. 1882.

**Description from holotype** (M 0275818): Leaf spots circular, brown to black. *Pseudothecia* on leaf surface, solitary, globose to subglobose, 225–265 × 210–260 μm. *Ostiole* 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 doliform, 5.5–8 × 4.5–6 μm. *Conidia* ellipsoidal to ovoid, smooth-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 Königstein, from leaves of Rubus idaeus, Aug. 1893, W. Krieger (holotype of *Phyllosticta argillacea* Fungi saxoni, 1187, S). Sweden, Umeå, Västerås, from a shoot of Rubus idaeus, Jan. 2000, S. Hellqvist, CBS 115577; from Rubus arcticus subsp. *stellaricactus*, 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 246888, 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-thin-walled, aseptate, 16.5–26 × 5.5–8 μm, gultutlate.

**Description from ex-epitype culture** (CBS 375.62): *Conidiomata* pycnidial, solitary, globose, with some hyphal outgrowths, superficial 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 twolayered, 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-thin-walled, aseptate, 14–27(–34) × 4.5–11(–15) μm, with 20–40 large guttules. *Conidial matrix* pale pink. *Chlamymospores* 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.
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, Aípes Marítimes, 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
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 cataria*, deposited in CBS Mar. 2000, CBS 102635 = PD 77/1131.

**Notes:** This species was first reported from *Nepeta cataria* 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) 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. 2002).

**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. Pyecnidium. I–J. Conidiogenous cells. K–L. Conidia. Scale bars: G = 100 μm; H = 50 μm; I–L = 5 μm.

**Clade 16: Neodidymellopsis**

**Neodidymellopsis** 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. **Conidiomata** pyecnidial, globose to subglobose, solitary or confluent, ostiolate. **Asci** cylindrical to clavate, sessile or stipitate, 8-spored, bitunicate. **Ascospores** observed in some species, intercalary or terminal, globose to oval, single or in chains, brown, smooth, sometimes dicytochwamydospores. **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. **Ascosporae** subovoid to oblong, ellipsoidal, hyaline, smooth, 1(–3)-septate, symmetrical or asymmetrical, constricted at the septum, bi- to triseriate.
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-ascocytta” 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 sub-globose, 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 isodiamic 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 sub-globose, or irregular, covered with hyphal outgrowths, semi-immersed or immersed, 100−340 × 75−235 μm. Ostioles
Fig. 39. Xenodiymella 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.
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, 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 caeruleum, 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 ellipsoid 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
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(–600) μm. Ostioles single, papillate. Pycnial 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, incipiently 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
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 outgrowths and with a clear elongated neck around the ostioles, (145–)155–280(–300) × (120–)140–230(–250) μm. Ostoioles 1–4(–6), on a distinctly elongated neck (up to 170 μm). *Pycnidial wall* pseudoparenchymatous, 3–6-layered, 16–41 μm thick, composed of isidiomeric 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, asceptate, 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 concolorous. 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 discoloration 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 maaglesi, deposited in CBS Jun. 1991, H. Ceval (epitype designated here CBS H-5199, MBT20498, 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 aepitype. *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. 2009a).

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 12395 differs from CBS 123395 in 20 bp.

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

Specimens 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* Worr. 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 gossypicola* (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 *Fragaria pennsylvania*ica, 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 alphtoides 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.

*Microsphaeropsisidaeae* 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 doliform 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 doliform or subcylindrical, with a prominent apical perincial 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
Microsphaeropsisidaceae 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. Pycnidal 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 idiogenous, 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. Fückel, 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 Peyronellaeae 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 included nine new genera, which were well-supported in the molecular phylogenetic analyses, i.e. Allophoma, Calophoma, Heterophoma, Neoascochyta, Neo-didymelliosis, 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, Neo-didymelliosis, 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, Peyronellaeae, 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 Microsphaeriaceae in the present study; Pithoascus was recently placed in Microascales (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, Platycthora 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 Platycthora 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, Neodidymelliosis, 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, conidiosgenesis 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, conidiosgenesis 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 conidiosgenesis.

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. gossypicola (syn. Phoma gossypicola) 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 consorted 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 undersampled by mycologists and plant pathologists in the past.

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