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PHYLOGENY, TAXONOMY AND THE ECOLOGY OF *CALONECTRIA* SPECIES

QIANLI LIU

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Phylogeny, taxonomy and the ecology of *Calonectria* species

By

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Submitted in partial fulfilment of the requirements for the degree

PHILOSOPHIAE DOCTOR

In the

Faculty of Natural and Agricultural Sciences

Department of Biochemistry, Genetics and Microbiology

Forestry and Agricultural Biotechnology Institute

University of Pretoria

Pretoria, South Africa

March 2023

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DECLARATION

I, Ms. QianLi Liu, the undersigned, declare that the thesis, which I hereby submit for the degree of *Philosophiae Doctor* at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any tertiary institution.

Qianli Liu

QianLi Liu

March 2023

Pretoria, South Africa

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ACKNOWLEDGEMENTS

Time flies by like a flash of light. The 6-years that I have pursued my doctoral degree will come to an end soon. In the long “river of life”, six years is not a long time, but during this period, I have gained so much ——scientific knowledge and a determined spirit. Looking back on the whole doctoral career, there are more people that I need to thank than is possible.

First and foremost, I am extremely grateful to my supervisors, Prof ShuaiFei Chen, Prof Mike J. Wingfield, Prof Brenda D. Wingfield and Prof Tuan A. Duong for offering me the wonderful opportunity to study towards a Ph.D. at the University of Pretoria. Your immense knowledge, invaluable guidance and continuous assistance have encouraged me greatly. Without your support, it would not have been possible for me to complete my research and other components that make up a PhD.

My special thanks go to Prof ShuaiFei Chen, my primary supervisor, for providing me the opportunity to join the Forest Health Research Group, the Research Institute of Fast-growing Trees (RIFT) (previously: China Eucalypt Research Centre, CERC). Your enthusiasm, dynamism, vision and sincerity have inspired me deeply. This has enabled me to complete the transformation from a scientific novice to a scientific explorer. This will benefit me during the rest of my life. It was s a great privilege and honor to work and study under your guidance.

I would like to express my sincere gratitude to Prof Mike J. Wingfield. You are always 100% passionate about your work and have shared valuable comments and suggestions enabling me to complete my studies. Your diligent and pragmatic work attitude has deeply inspired me and made me better understand the spirit of an outstanding scientist.

My sincere thanks to all the colleagues at RIFT for their constant support and assistance. A special thanks to Prof YaoJian Xie, Prof ShaoXiong Chen, Prof JianZhong Luo, Ms. TianHui Li and Dr APeng Du, for their unlimited encouragement and support.

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I am deeply grateful to my friends at RIFT including Mr. GuoQing Li, Dr FeiFei Liu and Dr JieQiong Li. We have spent the happiest six years together, making constant efforts to protect the health of *Eucalyptus* in South China. Our engagements have always been full of enthusiasm and hope for our work and life. Many thanks also to Mr. QuanChao Wang, Ms. WenXia Wu, Ms. WenWen Li, Ms. Wen Wang and other friends in Forest Health Research Group for their selfless assistance.

I would like to extend my sincere thanks to Prof Pedro W. Crous from Westerdijk Fungal Biodiversity Institute, for providing me with valuable ideas regarding the taxonomy of *Calonectria* species. A special thanks also to Prof Jolanda Roux and Prof Irene Barnes, for sharing their knowledge and enthusiasm for forest pathology during their visit to China. This broadened my recognition of the importance of the 'world of fungi" considerably.

Last but not least, I thank my family: my parents, my husband and my brother for their endless love, caring, understanding and for supporting me throughout my life. They have taught me how to face setbacks and learn from them. They are my eternal spiritual pillar and they provide me with the power to move onwards.

This study was initiated through the bilateral agreement between the Governments of China and South Africa. I thank RIFT for providing the experimental equipment throughout my Ph.D. I am grateful for the funding via projects The National Key R&D Program of China (China-South Africa Forestry Joint Research Centre Project; project No. 2018YFE0120900), the special fund for basic scientific research of State Key Laboratory of Tree Genetics and Breeding (SKLTGB) of China (project No. TGB2017001), the National Ten-thousand Talents Program (Project No. W03070115) and the GuangDong Top Young Talents Program in China (Project No. 20171172).

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PREFACE

The Ascomycota genus *Calonectria* (order Hypocreales) includes many important pathogens that can cause severe diseases on various plants important to forestry, agriculture and horticulture. Numerous of these plants are economically important such as *Eucalyptus* spp., *Pinus* spp., *Arachis hypogaea* (peanut) and *Glycine max* (soybean). Species of *Calonectria* on these and other plants genera have a cosmopolitan distribution and been reported from all continents except Antarctica.

As a fast-growing tree species, *Eucalyptus* has a high level of adaptability and plays a key role in protecting China's timber security. Since their first introduction in 1890 as ornamentals, *Eucalyptus* species have been rapidly established in China, reaching 5.46 million hm^2 by 2018. Due in part to the relatively narrow genetic basis, many disease problems threaten *Eucalyptus* sustainability. Among these diseases is leaf blight caused by *Calonectria* species, which has emerged as a severe constraint to forestry in Southern China. This fact justified the various studies undertaken in this thesis.

Calonectria species are known as soil-associated fungi and are widely distributed both on *Eucalyptus* leaves and in the soils associated with these trees. However, little knowledge is available regarding the connections between *Calonectria* species in these two ecological niches. Questions such as whether the pathogens causing Eucalyptus leaf blight mainly originated from the soil remains poorly understood.

The overall aim of the studies presented in this thesis was to expand available knowledge regarding the phylogeny, taxonomy and ecology of *Calonectria* species, especially focusing on these fungi occurring on *Eucalyptus* in China. The research had two main areas of focus. Firstly, to reconsider the species boundaries and phylogenetic relationships for *Calonectria*, updating the criteria and approaches for effective *Calonectria* species identification. The second aim was to consider the diversity and distribution of *Calonectria* species in *Eucalyptus* plantations and soils in Southern China.

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Chapter one of this thesis presents a review of the literature providing a general background regarding the genus *Calonectria*. This covers the taxonomic history, the fungal species concepts and the operational approaches widely applied to *Calonectria* species recognition. Equally importantly, the ecology of these fungi, including their geographic distribution, host range and dispersal pattern are considered. A complete list of the geographical distribution and host information supported by molecular data for all published species is included.

During the past 20 years, the taxonomy of *Calonectria* has received considerable attention. Yet, there is a lack of uniformity of sequence data and consistency in the genetic markers that have been applied in different studies. Thus, at the start of this study, there was an urgent need to re-evaluate the taxonomy of *Calonectria* species and to develop a suite of reliable DNA barcodes for species identification. I**n Chapter two** of the thesis, we have re-sequenced eight gene regions for 128 *Calonectria* species and their ex-types isolates. In this way, we have sought to determine their phylogenetic relationships and re-considered species boundaries for *Calonectria*. In addition, a robust set of DNA barcodes for *Calonectria* species identification were also developed. Results from this research provided a foundation for the studies undertaken in the subsequent chapters of the thesis.

In recent years, leaf blight caused by *Calonectria* species has seriously threatened *Eucalyptus* plantations in FuJian Province, southeastern China. Many *Calonectria* species have been isolated from diseased *Eucalyptus* tissues and were regarded as the causal agents of Calonectria leaf blight in this province. Yet, as soil-borne fungi, very little is known about the species diversity of these fungi in FuJian soils. **Chapter three** of the thesis focuses on the diversity and distribution characteristics of *Calonectria* species in soils collected from plantations and natural forests in FuJian Province, particularly *Eucalyptus* species. Extensive collections of soil samples were made in *Eucalyptus* and adjacent plantations, including those of *Cunninghamia lanceolata*, *Phyllostachys heterocycle* and *Pinus massoniana* as well as in natural forests. A large

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number of *Calonectria* isolates from soils were included and identified based on six-gene phylogenetic inference and morphology.

Previous research results suggested that many *Calonectria* species are distributed in *Eucalyptus* plantations, both in diseased tissues and soils under these trees. However, very little is known about the species diversity and distribution of these fungi isolated from diseased tissues or soils. In **Chapter four** of the thesis, extensive disease surveys of *Eucalyptus* plantations were conducted in YunNan Province, southwestern China. A large number of isolates were collected from diseased *Eucalyptus* leaves as well as from the soils under the trees. These were identified based on the multi-gene phylogeny and morphology. The overall aim was to clarify the species diversity and distribution characteristics of *Calonectria* spp. in diseased *Eucalyptus* leaves and soil samples and to consider the relative importance of these two substrates in the development of disease problems.

The studies in this thesis provided reliable approach for the taxonomy of *Calonectria* species. They have also led to a better understanding the phylogeny, taxonomy and ecology of species in the genus *Calonectria*. The thesis is presented as four chapters, including a literature review and three chapters covering experimental work. Each chapter was written as an independent unit and prepared for publication in journals. In this regard, some repetition of information and references in these chapters was necessary.

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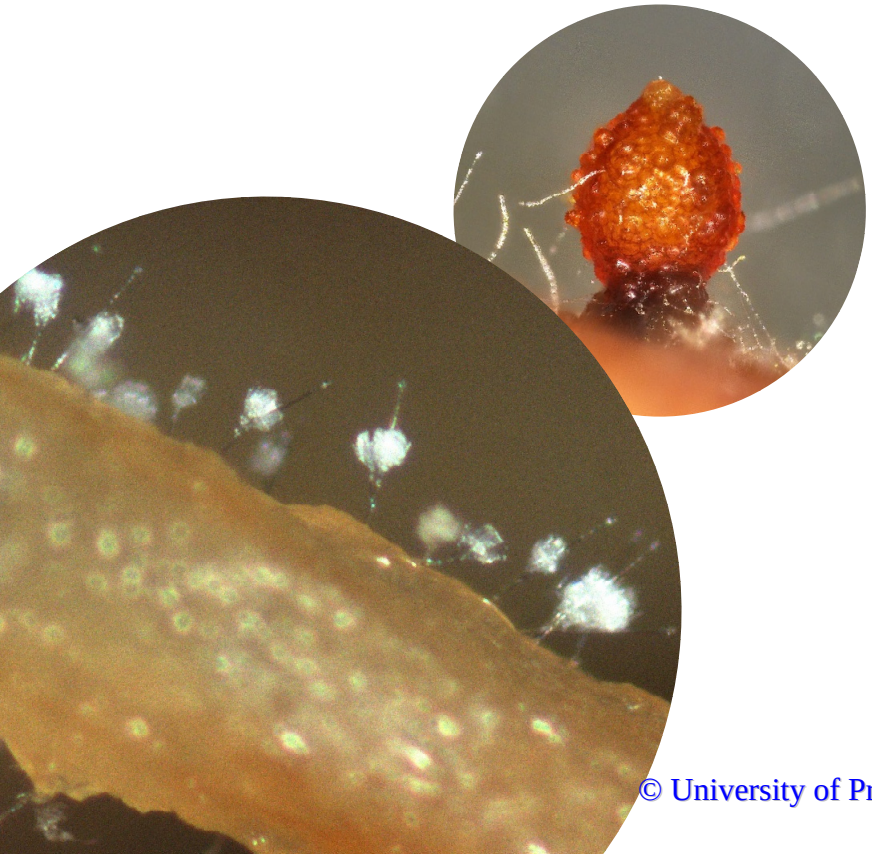
CHAPTER 1

Taxonomy, distribution and dispersal of species in the genus *Calonectria*

Literature review:

Liu QL, Wingfield MJ, Duong TA, Wingfield BD and Chen SF.

Taxonomy, distribution and dispersal of species in the genus *Calonectria*



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Taxonomy, distribution and dispersal of species in the genus *Calonectria*

1.0 INTRODUCTION

Calonectria (Ca.) is a genus of Ascomycota fungi classified in the family *Nectriaceae*; and represents one of eight families in the order *Hypocreales* (Lombard et al. 2015b). Species in this genus are characterized by having sexual morphs with bright yellow to dark red ascomata and 4-8-spored clavate asci. Compared with the sexual morphs, the asexual states are those most commonly encountered in nature, and they play a key role in *Calonectria* species identification (Peerally 1991; Crous 2002).

Species of *Calonectria* have a cosmopolitan distribution occurring on almost every continent, but they are particularly common in subtropical and tropical regions of the world (Crous 2002; Liu et al. 2020). *Calonectria* is a large genus that includes diverse species with different morphological and ecological characteristics (Liu et al. 2020). *Calonectria* species are soil-borne fungi, widely distributed in soils, but some are also important pathogens of plants (Wu & Chen 2021). Some species are aggressive pathogens, causing disease symptoms including cutting rot, damping off, foliar spots, leaf and shoot blight, root and collar rot, and stem cankers (Old et al. 2003; Chen et al. 2011; Lombard et al. 2010c).

Calonectria species are polyphagous having a broad host range and capable of infecting plant species in approximately 100 families (Lombard et al. 2010b; Vitale et al. 2013; Alfenas et al. 2015; Gai et al. 2017; Daughtrey 2019). In Europe, USA and the Mediterranean basin, *Calonectria* species causing severe damage to many ornamental plant nursery species, such as boxwood blight of *Buxus* spp. (Daughtrey 2019), leaf spot of *Callistemon* spp. (Vitale et al. 2013) and *Metrosideros* spp. (Lombard et al. 2011). In Asia, USA, South Africa and South America, *Calonectria* species are considered as important pathogens responsible for many agricultural and forestry crops diseases, such as Cylindrocladium black rot of peanut (*Arachis hypogaea*) (Gai et al. 2012; 2017), red crown rot of soybean (*Glycine max*) (Yamamoto et al. 2017; Jiang et

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al. 2020a), and leaf and shoot blight of *Eucalyptus* spp. (Crous et al. 2006; Alfenas et al. 2015; Li et al. 2017).

During the past 20 years, and especially due to the extensive application of DNA sequencing technologies, there has been a dramatic increase in the number of described *Calonectria* species. This has substantially expanded our knowledge about the geographic distribution and host range of *Calonectria* species. To date, there are 136 species of *Calonectria* (Crous et al. 2018, 2019, 2021a, b; Wang et al. 2019; Liu et al. 2020, 2022; Mohali & Stewart 2021; Pham et al. 2022; Sanchez-Gonzalez et al. 2022), this excludes *Ca. curvata*, *Ca. hederae* and *Ca. pyrochroa* due to a lack of ex-type cultures or DNA sequence data (Lombard et al. 2010b, 2016). The 133 species identified based on phylogenetic analyses and morphology are grouped into 11 larger groupings including the *Calonectria brassicae*, *Ca. candelabrum*, *Ca. colhounii*, *Ca. cylindrospora*, *Ca. gracilipes*, *Ca. kyotensis*, *Ca. mexicana*, *Ca. naviculata*, *Ca. pteridis*, *Ca. reteaudii* and *Ca. spathiphylli* species complexes (Liu et al. 2020). These also include what are referred to as the Prolate and Sphaero-Naviculate groups based on the morphological variation of the stipes.

This aim of this review is to provide a comprehensive overview of the taxonomy of the genus *Calonectria*, and especially to consider the practical applications of the morphological, biological and phylogenetic species concepts that were used in the *Calonectria* species identification. This review also summarizes the global distribution, host information and modes of dispersal of *Calonectria* species, providing basic knowledge to inform the management of diseases caused by these fungi.

2.0 TAXONOMIC HISTORY

The genus *Calonectria* was first introduced in 1867 by the botanist Giuseppe De Notaris based on *Ca. daldiniana* (type species), which was isolated from dead leaves of *Magnolia grandiflora* in Italy (De Notaris 1867; Crous 2002). Almost a century later, Rossman (1979) synonymized *Ca. daldiniana* under *Ca. pyrochroa* based on

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morphological features. The sexual state (Fig. 1) of *Calonectria* is characterized by having bright yellow to dark red perithecia, with scaly to warty ascocarp walls (Rossman 1979). The asexual genus *Cylindrocladium* (Cy.) was originally described by Andrew Price Morgan in 1982, which is based on the species *Cy. scoparium* collected from dead pods of honey locust (*Gleditsia triacanthos*) in Ohio, USA (Morgan 1982). *Cylindrocladium* spp. are characterized by having branched conidiophores giving rise to cylindrical conidia, with stipe extensions terminating in diversely shaped vesicles (Crous & Wingfield 1994). This asexual state is more frequently observed in nature and provides a greater number of distinguishing features for *Calonectria* than the sexual state (Crous 2002). For almost 50 years, the morphological characteristics of the asexual structures (Fig. 1) played the dominant role in *Calonectria* species delimitation (Boedijn and Reitsma 1950; Peerally 1991; Crous and Wingfield 1994; Crous 2002).

In 1950, Boedijn and Reitsma published the first review of *Cylindrocladium*. In this monograph, seven *Cylindrocladium* species were recognized, and *Cy. ilicicola* was linked with its sextual state *Ca. ilicicola* (Boedijn and Reitsma 1950). More than 40 years later, Peerally (1991) introduced 26 species of *Cylindrocladium*, 10 of which were linked with the sexual morph in *Calonectria*, and the additional 16 species were not known to have a sexual state. Peerally (1991) thus emphasized the fact that the asexual morphology should be regarded as providing the most important criteria in the taxonomy of *Calonectria* species. In 1994, Crous and Wingfield (1994) further highlighted the importance of asexual characteristics in *Calonectria* species identification and described 22 *Cylindrocladium* species and one variety *Cy. colhounii* var. *macroconidialis*. In 2002, based on comparisons of the asexual morphological characteristics, Crous (2002) recognized 39 *Cylindrocladium* species, 28 of which were associated with their sexual states in *Calonectria* and additional 11 species in the absence of a perithecial state.

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As additional *Calonectria* species were described, the dual nomenclature system for the fungi resulted in a certain degree of confusion (Wingfield et al. 2012). This was especially evident where sexual state epithets were different to those of the asexual state (Lombard et al. 2010b). According to the Amsterdam Declaration on Fungal Nomenclature, the single-name nomenclatural system should be applied for all pleomorphic fungi (Hawksworth 2005; Hawksworth et al. 2011; McNeill et al. 2012). Therefore, regardless of whether the perithecial states were known or not, all *Cylindrocladium* species were transferred to the genus *Calonectria* following the priority rule (Lombard et al. 2010b).

As DNA sequencing technologies advanced, the efficacy of the morphology-based species identification in *Calonectria* began to be questioned (Lombard et al. 2010b). Thus, the utility of morphological characters alone in the recognition of *Calonectria* has been replaced by a polyphasic approach, that includes multi-gene phylogenetic analyses combined with morphological and biological characteristics (Crous et al. 2004, 2006; Lombard et al. 2010b).

In 2010, based on the DNA sequence comparison of seven gene regions (*act*, *cmdA*, *his3*, ITS, LSU, *tef1* and *tub2*) together with the morphological and biological characteristics, Lombard et al. (2010b) re-evaluated the phylogenetic relationships between all the published *Calonectria* species. This resulted in the validation of 68 *Calonectria* spp., including two species *Ca. curvata* and *Ca. hederae* for which cultures were not available. This genus-wide phylogeny clearly showed the presence of two major clades; the Prolate Group and the Sphaero-Naviculate Group. These two clades consist of 13 sub-clades (species complexes), which can be correlated with distinct morphological characteristics. The study of Lombard (2010b) highlighted the fact that DNA sequences of *cmdA*, *his3*, *tef1* and *tub2* gene regions provided good resolution to recognize *Calonectria* spp. Thus, in subsequent studies, DNA sequences of the four gene regions were commonly used in the taxonomy of *Calonectria* (Chen et al. 2011; Alfenas et al. 2015; Lombard et al. 2015a, 2016; Li et al. 2017; Pham et al. 2019).

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However, for some published species, sequence data were inconsistent across studies and DNA barcodes used for identification were not uniform. This highlighted a need for an extensive reassessment of the genus.

In response to a need for a re-evaluation of *Calonectria*, Liu et al. (2020) re-sequenced eight gene regions (*act*, *cmdA*, *his3*, ITS, LSU, *rpb2*, *tef1* and *tub2*) of all *Calonectria* species, and reconsidered the species boundaries for the genus based on the multigene phylogeny combined with morphological characteristics. In that study, 169 published *Calonectria* species were re-identified and 120 species were validated. This genus-wide phylogeny resolved *Calonectria* into 11 species complexes, nine of which (the *Calonectria brassicae*, *Ca. candelabrum*, *Ca. colhounii*, *Ca. cylindrospora*, *Ca. gracilipes*, *Ca. mexicana*, *Ca. pteridis*, *Ca. reteaudii* and *Ca. spathiphylli* species complexes) reside in the Prolate Group. The remaining two (the *Ca. kyotensis* and *Ca. naviculata* species complexes) resided in the Sphaero-Naviculate Group. This study generated a suite of reliable and effective DNA barcodes (*act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2*) for *Calonectria*, which provided a foundation for the future taxonomy study of *Calonectria*, including the recent study of Pham et al. (2022).

3.0 SPECIES CONCEPTS AND THEIR APPLICATION IN CALONECTRIA

3.1 Species concepts in fungi

The definition of what a species is represents a topic continually being debated among biologists, and it is one for which there is no general agreement (Taylor et al. 2000; Agapow et al. 2004; Cai et al. 2011; Freudenstein et al. 2017). There are at least 40 different species concepts that have been proposed by various scholars (Zachos 2016; Hill 2017; Shanker et al. 2017). These are generally based on the operational convenience and practical applicability in the taxonomic studies. These concepts were inevitably influenced by the professional insights of scholars and the understanding of the evolutionary process of speciation (Cai et al. 2011). Therefore, it is fundamentally impossible to expect a universal species concept that is appropriate for all species in

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taxonomic practice (Giraud et al. 2008). With the rapid development of molecular tools, many of these concepts have been extensively revised (Steenkamp et al. 2018). Three operational species concepts have been commonly used for fungi, including the Morphological Species Concept (MSC), the Biological Species Concept (BSC) and the Phylogenetic Species Concept (PSC).

The MSC defines "species are the smallest groups that are consistently and persistently distinct, and distinguishable by ordinary means" (Cronquist 1978). This species concept emphasizes the morphological divergence and distinguish species based on their form and structural features. Until quite recently, the most widely used species concept for fungi has been the MSC (Smith & Black 1990; Crous 2002). However, morphological characteristics may not delimit species precisely due to overlapping characters, morphological plasticity and cryptic species (Verkley et al. 2004; Hyde et al. 2009; Lombard et al. 2010a), and sometimes the morphological characters are influenced by environmental conditions and geographical distributions and exhibit a certain degree of variation within a species (Tulloss 2005; Vasilyeva & Stephenson 2010).

The BSC defines "species as populations whose members interbreed and produce viable, fertile offspring" (Mayr 1942). This species concept relies on reproductive isolation or intersterility and commonly are conducted through laboratory sexual compatibility tests. This approach has been successfully applied in the taxonomic studies of many fungi (Korhonen 1978; Kile et al. 1996; Turner et al. 2001). However, there are also obvious limitations for BSC, such as the fact that it cannot be used easily for homothallic species nor at all in the case of asexual fungi (Taylor et al. 2000; Cai et al. 2011). In addition, in the case of allopatric speciation or sympatric speciation (speciation following host shift and specialization), intersterility may occur later than genetic divergence (Coyne & Orr 1997; Giraud et al. 2008, 2010), which can lead to some sibling species remaining interfertile for some time (Peever 2007), making the laboratory mating tests an unreliable approach to delimiting species.

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The PSC defines “a species is the smallest population or group of populations within which there is a parental pattern of ancestry and descent” (Cracraft 1983; Zachos 2016). Based on the evolutionary divergence between monophyletic lineages, PSC reliance on phylogenetic analyses of sequence differences, usually DNA sequences, to delineate species (Taylor et al. 2000). This approach is more efficient and operable compared to the laboratory mating tests and morphological description. Based on the analyses of single gene sequence, many fungi can thus be readily classified into the genus level (Bruns et al. 1998; Cooke et al. 2000). However, it can be problematic to distinguish them at species level because the information provided by a single gene is insufficient to reflect the evolutionary history of the fungus (Giraud et al. 2008; Cai et al. 2011).

Taylor et al. (2000) proposed the Genealogical Concordance Phylogenetic Species Recognition (GCPSR). As an extension of the PSC, the GCPSR is based on concordance of multiple unlinked gene genealogies to distinguish species and provides a more powerful taxonomic resolution in defining species boundaries. Currently, this approach has played an important role in the taxonomic studies of fungi (Dettman et al. 2003; Pringle et al. 2005; Peterson 2008; Pavlic et al. 2009; Lombard et al. 2019) and it is widely considered as a powerful approach.

With the application of the multigene phylogenetic species concept, in some cases phylogenies based on individual genes may exhibit topological differences, and thus conflicting gene trees (Delsuc et al. 2005). Regardless of the degree of conflict among gene trees, for any taxa, its evolutionary history is unique. Conflicting gene trees suggested that some inferred phylogenies fail to accurately reflect the evolutionary relationship of species. To address this problem, a new discipline formed by the intersection of phylogenetic biology and genomics has emerged — this is phylogenomics (Delsuc et al. 2005; Philippe et al. 2011). Based on the genome-scale information, phylogenomics provides a powerful means to correctly understand and resolve gene tree conflicts (Rokas et al. 2003), and improved the resolution of the evolutionary relationships of fungi (Fitzpatrick et al. 2006; Stajich 2017; Choi & Kim

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2017; Li et al. 2021b). In recent years, with the implementation of the 1000 Fungal Genome Project (http://1000.fungalgenomes.org) (Stajich 2017), fungal genome sequence databases have expanded to a point where phylogenomics can be successfully employed to better understand fungal taxonomy, such as the order *Polyporales* (Binder et al. 2013), *Pucciniales* (Aime et al. 2017), the genus *Aspergillus* (Steenwyk et al. 2019), *Fusarium* (Geiser et al. 2021; O'Donnell et al. 2020), *Penicillium* (Steenwyk et al. 2019), and the *Trichophyton rubrum* complex (Cornet et al. 2021). In the following section, the application of the three species concepts to the taxonomy of *Calonectria* is discussed.

3.2 The morphological species concept (MSC)

Prior to the 1990's, *Calonectria* species identification was based on comparisons of microscopic morphological characteristics and occasionally on sexual compatibility under standardized conditions (Boedijn & Reitsma 1950; Crous & Wingfield 1994; Crous 2002). Typically, carnation-leaf agar (CLA) was applied as the standardized medium to induce the morphological structures of *Calonectria* species. More recently, synthetic nutrient-poor agar (SNA; Nirenburg 1981; Lombard et al. 2009; Alfenas et al. 2015) and minimal salt agar (MSA; Guerber & Correll 2001; Lombard et al. 2010b) with sterile toothpicks have been widely used to induce the asexual and sexual structures of *Calonectria* species.

Compared with the sexual stage, the asexual stage occurs more commonly in nature (Crous 2002) and provides more morphological information to distinguish between *Calonectria* species (Lombard et al. 2010b). The morphological features of the asexual structures (Fig. 1), including vesicle shape and diameter, macroconidial septation and dimensions have been extensively employed in the taxonomy of these fungi. Important morphology characteristics of the sexual structures (Fig. 1) used in the taxonomy include number of ascospores in the asci, ascospore septation and dimensions (Crous & Wingfield 1994; Crous 2002; Chen et al. 2011; Liu et al. 2020).

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With the deepening of research, it has been found that there are insufficient morphological features to provide accurate delineation of *Calonectria* species and use only of these characteristics have led to inaccurate identifications (Crous 2002; Lombard et al. 2010b). This is because some species share similar morphological characteristics in some cases even with different species complexes, for example, *Ca. nemuricola* (*Ca. candelabrum* species complex) and *Ca. insularis* (*Ca. cylindrospora* species complex) both produce obpyriform vesicles, and 1-septate macroconidia with overlapping dimensions (Liu et al. 2020). Variability in the morphological characteristics observed in some species can also result in confusion with regards to species identification, for example, *Ca. spathulata* (Crous & Kang 2001) and *Ca. stipitata* (Lombard et al. 2016) were previously considered as different, the macroconidia of *Ca. spathulata* (av. 80 × 6 µm) are obviously larger than those of *Ca. stipitata* (av. 32 × 4 µm). In a subsequent study, based on the eight-gene phylogenetic analyses, Liu (2020) synonymized *Ca. stipitata* with *Ca. spathulata*, and the morphological differences were considered as representing intraspecific variation. It was also evident that the morphology of these *Calonectria* species were easily affected by the incubation environment, where for example Crous (1992) found that different culture media and culture ages could directly influence vesicle length and width in some isolates.

3.3 The biological species concept (BSC)

For fungi in the Ascomycota, the mating systems are bipolar, with two non-allelic idiomorphs (typically designated as *MAT1-1* and *MAT1-2*) being present in cells of opposite mating type (Debuchy & Turgeon 2006). In homothallic fungi, individuals are self-fertile and contain both idiomorphs *MAT1-1* and *MAT1-2*, and can complete the sexual cycle on their own. In contrast, heterothallic fungi individuals are self-sterile, contain either the *MAT1-1* or *MAT1-2* idiomorph and can only mate with isolates of opposite mating type (Ni et al. 2011; Lopes et al. 2018).

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Both homothallic and heterothallic mating systems are found in *Calonectria*, with the majority being heterothallic (Crous 2002; Li et al. 2020). Based on the whole-genome sequences of seven *Calonectria* species, Li et al. (2020) designed mating type markers to clarify the mating strategies of 65 *Calonectria* species. The results revealed that 44 were heterothallic and showed that heterothallism represented the ancestral state in *Calonectria*. Both mating systems were also found to occur within the different species complex; for example, *Ca. bumicola*, *Ca. crousiana* and *Ca. gracilis* belong to the *Ca. reteaudii*, *Ca. brassicae* and *Ca. kyotensis* species complexes, respectively and were identified as homothallic, while the majority of species in these complexes are heterothallic (Li et al. 2020).

The BSC has been extensively applied for *Calonectria* species delimitation (Crous et al. 1998; Schoch et al. 1999, 2000; Crous 2002; Lombard et al. 2010a, b). For example, in the heterothallic species *Ca. candelabrum*, *Ca. mexicana*, *Ca. ovata* and *Ca. pauciramosa* (Crous et al. 1998; Schoch et al. 1999), ascomata formed only between individuals of the opposite mating type.

Although the BSC is useful in the taxonomy of *Calonectria*, this approach also has obvious limitations and is not reliable under some conditions. Isolates of some phylogenetically closely related species, may retain the capability to recombine and produce viable progeny (Crous 2002). For example, interspecies mating was found in *Ca. cylindrospora*, *Ca. hawksworthii* and *Ca. insularis*, although their progeny are usually not fertile (Crous 2002). In addition, mating tests in the laboratory can be time-consuming. It can take up to 4-8 weeks for the formation of perithecia in some *Calonectria* species (Schoch et al. 1999; Crous 2002; Li et al. 2017). Another limitation is that the tests are easily affected by the incubation conditions, which may lead to the results of mating tests in the laboratory inconsistent with field observations (Crous 2002; Liu et al. 2017; Li et al. 2020). For example, *Ca. aciculata* and *Ca. lichi* were shown to be homothallic (Li et al. 2020), while they failed to produce fertile ascospores in culture even after 2 months of incubation (Li et al. 2017; Liu et al. 2017). Another problem is

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that some isolates can lose the ability to cross and produce fertile progeny leading to unreliable experimental results (Lombard et al. 2010b).

3.4 The phylogenetic species concept (PSC)

With the development of DNA sequencing technology, DNA-based phylogenetic analyses have played an important role in the taxonomy of *Calonectria* species. In 1997, Jeng et al. utilized the DNA sequences of the ITS region (5.8S ribosomal RNA gene and flanking internally transcribed spacers) to successfully resolve the identification of *Ca. cylindrospora* and *Ca. kyotensis* (Jeng et al. 1997; Liu et al. 2020). A subsequent study revealed that in comparison with sequences for the ITS region, the *tub2* (β-tubulin) and *his3* (histone H3) gene regions provide better resolution for species identification (Crous et al. 1999; Schoch et al. 2000, 2001; Kang et al. 2001b). Schoch et al. (2001) conducted phylogenetic analyses of 35 *Calonectria* species using the *tub2* sequence data and compared the morphological and biological species concept used for these fungi. Their phylogeny divided this genus into two groups and subdivided into 10 clades supported with strong bootstrap values and to provide a foundation for investigating the taxonomy of this genus.

The GCPSR proposed by Taylor et al 2000, has provided increased taxonomic resolution in determining *Calonectria* species boundaries (Lombard et al. 2010b, 2016; Alfenas et al. 2015; Pham et al. 2019; Liu et al. 2020). In 2010, Lombard et al. (2010b) employed seven gene regions including *act* (actin), *cmdA*, *his3*, ITS, LSU (28S nuclear ribosomal large subunit), *tef1* and *tub2* to re-identify 66 accepted *Calonectria* species and showed that the *cmdA* gene region provided the best revolution to distinguish *Calonectria* species. This study also produced a phylogenetic tree using combined sequence analysis of *act*, *tub2*, *cmdA* and *his3* to re-consider the phylogenetic relationships of all *Calonectria* species. Their results confirmed that *Calonectria* includes two major groups Prolate Group and Sphaero-Naviculate Group, and that it includes 13 subclades treated as species complexes.

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In the following 10 years, a polyphasic approach, including multigene phylogenetic analyses together with the morphological characteristics was widely applied for the taxonomic studies of *Calonectria* species (Chen et al. 2011; Alfenas et al. 2013, 2015; Lombard et al. 2015a, 2016; Li et al. 2017; Pham et al. 2019), which has also led to the description of many new species. However, a lack of consistency in the molecular markers and sequence data used in different studies raised questions regarding the reliability of species boundaries, there was thus a need to develop an optimal set of DNA barcodes regions for the *Calonectria* species identification. In 2020, Liu et al. (2020) utilized DNA sequences of eight-gene regions to re-construct the genus-wide phylogenetic trees and re-considered the phylogenetic relationship for all the 169 *Calonectria* species. Based on this research, 120 defined *Calonectria* species are now accepted and group in 11 species complexes. Liu et al. (2020) proposed a set of reliable DNA barcodes for *Calonectria*, including *act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2*. In subsequent studies, DNA sequences of the six gene regions have been widely applied in the taxonomy of *Calonectria* and these have provided a stable resolution for *Calonectria* taxonomy (Pham et al. 2022; Liu et al. 2022).

In recent years, with the rapid development of whole-genome sequencing technology, large numbers of fungi have had their whole-genome sequenced (Stajich 2017). Phylogenomics, relies on the genome-scale data, and such studies have greatly advanced our understanding of the evolutionary relationship of many fungal groups (Aime et al. 2017; Geiser et al. 2021). To date, 17 *Calonectria* genomes have been sequenced and these include *Calonectria aciculata*, *Ca. crousiana*, *Ca. fujianensis*, *Ca. hawksworthii*, *Ca. henricotiae*, *Ca. honghensis*, *Ca. hongkongensis*, *Ca. ilicicola*, *Ca. leucothoes*, *Ca. montana* (synonymized as *Ca. canadiana*), *Ca. multiphialidica*, *Ca. naviculata*, *Ca. pauciramosa*, *Ca. pseudonaviculata*, *Ca. pseudoreteaudii*, *Ca. pseudoturangicola* and *Ca. pteridis* (Crouch et al. 2017; Ye et al. 2018; Liu et al. 2019; Gai et al. 2020; LeBlanc et al. 2021; Li et al. 2021a; Tian et al. 2022). In future, as more whole-genome sequences of *Calonectria* species are available, phylogenomic analyses will provide reliable evolutionary relationships for *Calonectria* species.

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4.0 CALONECTRIA AS PLANT PATHOGENS

Species of *Calonectria* were initially considered as saprobes (Graves 1915). In 1915, Graves reported a root rot disease on *Pinus* spp. infected by *Ca. cylindrospora* (as *Cy. scoparium*) but failed to induce the disease symptoms by inoculating this fungus on healthy *Pinus* seedlings, supporting the view of a saprobic lifestyle. However, in 1917, Massey demonstrated pathogenicity of *Ca. cylindrospora* with an inoculation test on roses in a greenhouse in the USA. Subsequently, *Calonectria* species have been reported as economically important plant pathogens and have been shown to have a broad range of hosts including nearly 335 plant species (Crous 2002; Lombard et al. 2010b).

Species of *Calonectria* can infect any part of the plant including the leaves, stems, roots, flowers and fruits. They are also associated with a wide range of disease symptoms including cutting rot (Crous et al. 1998; Crous and Kang 2001; Lombard et al. 2010c; Alfenas et al. 2013), crown rot (Vitale et al. 2008; Lombard et al. 2011; Kleczewski et al. 2019; Akamatsu et al. 2020), damping-off (Sharma et al. 1984; Polizzi et al. 2007; Alfenas et al. 2015; Stępniewska et al. 2020), fruit rot (Silva et al. 2001; Serrato-Diaz et al. 2013; Lopes et al. 2017; Yang et al. 2022), leaf blight (Alfenas et al. 2013, 2015; Chen et al. 2011; Li et al. 2017); leaf spot (Hirooka et al. 2008; Lombard et al. 2011; Gai et al. 2017; Bartíková et al. 2020), root rot (Lombard et al. 2011; Pei et al. 2015; Risède & Simoneau 2001; Yi et al. 2022), shoot blight (Bolland et al. 1985; Crous et al. 1991; Polizzi et al. 2009) and soft rot (Zhang et al. 2020).

5.0 DISTRIBUTION OF *CALONECTRIA* SPECIES

5.1 Geographic distribution

Based on the phylogenetic analyses, all 133 *Calonectria* species grouped in 11 species complexes can be shown to have distinct geographic distribution characteristics. For example, both the *Ca. brassicae* and *Ca. candelabrum* species complexes can be

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regarded as representing a South-American clade. There are 16 species included in the *Ca. brassicae* species complex, and with the exception of *Ca. clavata*, the other 15 species are mainly reported in South American countries (Table 1). The *Ca. candelabrum* species complex incorporates 21 species, and with the exception of *Ca. brevistipitata*, the remaining 20 species were mainly identified from South America (Table 1).

The *Ca. colhounii*, *Ca. kyotensis* and *Ca. reteaudii* species complex can be considered as the Asian clades. Thirteen species are now accommodated in the *Ca. colhounii* species complex, and with the exception of *Ca. macroconidialis*, *Ca. madagascariensis* and *Ca. paracolohounii*, the remaining ten species were first reported in Asian countries (Table 1). There are 29 species incorporated in the *Ca. kyotensis* species complex, with the exception of *Ca. colombiensis* and *Ca. uniseptata*, the other species have mainly been reported from Asian countries (Table 1). The *Ca. reteaudii* species complex now incorporates nine species, with the exception of *Ca. acicola*, *Ca. australiensis* and *Ca. lombardiana*, the remaining six species were mainly reported in Asia (Table 1). In contrast, the *Ca. mexicana* species complex can be regarded as a North American clade. Currently, there are nine species were included in this species complex, and with the exception of *Ca. pseudomexicana*, the remaining eight species have been reported from North American countries (Table 1).

Calonectria species are widely distributed around the world and have been reported from all continents except Antarctica, but they are particularly extensively distributed in tropical and subtropical areas of the world. At present, species in this genus have been recorded in 53 countries (Fig. 2, Table 2), and among them, more than 10 species have been reported from Ecuador, Indonesia and Vietnam. Brazil, China and the USA have the largest number of *Calonectria* species reports with 45, 30 and 22, respectively (Table 2).

5.1.1 Current status of *Calonectria* species in terms of biological invasions

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Biological invasion seriously damages the global ecosystem, leading to the loss of biodiversity, and threatening human health and safety (Tobin 2015; Wingfield et al. 2017; Paap et al. 2022). This is consequently also a topic of serious global concern. Invasive species include all organisms such as plants, animals and microorganisms. Compared with animals and plants, research on invasive microorganisms is relatively poorly represented (Diagne et al. 2021; Paap et al. 2022). However, plant diseases caused by invasive pathogens are a serious threat to global crop safety and the future of natural woody ecosystems. Dutch elm disease caused by *Ophiostoma* spp., chestnut blight caused by *Cryphonectria parasitica* (Thakur et al. 2019) and rice blast caused by *Magnaporthe oryzae* (Qiu et al. 2022) are a few examples.

Several researchers have investigated the origin and invasion status of some widespread *Calonectria* species by conducting population studies at the global scale. *Calonectria pseudonaviculata*, the causal agent of boxwood blight, was initially detected in 1994 in the UK, and has been extensively reported in European countries since 2005. In 2010, the disease was detected in Asia bordering Europe and in various regions in North America (Gehesquière et al. 2016; LeBlanc et al. 2019). To date, *Ca. pseudonaviculata* has been reported in 20 countries (Gorgiladze et al. 2011; Ivors & LeBude 2011; Akilli et al. 2012; Gasich et al. 2013; Mirabolfathy et al. 2013; Gehesquière et al. 2016; Ward Gauthier et al. 2016; Bartíková et al. 2020). The geographic origin of the species remains unclear, but it is presumed to have originated from the center diversity of *Buxus* in East Asia, the Caribbean, or Madagascar (Daughtrey 2019; Castroagudín et al. 2020; LeBlanc et al. 2021; Barker et al. 2022). In this regard, it was likely introduced into Europe via the ornamental nursery trade and then to western Asia and North America (Daughtrey 2019).

Calonectria pauciramosa is an invasive pathogen that can cause devastating diseases on many important plants (Crous 2002; Lombard et al. 2010a, 2015; Li et al. 2021a). This species has a wide geographic distribution and been reported in 13 countries on five continents. Previous research by Schoch et al. (2001) suggested that *Ca.*

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pauciramosa most likely originated from Central or South American and this view was supported by Li et al. (2017), by conducting a study of its global distribution and genetic diversity. The results of that study suggested that *Ca. pauciramosa* may have originated in South America (Ecuador or Uruguay), and then spread to several other continents through plant or soil material.

The above research provides some guidance to develop strategies focused on slowing the spread of *Calonectria* spp. globally. Yet their pathways of movement globally remain poorly understood and need more intensive research. For example, *Ca. ilicicola*, the causal agent of soybean red crown rot and peanut black rot, was first reported in Georgia in 1965 and subsequently spread to South Carolina, North Carolina, and Virginia. It also causes serious economic losses in Australia, China, and Japan and has been reported in 10 countries (Johnson 1985; Crous et al. 2004; Gai et al. 2017; Akamatsu et al. 2020). Currently, there are two hypotheses about the origin of this pathogen. One hypothesis is that the species was introduced into GuangDong Province, China from the USA through infected peanut seeds, and then further spread to FuJian, JiangXi and other Provinces in China. Another hypothesis is that this pathogen might originated from China and was then moved to other countries.

Calonectria pseudoreteaudii, the most important pathogen of Eucalyptus leaf blight, was originally described in GuangDong Province, China in 2010 (Lombard et al. 2010c), and subsequently reported on *Eucalyptus* and *Macadamia* plantation in Hanoi, Vietnam in 2012 (Crous et al. 2012). Since 2011, *Ca. pseudoreteaudii* has been extensively observed in *Eucalyptus* plantations, nurseries and soils in southern China (Chen et al. 2011; Lombard et al. 2015; Li et al. 2017; Wang & Chen 2020; Wu & Chen 2021; Li et al. 2022). In 2020, this species was also found on *Macadamia* plantation in YunNan and GuangXi Provinces, China (Jiang et al. 2020b, c). To date, *Calonectria pseudoreteaudii* is regarded as the most widely distributed species and has been reported in almost all previous studies on diseased *Eucalyptus* plantations in southern China. This raises many questions regarding its origin and movement. It is not known

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how it has spread between China and Vietnam and whether it also occurs in other neighboring Asian countries.

5.2 Host range

Calonectria species are well-known soil-inhabiting fungi (Crous 2002; Li et al. 2017; Liu et al. 2020). Of the 133 published *Calonectria* species, 82 have been isolated from soils, 79 species have been reported only from plant tissue, and 28 have been recorded from both plant tissue and soils (Table 1).

Members of some species complexes are mostly soil-borne fungi, such as species in the *Ca. brassicae* and *Ca. kyotensis* species complexes. For example, there are 16 species included in the *Ca. brassicae* species complex and while 12 have been isolated from soil samples, only six species have been reported from plant tissues. Similarly, there are 29 species currently accommodated in the *Ca. kyotensis* species complex, of which 24 have been isolated from soil samples and 15 have been recorded from plant tissues. Some *Calonectria* species are broadly dispersed in soil, but rarely infect plants under natural conditions. For example, *Ca. aconidialis* (*Ca. kyotensis* species complex), is one of the most widely distributed species in the soils of South China, and has been reported from soils in FuJian, GuangDong, GuangXi and HaiNan Provinces of China (Lombard et al. 2015a; Liu et al. 2022), while this species only been reported from infected *Eucalyptus* plantation in GuangDong Province of China (Li et al. 2022). Some species are both widely distributed in soils and also well-known to cause plant disease. An example is found in *Ca. ilicicola* (*Ca. kyotensis* species complex), which has been reported from diseased plant species in Australia, China, Indonesia, Iran, Italy, Japan, South Korea and the USA (Table 1), and is also extensively distributed in soils in China (GuangDong, FuJian and YunNan Provinces), Malaysia and Vietnam (Table 1).

Some species complexes include many important plant pathogens, such as the *Ca. colhounii*, *Ca. cylindrospora*, *Ca. pteridis* and *Ca. reteaudii* species complexes (Liu et al. 2020) and they are well-known causal agents of Calonectria leaf blight (CLB) on

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Eucalyptus. There are 13, 12, seven and nine species included in these species complexes, respectively, and five, eight, three, five of them have been reported from diseased *Eucalyptus* plantations, respectively (Table 1).

Calonectria species have been reported to cause serious disease on a variety of crops, especially in the plant families Fabaceae, Musaceae and Rosaceae (Risède & Simoneau 2004; Gehesquière et al. 2013; Gai et al. 2017; Jiang et al. 2020a; Iriarte et al. 2021). Among them, Cylindrocladium black rot of peanut and red crown rot of soybean caused by the soil-borne fungus *Ca. ilicicola* occur in many parts of the world, causing serious economic losses to these two crops (Gai et al. 2017), countries including in Australia (Johnson 1985), China (FuJian, GuangDong, JiangXi and ZheJiang) (Gai et al. 2012, 2017), Japan (Akita, Fukushima, Nagano, Niigata, Toyama and Tsukuba) (Yamamoto et al. 2017; Akamatsu et al. 2020) and the USA (Georgia, North Carolina, South Carolina, and Texas) (Crous et al. 2004; Gai et al. 2017) (Table 1).

Other diseases of agricultural crops caused by *Calonectria* species include the toppling disease of *Musa* sp. by *Ca. brassicae* (in Cameroon; Crous et al. 2006), *Ca. clavata* (in France and Saint Lucia; Crous et al. 2006), *Ca. cylindrospora* (in Cameroon and France; Risède & Simoneau 2004), *Ca. kyotensis* (in Cameroon; Risède & Simoneau 2004) and *Ca. spathiphylli* (in Cameroon, Costa Rica and Dominica; Risède & Simoneau 2004). In addition, postharvest rot and damping-off in strawberry is caused by *Ca. fragariae* (in Brazil; Lopes et al. 2017) and *Ca. canadiana* (in Japan; Hirooka et al. 2009), respectively (Table 1).

In horticulture, *Calonectria* species are reported to cause extensive damage in the cut-flower and ornamental plant industries and include diseases of plants in the families *Araceae*, *Buxaceae*, *Ericaceae*, and *Myrtaceae* in Northern Hemisphere (Vitale et al. 2013; Daughtrey 2019; Aiello et al. 2022). Among them, Boxwood blight caused by two sister species *Ca. pseudonaviculata* and *Ca. henricotiae* have become a major threat to the boxwood (*Buxus* spp.) worldwide. Until now, *Ca. pseudonaviculata* has been reported in 20 countries around the world (Table 1), including Abkhazia, Austria,

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Belgium, Canada, Croatia, Czech Republic, France, Georgia, Germany, Iran, Ireland, Italy, New Zealand, The Netherlands, Slovenia, Spain, Switzerland, Turkey, UK, and the USA (Table 1). *Calonectria henricotiae* has been discovered in six countries, including Belgium, Czech Republic, Germany, Slovenia, The Netherlands, and the UK (Gehesquière et al. 2016; Bartíková et al. 2020), where it brings sizable economic losses to the world horticultural industry (Table 1).

Other important diseases on ornamental plants associated with *Calonectria* species include leaf spot disease of *Metrosideros* spp. caused by *Ca. metrosideri* (in Brazil; Alfenas et al. 2015), *Ca. pauciramosa* (in Tunisia; Lombard et al. 2011), *Ca. pseudometrosideri* (in Brazil; Alfenas et al. 2015) and *Ca. pseudomexicana* (in Tunisia; Lombard et al. 2011), and leaf blight of *Callistemon* spp. caused by *Ca. pauciramosa* (in Italy; Lombard et al. 2010a) and *Ca. pseudomexicana* (in Tunisia; Lombard et al. 2011) (Table 1).

In forestry, *Calonectria* species are important pathogens associated with numerous tree species, especially in the families Fabaceae (*Acacia* spp.), Myrtaceae (*Eucalyptus* spp.) and Pinaceae (*Pinus* spp.) (Crous 2002; Lombard et al. 2010c; Alfenas et al. 2015). Among them, Calonectria leaf blight (CLB) has become one of the most prominent diseases of *Eucalyptus* in plantations and nurseries. *Calonectria* species such as *Ca. candelabrum* (Schoch et al. 2000; Silva et al. 2020), *Ca. eucalypti* (Lombard et al. 2010b; Li et al. 2017), *Ca. pauciramosa* (Schoch et al. 2001; Lombard et al. 2010a, 2015), *Ca. pseudoreteaudii* (Lombard et al. 2010c; Crous et al. 2012; Wang & Chen 2020), *Ca. pteridis* (Graca et al. 2009; Alfenas et al. 2015), *Ca. queenslandica* (Lombard et al. 2010c; Li et al. 2022) and *Ca. reteaudii* (Crous et al. 2006; Pandey et al. 2010; Pham et al. 2022) are causal agents that are widely distributed around the world, causing severe defoliation and damping-off on *Eucalyptus* spp. plantation and nurseries and resulting in significant economic losses to the world *Eucalyptus* industry (Table 1).

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Calonectria pauciramosa causes leaf blight in *Eucalyptus* plantations and occurs in many countries including Brazil, China, Ecuador, Kenya, Mozambique, South Africa, and Uruguay (Schoch et al. 2001; Lombard et al. 2010b, 2015a; Li et al. 2021a). *Calonectria pseudoreteaudii* has been recorded in multiple regions of China and Vietnam (Lombard et al. 2010c; Crous et al. 2012; Wang & Chen 2020) and is especially widely distributed in the main planting areas of *Eucalyptus* in Southern China. This species is regarded as the most dominant pathogen responsible for CLB in China (Li et al. 2017; Wang & Chen 2020; Wu & Chen 2021). In Brazil, several *Calonectria* species are associated with the *Eucalyptus* leaf blight, and among these, *Ca. pteridis* is apparently the most common species (Alfenas et al. 2015, 2016). The most common and aggressive causal agent of CLB in South-East Asia is *Ca. reteaudii*, which has been found in several countries including India, Indonesia, Madagascar, Malaysia, Thailand and Vietnam (Crous et al. 2006; Pandey et al. 2010; Pham et al. 2022) (Table 1).

Other forestry crop diseases caused by *Calonectria* species including root rot, stem canker, and needle blight of *Pinus*. Several species have been reported to responsible for these diseases, including *Ca. brachiatica* (in Colombia; Lombard et al. 2009), *Ca. brassicae* (in Brazil and Colombia; Lombard et al. 2009), *Ca. canadiana* (in Poland; Stępniewska et al. 2020), *Ca. pacifica* (in Japan; Taniguchi et al. 2008), *Ca. pauciramosa* (in South Africa; Lombard et al. 2010a), *Ca. pini* (in Colombia; Lombard et al. 2009) and *Ca. pteridis* (in Spain; Crous 2002) (Table 1).

5.2.1 Host specificity

Many well studied *Calonectria* species do not exhibit a host specificity pattern and rather can cause disease in diverse plant hosts. For example, *Ca. colhounii*, *Ca. ilicicola* and *Ca. pauciramosa*. *Ca. colhounii* is an important pathogen of *Eucalyptus* (*Myrtaceae*) and causes leaf blight and stem rot of blueberry (Ericaceae). Moreover, this species has been reported on eight host genera in five families in Africa, Asia, Europe, North America, and Oceania (Table 1). *Calonectria ilicicola* is consistently responsible for the Cylindrocladium black rot of peanut (*Fabaceae*) and red crown rot

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of soybean (*Fabaceae*) around the world and has been found to occur on 12 host genera in nine families in Africa, Asia, Europe, North America and Oceania (Table 1). As a well-known pathogen of Calonectria leaf blight on *Eucalyptus*, *Ca. pauciramosa* has been observed from 15 host genera in eight plant families in Africa, Asia, Europe, South and North America and Oceania (Table 1). *Ca. pauciramosa* has not only been found on various *Myrtaceae* plants in many countries, but also has been reported on plants in the *Ericaceae*, *Plumbaginaceae* and *Rosaceae*. In addition to angiosperms, *Ca. pauciramosa* also occurs on gymnosperms including *Pinaceae* and *Podocarpaceae* (Table 1).

In contrast, some *Calonectria* species have narrower host ranges, such as the notorious pathogen *Ca. pseudoreteaudii*. This species typically infects *Eucalyptus* spp. (*Myrtaceae*), but has been recently reported to cause the fruit spot disease on *Macadamia* spp. (*Proteaceae*) in China and Vietnam (Crous et al. 2012; Jiang et al. 2020). Some species are restricted to certain plant families. For example, *Ca. henricotiae* and *Ca. pseudonaviculata* have been reported globally, however, have only been observed to occur on *Buxaceae* plants.

5.3 Potential effect of climate change on geographic distribution of *Calonectria* species

The effects of climate change shaping the geographical distribution of *Calonectria* species have not been widely studied. However, we hypothesize that global warming will contribute to the further expansion of the distribution range of *Calonectria* species. This is supported by Barker et al. (2022), who employed recorded climate data to predict the potential global distribution of *Ca. pseudonaviculata*, and to examine the roles of climate factors in shaping its invaded range. Results suggested *Ca. pseudonaviculata* has the capability to broaden its geographical range and could easily propagate and establish in the not-yet-invaded areas in eastern and southern Europe, North America, and many regions where *Buxus* are native, due to the suitable climate conditions.

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In terms of climate change, it is relevant to recognize that *Calonectria* species have a large geographic distribution and that these are also found in very different climatic zones. Among the 133 species currently recognized, 42 species have been discovered in more than one country (Table 1), and species such as *Ca. colhounii*, *Ca. ilicicola*, *Ca. pauciramosa*, *Ca. pseudonaviculata* even have been recorded in more than 10 countries (Table 1). Most *Calonectria* species have been reported in tropical and subtropical regions of the world, such as those in the South-American clade (*Ca. brassicae* and *Ca. candelabrum* species complexes), and species in the Asian clade (*Ca. colhounii*, *Ca. kyotensis* and *Ca. reteaudii)* (Liu et al. 2020; Table 1). In contrast, there are some species that appear to be better adapted to temperate regions, such as *Ca. henricotiae* and *Ca. pseudonaviculata* (Gehesquière et al. 2016; Bartíková et al. 2020). Some species have strong adaptability to the environment and could survive in many different climate conditions, from temperate to tropic regions. For example, *Ca. pauciramosa* has been recorded in 12 countries, from tropical Africa (Crous et al. 2013; Lombard et al. 2010a, 2016; Li et al. 2021a) and South America (Schoch et al. 2001), to subtropical Asia (Lombard et al. 2015a; Liu et al. 2020), as well as more temperate countries in Europe, North America and Oceania (Lombard et al. 2010a, 2016; Liu et al. 2020).

6.0 DISPERSAL OF *CALONECTRIA* SPECIES

Understanding the pathogen dispersal mode is essential for effective disease management. By reducing transmission routes, the large-scale dissemination of a pathogen can be avoided and thereby the occurrence of extensive diseases prevented. *Calonectria* species dispersal generally occurs through two major modes: Natural dispersal (via soil and water) and human mediated dispersal.

6.1 Soil dispersal

Most *Calonectria* species can be regarded as soil borne fungi. Currently, among the 133 described species, 82 have been observed from soils in 15 countries, 17 species have been observed from soils in more than two countries (Table 1). Some *Calonectria*

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disease epidemics are polycyclic with repeated infection cycles in a single crop cycle (Crous 2002). The living structures of *Calonectria* species such as *Ca. ilicicola* fall to the ground along with infected plant tissues and provide the primary inoculum for infection. Some *Calonectria* species can survive in the soil for long periods (up to 15 years or more) by producing dormant structures, such as microsclerotia in the soil that then germinate when conditions are conducive to infection (Rowe et al. 1974; Crous 2002; Henricot 2006; Kuruppu et al. 2004; Gehesquière 2014).

6.2 Water dispersal

Water mediated dispersal (water splash, runoff or wind-driven rain) can be regarded important for the *Calonectria* species transmission. In nurseries, rain can splash the pathogens from the soil or infected plants and enable them to land on nearby healthy host surfaces, to achieve short-distance dispersal (Gehesquière 2014; Aiello et al. 2022). Gehesquière (2014) also showed water mediated dispersal was the main short distance dispersal pathway of *Ca. pseudonaviculata*.

6.3 Human-mediated dispersal

Human-mediated dispersal plays a key role in the process of *Calonectria* species transmission, mainly classified as short-distance and long-distance spread. Contaminated tools, such as pruning shears, footwear and leather working gloves used during farming management, or the use of agricultural equipment, seem to be the short-distance movement factors of pathogens (Gehesquière 2014; Allio et al. 2022). In addition, agricultural fertilization and irrigation also contribute to pathogen dissemination in the field (Gehesquière 2014; LaMondia & Maurer 2020).

Global trade in plants and plant products has been shown to be a major pathway for the dispersal of pathogens (Wingfield et al. 2001; Santini et al. 2018). Although very little attention has been paid to the global movement of *Calonectria* spp., it seems likely that this has been one of the most important pathways of long-distance movement of these

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fungi. We base this view on the fact that *Calonectria* spp. are common on plant tissues and in soil; two substrates very easily moved between countries.

Through the worldwide population analysis, LeBlanc (2019) showed that the most common genotype of *Ca. pseudonaviculata* was observed on all continents where boxwood blight is reported and thus showed that this pathogen spreads within and between countries. Daughtrey (2019) hypothesized that *Ca. pseudonaviculata* was likely introduced to Europe via nursery trade from East Asia on an ornamental species and to western Asia and North America, bringing immeasurable losses to the world horticultural industry. Randall-Schadel et al. (2001) confirmed *Ca. ilicicola* is seed-transmitted and could spread through hyphae and microsclerotia on peanut seeds. Gai (2017) hypothesized that the Cylindrocladium black rot of peanut caused by *Ca. ilicicola* possibly originated from the USA and the fungus migrated into China through the trade of infected peanut seeds. Thus, more strict quarantine regulations needed to be implemented to prevent the introduction of pathogens from foreign sources.

7.0 CONCLUSIONS

The genus *Calonectria* represents a diverse and cosmopolitan group of fungi that cause severe diseases on agricultural, forestry and horticultural crops, bringing serious losses to the world economy. In recent years, there have been an increasing number of disease reports caused by *Calonectria* species. Yet there are many questions regarding these fungi that have not been considered.

Some relevant questions relating to the study of *Calonectria* spp. are studied in the chapters of this thesis. The most important of these has been to provide a more comprehensive and reliable basis to identify these fungi. This question is addressed in the first research chapter and seeks to provide the most comprehensive understanding of species boundaries in *Calonectria*.

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Contemporary studies on *Calonectria* have focused strongly on those species that occur on *Eucalyptus* or at least are associated with the *Eucalyptus* industry. This is also true of the research included in this thesis These include studies and questions that arose from a comprehensive review of the literature which served to highlight many questions relating to *Calonectria* species that require greater understanding. These for example include those related to the basis of host specificity, which remains poorly understood. Likewise, some species appear to occur almost exclusively in soil whereas others are more commonly found infecting plant tissues. Such questions are intriguing and likely to be better understood in the future, particularly as studies at the genome level become increasingly common.

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Table 1. Location and hosts for the 133 *Calonectria* species identified using DNA sequence-based analyses.

Code B[a]	Species	Geographic distribution	Hosts	References
1. *Calonectria brassicae* species complex				
B12	***Calonectria brachiatica***	Colombia	*Pinus maximinoi*	Lombard *et al.* (2009), Liu *et al.* (2020)
B16	***Ca. brassicae***	Brazil	*Pinus caribeae*, Soil	Crous *et al.* (1999, 2006), Schoch *et al.* (2001), Lombard e*t al.* (2009)
		Cameroon	*Musa* sp.	Crous *et al.* (2006)
		Colombia	*Pinus maximinoi*	Lombard *et al.* (2009)
		Ecuador	Soil	Crous *et al.* (2006)
		Indonesia	*Argyreia splendens*	Crous (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
		Mauritius	*Camellia sinensis*	Schoch *et al.* (2001)
		South Africa	*Eucalyptus* sp.	Risède & Simoneau (2001)
		Vietnam	*Argyreia splendens*	Schoch *et al.* (2001)
B25	***Ca. clavata***	France	*Musa* sp.	Crous *et al.* (2006)
		Saint Lucia	*Musa* sp.	Crous *et al.* (2006)
		USA	*Callistemon viminalis,* Root debris in peat	El-Gholl *et al.* (1993b), Crous (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
B34	***Ca. duoramosa***	Brazil	Soil (tropical rainforest), Soil *(Eucalyptus* plantation)	Alfenas *et al.* (2015)
B35	***Ca. ecuadoriae***	Ecuador	Soil	Crous *et al.* (2006), Lombard *et al.* (2016), Liu *et al.* (2020)
B43	***Ca. gracilis***	Brazil	*Atta cephalotes* nest, *Manilkara zapota*, Soil	Crous *et al.* (1993b, 2006), Reis *et al.* (2015)
B77	***Ca. octoramosa***	Ecuador	Soil	Marin-Felix *et al.* (2017), Liu *et al.* (2020)
B78	***Ca. orientalis***	Brazil	Soil (*Eucalyptus* plantation)	Alfenas *et al.* (2015)
		China	Soil (*Eucalyptus* plantation)	Liu *et al.* (2021)
		Indonesia	Soil	Lombard *et al.* (2016), Liu *et al.* (2020)
B82	***Ca. paraensis***	Brazil	Soil (tropical rainforest), Soil *(Eucalyptus* plantation)	Alfenas *et al.* (2015)
B83	***Ca. parvispora***	Brazil	Soil	Marin-Felix *et al.* (2017), Liu *et al.* (2020)
		Colombia	Soil	Lombard *et al.* (2016)

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B84	***Ca. pauciphialidica***	Ecuador	Soil	Crous *et al.* (2006), Lombard *et al.* (2010c), Liu *et al.* (2020)
B88	***Ca. pini***	Colombia	*Pinus patula*	Lombard *et al.* (2010c), Liu *et al.* (2020)
B91	***Ca. pseudobrassicae***	Brazil	Soil (*Eucalyptus* plantation)	Alfenas *et al.* (2015)
B92	***Ca. pseudoecuadoriae***	Ecuador	Soil	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
B105	***Ca. quinqueramosa***	Brazil	Soil (*Eucalyptus* plantation)	Alfenas *et al.* (2015)
B107	***Ca. robigophila***	Brazil	*Eucalyptus* sp. (leaf)	Alfenas *et al.* (2015)

2. *Calonectria candelabrum* species complex

B13	***Ca. brasiliana***	Brazil	Soil	Lombard *et al.* (2016), Liu *et al.* (2020)
B15	***Ca. brassiana***	Brazil	Soil (*Eucalyptus brassiana* plantation)	Alfenas *et al.* (2015)
B18	***Ca. brevistipitata***	Mexico	Soil	Lombard *et al.* (2016), Liu *et al.* (2020)
B21	***Ca. candelabrum***	Argentina	*Eucalyptus grandis*	Lombard *et al.* (2010a)
		Brazil	*Eucalyptus* sp., Soil	Schoch *et al.* (2000), Lombard *et al.* (2015, 2016), Liu *et al.* (2020),
		Ecuador	*Eucalyptus grandis*	Lombard *et al.* (2010b), Liu *et al.* (2020)
		Paraguay	*Eucalyptus benthamii*	Silva *et al.* (2020)
B28	***Ca. colombiana***	Colombia	Soil	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a)
B37	***Ca. eucalypticola***	Brazil	*Eucalyptus* sp. (seeding)	Alfenas *et al.* (2015)
B38	***Ca. fragariae***	Brazil	*Fragaria* × *ananassa*	Lopes *et al.* (2017)
B40	***Ca. glaebicola***	Brazil	*Eucalyptus* sp., Soil *(Eucalyptus* plantation)	Alfenas *et al.* (2015)
B68	***Ca. metrosideri***	Brazil	*Metrosideros polymorpha*	Alfenas *et al.* (2013, 2015)
B76	***Ca. nemuricola***	Brazil	Soil (tropical rainforest)	Alfenas *et al.* (2015)
B85	***Ca. pauciramosa***	Australia	Soil	Lombard *et al.* (2010a)
		Brazil	*Eucalyptus sp.*	Schoch *et al.* (2001)
		China	*E. urophylla* × *E. grandis*	Lombard *et al.* (2015), Liu *et al.* (2020)
		Ecuador	*Eucalyptus grandis*	Li *et al.* (2020)
		Germany	*Azalea* sp.	Lombard *et al.* (2010a)
		Italy	*Arbutus unedo, Callistemon citrinus*	Lombard *et al.* (2010a, b), Liu *et al.* (2020)

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		Kenya	*Eucalyptus grandis*	Lombard *et al.* (2010a)
		Mozambique	*E. grandis* × *E. camaldulensis*	Crous *et al.* (2013), Lombard *et al.* (2016), Liu *et al.* (2020)
		New Zealand	*Limonium* sp., *Machaerina sinclairii, Rhododendron* sp., *Vriesea* sp.	Lombard *et al.* (2010a), Lombard *et al.* (2016), Liu *et al.* (2020)
		South Africa	*Acacia mearnsii, Cliffordia feruginea, Eucalyptus grandis, Pinus* sp., *Podocarpus* sp., *Prunus avium*, Soil	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a, 2016), Liu *et al.* (2020)
		Uruguay	*Eucalyptus grandis*	Lombard *et al.* (2010a)
		USA	*Erica capensis, Myrtus communis*	Lombard *et al.* (2010a, 2016), Liu *et al.* (2020)
		Tunisia	*Metrosideros thomasii*, *Myrtus communis*	Lombard *et al.* (2011)
B87	***Ca. piauiensis***	Brazil	Soil *(Eucalyptus* plantation), Soil (tropical rainforest)	Alfenas *et al.* (2015)
B93	***Ca. pseudometrosideri***	Brazil	*Eucalyptus* sp., *Metrosideros polymorpha,* Soil *(Eucalyptus* plantation)	Alfenas *et al.* (2015)
B99	***Ca. pseudospathulata***	Brazil	Soil (tropical rainforest)	Alfenas *et al.* (2015)
B103	***Ca. putriramosa***	Brazil	*Eucalyptus* cutting	Lombard *et al.* (2016), Liu *et al.* (2020)
		Brazil	Soil	Lombard *et al.* (2016), Liu *et al.* (2020)
B109	***Ca. silvicola***	Brazil	Soil (tropical rainforest)	Alfenas *et al.* (2015)
B111	***Ca. spathulata***	Brazil	*Eucalyptus viminalis*	Crous & Kang (2001), Crous (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
		Colombia	*Eucalyptus* sp.	Lombard *et al.* (2016), Liu *et al.* (2020)
		Ecuador	Soil	Crous & Kang (2001)
		Zambia	*Eucalyptus grandis*	Chungu *et al.* (2010)
B119	***Ca. venezuelana***	Venezuela	Soil	Lombard *et al.* (2016), Liu *et al.* (2020)
B121	***Ca. hemileiae***	Brazil	on pustules of *Hemileia vastatrix* formed on leaves of *Coffea arabica*	Crous *et al.* (2018)
B122	***Ca. matogrossensis***	Brazil	*Eucalyptus urophylla* clone I144 (leaves)	Crous *et al.* (2019)
	Ca. imperata	Brazil	*E. urophylla*	Sanchez-Gonzalez *et al.* (2022)
3. *Calonectria colhounii* species complex				
B3	***Ca. aciculata***	China	*Eucalyptus urophylla* × *E. grandis*	Li *et al.* (2017), Liu *et al.* (2020)

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B27	***Ca. colhounii***	Australia	*Arachis pintoi, Eleaeocarpus angustifolius*	Crous *et al.* (2006)
		Belgium	*Rhododendron* sp.	Inghelbrecht *et al.* (2011)
		Canada	*Hydrastis canadensis*	Reeleder (2004)
		China	*Vaccinium* sp.	Luan *et al.* (2006)
		Indonesia	*Eucalyptus* sp.	Schoch *et al.* (2001), Crous *et al.* (2006)
		Mauritius	*Camellia sinensis*	Peerally (1973), Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010b)
		South Africa	*Eucalyptus* sp., Soil	Schoch *et al.* (2001), Crous *et al.* (2006)
		South Korea	*Vaccinium corymbosum*	Jeon *et al.* (2010)
		Thailand	Soil	Schoch *et al.* (2001), Crous *et al.* (2006)
		USA	*Eucalyptus grandis, Leucothoe fontanesiana, Rhododendron* sp., *Vaccinium corymbosum*	Crous *et al.* (2006), Benson *et al.* (2011), Sadowsky *et al.* (2011)
B36	***Ca. eucalypti***	Indonesia	*Eucalyptus grandis*	Lombard *et al.* (2010b), Liu *et al.* (2020)
		China	*Eucalyptus dunnii*	Chen *et al.* (2011), Liu *et al.* (2020)
B39	***Ca. fujianensis***	China	*Eucalyptus grandis, Nymphaea tetragona*	Chen *et al.* (2011), Xu *et al.* (2012), Liu *et al.* (2020)
B47	***Ca. honghensis***	China	Soil *(Eucalyptus* plantation)	Li *et al.* (2017)
B53	***Ca. indusiata***	Ecuador	Unknown	Crous *et al.* (2006)
		Sri lanka	*Camellia sinensis*	Crous (2002), Lombard *et al.* (2010b, 2016), Marin-Felix *et al.* (2017)
		USA	*Rhododendron* sp., *Rumohra adiantiformis, Strelitzia nicolaii*	Crous *et al.* (1999, 2006), Crous (2002)
B62	***Ca. lichi***	China	Soil	Li *et al.* (2017), Liu *et al.* (2020)
B64	***Ca. macroconidialis***	South Africa	*Eucalyptus grandis*	Crous (2002), Lombard *et al.* (2010b), Liu *et al.* (2020)
B65	***Ca. madagascariensis***	Madagascar	Soil	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010b), Liu *et al.* (2020)
		Congo	Soil	Crous *et al.* (2006)
B70	***Ca. monticola***	Thailand	Soil	Crous *et al.* (2015)
B81	***Ca. paracolhounii***	Australia	*Annona reticulata* (fruit)	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
		USA	N/A	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)

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B123	***Ca. xianrensis***	China	Soil (near *Eucalyptus* plantation)	Wang *et al.* (2019)
	Ca. minensis	China	Soil (*Eucalyptus* plantation)	Liu *et al.* (2022)
4. *Calonectria cylindrospora* species complex				
B9	***Ca. auriculiformis***	Vietnam	Soil (*Acacia auriculiformis* plantation)	Pham *et al.* (2019), Liu *et al.* (2020)
		China	Soil (*Eucalyptus* plantation)	Wu & Chen (2021)
B14	***Ca. brasiliensis***	Brazil	*Anadenanthera peregrina, Azadirachta indica , Eucalyptus* sp., *Piptadenia gonoacantha*	Batista (1951), Lombard *et al.* (2010a), Alfenas *et al.* (2013, 2015), Liu *et al.* (2020)
B22	***Ca. cerciana***	China	*Eucalyptus urophylla* × *E. grandis* hybrid cutting, Soil *(Eucalyptus* plantation)	Lombard *et al.* (2010b, 2015), Liu *et al.* (2020)
		India	*Eucalyptus tereticornis*	Bose *et al.* (2020)
B32	***Ca. cylindrospora***	Belgium	*Rosa* sp.	Gehesquière *et al.* (2013)
		Brazil	*Eucalyptus* sp.	Risède & Simoneau (2001)
		Cameroon	*Musa* sp.	Risède & Simoneau (2004)
		China	*Rosa chinensis*	Jia *et al.* (2021)
		France	*Musa* sp.	Risède & Simoneau (2004)
		Italy	*Pistacia lentiscus*	Lombard *et al.* (2015a, 2016), Liu *et al.* (2020)
		USA	*Blephilia ciliata, Dodonea viscosa, Ilex vomitoria, Leucothoe catesbaei, Mahonia bealei, Rosa* sp.	Schoch *et al.* (2000), Crous (2002), Crous *et al.* (2001, 2013), Lombard *et al.* (2010b, 2015a), Liu *et al.* (2020), Iriarte *et al.* (2021)
B44	***Ca. hawksworthii***	China	*Eucalyptus urophylla* × *E. grandis, Nelumbo nucifera*	Chen *et al.* (2015), Lombard *et al.* (2015a), Liu *et al.* (2020)
		Indonesia	*Eucalyptus* sp.	Lombard *et al.* (2010a), Liu *et al.* (2020)
		Malaysia	Soil	Pham *et al.* (2022)
		Mauritius	*Nelumbo nucifera*	Crous (2002), Liu *et al.* (2020)
		Venezuela	*Theobroma cacao*	del Castillo *et al.* (2016)
B54	***Ca. insularis***	Brazil	Soil	Schoch *et al.* (2000)
		Madagascar	Soil	Schoch *et al.* (1999), Lombard *et al.* (2010b, 2016), Liu *et al.* (2020)
		Mexico	Soil	Lombard *et al.* (2010b, 2016), Liu *et al.* (2020)
B56	***Ca. lageniformis***	Brazil	*Eucalyptus* sp.	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)

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		Mauritius	*Eucalyptus* sp.	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
B67	***Ca. maranhensis***	Brazil	*Eucalyptus* sp.	Alfenas *et al.* (2015)
B89	***Ca. plurilateralis***	Ecuador	Soil	Lombard *et al.* (2016), Liu *et al.* (2020)
B90	***Ca. propaginicola***	Brazil	*Eucalyptus* sp. (seeding)	Alfenas *et al.* (2015)
B115	***Ca. tonkinensis***	Vietnam	Soil (*Eucalyptus* plantation)	Pham *et al.* (2019), Liu *et al.* (2020)
B118	***Ca. variabilis***	Brazil	*Eucalyptus* sp., *Schefflera morototoni, Theobroma grandiflorum*	Crous *et al.* (1993a), Schoch *et al.* (2001), Crous (2002), Lombard *et al.* (2010b, 2016), Liu *et al.* (2020)
5. *Calonectria gracilipes* species complex				
B7	***Ca. angustata***	USA	*Tillandsia capitata*	Crous *et al.* (2006), Lombard *et al.* (2010b), Liu *et al.* (2020)
B42	***Ca. gracilipes***	Colombia	Soil	Crous *et al.* (2006), Crous (2002), Liu *et al.* (2020)
B50	***Ca. hurae***	Brazil	*Rumohra adiantiformis*	Crous (2002), Crous *et al.* (2006), Liu *et al.* (2020)
		USA	*Rumohra adiantiformis*	Crous *et al.* (2006)
B60	***Ca. leguminum***	Brazil	*Annona squamosa*	Crous (2002), Lombard *et al.* (2010b), Liu *et al.* (2020)
B108	***Ca. rumohrae***	Panama	*Rumohra adiantiformis*	El-Gholl *et al.* (1997), Crous (2002), Crous *et al.* (2006), Liu *et al.* (2020)
		The Netherlands	*Adiantum* sp.	El-Gholl *et al.* (1997), Crous (2002), Crous *et al.* (2006), Liu *et al.* (2020)
6. *Calonectria kyotensis* species complex				
B4	***Ca. aconidialis***	China	*Eucalyptus urophylla* × *E. grandis*, Soil *(Eucalyptus* plantation)	Lombard *et al.* (2015a), Liu *et al.* (2020), Li *et al.* (2022)
B5	***Ca. aeknauliensis***	Indonesia	Soil (*Eucalyptus* plantation)	Pham *et al.* (2019), Liu *et al.* (2020)
B8	***Ca. asiatica***	China	Soil *(Eucalyptus* plantation)	Li *et al.* (2017)
		Thailand	Debris (leaf litter)	Crous *et al.* (2004), Lombard *et al.* (2010b)
B17	***Ca. brassicicola***	Indonesia	Soil (*Brassica* sp.)	Lombard *et al.* (2016)
		New Zealand	Unknown	Lombard *et al.* (2016)
B19	***Ca. bumicola***	Indonesia	Soil (*Eucalyptus* plantation)	Pham *et al.* (2019), Liu *et al.* (2020)
B20	***Ca. canadiana***	Canada	*Picea* sp.	Kang *et al.* (2001b), Crous (2002), Lechat *et al.* (2010), Liu *et al.* (2020)
		China	*Beta vulgaris, Paeonia suffruticosa*, Soil	Li *et al.* (2010), Liu & Chen (2017), Liu *et al.* (2020), Shao & Li (2021)

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		Japan	*Fragaria* × *ananassa Duchesne, Heuchera sanguinea*	Hirooka *et al.* (2009)
		Poland	*Picea abies, Pinus sylvestris*	Stępniewska *et al.* (2020)
B23	***Ca. chinensis***	China	Soil (*Eucalyptus* plantation)	Crous *et al.* (2004), Lombard *et al.* (2010b), Liu *et al.* (2021)
		Vietnam	Soil (*Acacia* hybrid plantation)	Pham *et al.* (2019), Liu *et al.* (2020)
B26	***Ca. cochinchinensis***	Vietnam	Soil (*Acacia auriculiformis* plantation), Soil (*Hevea brasiliensis* plantation)	Pham *et al.* (2019), Liu *et al.* (2020)
B29	***Ca. colombiensis***	Colombia	Soil (*Eucalyptus grandis*)	Crous *et al.* (2004), Liu *et al.* (2020)
B31	***Ca. curvispora***	Indonesia	Soil (*Eucalyptus* plantation)	Pham *et al.* (2019), Liu *et al.* (2020)
		Madagascar	Soil	Victor *et al.* (1997), Crous (2002), Lombard *et al.* (2010b, 2015), Liu *et al.* (2020)
B46	***Ca. heveicola***	Vietnam	Soil (*Hevea brasiliensis* plantation)	Pham *et al.* (2019), Liu *et al.* (2020)
B48	***Ca. hongkongensis***	China	Soil (*Eucalyptus* plantation)	Li *et al.* (2017)
		Vietnam	Soil (*Acacia mangium* plantation)	Pham *et al.* (2019)
		USA	*Nephelium lappaceum*	Serrato-Diaz *et al.* (2013)
B51	***Ca. ilicicola***	Australia	*Arachis hypogaea, Carica papaya, Persea americana*	Johnson (1985), Dann *et al.* (2012), Male *et al.* (2012)
		China	*Arachis hypogaea, Glycine max, Manglietia decidua, Medicago sativa*, Soil *(Eucalyptus plantation), Vaccinium* sp., *Zingiber officinale*	Pei *et al.* (2015), Gai *et al.* (2017), Fei *et al.* (2018), Zhang *et al.* (2020), Liu *et al.* (2021), Yi *et al.* (2022)
		Indonesia	*Solanum tuberosum*	Boedijn & Reitsma (1950), Crous (2002), Lombard *et al.* (2010b), Liu *et al.* (2020)
		Iran	*Anthurium andraeanum*	Mirabolfathy *et al.* (2010)
		Italy	*Laurus nobilis*	Polizzi *et al.* (2012)
		Japan	*Arachis hypogaea, Glycine max*, *Howea belmoreana*	Misonou (1973), Hirooka *et al.* (2008), Yamamoto *et al.* (2017), Akamatsu *et al.* (2020)
		Malaysia	Soil	Pham *et al.* (2022)
		South Korea	*Glycine max*	Sung (1980), Gai *et al.* (2017)
		USA	*Arachis hypogaea, Glycine max, Howea forsteriana*	Crous *et al.* (2004), Kuruppu *et al.* (2004)
		Vietnam	Soil (*Eucalyptus* plantation)	Pham *et al.* (2019)

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B52	***Ca. indonesiae***	Indonesia	*Syzygium aromaticum*	Crous *et al.* (2004), Liu *et al.* (2020)
B55	***Ca. kyotensis***	Cameroon	*Musa* sp.	Risède & Simoneau (2004)
		Canada	*Picea* sp.	Kang *et al.* (2001b)
		China	Soil (*Eucalyptus* plantation)	Lombard *et al.* (2015a), Liu *et al.* (2020)
		Japan	*Robinia pseudoacacia*	Terashita (1968), Crous (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
		USA	*Prunus persica*	Sobers (1968), Crous (2002), Marin-Felix *et al.* (2017), Liu *et al.* (2020)
B57	***Ca. lantauensis***	China	Soil	Li *et al.* (2017), Liu *et al.* (2020)
B58	***Ca. lateralis***	Brazil	*Carapichea ipecacuanha*	Ferreira *et al.* (2020)
		China	Soil (*Eucalyptus* plantation)	Lombard *et al.* (2015a), Liu *et al.* (2020)
		Vietnam	Soil (*Eucalyptus* plantation)	Pham *et al.* (2019)
B66	***Ca. malesiana***	Indonesia	Soil	Crous *et al.* (2004), Liu *et al.* (2020)
		Thailand	Leaf litter	Crous *et al.* (2004), Liu *et al.* (2020)
		Vietnam	Soil (*Eucalyptus urophylla* plantation), Soil (*Hevea brasiliensis* plantation), Soil (natural forest)	Pham *et al.* (2019)
B80	***Ca. pacifica***	China	Soil (*Eucalyptus* plantation)	Liu *et al.* (2022)
		Japan	*Pinus thunbergii*	Taniguchi *et al.* (2008)
		New Zealand	*Ipomoea aquatica, Quercus palustris*	Kang *et al.* (2001b), Crous (2002), Crous *et al.* (2004), Lombard *et al.* (2010b), Liu *et al.* (2020)
		Thailand	Soil	Kang *et al.* (2001b)
		USA	*Araucaria heterophylla*	Kang *et al.* (2001b), Crous (2002), Crous *et al.* (2004), Liu *et al.* (2020)
B86	***Ca. penicilloides***	Japan	*Prunus* sp.	Tubaki (1958), Crous (2002), Liu *et al.* (2020)
B112	***Ca. sumatrensis***	Indonesia	Soil	Crous *et al.* (2004), Liu *et al.* (2020)
		Malaysia	Soil	Pham *et al.* (2022)
B113	***Ca. syzygiicola***	Indonesia	*Syzygium aromaticum*	Lombard *et al.* (2016)
B116	***Ca. uniseptata***	Germany	*Paphiopedilum callosum*	Lombard *et al.* (2016)
B120	***Ca. yunnanensis***	China	Soil *(Eucalyptus* plantation)	Li *et al.* (2017)

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		Vietnam	Soil (natural forest)	Pham *et al.* (2019)
B124	***Ca. singaporensis***	Singapore	leaf litter (submerged in a small stream)	Crous *et al.* (2021)
B127	***Ca. borneana***	Malaysia	Soil (*Eucalyptus* plantation)	Pham *et al.* (2022)
B128	***Ca. ladang***	Malaysia	Soil (*Eucalyptus* plantation)	Pham *et al.* (2022)
B129	***Ca. pseudomalesiana***	Malaysia	Soil (*Eucalyptus* plantation)	Pham *et al.* (2022)
B130	***Ca. tanah***	Malaysia	Soil (*Eucalyptus* plantation)	Pham *et al.* (2022)
7. *Calonectria mexicana* species complex				
B11	***Ca. avesiculata***	USA	*Ilex vomitoria*	Schubert *et al.* (1989), Crous (2002), Lombard *et al.* (2010b)
B24	***Ca. citri***	USA	*Citrus sinensis*	Fawcett & Klotz (1937), Crous (2002), Liu *et al.* (2020)
B59	***Ca. lauri***	Belgium	*Buxus sempervirens*	Lechat *et al.* (2010), Vu *et al.* 2019
		France	*Ilex aquifolium*	Lechat *et al.* (2010), Vu *et al.* 2019
		The Netherlands	*Ilex aquifolium*	Lechat *et al.* (2010), Lombard *et al.* (2010b), Liu *et al.* (2020)
		UK	*Laurus nobilis*	Henricot & Culham (2002)
		USA	*Umbellularia californica*	Crous *et al.* (2021)
B61	***Ca. leucothoes***	USA	*Leucothoe axillaris*	Crous (2002), Lombard *et al.* (2015a), Liu *et al.* (2020)
B69	***Ca. mexicana***	Mexico	Soil	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010b), Marin-Felix *et al.* (2017)
		Tunisia	*Dodonaea viscosa*	Lombard *et al.* (2011)
B94	***Ca. pseudomexicana***	Tunisia	*Callistemon laevis*, *Metrosideros excelsa*	Lombard *et al.* (2011), Liu *et al.* (2020)
B100	***Ca. pseudouxmalensis***	Mexico	Soil	Lombard *et al.* (2016), Liu *et al.* (2020)
B117	***Ca. uxmalensis***	Mexico	Soil	Lombard *et al.* (2016), Liu *et al.* (2020)
B125	***Ca. californiensis***	USA	*Umbellularia californica*	Crous *et al.* (2021)
8. *Calonectria naviculata* species complex				
B45	***Ca. henricotiae***	Belgium	*Buxus sempervirens*	Gehesquière *et al.* (2016)
		Czech Republic	*Buxus* sp.	Bartíková *et al.* (2020)
		Germany	*Buxus* sp.	Gehesquière *et al.* (2016)

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		Slovenia	*Buxus sempervirens*	Gehesquière *et al.* (2016)
		The Netherlands	*Buxus sempervirens*	Gehesquière *et al.* (2016)
		UK	*Buxus* sp.	Gehesquière *et al.* (2016)
B71	***Ca. multilateralis***	Mexico	Soil	Lombard *et al.* (2016), Liu *et al.* (2020)
B72	***Ca. multinaviculata***	Brazil	Soil (*Eucalyptus* plantation)	Alfenas *et al.* (2015)
B73	***Ca. multiphialidica***	Cameroon	Soil (roots of *Musa* sp.)	Crous *et al.* (2004), Lombard *et al.* (2010b), Liu *et al.* (2020)
B75	***Ca. naviculata***	Brazil	Leaf litter, Soil	Crous (2002), Lombard *et al.* (2010b, 2015a), Marin-Felix *et al.* (2017)
B95	***Ca. pseudonaviculata***	Abkhazia	*Buxus* sp.	Gasich *et al.* (2013)
		Austria	*Buxus* sp.	Ivors & LeBude (2011)
		Belgium	*Buxus sempervirens*	Gehesquière *et al.* (2016)
		Canada	*Buxus* sp.	Gehesquière *et al.* (2016)
		Croatia	*Buxus* sp.	Gehesquière *et al.* (2016)
		Czech Republic	*Buxus* sp.	Bartíková *et al.* (2020)
		France	*Buxus* sp.	Gehesquière *et al.* (2016)
		Georgia	*Buxus colchica*	Gorgiladze *et al.* (2011)
		Germany	*Buxus* sp.	Gehesquière *et al.* (2016)
		Iran	*Buxus sempervirens*	Mirabolfathy *et al.* (2013)
		Ireland	*Buxus* sp.	Ivors & LeBude (2011)
		Italy	*Buxus sempervirens*	Gehesquière *et al.* (2016)
		New Zealand	*Buxus sempervirens*	Crous *et al.* (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
		The Netherlands	*Buxus* sp.	Gehesquière *et al.* (2016)
		Slovenia	*Buxus sempervirens*	Gehesquière *et al.* (2016)
		Spain	*Buxus* sp.	Gehesquière *et al.* (2016)
		Switzerland	*Buxus* sp.	Gehesquière *et al.* (2016)
		Turkey	*Buxus sempervirens*	Akilli *et al.* (2012)
		UK	*Buxus sp.*	Gehesquière *et al.* (2016)

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		USA	*Buxus sempervirens, Pachysandra terminali, Sarcococca hookerian*	Malapi-Wight *et al.* (2016), Ward Gauthier et al. (2016), Kong *et al.* (2017)
B126	***Ca. vigiensis***	Venezuela	*Theobroma cacao*	Mohali & Stewart (2021)
9. *Calonectria pteridis* species complex				
B6	***Ca. amazonica***	Brazil	*Eucalyptus tereticornis*	Lombard *et al.* (2016), Liu *et al.* (2020)
B41	***Ca. gordoniae***	USA	*Gordonia lasianthus*	Leahy *et al.* (2000), Crous (2002), Lombard *et al.* (2010b), Liu *et al.* (2020)
B79	***Ca. ovata***	Brazil	*Eucalyptus urophylla, Eucalyptus tereticornis,* Soil *(Eucalyptus* plantation)	El-Gholl *et al.* (1993a), Crous (2002), Lombard *et al.* (2010b), Marin-Felix *et al.* (2017), Liu *et al.* (2020)
B96	***Ca. pseudopteridis***	USA	*Washingtonia robusta*	Alfenas *et al.* (2015), Lombard *et al.* (2016), Liu et al. (2020)
B101	***Ca. pseudovata***	Brazil	Soil (*Eucalyptus* plantation)	Alfenas *et al.* (2015)
B102	***Ca. pteridis***	Brazil	*Eucalyptus* sp.	Alfenas *et al.* (2015)
		China	*Serenoa repens*	Yang *et al.* (2014)
		New Zealand	Unknown	Crous *et al.* (2006)
		Spain	*Pinus* sp.	Lombard *et al.* (2010b)
		The Netherlands	*Drosera sp., Guzmania wittmackii, Tillandsia wagneriana*	Crous *et al.* (2006)
		USA	*Arachniodes adiantiformis*	Crous *et al.* (1993b, 2006), Crous (2002), Lombard *et al.* (2010b), Marin-Felix *et al.* (2017)
B114	***Ca. terricola***	Brazil	Soil (*Eucalyptus* plantation)	Lombard *et al.* (2016)
10. *Calonectria reteaudii* species complex				
B1	***Ca. acaciicola***	Vietnam	Soil (*Acacia auriculiformis* plantation)	Pham *et al.* (2019), Liu *et al.* (2020)
B2	***Ca. acicola***	New Zealand	*Phoenix canariensis*	Gadgil & Dick (2004), Lombard *et al.* (2010b), Liu *et al.* (2020)
B10	***Ca. australiensis***	Australia	*Ficus pleurocarpa*	Crous *et al.* (2006), Lombard *et al.* (2010b), Liu *et al.* (2020)
B30	***Ca. crousiana***	China	*Eucalyptus grandis*	Chen *et al.* (2011), Liu *et al.* (2020)
B63	***Ca. lombardiana***	Australia	*Xanthorrhoea australis*	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010b), Liu *et al.* (2020)
B74	***Ca. multiseptata***	Indonesia	*Eucalyptus grandis*	Crous *et al.* (1998, 2006), Crous (2002), Liu *et al.* (2020)
B97	***Ca. pseudoreteaudii***	China	*Eucalyptus urophylla* × *E. grandis, Macadamia* sp., Soil (*Eucalyptus* plantation)	Lombard *et al.* (2010c), Liu *et al.* (2020), Jiang *et al.* (2020b,c), Wu & Chen (2021)
		Vietnam	*Eucalyptus hybrid, Macadamia* sp.	Crous *et al.* (2012), Liu *et al.* (2020)

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B104	***Ca. queenslandica***	Australia	*Eucalyptus urophylla, Eucalyptus pellita*	Kang *et al.* (2001a), Lombard *et al.* (2010b), Liu *et al.* (2020)
		China	*Eucalyptus urophylla* × *E. grandis*	Li *et al.* (2022)
B106	***Ca. reteaudii***	Australia	*Ficus pleurocarpa*	Crous *et al.* (2006)
		China	Soil (*Eucalyptus* plantation)	Wu & Chen (2021)
		India	*Eucalyptus* sp.	Pandey *et al.* (2010)
		Indonesia	*Eucalyptus urophylla, Hibiscus sabdariffa*	Crous *et al.* (2006), Lombard *et al.* (2010b)
		Madagascar	*Eucalyptus* sp.	Crous *et al.* (2006), Lombard *et al.* (2010b)
		Malaysia	*Eucalyptus* sp., Soil	Pham *et al.* (2022)
		Thailand	*Eucalyptus* sp.	Crous *et al.* (2006)
		Vietnam	*Eucalyptus camaldulensis, Eucalyptus urophylla*	Kang *et al.* (2001a), Crous (2002), Crous *et al.* (2006), Pham *et al.* (2019), Liu *et al.* (2020)
		Venezuela	*Theobroma cacao*	del Castillo *et al.* (2016)
11. *Calonectria spathiphylli* species complex				
B33	***Ca. densa***	Ecuador	Soil	Lombard *et al.* (2010b), Liu *et al.* (2020)
B49	***Ca. humicola***	Ecuador	Soil	Lombard *et al.* (2010b), Liu *et al.* (2020)
B98	***Ca. pseudospathiphylli***	Ecuador	Soil	Kang *et al.* (2001b), Crous (2002), Lombard *et al.* (2010b), Marin-Felix *et al.* (2017)
B110	***Ca. spathiphylli***	Cameroon	*Musa* sp.	Risède & Simoneau (2004)
		Costa Rica	*Musa* sp.	Risède & Simoneau (2004)
		Dominica	*Musa* sp.	Risède & Simoneau (2004)
		France	*Heliconia* sp.	Risède & Simoneau (2004)
		Mauritius	*Camellia sinensis*	Risède & Simoneau (2001)
		South Africa	*Spathiphyllum* sp.	Schoch & Crous (1999); Kang *et al.* (2001b)
		Switzerland	*Spathiphyllum* sp.	El-Gholl *et al.* (1992), Crous (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
		USA	*Heliconia* sp., *Spathiphyllum* sp.	El-Gholl *et al.* (1992), Kang *et al.* (2001b), Crous (2002), Lombard *et al.* (2010b, 2016), Liu *et al.* (2020)
	Ca. paragominensis	Brazil	*E. grandis* × *E. brassiana*	Sanchez-Gonzalez *et al.* (2022)

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[a] Codes (B1 to B120) of the 120 accepted *Calonectria* species resulting from Liu *et al.* (2020).

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Table 2. Distribution characteristics of the *Calonectria* species identified based on molecular data around the world.

No.	Country	Code B[a]	Species	Species complex	Reference
1	Abkhazia	B95	*Calonectria pseudonaviculata*	*Ca. naviculata*	Gasich *et al.* (2013)
2	Argentina	B21	*Ca. candelabrum*	*Ca. candelabrum*	Lombard *et al.* (2010a)
3	Australia	B10	*Ca. australiensis*	*Ca. reteaudii*	Crous *et al.* (2006), Lombard *et al.* (2010b), Liu *et al.* (2020)
		B27	*Ca. colhounii*	*Ca. colhounii*	Crous *et al.* (2006)
		B51	*Ca. ilicicola*	*Ca. kyotensis*	Male *et al.* (2012)
		B63	*Ca. lombardiana*	*Ca. reteaudii*	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010c), Liu *et al.* (2020)
		B81	*Ca. paracolhounii*	*Ca. colhounii*	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Lombard *et al.* (2010a)
		B104	*Ca. queenslandica*	*Ca. reteaudii*	Lombard *et al.* (2010c), Liu *et al.* (2020)
		B106	*Ca. reteaudii*	*Ca. reteaudii*	Crous *et al.* (2006)
4	Austria	B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Ivors & LeBude (2011)
5	Belgium	B27	*Ca. colhounii*	*Ca. colhounii*	Inghelbrecht *et al.* (2011)
		B32	*Ca. cylindrospora*	*Ca. cylindrospora*	Gehesquière *et al.* (2013)
		B45	*Ca. henricotiae*	*Ca. naviculata*	Gehesquière *et al.* (2016)
		B59	*Ca. lauri*	*Ca. mexicana*	Lechat *et al.* (2010), Vu *et al.* 2019
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
6	Brazil	B6	*Ca. amazonica*	*Ca. pteridis*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B13	*Ca. brasiliana*	*Ca. candelabrum*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B14	*Ca. brasiliensis*	*Ca. cylindrospora*	Batista (1951), Crous (2002), Lombard *et al.* (2010b), Liu *et al.* (2020)
		B15	*Ca. brassiana*	*Ca. candelabrum*	Alfenas *et al.* (2015)
		B16	*Ca. brassicae*	*Ca. brassicae*	Crous *et al.* (1999, 2006); Schoch *et al.* (2001)
		B21	*Ca. candelabrum*	*Ca. candelabrum*	Crous (2002), Lombard et al. (2015b), Liu et al. (2020)
		B32	*Ca. cylindrospora*	*Ca. cylindrospora*	Risède & Simoneau (2001)
		B34	*Ca. duoramosa*	*Ca. brassicae*	Alfenas *et al.* (2015)
		B37	*Ca. eucalypticola*	*Ca. candelabrum*	Alfenas *et al.* (2015)
		B38	*Ca. fragariae*	*Ca. candelabrum*	Lopes *et al.* (2017)
		B40	*Ca. glaebicola*	*Ca. candelabrum*	Alfenas *et al.* (2015)
		B43	*Ca. gracilis*	*Ca. brassicae*	Crous *et al.* (2006), Lombard *et al.* (2016)

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		B50	*Ca. hurae*	*Ca. gracilipes*	Crous *et al.* (2006), Liu *et al.* (2020)
		B54	*Ca. insularis*	*Ca. cylindrospora*	Schoch *et al.* (2000)
		B56	*Ca. lageniformis*	*Ca. cylindrospora*	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
		B58	*Ca. lateralis*	*Ca. kyotensis*	Ferreira *et al.* (2020)
		B60	*Ca. leguminum*	*Ca. gracilipes*	Crous (2002), Lombard *et al.* (2010b), Liu et al. (2020)
		B67	*Ca. maranhensis*	*Ca. cylindrospora*	Alfenas *et al.* (2015)
		B68	*Ca. metrosideri*	*Ca. candelabrum*	Alfenas *et al.* (2013, 2015)
		B72	*Ca. multinaviculata*	*Ca. naviculata*	Alfenas *et al.* (2015)
		B75	*Ca. naviculata*	*Ca. naviculata*	Crous (2002), Lombard *et al.* (2010b)
		B76	*Ca. nemuricola*	*Ca. candelabrum*	Alfenas *et al.* (2015)
		B78	*Ca. orientalis*	*Ca. brassicae*	Alfenas *et al.* (2015)
		B79	*Ca. ovata*	*Ca. pteridis*	El-Gholl *et al.* (1993a), Crous (2002), Liu *et al.* (2020)
		B82	*Ca. paraensis*	*Ca. brassicae*	Alfenas *et al.* (2015)
		B83	*Ca. parvispora*	*Ca. brassicae*	Marin-Felix *et al.* (2017), Liu *et al.* (2020)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Schoch *et al.* (2001)
		B87	*Ca. piauiensis*	*Ca. candelabrum*	Alfenas *et al.* (2015)
		B90	*Ca. propaginicola*	*Ca. cylindrospora*	Alfenas *et al.* (2015)
		B91	*Ca. pseudobrassicae*	*Ca. brassicae*	Alfenas *et al.* (2015)
		B93	*Ca. pseudometrosideri*	*Ca. candelabrum*	Alfenas *et al.* (2015)
		B99	*Ca. pseudospathulata*	*Ca. candelabrum*	Alfenas *et al.* (2015)
		B101	*Ca. pseudovata*	*Ca. pteridis*	Alfenas *et al.* (2015)
		B102	*Ca. pteridis*	*Ca. pteridis*	Alfenas *et al.* (2015)
		B103	*Ca. putriramosa*	*Ca. candelabrum*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B105	*Ca. quinqueramosa*	*Ca. brassicae*	Alfenas *et al.* (2015)
		B107	*Ca. robigophila*	*Ca. brassicae*	Alfenas *et al.* (2015)
		B109	*Ca. silvicola*	*Ca. candelabrum*	Alfenas *et al.* (2015)
		B111	*Ca. spathulata*	*Ca. candelabrum*	Crous & Kang (2001), Liu *et al.* (2020)
		B114	*Ca. terricola*	*Ca. pteridis*	Lombard *et al.* (2016)
		B118	*Ca. variabilis*	*Ca. cylindrospora*	Crous *et al.* (1993a), Crous (2002), Lombard *et al.* (2016)
		B121	*Ca. hemileiae*	*Ca. candelabrum*	Crous *et al.* (2018)
		B122	*Ca. matogrossensis*	*Ca. candelabrum*	Crous *et al.* (2019)
			Ca. imperata	*Ca. candelabrum*	Sanchez-Gonzalez *et al.* (2022)
			Ca. paragominensis	*Ca. spathiphylli*	Sanchez-Gonzalez *et al.* (2022)
7	Cameroon	B16	*Ca. brassicae*	*Ca. brassicae*	Crous *et al.* (2006)
		B32	*Ca. cylindrospora*	*Ca. cylindrospora*	Risède & Simoneau (2004)
		B55	*Ca. kyotensis*	*Ca. kyotensis*	Risède & Simoneau (2004)
		B73	*Ca. multiphialidica*	*Ca. naviculata*	Crous *et al.* (2004), Lombard *et al.* (2010a), Liu *et al.* (2020)
		B110	*Ca. spathiphylli*	*Ca. spathiphylli*	Risède & Simoneau (2004)
8	Canada	B20	*Ca. canadiana*	*Ca. kyotensis*	Kang *et al.* (2001b), Crous (2002), Lechat *et al.* (2010), Liu et al. (2020)
		B27	*Ca. colhounii*	*Ca. colhounii*	Reeleder (2004)

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		B55	*Ca. kyotensis*	*Ca. kyotensis*	Kang *et al.* (2001b)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
9	Georgia	B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gorgiladze *et al.* (2011)
10	China	B3	*Ca. aciculata*	*Ca. colhounii*	Li *et al.* (2017), Liu *et al.* (2020)
		B4	*Ca. aconidialis*	*Ca. kyotensis*	Lombard *et al.* (2015a), Liu *et al.* (2020)
		B8	*Ca. asiatica*	*Ca. kyotensis*	Li *et al.* (2017)
		B9	*Ca. auriculiformis*	*Ca. cylindrospora*	Wu & Chen (2021)
		B20	*Ca. canadiana*	*Ca. kyotensis*	Liu & Chen (2017), Liu *et al.* (2020)
		B22	*Ca. cerciana*	*Ca. cylindrospora*	Lombard *et al.* (2010c), Liu *et al.* (2020)
		B23	*Ca. chinensis*	*Ca. kyotensis*	Crous *et al.* (2004), Lombard *et al.* (2010b), Liu *et al.* (2020)
		B27	*Ca. colhounii*	*Ca. colhounii*	Luan et al. (2006)
		B30	*Ca. crousiana*	*Ca. reteaudii*	Chen *et al.* (2011), Liu *et al.* (2020)
		B32	*Ca. cylindrospora*	*Ca. cylindrospora*	Jia *et al.* (2021)
		B36	*Ca. eucalypti*	*Ca. colhounii*	Chen *et al.* (2011), Liu *et al.* (2020)
		B39	*Ca. fujianensis*	*Ca. colhounii*	Xu *et al.* (2012), Liu *et al.* (2020)
		B44	*Ca. hawksworthii*	*Ca. cylindrospora*	Lombard *et al.* (2015a), Liu *et al.* (2020)
		B47	*Ca. honghensis*	*Ca. colhounii*	Li *et al.* (2017), Liu *et al.* (2020)
		B48	*Ca. hongkongensis*	*Ca. kyotensis*	Li *et al.* (2017), Liu *et al.* (2020)
		B51	*Ca. ilicicola*	*Ca. kyotensis*	Yi *et al.* (2022)
		B55	*Ca. kyotensis*	*Ca. kyotensis*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B57	*Ca. lantauensis*	*Ca. kyotensis*	Li *et al.* (2017), Liu *et al.* (2020)
		B58	*Ca. lateralis*	*Ca. kyotensis*	Lombard *et al.* (2015a), Liu *et al.* (2020)
		B62	*Ca. lichi*	*Ca. colhounii*	Liu & Chen (2017), Liu *et al.* (2020)
		B78	*Ca. orientalis*	*Ca. brassicae*	Liu *et al.* (2021)
		B80	*Ca. pacifica*	*Ca. kyotensis*	Liu *et al.* (2022)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Lombard *et al.* (2015a), Liu *et al.* (2020)
		B97	*Ca. pseudoreteaudii*	*Ca. reteaudii*	Lombard *et al.* (2010c), Liu *et al.* (2020)
		B102	*Ca. pteridis*	*Ca. pteridis*	Yang *et al.* (2014)
		B104	*Ca. queenslandica*	*Ca. reteaudii*	Li *et al.* (2022)
		B106	*Ca. reteaudii*	*Ca. reteaudii*	Wu & Chen (2021)
		B120	*Ca. yunnanensis*	*Ca. kyotensis*	Li *et al.* (2017), Liu *et al.* (2020)
		B123	*Ca. xianrensis*	*Ca. colhounii*	Wang *et al.* (2019)
			Ca. minensis	*Ca. colhounii*	Liu *et al.* (2022)
11	Colombia	B12	*Ca. brachiatica*	*Ca. brassicae*	Lombard *et al.* (2009), Liu *et al.* (2020)
		B16	*Ca. brassicae*	*Ca. brassicae*	Lombard *et al.* (2009)
		B28	*Ca. colombiana*	*Ca. candelabrum*	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010b)
		B29	*Ca. colombiensis*	*Ca. kyotensis*	Crous *et al.* (2004), Liu *et al.* (2020)
		B42	*Ca. gracilipes*	*Ca. gracilipes*	Crous *et al.* (1997a, 2006), Crous (2002), Liu *et al.* (2020)

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		B83	*Ca. parvispora*	*Ca. brassicae*	Lombard *et al.* (2016)
		B88	*Ca. pini*	*Ca. brassicae*	Lombard *et al.* (2010b), Liu *et al.* (2020)
		B111	*Ca. spathulata*	*Ca. candelabrum*	Lombard *et al.* (2016), Liu *et al.* (2020)
12	Congo	B65	*Ca. madagascariensis*	*Ca. colhounii*	Crous *et al.* (2006)
13	Costa Rica	B110	*Ca. spathiphylli*	*Ca. spathiphylli*	Risède & Simoneau (2004)
14	Croatia	B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
15	Czech Republic	B45	*Ca. henricotiae*	*Ca. naviculata*	Bartíková *et al.* (2020)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Bartíková *et al.* (2020)
16	Dominica	B110	*Ca. spathiphylli*	*Ca. spathiphylli*	Risède & Simoneau (2004)
17	Ecuador	B16	*Ca. brassicae*	*Ca. brassicae*	Crous *et al.* (2006)
		B21	*Ca. candelabrum*	*Ca. candelabrum*	Lombard *et al.* (2010b), Liu *et al.* (2020)
		B33	*Ca. densa*	*Ca. spathiphylli*	Lombard *et al.* (2010b), Liu *et al.* (2020)
		B35	*Ca. ecuadoriae*	*Ca. brassicae*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B49	*Ca. humicola*	*Ca. spathiphylli*	Lombard *et al.* (2010b), Liu *et al.* (2020)
		B53	*Ca. indusiata*	*Ca. colhounii*	Crous *et al.* (2006)
		B77	*Ca. octoramosa*	*Ca. brassicae*	Marin-Felix *et al.* (2017), Liu *et al.* (2020)
		B84	*Ca. pauciphialidica*	*Ca. brassicae*	Crous *et al.* (2006), Lombard *et al.* (2010c), Liu *et al.* (2020)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Li *et al.* (2021a)
		B89	*Ca. plurilateralis*	*Ca. cylindrospora*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B92	*Ca. pseudoecuadoriae*	*Ca. brassicae*	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
		B98	*Ca. pseudospathiphylli*	*Ca. spathiphylli*	Kang *et al.* (2001b), Crous (2002), Lombard *et al.* (2016)
		B111	*Ca. spathulata*	*Ca. candelabrum*	Crous & Kang (2001)
18	France	B25	*Ca. clavata*	*Ca. brassicae*	Crous *et al.* (2006)
		B32	*Ca. cylindrospora*	*Ca. cylindrospora*	Risède & Simoneau (2004)
		B59	*Ca. lauri*	*Ca. mexicana*	Lechat *et al.* (2010), Vu *et al.* 2019
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
		B110	*Ca. spathiphylli*	*Ca. spathiphylli*	Risède & Simoneau (2004)
19	Germany	B45	*Ca. henricotiae*	*Ca. naviculata*	Gehesquière *et al.* (2016)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Lombard *et al.* (2010a)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
		B116	*Ca. uniseptata*	*Ca. kyotensis*	Lombard *et al.* (2016)
20	India	B22	*Ca. cerciana*	*Ca. cylindrospora*	Bose *et al.* (2020)
		B106	*Ca. reteaudii*	*Ca. reteaudii*	Pandey *et al.* (2010)
21	Indonesia	B5	*Ca. aeknauliensis*	*Ca. kyotensis*	Pham *et al.* (2019), Liu *et al.* (2020)
		B16	*Ca. brassicae*	*Ca. brassicae*	Crous (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
		B17	*Ca. brassicicola*	*Ca. kyotensis*	Lombard *et al.* (2016)
		B19	*Ca. bumicola*	*Ca. kyotensis*	Pham *et al.* (2019), Liu *et al.* (2020)
		B27	*Ca. colhounii*	*Ca. colhounii*	Schoch *et al.* (2001), Crous *et al.* (2006)
		B31	*Ca. curvispora*	*Ca. kyotensis*	Pham *et al.* (2019), Liu *et al.* (2020)
		B36	*Ca. eucalypti*	*Ca. colhounii*	Lombard et al. (2010b), Liu *et al.* (2020)
		B44	*Ca. hawksworthii*	*Ca. cylindrospora*	Lombard et al. (2010b), Liu et al. (2020)
		B51	*Ca. ilicicola*	*Ca. kyotensis*	Boedijn & Reitsma (1950), Crous (2002), Lombard *et al.* (2010a), Liu *et al.* (2020)
		B52	*Ca. indonesiae*	*Ca. kyotensis*	Crous *et al.* (2004), Liu *et al.* (2020)

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		B66	*Ca. malesiana*	*Ca. kyotensis*	Crous *et al.* (2004), Liu *et al.* (2020)
		B74	*Ca. multiseptata*	*Ca. reteaudii*	Crous *et al.* (2006), Liu *et al.* (2020)
		B78	*Ca. orientalis*	*Ca. brassicae*	Lombard *et al.* (2010b), Liu *et al.* (2020)
		B106	*Ca. reteaudii*	*Ca. reteaudii*	Lombard *et al.* (2010c)
		B112	*Ca. sumatrensis*	*Ca. kyotensis*	Crous *et al.* (2004), Liu *et al.* (2020)
		B113	*Ca. syzygiicola*	*Ca. kyotensis*	Lombard *et al.* (2016)
22	Iran	B51	*Ca. ilicicola*	*Ca. kyotensis*	Mirabolfathy *et al.* (2010)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Mirabolfathy *et al.* (2013)
23	Ireland	B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Ivors & LeBude (2011)
24	Italy	B32	*Ca. cylindrospora*	*Ca. cylindrospora*	Lombard *et al.* (2015a,b, 2016), Liu *et al.* (2020)
		B51	*Ca. ilicicola*	*Ca. kyotensis*	Polizzi *et al.* (2012)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Lombard *et al.* (2010a), Liu *et al.* (2020)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
25	Japan	B20	*Ca. canadiana*	*Ca. kyotensis*	Hirooka *et al.* (2009)
		B51	*Ca. ilicicola*	*Ca. kyotensis*	Hirooka *et al.* (2008)
		B55	*Ca. kyotensis*	*Ca. kyotensis*	Terashita (1968), Crous (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
		B80	*Ca. pacifica*	*Ca. kyotensis*	Taniguchi *et al.* (2008)
		B86	*Ca. penicilloides*	*Ca. kyotensis*	Tubaki (1958), Crous (2002), Liu *et al.* (2020)
26	Kenya	B85	*Ca. pauciramosa*	*Ca. candelabrum*	Lombard *et al.* (2010a)
27	Madagascar	B31	*Ca. curvispora*	*Ca. kyotensis*	Victor *et al.* (1997), Lombard *et al.* (2015a), Liu *et al.* (2020)
		B54	*Ca. insularis*	*Ca. cylindrospora*	Schoch *et al.* (1999), Lombard *et al.* (2016), Liu *et al.* (2020)
		B65	*Ca. madagascariensis*	*Ca. colhounii*	Crous *et al.* (2006), Liu *et al.* (2020)
		B106	*Ca. reteaudii*	*Ca. reteaudii*	Crous *et al.* (2006)
28	Malaysia	B44	*Ca. hawksworthii*	*Ca. cylindrospora*	Pham *et al.* (2022)
		B51	*Ca. ilicicola*	*Ca. kyotensis*	Pham *et al.* (2022)
		B106	*Ca. reteaudii*	*Ca. reteaudii*	Pham *et al.* (2022)
		B112	*Ca. sumatrensis*	*Ca. kyotensis*	Pham *et al.* (2022)
		B127	*Ca. borneana*	*Ca. kyotensis*	Pham *et al.* (2022)
		B128	*Ca. ladang*	*Ca. kyotensis*	Pham *et al.* (2022)
		B129	*Ca. pseudomalesiana*	*Ca. kyotensis*	Pham *et al.* (2022)
		B130	*Ca. tanah*	*Ca. kyotensis*	Pham *et al.* (2022)
29	Mauritius	B16	*Ca. brassicae*	*Ca. brassicae*	Schoch *et al.* (2001)
		B27	*Ca. colhounii*	*Ca. colhounii*	Peerally (1973), Crous *et al.* (2006)
		B44	*Ca. hawksworthii*	*Ca. cylindrospora*	Crous (2002), Liu *et al.* (2020)
		B56	*Ca. lageniformis*	*Ca. cylindrospora*	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
		B110	*Ca. spathiphylli*	*Ca. spathiphylli*	Risède & Simoneau (2001)
30	Mexico	B18	*Ca. brevistipitata*	*Ca. candelabrum*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B54	*Ca. insularis*	*Ca. cylindrospora*	Lombard *et al.* (2010a, 2016), Liu *et al.* (2020)
		B69	*Ca. mexicana*	*Ca. mexicana*	Schoch *et al.* (1999), Lombard *et al.* (2010a), Marin-Felix *et al.* (2017)
		B71	*Ca. multilateralis*	*Ca. naviculata*	Lombard *et al.* (2016), Liu *et al.* (2020)

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		B100	*Ca. pseudouxmalensis*	*Ca. mexicana*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B117	*Ca. uxmalensis*	*Ca. mexicana*	Lombard *et al.* (2016), Liu *et al.* (2020)
31	Mozambique	B85	*Ca. pauciramosa*	*Ca. candelabrum*	Crous *et al.* (2013), Lombard *et al.* (2016), Liu *et al.* (2020)
32	New Zealand	B2	*Ca. acicola*	*Ca. reteaudii*	Gadgil & Dick (2004), Lombard *et al.* (2016), Liu *et al.* (2020)
		B17	*Ca. brassicicola*	*Ca. kyotensis*	Lombard *et al.* (2016)
		B80	*Ca. pacifica*	*Ca. kyotensis*	Crous *et al.* (2004), Lombard *et al.* (2010b), Liu *et al.* (2020)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Crous *et al.* (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
		B102	*Ca. pteridis*	*Ca. pteridis*	Crous *et al.* (2006)
33	Panama	B108	*Ca. rumohrae*	*Ca. gracilipes*	El-Gholl *et al.* (1997), Crous *et al.* (2006), Liu *et al.* (2020)
34	Paraguay	B21	*Ca. candelabrum*	*Ca. candelabrum*	Silva *et al.* (2020)
35	Poland	B20	*Ca. canadiana*	*Ca. kyotensis*	Stępniewska *et al.* (2020)
36	Saint Lucia	B25	*Ca. clavata*	*Ca. brassicae*	Crous *et al.* (2006)
37	Singapore	B124	*Ca. singaporensis*	*Ca. kyotensis*	Crous *et al.* (2021a)
38	Slovenia	B45	*Ca. henricotiae*	*Ca. naviculata*	Gehesquière *et al.* (2016)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
39	South Africa	B16	*Ca. brassicae*	*Ca. brassicae*	Risède & Simoneau (2001)
		B27	*Ca. colhounii*	*Ca. colhounii*	Schoch *et al.* (2001), Crous *et al.* (2006)
		B64	*Ca. macroconidialis*	*Ca. colhounii*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Schoch *et al.* (1999), Lombard *et al.* (2010a), Liu *et al.* (2020)
		B110	*Ca. spathiphylli*	*Ca. spathiphylli*	Schoch & Crous (1999), Kang *et al.* (2001b)
40	South Korea	B27	*Ca. colhounii*	*Ca. colhounii*	Jeon *et al.* (2010)
		B51	*Ca. ilicicola*	*Ca. kyotensis*	Sung (1980), Gai *et al.* (2017)
41	Spain	B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
		B102	*Ca. pteridis*	*Ca. pteridis*	Lombard *et al.* (2010c)
42	Sri lanka	B53	*Ca. indusiata*	*Ca. colhounii*	Crous (2002), Lombard *et al.* (2010b, 2016), Marin-Felix *et al.* (2017)
43	Switzerland	B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
		B110	*Ca. spathiphylli*	*Ca. spathiphylli*	Crous (2002), Lombard *et al.* (2016), Liu *et al.* (2020)
44	Thailand	B8	*Ca. asiatica*	*Ca. kyotensis*	Crous *et al.* (2004), Lombard *et al.* (2010b)
		B27	*Ca. colhounii*	*Ca. colhounii*	Schoch *et al.* (2001), Crous *et al.* (2006)
		B66	*Ca. malesiana*	*Ca. kyotensis*	Crous *et al.* (2004), Liu *et al.* (2020)
		B70	*Ca. monticola*	*Ca. colhounii*	Crous *et al.* (2015)
		B80	*Ca. pacifica*	*Ca. kyotensis*	Kang *et al.* (2001b)
		B106	*Ca. reteaudii*	*Ca. reteaudii*	Crous *et al.* (2006)
45	Turkey	B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Akilli *et al.* (2012)
46	The Netherlands	B45	*Ca. henricotiae*	*Ca. naviculata*	Gehesquière *et al.* (2016)

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		B59	*Ca. lauri*	*Ca. mexicana*	Lechat *et al.* (2010), Liu *et al.* (2020)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière et al. (2016)
		B102	*Ca. pteridis*	*Ca. pteridis*	Crous *et al.* (2006)
		B108	*Ca. rumohrae*	*Ca. gracilipes*	El-Gholl *et al.* (1997), Crous (2002), Crous *et al.* (2006), Liu *et al.* (2020)
47	Tunisia	B69	*Ca. mexicana*	*Ca. mexicana*	Lombard *et al.* (2011)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Lombard *et al.* (2011)
		B94	*Ca. pseudomexicana*	*Ca. mexicana*	Lombard *et al.* (2011), Liu et al. (2020)
48	UK	B45	*Ca. henricotiae*	*Ca. naviculata*	Gehesquière *et al.* (2016)
		B59	*Ca. lauri*	*Ca. mexicana*	Henricot & Culham (2002)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Gehesquière *et al.* (2016)
49	Uruguay	B85	*Ca. pauciramosa*	*Ca. candelabrum*	Lombard *et al.* (2010a)
50	USA	B7	*Ca. angustata*	*Ca. gracilipes*	Crous *et al.* (2006), Liu *et al.* (2020)
		B11	*Ca. avesiculata*	*Ca. mexicana*	Schubert *et al.* (1989), Crous (2002), Lombard *et al.* (2010b)
		B24	*Ca. citri*	*Ca. mexicana*	Fawcett & Klotz (1937), Crous (2002), Liu *et al.* (2020)
		B25	*Ca. clavata*	*Ca. brassicae*	El-Gholl *et al.* (1993b), Lombard *et al.* (2016), Liu *et al.* (2020)
		B27	*Ca. colhounii*	*Ca. colhounii*	Benson *et al.* (2011)
		B32	*Ca. cylindrospora*	*Ca. cylindrospora*	Crous *et al.* (2013), Liu *et al.* (2020)
		B41	*Ca. gordoniae*	*Ca. pteridis*	Leahy *et al.* (2000), Crous (2002), Liu *et al.* (2020)
		B48	*Ca. hongkongensis*	*Ca. kyotensis*	Serrato-Diaz *et al.* (2013)
		B50	*Ca. hurae*	*Ca. gracilipes*	Crous *et al.* (2006)
		B51	*Ca. ilicicola*	*Ca. kyotensis*	Crous *et al.* (2004)
		B53	*Ca. indusiata*	*Ca. colhounii*	Crous *et al.* (2006)
		B55	*Ca. kyotensis*	*Ca. kyotensis*	Sobers (1968), Marin-Felix *et al.* (2017), Liu *et al.* (2020)
		B59	*Ca. lauri*	*Ca. mexicana*	Crous *et al.* (2021)
		B61	*Ca. leucothoes*	*Ca. mexicana*	Crous (2002), Lombard *et al.* (2015a), Liu *et al.* (2020)
		B80	*Ca. pacifica*	*Ca. kyotensis*	Crous (2002), Crous *et al.* (2004), Liu et al. (2020)
		B81	*Ca. paracolhounii*	*Ca. colhounii*	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
		B85	*Ca. pauciramosa*	*Ca. candelabrum*	Lombard *et al.* (2010a)
		B95	*Ca. pseudonaviculata*	*Ca. naviculata*	Ward Gauthier *et al.* (2016)
		B96	*Ca. pseudopteridis*	*Ca. pteridis*	Alfenas *et al.* (2015), Lombard *et al.* (2016), Liu *et al.* (2020)
		B102	*Ca. pteridis*	*Ca. pteridis*	Crous *et al.* (2006), Crous (2002), Marin-Felix *et al.* (2017)
		B110	*Ca. spathiphylli*	*Ca. spathiphylli*	Crous (2002), Lombard et al. (2010b, 2016), Liu *et al.* (2020)
		B125	*Ca. californiensis*	*Ca. mexicana*	Crous *et al.* (2021)
51	Venezuela	B44	*Ca. hawksworthii*	*Ca. cylindrospora*	del Castillo *et al.* (2016)
		B106	*Ca. reteaudii*	*Ca. reteaudii*	del Castillo *et al.* (2016)

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		B119	*Ca. venezuelana*	*Ca. candelabrum*	Lombard *et al.* (2016), Liu *et al.* (2020)
		B126	*Ca. vigiensis*	*Ca. naviculata*	Mohali & Stewart (2021)
52	Vietnam	B1	*Ca. acaciicola*	*Ca. reteaudii*	Pham *et al.* (2019), Liu *et al.* (2020)
		B9	*Ca. auriculiformis*	*Ca. cylindrospora*	Pham *et al.* (2019), Liu *et al.* (2020)
		B16	*Ca. brassicae*	*Ca. brassicae*	Schoch *et al.* (2001)
		B23	*Ca. chinensis*	*Ca. kyotensis*	Pham *et al.* (2019), Liu *et al.* (2020)
		B26	*Ca. cochinchinensis*	*Ca. kyotensis*	Pham *et al.* (2019), Liu *et al.* (2020)
		B46	*Ca. heveicola*	*Ca. kyotensis*	Pham *et al.* (2019), Liu *et al.* (2020)
		B48	*Ca. hongkongensis*	*Ca. kyotensis*	Pham *et al.* (2019)
		B51	*Ca. ilicicola*	*Ca. kyotensis*	Pham *et al.* (2019)
		B58	*Ca. lateralis*	*Ca. kyotensis*	Pham *et al.* (2019)
		B66	*Ca. malesiana*	*Ca. kyotensis*	Pham *et al.* (2019)
		B97	*Ca. pseudoreteaudii*	*Ca. reteaudii*	Crous *et al.* (2012), Liu *et al.* (2020)
		B106	*Ca. reteaudii*	*Ca. reteaudii*	Kang *et al.* (2001a), Crous (2002), Crous *et al.* (2006), Liu *et al.* (2020)
		B115	*Ca. tonkinensis*	*Ca. cylindrospora*	Pham *et al.* (2019), Liu *et al.* (2020)
		B120	*Ca. yunnanensis*	*Ca. kyotensis*	Pham *et al.* (2019)
53	Zambia	B111	*Ca. spathulata*	*Ca. candelabrum*	Chungu *et al.* (2010)

[a] Codes (B1 to B120) of the 120 accepted *Calonectria* species resulting from Liu *et al.* (2020).

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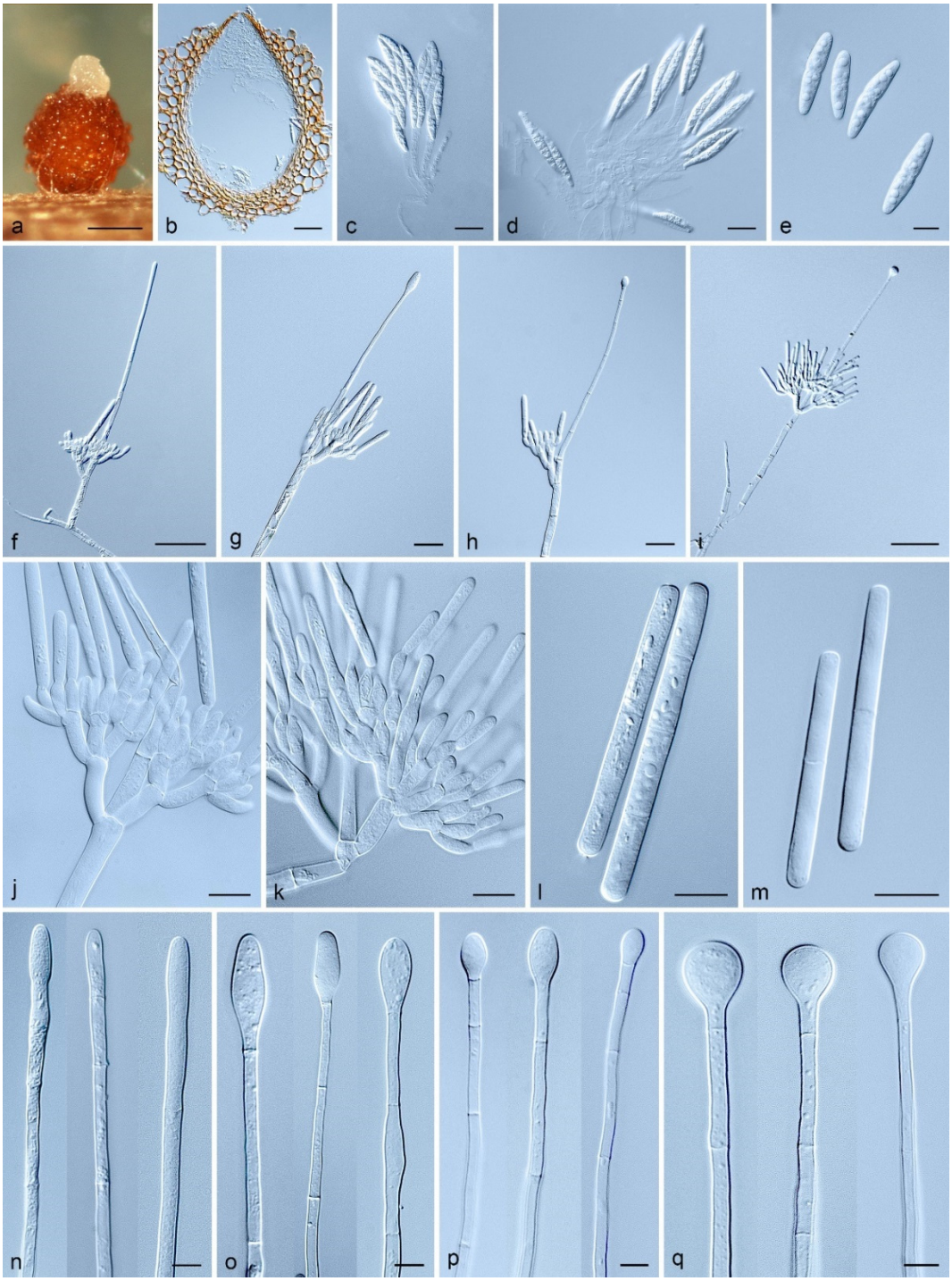


Fig 1. Morphological characteristics of *Calonectria* species. **a–e.** Sexual morphs; **a.** Perithecium of *Ca. aconidialis* CSF 9937; **b.** Vertical section through a perithecium of *Ca. ilicicola* CSF 9862; **c.** Asci of *Ca. hongkongensis* CSF 9819 with eight ascospores; **d.** Asci of *Ca. minensis* CSF 9941 with four ascospores; **e.** Ascospores of *Ca. kyotensis* CSF 9824 with one septate. **f–q.** Asexual morphs; **f.** Macroconidiophore with a clavate vesicle in *Ca. minensis* CSF 9933; **g.** Macroconidiophore with an obpyriform vesicle in

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Ca. brevistipitata CBS 110837; **h.** Macroconidiophore with an ovoid vesicle in *Ca. humicola* CMW 31186; **i.** Macroconidiophore with a sphaeropedunculate vesicle in *Ca. cochinchinensis* CMW 47187; **j.** Conidiogenous apparatus with conidiophore branches and doliiform to reniform phialides of *Ca. cerciana* CMW 37972; **k.** Conidiogenous apparatus with conidiophore branches and doliiform to reniform phialides of *Ca. cochinchinensis* CMW 47187; **l.** Microconidia of *Ca. dianii* (in Chapter four, unpublished yet) CSF 6520 with three septate; **m.** Microconidia of *Ca. cochinchinensis* CMW 47187 with one septate; **n.** Clavate vesicles of *Ca. minensis* CSF 9933; **o.** Obpyriform vesicles of *Ca. brevistipitata* CBS 110837; **p.** Ovoid vesicles of *Ca. humicola* CMW 31186; **q.** Sphaeropedunculate vesicles of *Ca. heveicola* CMW 49928. Scale bars: a = 200 µm, b = 50 µm, c, d, g, h = 20 µm, e, f, i–m = 10 µm, n–q = 5 µm.

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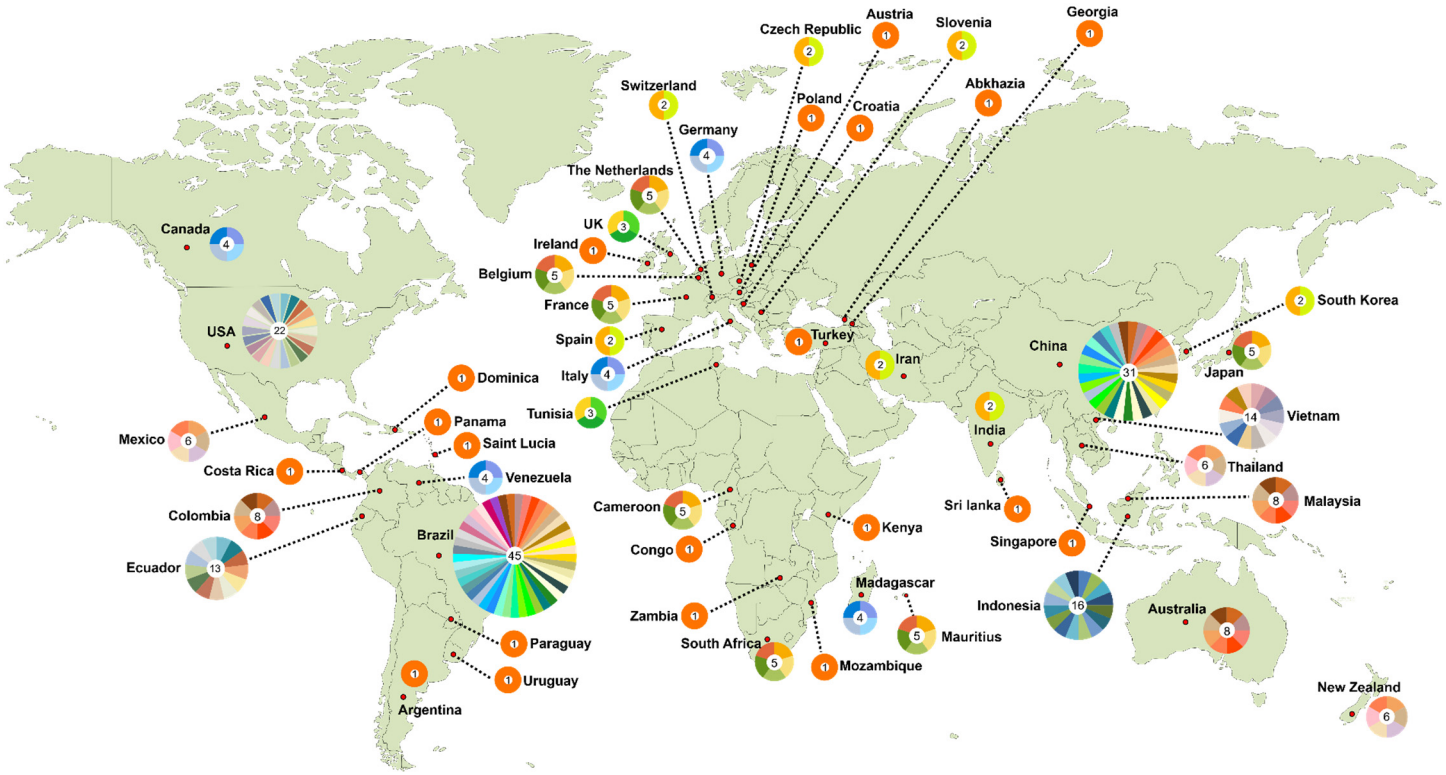


Fig 2. Distribution characteristics of 133 published *Calonectria* species in 53 countries around the world. Different colour in each pie graph represents different *Calonectria* species. The figure on the pie graph represents the total number of *Calonectria* species that have been reported in this country.

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CHAPTER 2

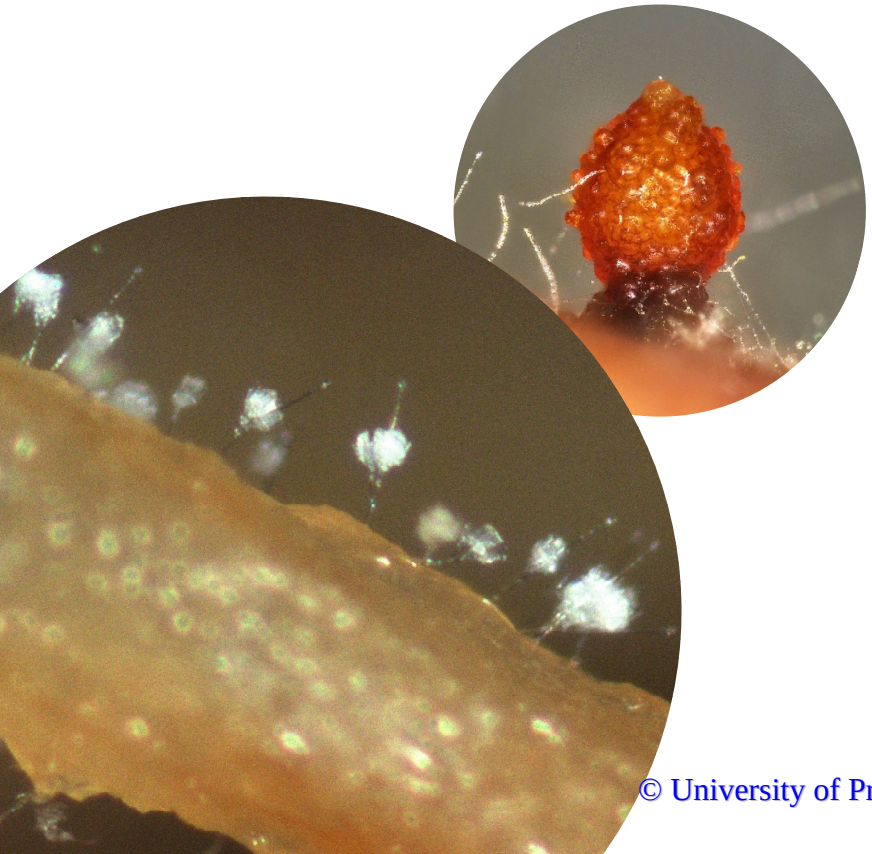
Reconsideration of species boundaries and proposed DNA barcodes for *Calonectria*

Research Chapter:

Liu QL, Li JQ, Wingfield MJ, Duong TA, Wingfield BD, Crous PW, Chen SF. 2020.

Reconsideration of species boundaries and proposed DNA barcodes for *Calonectria*.

Studies in Mycology 97: 100106



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Reconsideration of species boundaries and proposed DNA barcodes for *Calonectria*

Abstract: *Calonectria* represents a genus of phytopathogenic ascomycetous fungi with a worldwide distribution. In recent years, there has been an increase in the number of taxonomic studies on these fungi. Currently, there are 169 described species of *Calonectria* based on comparisons of DNA sequence data, combined with morphological characteristics. However, for some of these species, the sequence data utilised at the time of their description were relatively limited. This has justified an urgent need to reconsider the species boundaries for *Calonectria* based on robust genus-wide phylogenetic analyses. In this study, we utilised 240 available isolates including the ex-types of 128 *Calonectria* species, and re-sequenced eight gene regions (*act*, *cmdA*, *his3*, ITS, LSU, *rpb2, tef1* and *tub2*) for them. Sequences for 44 *Calonectria* species, for which cultures could not be obtained, were downloaded from GenBank. DNA sequence data of all the 169 *Calonectria* species were then used to determine their phylogenetic relationships. As a consequence, 51 species were reduced to synonymy, two new species were identified, and the name *Ca. lauri* was validated. This resulted in the acceptance of 120 clearly defined *Calonectria* spp. The overall data revealed that the genus includes 11 species complexes, distributed across the Prolate and Sphaero-Naviculate Groups known to divide *Calonectria*. The results also made it possible to develop a robust set of DNA barcodes for *Calonectria* spp. To accomplish this goal, we evaluated the outcomes of each of the eight candidate DNA barcodes for the genus, as well as for each of the 11 species complexes. No single gene region provided a clear identity for all *Calonectria* species. Sequences of the *tef1* and *tub2* genes were the most reliable markers; those for the *cmdA*, *his3*, *rpb2* and *act* gene regions also provided a relatively effective resolution for *Calonectria* spp., while the ITS and LSU failed to produce useful barcodes for species discrimination. At the species complex level, results showed that the most informative barcodes were inconsistent, but that a combination of six candidate barcodes (*tef1*, *tub2*, *cmdA*, *his3*, *rpb2* and *act*) provided stable and reliable resolution for all 11 species complexes. A six-gene combined phylogeny resolved all 120 *Calonectria* species, and revealed that *tef1*, *tub2*, *cmdA*, *his3*, *rpb2* and *act* gene regions are effective DNA barcodes for *Calonectria*.

Key words: *Cylindrocladium*, DNA barcoding, Multi-gene phylogeny, Plant pathogens, Taxonomy.

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INTRODUCTION

The genus *Calonectria* (*Hypocreales*, *Nectriaceae*) includes many aggressive plant pathogens and species that are broadly distributed in sub-tropical and tropical regions of the world. These species have a wide host range that includes more than 335 plant species (Crous 2002) and they are commonly collected from soils, leaves, stems, roots and fruits (Lombard *et al*. 2010a, 2015a, Chen *et al*. 2011, Alfenas *et al*. 2015, Gehesquiere *et al*. 2015, Li *et al*. 2017, Lopes *et al*. 2017, Marin-Felix *et al*. 2017, Jiang *et al*. 2019, Pham *et al*. 2019). A total of 169 species have been described in *Calonectria* (*Ca*.) using DNA sequence-based phylogenetic inference and morphological comparisons (Li *et al*. 2017, Marin-Felix *et al*. 2017, Pham *et al*. 2019).

Many species of *Calonectria* are well-known causal agents of important diseases on various agricultural, horticultural and forestry crops. Species such as *Ca. pseudonaviculata* and *Ca. henricotiae* are important agents of boxwood (*Buxus* spp.) blight in Germany, the Netherlands, Slovenia, UK and USA (Henricot & Culham 2002, Brand 2005, Gehesquiere *et al*. 2015, Daughtrey 2019, Freitas *et al*. 2019). Many species such as *Ca. pentaseptata* (in China and Vietnam, Crous *et al*. 2012, Li *et al*. 2017), *Ca. pteridis* (in Brazil, Freitas *et al*. 2019), *Ca. reteaudii* (in Australia, India and Vietnam, Old *et al*. 2003) and *Ca. spathulata* (in Colombia, Rodas *et al*. 2005) are important causal agents of Calonectria leaf blight (CLB) in *Eucalyptus* plantations. *Calonectria ilicicola* is known as a common pathogen responsible for the red crown rot of soybeans in China, Japan and USA (Gai *et al*. 2017, Yamamoto *et al*. 2017, Kleczewski *et al*. 2019), causing significant yield losses.

The importance of *Calonectria* spp. has justified many taxonomic studies on these fungi in recent years. Lombard *et al.* (2010a) provided a genus-wide phylogeny for the 66 available *Calonectria* spp. That study included sequence data for seven gene regions including *act* (actin), *cmdA* (calmodulin), *his3* (histone H3), ITS (the internal transcribed spacer regions 1 and 2 and the 5.8S gene of the ribosomal RNA), LSU (28S large subunit RNA gene), *tef1* (translation elongation factor 1-alpha) and *tub2* (β-tubulin). Subsequently, a polyphasic approach, including combined DNA sequence data for the *cmdA*, *tef1* and *tub2* gene regions together with morphological comparisons was used to resolve the taxonomy of 141 *Calonectria* species (Lombard *et al*. 2016). A year later, Marin-Felix *et al*. (2017) provided *rpb2* sequence data for 68 *Calonectria* species and Jayawardena *et al*. (2019) reconstructed the phylogeny of *Calonectria* based on sequence data for *cmdA*, *his3*, *tef1* and *tub2* gene regions. A problem has, however, arisen due to a lack of uniformity of sequence data in different studies, and

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particularly the *his3* and *rpb2*. Futhermore, some other gene regions are not consistently available for all of 169 species of *Calonectria*. This calls to question the strength and relevance of the phylogenetic backbone for an important group of plant pathogens as well as the reliability of species boundaries that must define plant disease diagnoses and management.

DNA barcoding provides an effective and widely used tool for fungal species identification (Schoch *et al*. 2012, Stielow *et al*. 2015, Vu *et al*. 2019). Various molecular markers have been utilised for species recognition in *Calonectria* (Lombard *et al*. 2010a, 2016, Li *et al*. 2017, Marin-Felix *et al*. 2017, Jayawardena *et al*. 2019). But there is a lack of consistency in the markers used in different studies. There remains a need for a standard suite of DNA barcodes to distinguish among all species in *Calonectria*. This can be a complex goal given that barcodes for a particular species complex in a genus is not necessarily best suited to other species complexes, as has been seen in *Fusarium* (Lombard *et al*. 2019, Maryani *et al*. 2019, Sandoval-Denis *et al*. 2019, Wang *et al*. 2019, Xia *et al*. 2019). Under these circumstances, it has become necessary to explore whether a similar situation also applies to *Calonectria*.

The aim of this study was to produce a comprehensive suite of DNA sequence data for all 169 currently recognised species of *Calonectria* using eight gene regions. These data were then utilised to construct a genus-wide phylogeny and to reconsider the phylogenetic relationships and species boundaries for *Calonectria*. Furthermore, the resolution power of each of these eight gene regions was evaluated for the genus as a whole and the species complexes that define it. This made it possible to identify an optimal suite of DNA barcodes that can be used to reliably identify *Calonectria* species.

MATERIALS AND METHODS

Isolates

Sequence data for 169 described *Calonectria* species (including data for the ex-type isolates) were included in the phylogenetic analyses. Of these, 240 isolates representing 128 species (Supplementary Table S1) were obtained from culture collections, including those of the Westerdijk Fungal Biodiversity Institute (CBS), Utrecht, The Netherlands, the culture collection of the Forestry Agricultural and Biotechnology Institute, University of Pretoria, Pretoria (CMW), South Africa, and the Culture Collection of the China Eucalypt Research Centre (CERC), Chinese Academy of Forestry (CAF), ZhanJiang, GuangDong Province, China. Isolates from these culture collections were plated onto 2 % malt extract agar (MEA:

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20 g malt extract and 20 g agar per litre water) and subsequently single hyphal-tips were transferred to fresh MEA plates and incubated at 25 °C for 7 d. It was not possible to obtain cultures for 76 isolates representing 44 of the described *Calonectria* species (Supplementary Table S2). In this case, sequences were downloaded from GenBank (http://www.ncbi.nlm.nih.gov) and included in the analyses. For three species (*Ca. angustata*, *Ca. pini* and *Ca. metrosideri*), isolates were sequenced and data were also downloaded from GenBank. They are consequently included in both Supplementary Tables S1 and S2. The fungarium specimens for the novel taxa represented by dried sporulating cultures were deposited in the Herbarium Mycologicum, Academiae Sinicae (HMAS), Beijing, China.

DNA extraction, PCR and sequencing

For the 240 *Calonectria* isolates representing 128 species obtained from culture collections (Supplementary Table S1) and used in this study, mycelium was harvested from 7-d-old cultures on MEA using a sterile scalpel, and genomic DNA was extracted using the CTAB method "5" described by Van Burik *et al*. (1998). Eight different loci were amplified and sequenced, including *act*, *cmdA*, *his3*, ITS, LSU, *rpb2*, *tef1* and *tub2*. Primers ACT-512F and ACT-783R (Carbone & Kohn 1999) were used to amplify the *act* gene region; CAL-228F and CAL-2Rd (Carbone & Kohn 1999, Quaedvlieg *et al*. 2011) for the *cmdA* gene region; CYLH3F and CYLH3R (Crous *et al*. 2004) for the *his3* gene region; V9G (De Hoog & van den Ende 1998) and ITS4 (White *et al*. 1990) for the ITS region; LR0R (Moncalvo *et al*. 1995) and LR5 (Vilgalys & Hester 1990) for the LSU region; fRpb2-5F and fRpb2-7cR (Liu *et al*. 1999, Reeb *et al*. 2004) for the *rpb2* gene region; EF1-728F (Carbone & Kohn 1999) and EF2 (O'Donnell *et al*. 1998) for the *tef1* gene region and primers pairs T1 (O'Donnell & Cigelnik 1997) and CYLTUB1R (Crous *et al*. 2004) were used to amplify the *tub2* gene region.

The PCR reaction mixtures consisted of 17.5 µL TopTaq™ Master Mix, 1 µL of each primer, 2 µL DNA samples and nuclease-free H_2O were made up to the final volume of 35 µL. The PCR conditions for the seven regions (with the exception of *rpb2*) were as follows: an initial denaturation step at 95 °C for 5 min; then 35 amplification cycles at [95 °C for 30 s; annealing 61 °C (*act*) / 55 °C (*cmdA*, *his3*, ITS, LSU) / 52 °C (*tef1* and *tub2*) for 30 s; 72 °C for 1 min], and the final extension step at 72 °C for 10 min. For the *rpb2* gene region, a touchdown PCR protocol was used: an initial denaturation step at 95 °C for 5 min, then (95 °C for 30 s, 58 °C for 30 s, 72 °C for 90 s) × 10 cycles, (95 °C for 30 s, 58 °C for 45 s, 72 °C for 90 s + 5 s / cycle increase) × 30 cycles, and final extension step at 72 °C for 10 min.

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All the PCR products were sequenced in both directions using the same primers used for amplification. Raw sequences for each gene region were edited and consensus sequences were generated using Geneious v. 9.1.4 (Kearse *et al*. 2012).

Phylogenetic analyses

Sequence data for eight gene regions of 316 *Calonectria* isolates were used in the phylogenetic analyses. These were derived from 240 isolates representing 128 species obtained from culture collections and sequenced in this study (Supplementary Table S1). For the 76 isolates representing 44 species that we were unable to obtain, available sequence data were downloaded from GenBank (Supplementary Table S2). Sequence data for *Curvicladiella cignea* (CBS 109167 and CBS 109168) were used as the outgroup taxa in the analyses following the example of Pham *et al*. (2019). Multiple sequences were aligned using the online version of MAFFT v. 7 (Katoh & Standley 2013) and the alignment was trimmed at both ends where necessary with MEGA v. 6.0.5 (Tamura *et al*. 2013). For some of the 316 isolates, not all of the eight gene regions were available, and here all of the available sequences were used in the individual analyses. In the case of the eight gene region combined analyses, missing sequence data were replaced with "N".

Two phylogenetic approaches were used in this study. These included Maximum Parsimony (MP) analyses performed with PAUP v. 4.0 b10 (Swofford 2003) and Maximum Likelihood (ML) analyses performed with PhyML v. 3.0 (Guindon & Gascuel 2003). The sequence datasets for the eight individual gene regions and a concatenated dataset for those regions were used to determine the phylogenetic relationships among species. A partition homogeneity test (PHT) (Farris *et al*. 1994) was conducted to determine whether the datasets for the eight gene regions could be combined.

For the MP analyses, all characters were unordered and equally weighted. Gaps were regarded as a fifth character, phylogenetic trees were obtained using a heuristic tree search criterion, including 1000 random stepwise additions and tree-bisection-reconstruction (TBR) branch swapping. Branches of zero-length were collapsed. Statistical supports for tree-branch points were determined using bootstrap analyses with 1000 replicates (Felsenstein 1985). Tree length (TL), retention index (RI), consistency index (CI), rescaled consistency index (RC) and homoplasy index (HI) (Supplementary Table S3) were calculated for parsimony trees.

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For the ML analyses, the best substitution model for each dataset was selected by JModeltest v. 2.1.7 (Posada 2008). All sequences generated in this study were submitted to GenBank (www.ncbi.nlm.nih.gov) (Supplementary Table S1) and final alignments were deposited in TreeBASE (http://treebase.org).

Individual *Calonectria* species were recognised based on concordance of multiple gene genealogies. Two criteria were applied in determining species boundaries based on phylogenetic analyses and sequence comparisons. These were (i) when isolate(s) formed a distinct lineage that differentiated them from other isolates in at least two of the eight individual gene regions sequenced and where these groupings did not contradict those for other loci; (ii) when the isolates formed independent lineages supported by high bootstrap values in the combined tree based on the eight-gene concatenated dataset, and where they had fixed Single Nucleotide Polymorphisms (SNPs) that differentiated them from their phylogenetically closest relatives. These phylogenetically defined taxa were then also considered in terms of their morphology and mating type. To avoid confusion, in Supplementary Table S1 and Table S2, the code "A" was used to represent the *Calonectria* species before the taxonomic reconsideration of species boundaries in the present study. The code "B" was used for the 120 species names that have been accepted after revision and as presented in the Taxonomy section of this study.

Morphology, mating system and geographic distribution

Depending on their availability, isolates representing the novel *Calonectria* spp. were selected for morphological study. Synthetic nutrient-poor agar (SNA, Nirenburg 1981) was used to induce the asexual morphs in culture. Agar plugs from axenic cultures were transferred to five replicate plates of SNA and incubated at 25 °C for 7 d. Fungal structures were transferred to a drop of 85 % lactic acid on microscope slides. Gross morphological characteristics were examined with a Zeiss Axio Imager A1 microscope (Carl Zeiss Ltd., Germany).

For isolates selected as the holotype of novel taxa, each characteristic morphological structure was measured with 50 replicates, and 30 replicate measurements were made for additional isolates. Minimum, maximum and average (mean) measurements were recorded as (minimum–) (average – standard deviation) – (average + standard deviation) (–maximum).

Optimal growth temperatures for each of the novel *Calonectria* spp. were determined on MEA. Agar plugs were transferred from the actively growing edges of 7-d-old cultures with a 5 mm

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diam cork borer and inoculated at the centres of 90 mm Petri dishes containing MEA. Cultures were grown at seven different temperatures ranging from 5 °C to 35 °C, at 5 °C intervals (each isolate with five replicates). Colony diameters were measured after seven days. Colony colours were described based on the colour charts of Rayner (1970) and using 7-d-old cultures on MEA incubated at 25 °C.

Morphological characteristics of all *Calonectria* species were re-evaluated in comparison to multilocus DNA sequence phylogenetic analyses. The important morphological features include vesicle shape and diameter, macroconidial septation and dimensions, perithecial colour, number of ascospores in the asci, ascospore septation and dimensions. In addition, ex-type isolate location and the mating system (heterothallic or homothallic) were also considered when known.

Selection of DNA barcodes for species recognition

The analyses of DNA sequences for eight gene regions made it possible to identified clear boundaries between putative *Calonectria* species. These data formed the basis to test the success of each of these gene regions to distinguish species. This Identification Success Rate (ISR) was calculated by dividing the number of identified species for each gene region by the total number of species of *Calonectria* recognised in the phylogenetic analyses of eight gene regions.

The ISR of each candidate DNA barcode was computed based on the eight individual gene phylogenetic trees and the eight-gene combined phylogenetic tree. For each candidate DNA barcode, the ISRs were calculated both for the entire genus *Calonectria*, and for each of the recognised species' complexes.

RESULTS

Phylogenetic analyses

Sequence data generated for the eight gene regions of the 240 isolates representing 128 of the 169 described species of *Calonectria* were deposited in GenBank (Supplementary Table S1). Amplicons generated for *act*, *cmdA*, *his3*, ITS, LSU, *rpb2*, *tef1* and *tub2* gene regions were approximately 300, 750, 500, 700, 870, 860, 560, 650 bp, and respectively. Sequence data for

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the 76 isolates representing 44 species for which cultures could not be obtained were downloaded from GenBank and included in the final datasets (Supplementary Table S2).

Alignments for each of the gene regions and for the combined datasets were as follows: *act* (246 isolates, 286 characters), *cmdA* (314 isolates, 721 characters), *his3* (305 isolates, 498 characters), ITS (268 isolates, 705 characters), LSU (267 isolates, 866 characters), *rpb2* (234 isolates, 863 characters), *tef1* (316 isolates, 563 characters), *tub2* (285 isolates, 652 characters) and combined (318 isolates, 5 154 characters). The partition homogeneity test (PHT) performed on the concatenated dataset of eight gene regions yielded a P-value of 0.01. This suggested some incongruence in the datasets for the eight regions, and the accuracy of the combined data could have suffered relative to the individual partitions (Cunningham 1997). Although the P-value was low, the datasets for multiple gene regions were combined for phylogenetic analyses, done in several of previous studies (Lombard *et al*. 2016, Marin-Felix *et al*. 2017, Pham *et al*. 2019).

Phylogenetic analyses based on the eight individual gene regions and the combined sequence datasets were conducted using both the ML and MP methods (TreeBASE No. 26083). Tree topologies derived from the ML and MP analyses of the six individual gene regions (*act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2*) and the combined datasets were essentially congruent with each other and they formed well-supported lineages generally matching the morphological features of the purported species. The non-coding gene regions (ITS and LSU) are known to have poor ability to discriminate between *Calonectria* species (Lombard *et al*. 2010a) and several species resided in a single clade even though they had clearly different morphological characteristics (Supplementary Figs S4, S5). Only the ML trees are presented in this study, and bootstrap support values from ML and MP analyses are indicated above the tree branches (Fig. 1, Supplementary Figs S1–8). Statistical results and important parameters emerging from the phylogenetic analyses were provided in Supplementary Table S3.

The combined datasets for the eight sequenced gene regions comprised 5 154 characters, including alignment gaps. Of these, 3 472 were parsimony-uninformative and 1 682 were parsimony-informative. The eight-gene phylogenetic tree (Fig. 1) divided the *Calonectria* spp. into 11 well-supported clades and these reside in two major groups, the Prolate Group and the Sphaero-Naviculate Group. In the Prolate Group, species are characterised by their clavate to pyriform to ellipsoidal vesicles. Nine well-supported clades reside in the Prolate Group. This group includes nine species complexes including the *Ca. brassicae*, *Ca. candelabrum*, *Ca.*

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colhounii, *Ca. cylindrospora*, *Ca. gracilipes*, *Ca. mexicana*, *Ca. pteridis*, *Ca. reteaudii* and *Ca. spathiphylli* species complexes (Fig. 1). The remaining two well-supported clades reside in the Sphaero-Naviculate Group. The Sphaero-Naviculate Group is defined by vesicles having sphaeropedunculate or naviculate morphology. The two clades in this group accommodate two species complexes, those defined by *Ca. kyotensis* and *Ca. naviculata* (Fig. 1).

The *Calonectria* species before their taxonomic reconsideration in this study (codes A1 to A169) and after the revision emerging from this study (codes B1 to B120) are presented (Supplementary Table S1 and Table S2, Fig. 1, Supplementary Figs S1–8). Based on the results of this study and a reconsideration of species boundaries, accepted species are listed in Table 1. These species are also presented in the Taxonomy section below together with the taxonomic synonyms.

Morphology, mating system and geographic distribution

The key morphological characteristics of *Calonectria* species were summarised, placing species in the 11 species complexes (Supplementary Table S4). Based on the typical/dominant vesicle shape of species in each species complex, the 11 species complexes were separated into six groups: (1) clavate or narrowly clavate vesicle group (*Ca. brassicae*, *Ca. colhounii*, *Ca. gracilipes* and *Ca. reteaudii* species complexes); (2) naviculate vesicle group (*Ca. naviculata* species complex); (3) ellipsoidal to obpyriform vesicle group (*Ca. candelabrum* species complex); (4) ellipsoidal vesicle with papillate apex group (*Ca. mexicana* species complex); (5) sphaeropedunculate vesicle group (*Ca. kyotensis* and *Ca. spathiphylli* species complexes); (6) varied shapes vesicle group (*Ca. cylindrospora* and *Ca. pteridis* species complexes) (Table 2, Fig. 1). Other than vesicle shape, differences in other key morphological features including macroconidial septation, perithecial colour, number of ascospores in the asci and ascospore septation are presented in Table 2, Supplementary Table S4 and Fig. 1. Differences in mating type and geographic distribution for the species in all 11 species complexes are documented in Table 2, Supplementary Table S4 and Fig. 1.

Species in four species complexes (*Ca. brassicae*, *Ca. colhounii*, *Ca. gracilipes* and *Ca. reteaudii*) have clavate or narrowly clavate vesicles. The *Ca. brassicae* species complex generally produces 1-septate macroconidia and 1-septate ascospores, distinguishing them from taxa in the *Ca. colhounii*, *Ca. gracilipes* and *Ca. reteaudii* species complexes. The *Ca. colhounii* species complex typically has yellow perithecia and 4-spored asci, rare in all the

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other species complexes. Species in both the *Ca. gracilipes* and *Ca. reteaudii* species complexes generally produce macroconidia with more than three septa (Table 2, Supplementary Table S4). Species in the *Ca. naviculata* species complex typically have naviculate vesicles and those in the *Ca. mexicana* species complex generally produces ellipsoidal vesicles with papillate apices, morphological features rarely found in other species complexes (Table 2, Supplementary Table S4). Ellipsoidal to obpyriform vesicles are typical of species in the *Ca. candelabrum* species complex (Table 2, Supplementary Table S4) and those in the *Ca. kyotensis* and *Ca. spathiphylli* species complexes generally produce sphaeropedunculate vesicles and have 1-septate macroconidia. Perithecial colour, and number of ascospores in the asci of *Ca. kyotensis* species complex taxa are generally similar to those in the *Ca. spathiphylli* species complex (Table 2, Supplementary Table S4). Species in the *Ca. cylindrospora* and *Ca. pteridis* species complexes do not have vesicles that are morphologically characteristic, those the former have vesicles of variable shape, while those in the latter are generally clavate or ovate (Table 2, Supplementary Table S4).

Morphological comparisons showed that most of the *Calonectria* species can be distinguished based on vesicle shape and diameter, macroconidial septation and dimensions, perithecial colour, number of ascospores in the asci, ascospore septation and dimensions (Supplementary Table S4). Some species were difficult to distinguish solely based on morphological characteristics. For example, the *Ca. pseudospathulata* (*Ca. candelabrum* species complex) and *Ca. auriculiformis* (*Ca. cylindrospora* species complex) all produce obpyriform vesicles, and 1-septate macroconidia with overlapping dimensions (Supplementary Table S4). Some species in the same species complex shared a similar morphology; for example, *Ca. pseudobrassicae* and *Ca. paraensis* (both in the *Ca. brassicae* species complex) both produce clavate vesicles, and 1-septate macroconidia with overlapping dimensions (Supplementary Table S4).

Species in the *Ca. naviculata* and *Ca. pteridis* species complexes are heterothallic, while those in the *Ca. gracilipes* species complex are homothallic. *Calonectria* species in the remaining eight complexes include both heterothallic and homothallic mating systems (Table 2, Supplementary Table S4).

A summary of species distribution globally, showed that species in the *Ca. candelabrum* and *Ca. naviculata* species complexes occur on all the continents other than Antarctica. In contrast, species in the *Ca. gracilipes*, *Ca. pteridis* and *Ca. spathiphylli* species complexes were from

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North and South America and those in the *Ca. reteaudii* species complex were from Asia and Oceania. Species in other species complexes occurred on between three and five continents (Table 2, Supplementary Table S4).

Species reduced to synonymy

Based on the criteria decided upon for species delimitation, 51 previously identified species represented synonyms of other known species (Supplementary Tables S1 and S2). Justification for reducing these 51 previously accepted taxa to synonymy with earlier names is provided in the taxonomy section.

Novel taxa

Based on phylogenetic placement in the individual gene phylogenies and multi-gene phylogenetic trees (Fig. 1, Supplementary Figs S1–8), two isolates (CMW 30602 and CMW 30980) formed two distinct lineages. These lineages were clearly distinct from those representing any of the other described species and they are recognised here as two novel taxa described in the Taxonomy section. In the *Ca. brassicae* species complex, a single isolate (CMW 30980), treated as *Ca. ecuadorae* in the earlier studies (Crous *et al*. 2006), formed a distinct lineage in the *rpb2*, *tef1*, and *tub2* and in the combined gene tree. This fungus clustered close to but separate from *Ca. ecuadorae* (ex-type CMW 23677, CBS 111706, and CBS 114164) and *Ca. octoramosa* (ex-type CBS 111423) (Fig. 1, Supplementary Figs S6–8). Isolate CMW 30980 is thus considered to represent a novel species. Isolate CMW 30602 in the *Ca. reteaudii* species complex was identified as *Ca. terrae-reginae* by Lombard *et al*. (2010c), and formed a distinct lineage in the ITS, *tef1* and *tub2* analyses as well as in the combined phylogenetic tree (Fig. 1, Supplementary Figs S4, S7, S8). This isolate represents an undescribed species closely related to but separate from *Ca. queenslandica* (ex-type CMW 30604, CMW 30601, and CMW 30603) (Fig. 1, Supplementary Figs S4, S7).

Calonectria lauri (Vanderw.) Lechat & Crous was proposed as the sexual morph of *Cylindrocladium ilicicola* by Lechat in 2010. The basionym *Tetracytum lauri* is invalid and thus the name *Ca. lauri* is invalid. The results of the present study have shown that *Ca. lauri* represents a well-defined species and its name is consequently validated in the taxonomy section.

Taxonomy (Species listed in alphabetical order)

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Following the results of the multi-gene phylogenetic analyses and consideration of the morphological characteristics of the 169 described *Calonectria* spp. (codes A1 to A169 in Supplementary Tables S1 and S2), 51 species are reduced to synonymy and three novel *Calonectria* species (*Calonectria lauri* was validated and it is treated as a valid species in the current study) are recognised. This results in 120 *Calonectria* spp. now accepted and these are listed in Table 1 (codes B1 to B120 in Supplementary Tables S1 and S2). Morphological characteristics of the *Calonectria* spp. identified in this study and their closest relatives are summarised (Supplementary Table S4). The 120 accepted *Calonectria* species emerging from this study and their synonymies are presented below.

acaciicola Calonectria N.Q. Pham *et al.*, Mycologia 111: 88. 2019.

In: *Calonectria reteaudii* species complex.

Typus: PREM 62105 holotype.

Ex-type culture: CBS 143557 = CMW 47173.

Type locality: **Vietnam**, Nghe An, Do Luong.

Type substrate: Soil in *Acacia auriculiformis* plantation.

Barcodes: *act* = MT334933; *cmdA* = MT335160; *his3* = MT335399; *rpb2* = MT412474; *tef1* = MT412690; *tub2* = MT412930 (alternative markers: ITS = MT359620; LSU = MT359380).

Notes: *Calonectria acaciicola* is phylogenetically closely related to *Ca. pseudoreteaudii* and *Ca*. *reteaudii*. The sequences of *cmdA*, *his3*, *rpb2*, *tef1* and *tub2* gene regions can differentiate *Ca. acaciicola* from these two species. The macroconidia of *Ca. acaciicola* [(av. 94 × 7 µm); Pham *et al*. 2019] are smaller than those of *Ca. pseudoreteaudii* [(av. 104 × 8 µm); Lombard *et al.* 2010c] but larger than those of *Ca. reteaudii* [(av. 84 × 6.5 µm); Kang *et al*. 2001a] (Supplementary Table S4).

acicola Calonectria Gadgil & M.A. Dick, N.Z. Jl For. Sci. 34: 316. 2004.

Synonym: *Cylindrocladium acicola* Gadgil & M.A. Dick, N.Z. Jl For. Sci. 34: 316. 2004.

In: *Calonectria reteaudii* species complex.

Typus: NZFRI-M 5213 holotype.

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Ex-type culture: CMW 30996.

Type locality: **New Zealand**, Northland.

Type substrate: *Phoenix canariensis*.

Barcodes: *act* = MT334935; *cmdA* = MT335162; *his3* = MT335401; *rpb2* = MT412476; *tef1* = MT412692; *tub2* = MT412932 (alternative markers: ITS = MT359622; LSU = MT359382).

Notes: *Calonectria acicola* is phylogenetically closely related to *Ca. multiseptata*. They can be distinguished from each other by the formation of megaconidiophores and megaconidia, a feature not observed in *Ca. acicola* but typical in *Ca. multiseptata* (Crous 2002, Gadgil & Dick 2004). *Calonectria acicola* is homothallic (Gadgil & Dick 2004) (Supplementary Table S4).

aciculata Calonectria J.Q. Li *et al.*, IMA Fungus 8: 273. 2017.

In: *Calonectria colhounii* species complex.

Typus: PREM 61941 holotype.

Ex-type culture: CBS 142883 = CMW 47645 = CERC 5342.

Type locality: **China**, YunNan Province.

Type substrate: *Eucalyptus urophylla* × *E. grandis*.

Barcodes: *act* = MT334937; *cmdA* = MT335164; *his3* = MT335403; *rpb2* = MT412478; *tef1* = MT412694; *tub2* = MT412934 (alternative markers: ITS = MT359624; LSU = MT359384).

Notes: *Calonectria aciculata* is closely related to *Ca. colhounii* and *Ca. honghensis*, but can be distinguished from these two species by its macroconidial dimensions. The macroconidia of *Ca. aciculata* [(av. 69 × 5.5 µm); Li *et al.* 2017] are longer than those of *Ca. colhounii* [(av. 65 × 5 µm); Peerally 1973] and *Ca. honghensis* [(av. 54 × 5.5 µm); Li *et al.* 2017]. *Calonectria aciculata* is homothallic (Li *et al.* 2020) (Supplementary Table S4).

aconidialis Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 162. 2015.

Synonyms: *Calonectria arbusta* L. Lombard *et al.*, Stud. Mycol. 80: 162. 2015.

Calonectria expansa L. Lombard *et al.*, Stud. Mycol. 80: 167. 2015.

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Calonectria guangxiensis L. Lombard *et al.*, Stud. Mycol. 80: 169. 2015.

Calonectria hainanensis L. Lombard *et al.*, Stud. Mycol. 80: 170. 2015.

Calonectria magnispora L. Lombard *et al.*, Stud. Mycol. 80: 174. 2015.

Calonectria parakyotensis L. Lombard *et al.*, Stud. Mycol. 80: 176. 2015.

Calonectria pluriramosa L. Lombard *et al.*, Stud. Mycol. 80: 178. 2015.

Calonectria pseudokyotensis L. Lombard *et al.*, Stud. Mycol. 80: 178. 2015.

Calonectria sphaeropedunculata L. Lombard *et al.*, Stud. Mycol. 80: 180. 2015.

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21481 holotype.

Ex-type culture: CBS 136086 = CMW 35174 = CERC 1850.

Type locality: **China**, HaiNan Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334938; *cmdA* = MT335165; *his3* = MT335404; *rpb2* = MT412479; *tef1* = MT412695 (alternative markers: ITS = MT359625; LSU = MT359385).

Notes: *Calonectria aconidialis* is phylogenetically closely related to *Ca. pacifica* and can be differentiated from that species by the sequences of *act*, *cmdA*, *his3*, *rpb2*, ITS, LSU and *tef1* gene regions. The asexual structures of *Ca. aconidialis* failed to develop (Lombard *et al*. 2015a). This species is homothallic (Lombard *et al*. 2015a) (Supplementary Table S4).

aeknauliensis Calonectria N.Q. Pham & M.J. Wingf., Mycologia 111: 93. 2019.

In: *Calonectria kyotensis* species complex.

Typus: PREM 62107 holotype.

Ex-type culture: CBS 143559 = CMW 48253.

Type locality: **Indonesia**, Northern Sumatra, Aek Nauli.

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Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334953; *cmdA* = MT335180; *his3* = MT335419; *rpb2* = MT412486; *tef1* = MT412710; (alternative markers: ITS = MT359640; LSU = MT359400).

Notes: *Calonectria aeknauliensis* is closely related to *Ca*. *curvispora* and *Ca*. *ilicicola*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. aeknauliensis* [(av. 47 × 5 µm); Pham *et al*. 2019] are shorter than those of *Ca. curvispora* [(av. 60 × 5 µm); Victor *et al.* 1997] and smaller than those of *Ca*. *ilicicola* [(av. 62 × 6 µm); Boedijn & Reitsma 1950] (Supplementary Table S4).

amazonica Calonectria L. Lombard & Crous, Stud. Mycol. 85: 171. 2016.

Synonyms: *Calonectria amazoniensis* L. Lombard & Crous, Stud. Mycol. 85: 173. 2016.

Calonectria tropicalis L. Lombard & Crous, Stud. Mycol. 85: 192. 2016.

Calonectria longiramosa L. Lombard & Crous, Stud. Mycol. 86: 114. 2017.

In: *Calonectria pteridis* species complex.

Typus: CBS H-22750 holotype.

Ex-type culture: CBS 116250 = CMW 51234 = CPC 3534.

Type locality: **Brazil**, Amazon.

Type substrate: *Eucalyptus tereticornis*.

Barcodes: *act* = MT334955; *cmdA* = MT335182; *his3* = MT335421; *rpb2* = MT412488; *tef1* = MT412712; *tub2* = MT412935 (alternative markers: ITS = MT359642; LSU = MT359402).

Notes: *Calonectria amazonica* is closely related to *Ca. pteridis* and *Ca. pseudopteridis*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. amazonica* [(av. 79 × 5 µm); Lombard *et al*. 2016] are smaller than those of *Ca. pteridis* [(av. 82 × 5.5 µm); Crous *et al*. 1993c] and *Ca*. *pseudopteridis* [(av. 87.5 × 5.7 µm); Sobers 1968, Alfenas *et al*. 2015]. *Calonectria amazonica* is heterothallic (Li *et al.* 2020) (Supplementary Table S4).

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amazoniensis Calonectria L. Lombard & Crous, Stud. Mycol. 85: 173. 2016.

(see ***Calonectria amazonica***)

In: *Calonectria pteridis* species complex.

Typus: CBS H-22751 holotype.

Ex-type culture: CBS 115440 = CMW 51222 = CPC 3885.

Type locality: **Brazil**, Amazon.

Type substrate: *Eucalyptus tereticornis*.

Barcodes: *act* = MT334957; *cmdA* = MT335184; *his3* = MT335423; *tef1* = MT412714; *tub2* = MT412937 (alternative markers: ITS = MT359644; LSU = MT359404).

Notes: *Calonectria amazoniensis* was treated as a synonym of *Ca. amazonica* in this study. In comparisons of DNA sequences for seven available gene regions, there were only three base differences in the *tub2* gene sequences between ex-type isolate of *Ca. amazoniensis* (CBS 115440) and the ex-type isolate of *Ca. amazonica* (CBS 116250). Both species produce clavate vesicles of similar dimensions (*Ca. amazoniensis*: 5–7 µm; *Ca. amazonica*: 5–6 µm) and 1-septate macroconidia. The macroconidia of *Ca. amazoniensis* (av. 69 × 4 µm) are smaller than those of *Ca. amazonica* (av. 79 × 5 µm) (Lombard *et al.* 2016), which was considered to represent intraspecific variation (Supplementary Table S4).

angustata Calonectria (Crous & El-Gholl) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium angustatum* Crous & El-Gholl, Mycoscience 41: 522. 2000.

In: *Calonectria gracilipes* species complex.

Typus: PREM 56546 holotype.

Ex-type culture: CBS 114544 = CMW 30990 = CPC 2347 = P99-0454.

Type locality: **USA**, Florida, Sarasota nursery.

Type substrate: *Tillandsia capitata.*

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Barcodes: *act* = MT334963; *his3* = MT335429; *rpb2* = MT412493; *tef1* = MT412720; *tub2* = MT412943 (alternative markers: ITS = MT359650; LSU = MT359410).

Notes: *Calonectria angustata* is phylogenetically closely related to *Ca. hurae* and *Ca. leguminum*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. angustata* [(av. 110 × 10 µm); Crous *et al.* 2000] are shorter than those of *Ca. hurae* [(av. 120 × 7.5 µm); Crous 2002] but larger than those of *Ca. leguminum* [(av. 60 × 5 µm); Figueiredo & Namekata 1967, Crous 2002] (Supplementary Table S4).

arbusta Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 162. 2015.

(see ***Calonectria aconidialis***)

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21482 holotype.

Ex-type culture: CBS 136079 = CMW 31370 = CERC 1705.

Type locality: **China**, GuangXi Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334940; *cmdA* = MT335167; *his3* = MT335406; *rpb2* = MT412480; *tef1* = MT412697 (alternative markers: ITS = MT359627; LSU = MT359387).

Notes: *Calonectria arbusta* was treated as a synonym of *Ca. aconidialis* in this study. In comparisons of DNA sequences for seven available gene regions, the only differences between the ex-type isolate of *Ca. arbusta* (CMW 31370) and the ex-type isolate of *Ca. aconidialis* (CMW 35174) was in the *his3* and *tef1* sequences, where there were two base differences in the *his3* and one base difference in the *tef1* sequences. Both species are homothallic and produce orange to orange-brown perithecia, 8-spored asci and 1-septate ascospores, and share the similar ascospores dimensions (*Ca. arbusta*: av. 38 × 7 µm; *Ca. aconidialis*: av. 36 × 6 µm) (Lombard *et al*. 2015a, Li *et al*. 2020; Supplementary Table S4).

asiatica Calonectria Crous & Hywel-Jones, Stud. Mycol. 50: 419. 2004.

Synonym: *Cylindrocladium asiaticum* Crous & Hywel-Jones, Stud. Mycol. 50: 419. 2004.

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In: *Calonectria kyotensis* species complex.

Typus: CBS 9889 holotype.

Ex-type culture: CBS 114073 = CMW 23782= CPC 3900.

Type locality: **Thailand**, Prathet Thai.

Type substrate: Leaf litter.

Barcodes: *act* = GQ280428; *cmdA* = AY725741; *his3* = AY725658; *tef1* = AY725705; *tub2* = AY725616 (alternative markers: ITS = GQ280550; LSU = GQ280672).

Notes: *Calonectria asiatica* is closely related to *Ca. yunnanensis*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. asiatica* [(av. 53 × 5 µm); Crous *et al*. 2004] are larger than those of *Ca. yunnanensis* [(av. 43 × 4.5 µm); Li *et al*. 2017], and the vesicles of *Ca. asiatica* (12–17 µm) are wider than those of *Ca. yunnanensis* (2–4.5 µm). *Calonectria asiatica* is homothallic (Crous *et al*. 2004) (Supplementary Table S4).

auriculiformis Calonectria N.Q. Pham *et al*., Mycologia 111: 85. 2019.

In: *Calonectria cylindrospora* species complex.

Typus: PREM 62109 holotype.

Ex-type culture: CBS 143561 = CMW 47178.

Type locality: **Vietnam**, Thanh Hoa, Hau Loc.

Type substrate: Soil in *Acacia auriculiformis* plantation.

Barcodes: *act* = MT334964; *cmdA* = MT335190; *his3* = MT335430; *rpb2* = MT412494; *tef1* = MT412721; *tub2* = MT412944 (alternative markers: ITS = MT359651; LSU = MT359411).

Notes: *Calonectria auriculiformis* is closely related to *Ca. lageniformis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. auriculiformis* (av. 43 × 4 µm) are longer than those of *Ca. lageniformis* (av. 40 × 5 µm).

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Furthermore, *Ca. auriculiformis* has five tiers of branches in its conidiogenous apparatus in comparison to three in *Ca. lageniformis* (Lombard *et al*. 2016, Pham *et al*. 2019).

australiensis Calonectria (Crous & K.D. Hyde) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium australiense* Crous & K.D. Hyde, Stud. Mycol. 55: 221. 2006.

In: *Calonectria reteaudii* species complex.

Typus: CBS H-17872 holotype.

Ex-type culture: CBS 112954 = CMW 23669 = CPC 4714.

Type locality: **Australia**, Queensland.

Type substrate: *Ficus pleurocarpa*.

Barcodes: *act* = MT334965; *cmdA* = MT335192; *his3* = MT335432; *rpb2* = MT412496; *tef1* = MT412723; *tub2* = MT412946 (alternative markers: ITS = MT359653; LSU = MT359413).

Notes: Phylogenetically, *Ca. australiensis* forms a distinct lineage separate from other species in this species complex.

avesiculata Calonectria T.S. Schubert *et al*., Canad. J. Bot. 67: 2415. 1989.

Synonym: *Cylindrocladium avesiculatum* D.L. Gill *et al*., Phytopathology 61: 60. 1971.

In: *Calonectria mexicana* species complex.

Typus: FLAS F55193 (holotype of *Ca. avesiculata*; Schubert *et al*. 1989), BPI 414546 (isosyntype of *Cy. avesiculatum*; Gill *et al*. 1971).

Ex-type culture: CBS 313.92 = CMW 23670 = CPC 2373 = ATCC 38226 (Lombard *et al*. 2010a).

Type locality: **USA**, Georgia, Cairo.

Type substrate: *Ilex vomitoria*.

Barcodes: *act* = GQ280431; *cmdA* = GQ267364; *his3* = DQ190620; *tef1* = GQ267294; *tub2* = AF333392 (alternative markers: ITS = GQ280553; LSU = GQ280675).

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Notes: *Calonectria avesiculata* is closely related to *Ca. mexicana*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. avesiculata* [(av. 64 × 5 µm); Schubert *et al*. 1989] are larger than those of *Ca*. *mexicana* [(av. 45 × 4 µm); Schoch *et al*. 1999], and the vesicles of *Ca. avesiculata* (1–4 µm) are narrower than those of *Ca*. *mexicana* (7–12 µm). Furthermore, *Ca. avesiculata* is characterised by producing a thick-walled stipe extension (Crous 2002), a feature not observed for *Ca. mexicana*. *Calonectria avesiculata* is heterothallic (Schubert *et al*. 1989) (Supplementary Table S4).

baviensis Calonectria N.Q. Pham *et al*., Mycologia 111: 90. 2019.

(see ***Calonectria reteaudii***)

In: *Calonectria reteaudii* species complex.

Typus: PREM 62111 holotype.

Ex-type culture: CBS 143563 = CMW 47410.

Type locality: **Vietnam**, Hanoi, Bavi.

Type substrate: *Eucalyptus urophylla.*

Barcodes: *act* = MT334966; *cmdA* = MT335193; *his3* = MT335433; *rpb2* = MT412497; *tef1* = MT412724; (alternative markers: ITS = MT359654; LSU = MT359414).

Notes: *Calonectria baviensis* was treated as a synonym of *Ca. reteaudii* in this study. In comparisons of DNA sequences for the seven available gene regions, a single base difference in each of the *cmdA*, *rpb2* and *tef1* sequences was found between the ex-type isolate of *Ca. baviensis* (CMW 47410) and the ex-type isolate of *Ca. reteaudii* (CMW 30984). Both species produce clavate vesicles with similar dimensions (*Ca. baviensis*: 3–6 µm; *Ca. reteaudii*: 3–6 µm) and 5-septate macroconidia. Macroconidia of *Ca. baviensis* (av. 96 × 6.5 µm) are longer than those of *Ca. reteaudii* (av. 84 × 6.5 µm) (Kang *et al.* 2001a, Pham *et al*. 2019), which was considered to represent intraspecific variation (Supplementary Table S4).

blephiliae Calonectria Crous & Hodges, Persoonia 31: 225. 2013.

(see ***Calonectria cylindrospora***)

In: *Calonectria cylindrospora* species complex.

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Typus: CBS H-21434 holotype.

Ex-type culture: CBS 136425 = CMW 51321 =CPC 21859.

Type locality: **USA**, North Carolina, Ellerbe.

Type substrate: *Blephilia ciliata*.

Barcodes: *act* = MT335005; *cmdA* = MT335235; *his3* = MT335475; *rpb2* = MT412539; *tef1* = MT412766; *tub2* = MT412984 (alternative markers: ITS = MT359696; LSU = MT359456).

Notes: *Calonectria blephiliae* was treated as a synonym of *Ca. cylindrospora* in this study. In comparisons of DNA sequences for eight gene regions, all sequences for the ex-type isolate of *Ca. blephiliae* (CBS 136425) were 100 % identical to those for the isolate of *Ca. cylindrospora* (CMW 30978); the only differences between the ex-type isolate of *Ca. blephiliae* (CBS 136425) and the isolate of *Ca. cylindrospora* (CBS 119670) was found in the *act* gene sequences where only one base difference was observed. *Calonectria cylindrospora* and *Ca. blephiliae* both produce clavate to ellipsoidal vesicles with overlapping dimensions (*Ca. blephiliae*: 7–10 µm; *Ca. cylindrospora*: 6–8 µm) and 1-septate macroconidia. The macroconidia of *Ca. blephiliae* (av. 50 × 4.5 µm) are larger than those of *Ca. cylindrospora* (av. 45 × 4 µm) (Crous 2002, Crous *et al.* 2013, Lombard *et al.* 2015b), which was considered to represent intraspecific variation (Supplementary Table S4).

brachiatica Calonectria L. Lombard *et al*., Persoonia 23: 44. 2009.

In: *Calonectria brassicae* species complex.

Typus: PREM 60197 holotype.

Ex-type culture: CBS 123700 = CMW 25298.

Type locality: **Colombia**, Buga.

Type substrate: *Pinus maximinoi*.

Barcodes: *cmdA* = MT335195; *his3* = MT335435; *rpb2* = MT412499; *tef1* = MT412726; *tub2* = MT412948 (alternative markers: ITS = MT359656; LSU = MT359416).

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Notes: *Calonectria brachiatica* is closely related to *Ca. parvispora*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. brachiatica* [(av. 44 × 5 µm); Lombard *et al*. 2009] are larger than those of *Ca. parvispora* [(av. 29 × 4 µm); Marin-Felix *et al*. 2017] (Supplementary Table S4).

brasiliana Calonectria L. Lombard & Crous, Stud. Mycol. 85: 174. 2016.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-22752 holotype.

Ex-type culture: CBS 111484 = CMW 51187 = CPC 1924.

Type locality: **Brazil**.

Type substrate: Soil.

Barcodes: *act* = MT334968; *cmdA* = MT335198; *his3* = MT335438; *rpb2* = MT412502; *tef1* = MT412729; *tub2* = MT412951 (alternative markers: ITS = MT359659; LSU = MT359419).

Notes: *Calonectria brasiliana* is closely related to *Ca. metrosideri*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. brasiliana* [(av. 53 × 4 µm); Lombard *et al*. 2016] are longer than those of *Ca. metrosideri* [(av. 45 × 4 µm); Alfenas *et al.* 2013a] (Supplementary Table S4).

brasiliensis Calonectria (Bat. & Cif.) L. Lombard *et al.*, Stud. Mycol. 66: 19. 2010.

Basionym: *Cylindrocladium scoparium* var. *brasiliensis* Bat. & Cif., (as *brasiliense*) Boletim de SA.I.C. Pernambuco 18: 188. 1952.

Synonyms: *Cylindrocladium brasiliense* (Bat. & Cif.) Peerally, (*as braziliensis*) CMI Descriptions of Pathogenic Fungi and Bacteria 427. 1974.

Calonectria hodgesii R.F Alfenas *et al*., Trop. Plant. Pathol. 38: 517. 2013.

Calonectria pseudohodgesii R.F. Alfenas *et al*., Stud. Mycol. 80: 118. 2015.

In: *Calonectria cylindrospora* species complex.

Typus: IMI 43688 holotype.

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Ex-type culture: CBS 230.51 = IMI 299576.

Type locality: **Brazil**, Ceara State.

Type substrate: *Eucalyptus* spp.

Barcodes: *act* = MT334970; *cmdA* = MT335200; *his3* = MT335440; *rpb2* = MT412504; *tef1* = MT412731; *tub2* = MT412953 (alternative markers: ITS = MT359661; LSU = MT359421).

Notes: *Calonectria brasiliensis* is closely related to *Ca*. *maranhensis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. brasiliensis* [(av. 38 × 3.5 µm); Batista 1951] are smaller than those of *Ca. maranhensis* [(av. 57 × 5 µm); Alfenas *et al.* 2015] (Supplementary Table S4).

brassiana Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 100. 2015.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-21376 holotype.

Ex-type culture: CBS 134855 = LPF378.

Type locality: **Brazil**, Piauí state, Teresina.

Type substrate: Soil in *Eucalyptus brassiana* plantation.

Barcodes: *cmdA* = KM396056; *his3* = KM396139; *tef1* = KM395882; *tub2* = KM395969.

Notes: *Calonectria brassiana* is closely related to *Ca. glaebicola*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. brassiana* (av. 53 × 4 µm) are longer than those of *Ca. glaebicola* (av. 50 × 4 µm) (Alfenas *et al*. 2015) (Supplementary Table S4).

brassicae Calonectria (Pamwar & Bohra) L. Lombard *et al*., Persoonia 23: 45. 2009.

Basionym: *Cylindrocladium brassicae* Panwar & Bohra, Indian Phytopathol. 27: 425. 1974.

Synonyms: *Cylindrocarpon gracile* Bugnic., Encycl. Mycologique 11: 162. 1939.

Cylindrocladium gracile (Bugnic.) Boesew., Trans. Brit. Mycol. Soc. 78: 554. 1982.

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Cylindrocladium clavatum Hodges & L.C. May, Phytopathology 62: 900. 1972.

In: *Calonectria brassicae* species complex.

Typus: PREM 51032 holotype.

Ex-type culture: CBS 111869 = CPC 2409.

Type locality: **Indonesia**.

Type substrate: *Argyreia splendens*.

Barcodes: *act* = MT334972; *cmdA* = MT335202; *his3* = MT335442; *rpb2* = MT412506; *tef1* = MT412733; *tub2* = MT412955 (alternative markers: ITS = MT359663; LSU = MT359423).

Notes: *Calonectria brassicae* is closely related to *Ca. brachiatica* and *Ca. parvispora*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. brassicae* [(av. 53 × 4.5 µm); Crous 2002] are longer than those of *Ca. brachiatica* [(av. 44 × 5 µm); Lombard *et al*. 2009] and *Ca. parvispora* [(av. 29 × 4 µm); Marin-Felix *et al*. 2017] (Supplementary Table S4).

brassicicola Calonectria L. Lombard & Crous, Stud. Mycol. 85: 174. 2016.

In: *Calonectria kyotensis* species complex.

Typus: CBS H-22753 holotype.

Ex-type culture: CBS 112841 = CMW 51206 = CPC 4552.

Type locality: **Indonesia**.

Type substrate: Soil under *Brassica* sp.

Barcodes: *cmdA* = KX784561; *tef1* = KX784689; *tub2* = KX784619.

Notes: *Calonectria brassicicola* is closely related to *Ca. sumatrensis*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. brassicicola* [(av. 42 × 5 µm); Lombard *et al*. 2016] are shorter than those of *Ca. sumatrensis* [(av. 58 × 5 µm); Crous *et al*. 2004], and the vesicles of *Ca. brassicicola* (3−5 µm) are narrower

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than those of *Ca. sumatrensis* (8–13 µm) (Crous *et al*. 2004, Lombard *et al*. 2016) (Supplementary Table S4).

brevistipitata Calonectria L. Lombard & Crous, Stud. Mycol. 85: 175. 2016.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-22754 holotype.

Ex-type culture: CBS 115671 = CMW 51226 = CPC 949.

Type locality: **Mexico**.

Type substrate: Soil.

Barcodes: *act* = MT334973; *cmdA* = MT335203; *his3* = MT335443; *rpb2* = MT412507; *tef1* = MT412734; *tub2* = MT412956 (alternative markers: ITS = MT359664; LSU = MT359424).

Notes: *Calonectria brevistipitata* is closely related to *Ca*. *nemoricola*, *Ca. pauciramosa* and *Ca*. *silvicola*, and can be distinguished from these three species by the dimensions of its macroconidia. The macroconidia of *Ca. brevistipitata* [(av. 31 × 3.5 µm); Lombard *et al*. 2016] are smaller than those of *Ca. nemoricola* [(av. 45 × 4 µm); Alfenas *et al*. 2015], *Ca. pauciramosa* [(av. 50 × 4.5 µm); Crous 2002] and *Ca*. *silvicola* [(av. 41 × 4.5 µm); Alfenas *et al*. 2015]. *Calonectria brevistipitata* is heterothallic (Li *et al*. 2020) (Supplementary Table S4).

bumicola Calonectria N.Q. Pham & M.J. Wingf., Mycologia 111: 94. 2019.

In: *Calonectria kyotensis* species complex.

Typus: PREM 62123 holotype.

Ex-type culture: CBS 143575 = CMW 48257.

Type locality: **Indonesia**, Northern Sumatra, Aek Nauli.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334975; *cmdA* = MT335205; *his3* = MT335445; *rpb2* = MT412509; *tef1* = MT412736 (alternative markers: ITS = MT359666; LSU = MT359426).

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Notes: *Calonectria bumicola* is phylogenetically closely related to *Ca*. *lantauensis* and can be differentiated from that species by the sequences of *act*, *cmdA*, *his3*, *rpb2* and *tef1* gene regions. The asexual and sexual morphs of *Ca. bumicola* could not be induced by Pham *et al*. (2019). This species was shown to be homothallic by Li *et al.* (2020).

canadiana Calonectria (J.C. Kang *et al*.) L. Lombard *et al*., IMA Fungus 1: 106. 2010.

Basionym: *Cylindrocladium canadense* J.C. Kang *et al*., Syst. Appl. Microbiol. 24: 210. 2001.

Synonyms: *Calonectria canadensis* (J.C. Kang *et al*.) L. Lombard *et al*., Stud. Mycol. 66: 56. 2010. *Nom. inval*., Art. 53.1.

Calonectria montana Q.L. Liu & S.F. Chen, Mycokeys 26: 48. 2017.

In: *Calonectria kyotensis* species complex.

Typus: PREM 57195 holotype.

Ex-type culture: CBS 110817 = CMW 23673 = STE-U 499.

Type locality: **Canada**.

Type substrate: *Picea* sp.

Barcodes: *act* = MT334976; *cmdA* = MT335206; *his3* = MT335446; *rpb2* = MT412510; *tef1* = MT412737; *tub2* = MT412958 (alternative markers: ITS = MT359667; LSU = MT359427).

Notes: Phylogenetically, *Ca. canadiana* forms a distinct lineage separate from other species in this species complex.

candelabrum Calonectria (Viégas) Rossman *et al.*, (as *candelabra*), Stud. Mycol. 80: 210. 2015.

Basionym: *Cylindrocladium candelabrum* Viégas, Bragantia 6: 370. 1946.

Synonyms: *Calonectria scoparia* Ribeiro & Matsuoka, In: Ribeiro, M.Sc. Thesis, Heterotalismo em *C. scoparium* Morgan: 28. 1978 (nom. inval., Art. 29).

Calonectria scoparia Peerally, Mycotaxon 40: 341. 1991.

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Calonectria pseudoscoparia L. Lombard *et al.*, Stud. Mycol. 66: 53. 2010.

In: *Calonectria candelabrum* species complex.

Typus: PREM 51044 (neotype of *Cy. candelabrum*; Crous 2002).

Ex-type culture: Not available.

Key cultures: CMW 31000 = CPC 1675 = UFV 117, CMW 31001 = STE-U 1679 = UFV 126 (Alfenas *et al*. 2015).

Key culture locality: **Brazil**, Amazonas (locality of CMW 31000 and CMW 31001; Alfenas *et al*. 2015).

Key culture substrate: *Eucalyptus* sp. (substrate of CMW 31000 and CMW 31001; Alfenas *et al*. 2015).

Barcodes: *Culture* CMW 31000: *act* = MT334977; *cmdA* = MT335207; *his3* = MT335447; *rpb2* = MT412511; *tef1* = MT412738; *tub2* = MT412959 (alternative markers: ITS = MT359668; LSU = MT359428); *culture* CMW 31001: *act* = MT334978; *cmdA* = MT335208; *his3* = MT335448; *rpb2* = MT412512; *tef1* = MT412739; *tub2* = MT412960 (alternative markers: ITS = MT359669; LSU = MT359429)

Notes: *Calonectria candelabrum* is closely related to *Ca. eucalypticola* and *Ca. venezuelana*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. candelabrum* [(av. 60 × 4.5 µm); Crous 2002] are longer than those of *Ca. eucalypticola* [(av. 50 × 4 µm); Alfenas *et al*. 2015] and *Ca. venezuelana* [(av. 58 × 5 µm); Lombard *et al*. 2016]. *Calonectria candelabrum* is heterothallic (Crous 2002, Li *et al*. 2020) (Supplementary Table S4).

cerciana Calonectria L. Lombard *et al*., Persoonia 24: 7. 2010.

Synonyms: *Calonectria papillata* L. Lombard *et al.*, Stud. Mycol. 80: 175. 2015.

Calonectria terrestris L. Lombard *et al.*, Stud. Mycol. 80: 182. 2015.

In: *Calonectria cylindrospora* species complex.

Typus: PREM 60241 holotype.

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Ex-type culture: CBS 123693 = CMW 25309.

Type locality: **China**, GuangDong, CERC nursery.

Type substrate: *E. urophylla* × *E. grandis* hybrid cutting.

Barcodes: *act* = MT334981; *cmdA* = MT335211; *his3* = MT335451; *rpb2* = MT412515; *tef1* = MT412742; *tub2* = MT412963 (alternative markers: ITS = MT359672; LSU = MT359432).

Notes: *Calonectria cerciana* is closely related to *Ca*. *tonkinensis*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. cerciana* (av. 44 × 5 µm) are larger than those of *Ca. tonkinensis* (av. 41.5 × 4 µm), and the vesicles of *Ca. cerciana* (8–13 µm) are wider than those of *Ca. tonkinensis* (3–7 µm) (Lombard *et al*. 2010c, Pham *et al*. 2019) (Supplementary Table S4).

chinensis Calonectria (Crous) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium chinense* Crous, Stud. Mycol. 50: 420. 2004.

Synonym: *Calonectria multistipitata* N.Q. Pham *et al*., Mycologia 111: 98. 2019.

In: *Calonectria kyotensis* species complex.

Typus: PREM 62118 holotype.

Ex-type culture: CBS 114827 = CMW 23674 = CPC 4101.

Type locality: **China**, Hong Kong.

Type substrate: Soil.

Barcodes: *act* = MT334990; *cmdA* = MT335220; *his3* = MT335460; *rpb2* = MT412524; *tef1* = MT412751; *tub2* = MT412972 (alternative markers: ITS = MT359681; LSU = MT359441).

Notes: *Calonectria chinensis* is phylogenetically closely related to *Ca*. *cochinchinensis* and *Ca. heveicola*, it can be distinguished from these two species by the sequences of *cmdA*, *his3*, *rpb2*, *tef1* and *tub2* gene regions.

citri Calonectria (H.S. Fawc. & Klotz) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

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Basionym: *Candelospora citri* H.S. Fawc. & Klotz, Mycologia 29: 213. 1937.

Synonym: *Cylindrocladium citri* (H.S. Fawc. & Klotz) Boedijn & Reitsma, Reinwardtia 1: 57. 1950.

In: *Calonectria mexicana* species complex.

Typus: K (isotype; Crous 2002).

Ex-type culture: CBS 186.36 = CMW 23675 (Lombard *et al*. 2010a).

Type locality: **USA**, Florida.

Type substrate: *Citrus sinensis*.

Barcodes: *act* = MT334992; *cmdA* = MT335222; *his3* = MT335462; *rpb2* = MT412526; *tef1* = MT412753; *tub2* = MT412974 (alternative markers: ITS = MT359683; LSU = MT359443).

Notes: *Calonectria citri* is closely related to *Ca. lauri*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. citri* [(av. 58 × 4 µm); Crous 2002] are smaller than those of *Ca. lauri* [(av. 60 × 5.5 µm); Lechat *et al*. 2010] (Supplementary Table S4).

clavata Calonectria Alfieri *et al*., Mycotaxon 48: 206. 1993.

Synonym: *Cylindrocladium flexuosum* Crous, Syst. Appl. Microbiol. 18: 248. 1995.

In: *Calonectria brassicae* species complex.

Typus: FLAS F55430 [holotype of *Ca. clavata*; El-Gholl *et al*. 1993b], PREM 51721 (holotype of *Cy. flexuosum*; Crous *et al*. 1995).

Ex-type culture: CBS 114557 = CMW 23690 = CPC 2536 = P078-1543 = ATCC 66389 (Crous 2002, Lombard *et al*. 2010a).

Type locality: **USA**, Florida, Lake Placid.

Type substrate: *Callistemon viminalis*.

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Barcodes: *act* = MT334993; *cmdA* = MT335223; *his3* = MT335463; *rpb2* = MT412527; *tef1* = MT412754; *tub2* = MT412975 (alternative markers: ITS = MT359684; LSU = MT359444).

Notes: Phylogenetically, *Ca. clavata* forms a distinct lineage separate from other species in this species complex. *Calonectria clavata* is heterothallic (El-Gholl *et al*. 1993b, Li *et al*. 2020).

cliffordiicola Calonectria L. Lombard & Crous, Stud. Mycol. 85: 177. 2016.

(see ***Calonectria pauciramosa***)

In: *Calonectria candelabrum* species complex.

Typus: CBS H-22755 holotype.

Ex-type culture: CBS 111812 = CMW 51190 = CPC 2631.

Type locality: **South Africa**, Western Cape Province, George.

Type substrate: *Cliffordia feruginea*.

Barcodes: *act* = MT335084; *cmdA* = MT335316; *his3* = MT335556; *rpb2* = MT412609; *tef1* = MT412847; *tub2* = MT413059 (alternative markers: ITS = MT359777; LSU = MT359537).

Notes: *Calonectria cliffordiicola* was treated as a synonym of *Ca. pauciramosa* in this study. In comparisons of DNA sequences for eight gene regions, all the sequences of the isolates of *Ca. cliffordiicola* (ex-type CBS 111812, CBS 111814, and CBS 111819) were 100 % identical to those of the isolates of *Ca. pauciramosa* (ex-type CBS 138824, CMW 2151, CMW 7592, CMW 9151, CMW 30823, and CMW 30875). Both species produce obpyriform to ellipsoidal vesicles with overlapping dimensions (*Ca. cliffordiicola*: 7–9 µm; *Ca. pauciramosa*: 5–11 µm) and 1-septate macroconidia, the macroconidia of *Ca. cliffordiicola* (av. 40 × 4 µm) are smaller than those of *Ca. pauciramosa* (av. 50 × 4.5 µm) (Crous 2002, Lombard *et al.* 2016), which was considered to represent intraspecific variation (Supplementary Table S4).

cochinchinensis Calonectria N.Q. Pham *et al*., Mycologia 111: 95. 2019.

In: *Calonectria kyotensis* species complex.

Typus: PREM 62115 holotype.

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Ex-type culture: CBS 143567 = CMW 49915.

Type locality: **Vietnam**, Tay Ninh, Duong Minh Chau.

Type substrate: Soil in *Hevea brasiliensis* plantation.

Barcodes: *act* = MT334995; *cmdA* = MT335225; *his3* = MT335465; *rpb2* = MT412529; *tef1* = MT412756; *tub2* = MT412977 (alternative markers: ITS = MT359686; LSU = MT359446).

Notes: *Calonectria cochinchinensis* is phylogenetically closely related to *Ca. heveicola* and can be differentiated from *Ca. heveicola* by sequence data of *act*, *cmdA*, *his3*, ITS, *tef1* and *tub2* gene regions. In addition, *Ca. cochinchinensis* produces longer stipe extensions [(147–208 µm); Pham *et al*. 2019] than those of *Ca. heveicola* [(138–189 µm); Pham *et al*. 2019] (Supplementary Table S4).

colhounii Calonectria Peerally, Mycol. Res. 61: 92. 1973.

Synonym: *Cylindrocladium colhounii* Peerally, Mycol. Res. 61: 92. 1973.

In: *Calonectria colhounii* species complex.

Typus: IMI 167581 holotype.

Ex-type culture: CBS 293.79 = CMW 30999.

Type locality: **Mauritius**.

Type substrate: *Camellia sinensis*.

Barcodes: *act* = GQ280443; *cmdA* = GQ267373; *his3* = DQ190639; *rpb2* = KY653376; *tef1* = GQ267301; *tub2* = DQ190564 (alternative markers: ITS = GQ280565; LSU = GQ280687).

Notes: *Calonectria colhounii* is phylogenetically closely related to *Ca. aciculata* and *Ca. honghensis*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. colhounii* [(av. 65 × 5 µm); Peerally 1973] are smaller than those of *Ca. aciculata* [(av. 69 × 5.5 µm); Li *et al.* 2017], and longer than those of *Ca. honghensis* [(av. 54 × 5.5 µm); Li *et al.* 2017]. In addition, the ascospores of *Ca. colhounii* (av. 55 × 6 µm) are longer than those of *Ca. honghensis* (av. 49 × 6 µm) (Peerally 1973, Li *et al.* 2017). *Calonectria colhounii* is homothallic (Peerally 1973) (Supplementary Table S4).

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colombiana Calonectria L. Lombard *et al.*, Stud. Mycol. 66: 23. 2010.

In: *Calonectria candelabrum* species complex.

Typus: PREM 60295 holotype.

Ex-type culture: CBS 115127 = CMW 30871 = CPC 1160.

Type locality: **Colombia**, La Selva.

Type substrate: Soil.

Barcodes: *act* = GQ280538; *cmdA* = GQ267455; *his3* = FJ972442; *tef1* = FJ972492; *tub2* = FJ972423 (alternative markers: ITS = GQ280660; LSU = GQ280782).

Notes: *Calonectria colombiana* is closely related to *Ca*. *brevistipitata*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. colombiana* (av. 37 × 3 µm) are longer than those of *Ca. brevistipitata* (av. 31 × 3.5 µm), and the vesicles of *Ca. colombiana* (8–12 µm) are wider than those of *Ca. brevistipitata* (5–8 µm) (Lombard *et al*. 2010b, 2016). *Calonectria colombiana* is characterised as being homothallic, while *Ca. brevistipitata* is heterothallic (Lombard *et al*. 2010b, Li *et al*. 2020) (Supplementary Table S4).

colombiensis Calonectria Crous, Stud. Mycol. 50: 421. 2004.

Synonym: *Cylindrocladium colombiense* Crous, Stud. Mycol. 50: 421. 2004.

In: *Calonectria kyotensis* species complex.

Typus: CBS 9890 holotype.

Ex-type culture: CBS 112220 = CMW 23676 = CPC 723.

Type locality: **Colombia**, La Selva.

Type substrate: Soil under *Eucalyptus grandi*s.

Barcodes: *act* = MT334998; *cmdA* = MT335228; *his3* = MT335468; *rpb2* = MT412532; *tef1* = MT412759; *tub2* = MT412980 (alternative markers: ITS = MT359689; LSU = MT359449).

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Notes: Phylogenetically, *Ca. colombiensis* forms a distinct lineage separate from other species in this species complex. *Ca. colombiensis* is homothallic (Li *et al.* 2020).

crousiana Calonectria S.F. Chen *et al*., Persoonia 26: 6. 2011.

In: *Calonectria reteaudii* species complex.

Typus: PREM 60453 holotype.

Ex-type culture: CBS 127198 = CMW 27249.

Type locality: **China**, FuJian Province.

Type substrate: *Eucalyptus grandis*.

Barcodes: *act* = MT335000; *cmdA* = MT335230; *his3* = MT335470; *rpb2* = MT412534; *tef1* = MT412761; *tub2* = MT412982 (alternative markers: ITS = MT359691; LSU = MT359451).

Notes: Phylogenetically, *Ca. crousiana* forms a distinct lineage separate from other species in this species complex. *Calonectria crousiana* is homothallic (Chen *et al*. 2011, Li *et al*. 2020).

curvispora Calonectria (Crous & D. Victor) L. Lombard *et al*., Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium curvisporum* Crous & D. Victor, Syst. Appl. Microbiol. 20: 283. 1997.

Synonym: *Calonectria vegrandis* N.Q. Pham & M.J. Wingfield, Mycologia 111: 99. 2019.

In: *Calonectria kyotensis* species complex.

Typus: PREM 51751 holotype.

Ex-type culture: CBS 116159 = CMW 23693 = CPC 765.

Type locality: **Madagascar**, Tamatave.

Type substrate: Soil.

Barcodes: *act* = MT335002; *cmdA* = MT335232; *his3* = MT335472; *rpb2* = MT412536; *tef1* = MT412763 (alternative markers: ITS = MT359693; LSU = MT359453).

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Notes: *Calonectria curvispora* is closely related to *Ca*. *aeknauliensis* and *Ca*. *ilicicola*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. curvispora* [(av. 60 × 5 µm); Victor *et al.* 1997] are smaller than those of *Ca*. *ilicicola* [(av. 62 × 6 µm); Boedijn & Reitsma 1950] but longer than those of *Ca. aeknauliensis* [(av. 47 × 5 µm); Pham *et al*. 2019] (Supplementary Table S4).

cylindrospora Calonectria (Ellis & Everh.) Rossman *et al.*, Stud. Mycol. 80: 210. 2015.

Basionym: *Diplocladium cylindrosporum* Ellis & Everh., Bull. Torrey Bot. Club 27: 58. 1900.

Synonyms: *Cylindrocladium scoparium* Morgan, Bot. Gaz. 17: 191. 1892.

Cylindrocladium pithecolobii Petch, Ann. Roy. Bot. Gard. (Peradeniya) 6: 244. 1917.

Cylindrocladium ellipticum Alfieri *et al*., Phytopathology 60: 1213. 1970.

Calonectria morganii Crous *et al*., Mycol. Res. 97: 706. 1993.

Calonectria blephiliae Crous & Hodges, Persoonia 31: 225. 2013.

In: *Calonectria cylindrospora* species complex.

Typus: PREM 51042 (holotype of *Ca. morganii*; Crous *et al*. 1993a), BPI 414576 (neotype of *Cy*. *scoparium*; Crous *et al*. 1993a).

Ex-type culture: Not available.

Key cultures: CBS 119670 = CMW 51310 = CPC 12766, CBS 110666 = CMW 30978 = STE-U 497 = P90.1479 (Crous 2002, Lombard *et al*. 2015a).

Key culture locality: **Italy** (locality of CBS 119670; Lombard *et al*. 2015a), **USA**, Florida (locality of CBS 110666; Lombard *et al*. 2015a).

Key culture substrate: *Pistacia lentiscus* (substrate of CBS 119670; Lombard *et al*. 2015a), *Ilex vomitoria* (substrate of CBS 110666; Lombard *et al*. 2015a).

Barcodes: Culture CBS 119670: *act* = MT335006; *cmdA* = MT335236; *his3* = MT335476; *rpb2* = MT412540; *tef1* = MT412767; *tub2* = MT412985 (alternative markers: ITS = MT359697; LSU = MT359457); culture CBS 110666: *act* = MT335007; *cmdA* = MT335237;

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his3 = MT335477; *rpb2* = MT412541; *tef1* = MT412768; *tub2* = MT412986 (alternative markers: ITS = MT359698; LSU = MT359458).

Notes: *Calonectria cylindrospora* is phylogenetically closely related to *Ca. variabilis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. cylindrospora* [(av. 45 × 4 µm); Crous *et al*. 1993a, Lombard *et al*. 2015b] are smaller than those of *Ca. variabilis* [(av. 73 × 5 µm); Crous *et al*. 1993b], *Ca. variabilis* readily produces a microconidial morph in culture on CLA (Crous *et al*. 1993b), which is not observed in *Ca. cylindrospora* (Crous 2002). *Calonectria cylindrospora* is characterised as being heterothallic, while *Ca. variabilis* is homothallic (Crous *et al*. 1993b).

densa Calonectria L. Lombard *et al.*, Stud. Mycol. 66: 46. 2010.

In: *Calonectria spathiphylli* species complex.

Typus: PREM 60302 holotype.

Ex-type culture: CBS 125261 = CMW 31182.

Type locality: **Ecuador**, Pichincha Province, Las Golondrinas.

Type substrate: Soil.

Barcodes: *act* = MT335008; *cmdA* = MT335238; *his3* = MT335478; *tef1* = MT412769; *tub2* = MT412987 (alternative markers: ITS = MT359699; LSU = MT359459).

Notes: *Calonectria densa* is closely related to *Ca. humicola* and it can be distinguished from that species by the formation of lateral stipe extensions, a characteristic not known for *Ca. humicola*. The macroconidia of *Ca. densa* [(av. 54 × 6 µm); Lombard *et al.* 2010a] are larger than those of *Ca. humicola* [(av. 51 × 5 µm); Lombard *et al.* 2010a] (Supplementary Table S4).

duoramosa Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 100. 2015.

In: *Calonectria brassicae* species complex.

Typus: CBS H-21380 holotype.

Ex-type culture: CBS 134656 = LPF434.

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Type locality: **Brazil**, Pará state, Monte Dourado.

Type substrate: Soil.

Barcodes: *cmdA* = KM396027; *his3* = KM396110; *tef1* = KM395853; *tub2* = KM395940.

Notes: *Calonectria duoramosa* forms a single lineage closely related to *Ca. octoramosa*, and the smaller numbers (–2) of fertile branches in its conidiogenous apparatus can be distinguished from *Ca. octoramosa* (–8). Furthermore, the macroconidia of *Ca. duoramosa* [(av. 46 × 4 µm); Alfenas *et al.* 2015] are longer than those of *Ca. octoramosa* [(av. 36 × 4 µm); Marin-Felix *et al*. 2017] (Supplementary Table S4).

ecuadorae Calonectria (Crous & M.J. Wingf.) L. Lombard *et al*., Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium ecuadorae* Crous & M.J. Wingf. (as *ecuadoriae*), Stud. Mycol. 55: 222. 2006.

Synonym: *Calonectria ecuadorensis* L. Lombard & Crous, Stud. Mycol. 86: 112. 2017.

In: *Calonectria brassicae* species complex.

Typus: CBS H-17871 holotype.

Ex-type culture: CBS 111406 = CMW 23677 = CPC 1635.

Type locality: **Ecuador**.

Type substrate: Soil.

Barcodes: *act* = MT335012; *cmdA* = MT335242; *his3* = MT335482; *rpb2* = MT412544; *tef1* = MT412773; *tub2* = MT412991 (alternative markers: ITS = MT359703; LSU = MT359463).

Notes: *Calonectria ecuadorae* is closely related to *Ca. octoramosa* and *Ca. pauciphialidica*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. ecuadorae* [(av. 51 × 4.5 µm); Crous *et al*. 2006] are larger than those of *Ca. octoramosa* [(av. 36 × 4 µm); Marin-Felix *et al*. 2017] and *Ca. pauciphialidica* (av. 29.5 × 3 µm) (Supplementary Table S4).

ecuadorensis Calonectria L. Lombard & Crous, Stud. Mycol. 86: 112. 2017

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(see ***Calonectria ecuadorae***)

In: *Calonectria brassicae* species complex.

Typus: CBS H-23134 holotype.

Ex-type culture: CBS 111706 = CMW 51821 = CPC 1636.

Type locality: **Ecuador**.

Type substrate: Soil.

Barcodes: *act* = MT335010; *cmdA* = MT335240; *his3* = MT335480; *rpb2* = MT412542; *tef1* = MT412771; *tub2* = MT412989 (alternative markers: ITS = MT359701; LSU = MT359461).

Notes: *Calonectria ecuadorensis* was treated as a synonym of *Ca. ecuadorae* in this study. In comparisons of DNA sequences for eight gene regions, the only difference between the ex-type isolate of *Ca. ecuadorensis* (CBS 111706) and the ex-type isolate of *Ca. ecuadorae* (CMW 23677) was in the *act*, *cmdA* and *rpb2* sequences, where there was one base difference in the *act*, two base differences in the *cmdA* and one base difference in the *rpb2* sequences. Both species produce clavate vesicles of similar dimensions (*Ca. ecuadorensis*: 4–6 µm; *Ca. ecuadorae*: 3–5 µm). The macroconidia of *Ca. ecuadorensis* (av. 37 × 4 µm) are smaller than those of *Ca. ecuadorae* (av. 51 × 4.5 µm) (Crous *et al*. 2006, Marin-Felix *et al*. 2017), which was considered to represent intraspecific variation (Supplementary Table S4).

ericae Calonectria L. Lombard & Crous, Stud. Mycol. 85: 178. 2016.

(see ***Calonectria pauciramosa***)

In: *Calonectria candelabrum* species complex.

Typus: CBS H-22756 holotype.

Ex-type culture: CBS 114458 = CMW 51211 = CPC 2019.

Type locality: **USA**, California.

Type substrate: *Erica capensis*.

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Barcodes: *act* = MT335087; *cmdA* = MT335319; *his3* = MT335559; *rpb2* = MT412612; *tef1* = MT412850; *tub2* = MT413062 (alternative markers: ITS = MT359780; LSU = MT359540).

Notes: *Calonectria ericae* was treated as a synonym of *Ca. pauciramosa* in this study. In comparisons of DNA sequences for eight gene regions, all the sequences of the isolates of *Ca. ericae* (ex-type CBS 114458, CBS 114456, and CBS 114457) were 100 % identical to those of the isolates of *Ca. pauciramosa* (ex-type CBS 138824, CMW 2151, CMW 7592, CMW 9151, CMW 30823, and CMW 30875). Both species produce obpyriform to ellipsoidal vesicles with similar dimensions (*Ca. ericae*: 6–10 µm; *Ca. pauciramosa*: 5–11 µm) and 1-septate macroconidia. The macroconidia of *Ca. ericae* (av. 37 × 4 µm) are smaller than those of *Ca. pauciramosa* (av. 50 × 4.5 µm) (Crous 2002, Lombard *et al.* 2016), which was considered to represent intraspecific variation (Supplementary Table S4).

eucalypti Calonectria L. Lombard *et al.*, Stud. Mycol. 66: 47. 2010.

Synonym: *Calonectria pseudocolhounii* S.F. Chen *et al*., Persoonia 26: 7. 2011.

In: *Calonectria colhounii* species complex.

Typus: PREM 60298 holotype.

Ex-type culture: CBS 125275 = CMW 18444.

Type locality: **Indonesia**, Sumatra Utara, Aek Nauli.

Type substrate: *Eucalyptus grandis*.

Barcodes: *act* = MT335013; *cmdA* = MT335243; *his3* = MT335483; *rpb2* = MT412545; *tef1* = MT412774; *tub2* = MT412992 (alternative markers: ITS = MT359704; LSU = MT359464).

Notes: *Calonectria eucalypti* is closely related to *Ca. aciculata* and *Ca. honghensis*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. eucalypti* [(av. 72 × 6 µm); Lombard *et al.* 2010a] are larger than those of *Ca. aciculata* [(av. 69 × 5.5 µm); Li *et al.* 2017] and *Ca. honghensis* [(av. 54 × 5.5 µm); Li *et al.* 2017]. *Calonectria eucalypti* is homothallic (Li *et al.* 2020) (Supplementary Table S4).

eucalypticola Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 105. 2015.

In: *Calonectria candelabrum* species complex.

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Typus: CBS H-21359 holotype.

Ex-type culture: CBS 134847 = LPF124.

Type locality: **Brazil**, Minas Gerais state, Santa Barbara.

Type substrate: *Eucalyptus* seedling.

Barcodes: *cmdA* = KM396051; *his3* = KM396134; *tef1* = KM395877; *tub2* = KM395964.

Notes: *Calonectria eucalypticola* is closely related to *Ca. candelabrum* and *Ca. venezuelana*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. eucalypticola* [(av. 50 × 4 µm); Alfenas *et al*. 2015] are smaller than those of *Ca. candelabrum* [(av. 60 × 4.5µm); Crous 2002] and *Ca. venezuelana* [(av. 58 × 5 µm); Lombard *et al*. 2016] (Supplementary Table S4).

expansa Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 167. 2015.

(see ***Calonectria aconidialis***)

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21483 holotype.

Ex-type culture: CBS 136247 = CMW 31392 = CERC 1727.

Type locality: **China**, GuangXi Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334942; *cmdA* = MT335169; *his3* = MT335408; *rpb2* = MT412481; *tef1* = MT412699 (alternative markers: ITS = MT359629; LSU = MT359389).

Notes: *Calonectria expansa* was treated as a synonym of *Ca. aconidialis* in this study. In comparisons of DNA sequences for seven available gene regions, only a single base difference in the *tef1* gene sequence was found between the ex-type isolate of *Ca. expansa* (CMW 31392) and the ex-type isolate of *Ca. aconidialis* (CMW 35174). Both species are homothallic and produce orange to orange-brown perithecia, 8-spored asci and 1-septate ascospores, and share

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the similar ascospores dimensions (*Ca. expansa*: av. 39 × 6 µm; *Ca. aconidialis*: av. 36 × 6 µm) (Lombard *et al*. 2015a, Li *et al*. 2020; Supplementary Table S4).

floridana Calonectria Sobers, Phytopathology 59: 366. 1969.

(see ***Calonectria kyotensis***)

In: *Calonectria kyotensis* species complex.

Typus: BPI 414553 holotype.

Ex-type culture: CBS 114692= CMW 51826 = ATCC 18882.

Type locality: **USA**, Georgia.

Type substrate: *Prunus persica*.

Barcodes: *act* = MT335015; *cmdA* = MT335245; *his3* = MT335485; *rpb2* = MT412547; *tef1* = MT412776; *tub2* = MT412994 (alternative markers: ITS = MT359706; LSU = MT359466).

Notes: *Calonectria floridana* was treated as a synonym of *Ca. kyotensis* in this study. In comparisons of DNA sequences for eight gene regions, the only difference between the ex-type isolate of *Ca. floridana* (CBS 114692) and the ex-type isolate of *Ca. kyotensis* (CBS 114525) was in the *cmdA*, *his3* and LSU sequences, where there was one base difference in the *cmdA*, two base differences in the *his3* and one base difference in the LSU sequences. Both species are homothallic and produce globose vesicles of similar dimensions (*Ca. floridana*: 8.3–17.9 µm; *Ca. kyotensis*: 8.8–19 µm) and 1-septate macroconidia. The macroconidia of *Ca. floridana* (av. 46 × 4.3 µm) are longer than those of *Ca. kyotensis* (av. 41 × 4 µm) (Terashita 1968, Sobers 1969, Crous 2002), which was considered to represent intraspecific variation (Supplementary Table S4).

foliicola Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 167. 2015.

(see ***Calonectria hawksworthii***)

In: *Calonectria cylindrospora* species complex.

Typus: CBS H-21472 holotype.

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Ex-type culture: CBS 136641 = CMW 31393.

Type locality: **China**, GuangXi Province.

Type substrate: *Eucalyptus urophylla* × *E. grandis* clone leaf.

Barcodes: *act* = MT335017; *cmdA* = MT335247; *his3* = MT335487; *rpb2* = MT412549; *tef1* = MT412778; *tub2* = MT412996 (alternative markers: ITS = MT359708; LSU = MT359468).

Notes: *Calonectria foliicola* was treated as a synonym of *Ca. hawksworthiii* in this study. In comparisons of DNA sequences for eight gene regions, the only differences between the ex-type isolate *Ca. foliicola* (CMW 31393) and the ex-type isolate *Ca. hawksworthii* (ex-type CBS 111870) was in the *act*, *his3* and *tub2* sequences, where there was one base difference in the *act*, three base differences in the *his3*, and three base differences in the *tub2* sequences. Both species produce ellipsoidal vesicles with overlapping dimensions (*Ca. foliicola*: 6–13 µm; *Ca. hawksworthii*: 6–9 µm) and 1-septate macroconidia. The macroconidia of *Ca. foliicola* (av. 47 × 5 µm) are shorter than those of *Ca. hawksworthii* (av. 56 × 4 µm) (Crous 2002, Lombard *et al*. 2015a), which was considered to represent intraspecific variation (Supplementary Table S4).

fragariae Calonectria R.F. Alfenas *et al*., Australas. Plant. Pathol. 47: 6. 2017.

In: *Calonectria candelabrum* species complex.

Typus: VIC 42833 holotype.

Ex-type culture: CBS 133607 = LPP040.

Type locality: **Brazil**, Espírito Santo State, Santa Maria do Jetibá.

Type substrate: *Fragaria* × *ananassa.*

Barcodes: *cmdA* = KM998966; *his3* = KM998964; *tef1* = KM998963; *tub2* = KM998965.

Notes: *Calonectria fragariae* is closely related to *Ca. pseudospathulata*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. fragariae* [(av. 39 × 4 µm); Lopes *et al*. 2017] are shorter than those of *Ca. pseudospathulata* [(av. 43 × 4 µm); Alfenas *et al*. 2015] (Supplementary Table S4).

fujianensis Calonectria S.F. Chen *et al*., Persoonia 26: 8. 2011.

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Synonym: *Calonectria nymphaeae* Yong Wang bis *et al*., Mycotaxon 122: 181. 2013.

In: *Calonectria colhounii* species complex.

Typus: PREM 60460 holotype.

Ex-type culture: CBS 127201 = CMW 27257.

Type locality: **China**, FuJian Province.

Type substrate: *Eucalyptus grandis*.

Barcodes: *act* = MT335019; *cmdA* = MT335249; *his3* = MT335489; *rpb2* = MT412551; *tef1* = MT412780; *tub2* = MT412998 (alternative markers: ITS = MT359710; LSU = MT359470).

Notes: *Calonectria fujianensis* is phylogenetically closely related to *Ca. lichi*. The sequences of ITS, *tef1* and *tub2* gene regions can differentiate *Ca. fujianensis* from that species. The macroconidia of *Ca. fujianensis* [(av. 52.5 × 4 µm); Chen *et al.* 2011] are smaller than those of *Ca. lichi* [(av. 65.7 × 6 µm); Liu & Chen 2017]. *Calonectria fujianensis* is homothallic (Chen *et al.* 2011) (Supplementary Table S4).

glaebicola Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 106. 2015.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-21378 holotype.

Ex-type culture: CBS 134852 = LPF406.

Type locality: **Brazil**, Minas Gerais state, Martinho Campos.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *cmdA* = KM396053; *his3* = KM396136; *tef1* = KM395879; *tub2* = KM395966.

Notes: *Calonectria glaebicola* is closely related to *Ca. brassiana*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. glaebicola* (av. 50 × 4 µm) are shorter than those of *Ca. brassiana* (av. 53 × 4 µm) (Alfenas *et al*. 2015) (Supplementary Table S4).

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gordoniae Calonectria (Leahy *et al*.) L. Lombard *et al*., Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium gordoniae* Leahy *et al*., Mycotaxon 76: 80. 2000.

In: *Calonectria pteridis* species complex.

Typus: FLAS F56790 holotype.

Ex-type culture: CBS 112142 = CMW 23694 = STE-U 3136 = ATCC 201837= P97-2567.

Type locality: **USA**, Florida.

Type substrate: *Gordonia lasianthus*.

Barcodes: *act* = MT335021; *cmdA* = MT335251; *his3* = MT335491; *rpb2* = MT412553; *tef1* = MT412782; *tub2* = MT413000 (alternative markers: ITS = MT359712; LSU = MT359472).

Notes: *Calonectria gordoniae* is closely related to *Ca. ovata*, *Ca. pseudovata* and *Ca. terricola*, and can be distinguished from these three species by the dimensions of its macroconidia. The macroconidia of *Ca. gordoniae* [(av. 50 × 4.5 µm); Leahy *et al*. 2000] are smaller than those of *Ca. ovata* [(av. 70 × 5 µm); El-Gholl *et al.* 1993a] and *Ca*. *pseudovata* [(av. 69 × 5 µm); Alfenas *et al*. 2015], but longer than those of *Ca. terricola* [(av. 46 × 4.5 µm); Lombard *et al*. 2016] (Supplementary Table S4).

gracilipes Calonectria Crous & Mchau, Mycologia 89: 654. 1997.

Synonym: *Cylindrocladium graciloideum* Crous & Mchau, Mycologia 89: 654. 1997.

In: *Calonectria gracilipes* species complex.

Typus: PREM 54417 (holotype of *Ca. gracilipes*; Crous *et al*. 1997a), PREM 55299 (holotype of *Cy. graciloideum*; Crous *et al*. 1997a).

Ex-type culture: CBS 115674 = CMW 51227 = STE-U 1153 (Crous 2002, Crous *et al.* 2006).

Type locality: **Colombia**, La Selva.

Type substrate: Soil.

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Barcodes: *act* = MT335022; *cmdA* = MT335252; *his3* = MT335492; *rpb2* = MT412554; *tef1* = MT412783; *tub2* = MT413001 (alternative markers: ITS = MT359713; LSU = MT359473).

Notes: *Calonectria gracilipes* is closely related to *Ca. angustata*, *Ca. hurae*, *Ca. leguminum* and *Ca. rumohrae*, and can be distinguished from these four species by the dimensions of its macroconidia. The macroconidia of *Ca. gracilipes* [(av. 45 × 4.5 µm); Crous *et al.* 1997a] are smaller than those of *Ca. angustata* [(av. 110 × 10 µm); Crous *et al.* 2000], *Ca. hurae* [(av. 120 × 7.5 µm); Crous 2002], *Ca. leguminum* [(av. 60 × 5 µm); Figueiredo & Namekata 1967, Crous 2002] and *Ca. rumohrae* [(av. 110 × 9 µm); El-Gholl *et al*. 1997]. *Calonectria gracilipes* is homothallic (Crous *et al.* 1997a) (Supplementary Table S4).

gracilis Calonectria Crous *et al*., Mycotaxon 46: 224. 1993.

Synonym: *Cylindrocladium pseudogracile* Crous, Mycol. Res. 101: 213. 1997.

In: *Calonectria brassicae* species complex.

Typus: PREM 51031a (holotype of *Ca. gracilis*; Crous *et al*. 1993c), PREM 51031b (holotype of *Cy. pseudogracile*; Crous *et al*. 1997b).

Ex-type culture: CBS 111807 = CMW 51189 = STE-U 2634 = AR2677 = PPRI 4176. (Crous 2002, Lombard *et al*. 2016)

Type locality: **Brazil**, Pará state.

Type substrate: *Manilkara zapota*.

Barcodes: *act* = GQ280488; *cmdA* = GQ267407; *his3* = DQ190646; *rpb2* = KY653390; *tef1* = GQ267323; *tub2* = AF232858 (alternative markers: ITS = GQ280610; LSU = GQ280732).

Notes: *Calonectria gracilis* is closely related to *Ca. quinqueramosa*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. gracilis* (av. 56 × 4.5 µm) are smaller than those of *Ca. quinqueramosa* (av. 59 × 5 µm), while the vesicles of *Ca. gracilis* [(2–11 µm); Crous *et al.* 1993c] are wider than those of *Ca. quinqueramosa* [(3–5 µm); Alfenas *et al*. 2015]. *Calonectria gracilis* is homothallic (Li *et al*. 2020) (Supplementary Table S4).

guangxiensis Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 169. 2015.

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(see ***Calonectria aconidialis***)

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21484 holotype.

Ex-type culture: CBS 136092 = CMW 35409 = CERC 1900.

Type locality: **China**, GuangXi Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334944; *cmdA* = MT335171; *his3* = MT335410; *tef1* = MT412701 (alternative markers: ITS = MT359631; LSU = MT359391).

Notes: *Calonectria guangxiensis* was treated as a synonym of *Ca. aconidialis* in this study. In comparisons of DNA sequences for six gene regions (*rpb2* and *tub2* are not available for *Ca. guangxiensis*, *tub2* not available for *Ca. aconidialis*), all six gene sequences for isolates of *Ca. guangxiensis* (ex-type isolate CMW 35409, and CMW 35411) were 100 % identical to the ex-type isolate of *Ca. aconidialis* (CMW 35174). Both species are homothallic and produce orange to orange-brown perithecia, 8-spored asci and 1-septate ascospores, and share the similar ascospores dimensions (*Ca. guangxiensis*: av. 36 × 6 µm; *Ca. aconidialis*: av. 36 × 6 µm) (Lombard *et al*. 2015a, Li *et al*. 2020; Supplementary Table S4).

hainanensis Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 170. 2015.

(see ***Calonectria aconidialis***)

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21480 holotype.

Ex-type culture: CBS 136248 = CMW 35187 = CERC 1863.

Type locality: **China**, HaiNan Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334946; *cmdA* = MT335173; *his3* = MT335412; *tef1* = MT412703 (alternative markers: ITS = MT359633; LSU = MT359393).

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Notes: *Calonectria hainanensis* was treated as a synonym of *Ca. aconidialis* in this study. In comparisons of DNA sequences for six available gene regions (*rpb2* and *tub2* are not available for *Ca. hainanensis*, *tub2* not available for *Ca. aconidialis*), all six gene sequences for the ex-type isolate of *Ca. hainanensis* (CMW 35187) were 100 % identical to the ex-type isolate of *Ca. aconidialis* (CMW 35174). Both species are homothallic and produce orange to orange-brown perithecia, 8-spored asci and 1-septate ascospores, and share the similar ascospores dimensions (*Ca. hainanensis*: av. 34 × 6 µm; *Ca. aconidialis*: av. 36 × 6 µm) (Lombard *et al.* 2015a; Supplementary Table S4).

hawksworthii Calonectria (Peerally) L. Lombard *et al*., Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium hawksworthii* Peerally, Mycotaxon 40: 375. 1991.

Synonyms: *Calonectria sulawesiensis* L. Lombard *et al.*, Stud. Mycol. 66: 53. 2010.

Calonectria foliicola L. Lombard *et al.*, Stud. Mycol. 80: 167. 2015.

In: *Calonectria cylindrospora* species complex.

Typus: MUCL 30866 holotype.

Ex-type culture: CBS 111870 = CMW 51194 = CPC 2405.

Type locality: **Mauritius**, Pamplemousses garden.

Type substrate: Leaves of *Nelumbo nucifera*.

Barcodes: *act* = MT335024; *cmdA* = MT335254; *his3* = MT335494; *rpb2* = MT412556; *tef1* = MT412785; *tub2* = MT413003 (alternative markers: ITS = MT359715; LSU = MT359475).

Notes: *Calonectria hawksworthii* is closely related to *Ca. brasiliensis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. hawksworthii* [(av. 56 × 4 µm); Crous 2002] are larger than those of *Ca. brasiliensis* [(av. 38 × 3.5 µm); Batista 1951] (Supplementary Table S4).

henricotiae Calonectria Gehesquière *et al*., Pl. Pathol. 65: 47. 2015.

In: *Calonectria naviculata* species complex.

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Typus: BPI 892910 holotype.

Ex-type culture: CBS 138102 = CB045.

Type locality: **Belgium**, East Flanders, Lokeren.

Type substrate: *Buxus sempervirens.*

Barcodes: *cmdA* = KF815157; *his3* = KF815185; *tub2* = JX535308 (alternative markers: ITS = JX535322).

Notes: *Calonectria henricotiae* is closely related to *Ca*. *pseudonaviculata*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. henricotiae* [(av. 56 × 5.6 µm); Gehesquiere *et al.* 2015] are shorter than those of *Ca. pseudonaviculata* [(av. 60 × 5 µm); Crous *et al.* 2002]. *Calonectria henricotiae* is heterothallic (Li *et al*. 2020) (Supplementary Table S4).

heveicola Calonectria N.Q. Pham *et al*., Mycologia 111: 95. 2019.

In: *Calonectria kyotensis* species complex.

Typus: PREM 62118 holotype.

Ex-type culture: CBS 143570 = CMW 49913.

Type locality: **Vietnam**, Binh Duong, Bau Bang.

Type substrate: Soil in *Hevea brasiliensis* plantation.

Barcodes: *act* = MT335025; *cmdA* = MT335255; *his3* = MT335495; *tef1* = MT412786; *tub2* = MT413004 (alternative markers: ITS = MT359716; LSU = MT359476).

Notes: *Calonectria heveicola* is phylogenetically closely related to *Ca*. *cochinchinensis* and can be differentiated from that species by sequences of *act*, *cmdA*, *his3*, ITS, *tef1* and *tub2* gene regions. In addition, *Ca*. *heveicola* [(138–189 µm); Pham *et al*. 2019] produces shorter stipe extensions than those of *Ca. cochinchinensis* [(147–208 µm); Pham *et al*. 2019]. *Calonectria heveicola* is heterothallic (Li *et al*. 2020) (Supplementary Table S4).

hodgesii Calonectria R.F Alfenas *et al*., Trop. Plant. Pathol. 38: 517. 2013.

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(see ***Calonectria brasiliensis***)

In: *Calonectria cylindrospora* species complex.

Typus: CBS H-21147 holotype.

Ex-type culture: CBS 133609 = LPF245.

Type locality: **Brazil**, Minas Gerais state, Viçosa.

Type substrate: *Anadenanthera peregrina*.

Barcodes: *cmdA* = KC491222; *tef1* = KC491225; *tub2* = KC491228.

Notes: *Calonectria hodgesii* was treated as a synonym of *Ca. brasiliensis* in this study. In comparisons of DNA sequences for three available gene regions, the only difference between the ex-type isolate of *Ca. hodgesii* (CBS 133609) and the ex-type isolate of *Ca. brasiliensis* (CBS 230.51) was in the *cmdA*, *tef1* and *tub2* sequences, where there were three base differences in the *cmdA*, one base difference in the *tef1* and one base difference in the *tub2* sequences. Both species produce ellipsoidal vesicles of similar dimensions (*Ca. hodgesii*: 6–11 µm; *Ca. brasiliensis*: 7–11 µm) and 1-septate macroconidia. The macroconidia of *Ca. hodgesii* (av. 50 × 4.5 µm) are larger than those of *Ca. brasiliensis* (av. 38 × 3.5 µm) (Batista 1951, Lombard *et al*. 2010b, Alfenas *et al*. 2013b), which was considered to represent intraspecific variation (Supplementary Table S4).

honghensis Calonectria J.Q. Li *et al.*, IMA Fungus 8: 273. 2017.

In: *Calonectria colhounii* species complex.

Typus: PREM 61943 holotype.

Ex-type culture: CBS 142885 = CMW 47669 = CERC 5572.

Type locality: **China**, YunNan Province, HongHe Region.

Type substrate: Soil in a *Eucalyptus* plantation.

Barcodes: *act* = MT335026; *cmdA* = MT335256; *his3* = MT335496; *rpb2* = MT412557; *tef1* = MT412787; *tub2* = MT413005 (alternative markers: ITS = MT359717; LSU = MT359477).

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Notes: *Calonectria honghensis* is closely related to *Ca. aciculata* and *Ca. colhounii*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. honghensis* [(av. 54 × 5.5 µm); Li *et al.* 2017] are shorter than those of *Ca. aciculata* [(av. 69 × 5.5 µm); Li *et al.* 2017] and *Ca. colhounii* [(av. 65 × 5 µm); Peerally 1973]. In addition, the ascospores of *Ca. honghensis* (av. 49 × 6 µm) are shorter than those of *Ca. colhounii* (av. 55 × 6 µm) (Peerally 1973, Li *et al.* 2017). *Calonectria honghensis* is homothallic (Li *et al.* 2020) (Supplementary Table S4).

hongkongensis Calonectria Crous, Stud. Mycol. 50: 422. 2004.

Synonym: *Cylindrocladium hongkongense* Crous, Stud. Mycol. 50: 422. 2004.

In: *Calonectria kyotensis* species complex.

Typus: CBS 9886 holotype.

Ex-type culture: CBS 114828= CMW 51217 = CPC 4670.

Type locality: **China**, Hong Kong.

Type substrate: Soil.

Barcodes: *act* = MT335028; *cmdA* = MT335258; *his3* = MT335498; *rpb2* = MT412559; *tef1* = MT412789; *tub2* = MT413007 (alternative markers: ITS = MT359719; LSU = MT359479).

Notes: *Calonectria hongkongensis* is closely related to *Ca. kyotensis*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. hongkongensis* [(av. 46.5 × 4 µm); Crous *et al.* 2004] are longer than those of *Ca. kyotensis* [(av. 41 × 4 µm); Terashita 1968], whereas the vesicles of *Ca. hongkongensis* (8–14 µm) are narrower than those of *Ca. kyotensis* (8.8–19 µm) (Sobers 1972, Crous et al. 2004). *Calonectria hongkongensis* is homothallic (Crous *et al.* 2004) (Supplementary Table S4).

humicola Calonectria L. Lombard *et al.*, Stud. Mycol. 66: 49. 2010

In: *Calonectria spathiphylli* species complex.

Typus: PREM 60369 holotype.

Ex-type culture: CBS 125251 = CMW 31183.

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Type locality: **Ecuador**, Pichincha Province, Las Golondrinas.

Type substrate: Soil.

Barcodes: *act* = MT335032; *cmdA* = MT335262; *his3* = MT335502; *tef1* = MT412793; *tub2* = MT413011 (alternative markers: ITS = MT359723; LSU = MT359483).

Notes: *Calonectria humicola* is phylogenetically closely related to *Ca. densa*, and can be distinguished from that species by its lack of lateral stipe extensions, a feature that is common in *Ca. densa*. The macroconidia of *Ca. humicola* [(av. 51 × 5 µm); Lombard *et al.* 2010a] are smaller than those of *Ca. densa* [(av. 54 × 6 µm); Lombard *et al.* 2010a] (Supplementary Table S4).

hurae Calonectria (Linder & Whetzel) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Cercosporella hurae* Linder & Whetzel, Mycologia 29: 656. 1937.

Synonyms: *Cylindrocladiopsis hurae* (Linder & Whetzel) U. Braun, Mycotaxon 51: 40. 1994.

Cylindrocladium hurae (Linder & Whetzel) Crous, In: Taxonomy and pathology of *Cylindrocladium* (*Calonectria*) and allied genera: 185. 2002.

Cylindrocladium heptaseptatum Sobers *et al*., Phytopathology 65: 333. 1975.

Cylindrocladiopsis lagerstroemiae J.M. Yen, Mycotaxon 8: 236. 1979.

In: *Calonectria gracilipes* species complex.

Typus: Chardon No. 363 (lectotype, Crous 2002).

Ex-type culture: Not available.

Key culture: CBS 114182= CMW 51823 = CPC 1714 = UFV 216 (Lombard *et al*. 2016).

Key culture locality: **Brazil** (Lombard *et al*. 2016).

Key culture substrate: *Rumohra adiantiformis* (Lombard *et al*. 2016).

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Barcodes: Culture CBS 114182: *act* = MT335035; *cmdA* = MT335265; *his3* = MT335505; *rpb2* = MT412563; *tef1* = MT412796; *tub2* = MT413014 (alternative markers: ITS = MT359726; LSU = MT359486).

Notes: *Calonectria hurae* is phylogenetically closely related to *Ca. angustata* and *Ca. rumohrae*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. hurae* [(av. 120 × 7.5 µm); Crous 2002] are longer and narrower than those of *Ca. angustata* [(av. 110 × 10 µm); Crous *et al.* 2000] and *Ca. rumohrae* [(av. 110 × 9 µm); El-Gholl *et al*. 1997] (Supplementary Table S4).

ilicicola Calonectria Boedijn & Reitsma, Reinwardtia 1: 58. 1950.

Synonyms: *Calonectria theae* var. *crotalariae* Loos, Trans. Brit. Mycol. Soc. 33: 18. 1950.

Calonectria crotalariae (Loos) D.K. Bell & Sobers, Phytopathology 56: 1364. 1966.

Cylindrocladium crotalariae (Loos) D.K. Bell & Sobers, Phytopathology 56: 1364. 1966. (*nom. inval*.!, Art.36)

Cylindrocladium parasiticum Crous, M.J. Wingf. & Alfenas, Mycol. Res. 97: 892. 1993.

In: *Calonectria kyotensis* species complex.

Typus: IMI 264540 holotype.

Ex-type culture: CBS 190.50 = CMW 30998 = STE-U 2482 = IMI 299389.

Type locality: **Indonesia**, Java, Bogor.

Type substrate: *Solanum tuberosum*.

Barcodes: *act* = MT335036; *cmdA* = MT335266; *his3* = MT335506; *rpb2* = MT412564; *tef1* = MT412797 (alternative markers: ITS = MT359727; LSU = MT359487).

Notes: *Calonectria ilicicola* is closely related to *Ca. aeknauliensis* and *Ca. curvispora*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. ilicicola* [(av. 62 × 6 µm); Boedijn & Reitsma 1950] are larger than those of *Ca. aeknauliensis* [(av. 47 × 5 µm); Pham *et al*. 2019] and *Ca. curvispora* [(av. 60 × 5 µm);

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Victor *et al.* 1997]. *Calonectria ilicicola* is homothallic (Li *et al.* 2020) (Supplementary Table S4).

indonesiae Calonectria (Crous) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium indonesiae* Crous, Stud. Mycol. 50: 424. 2004.

In: *Calonectria kyotensis* species complex.

Typus: CBS 9891 holotype.

Ex-type culture: CBS 112823 = CMW 23683 = CPC 4508.

Type locality: **Indonesia**, Warambunga.

Type substrate: Soil.

Barcodes: *act* = MT335037; *cmdA* = MT335267; *his3* = MT335507; *rpb2* = MT412565; *tef1* = MT412798; *tub2* = MT413015 (alternative markers: ITS = MT359728; LSU = MT359488).

Notes: *Calonectria indonesiae* is phylogenetically closely related to *Ca. chinensis*, *Ca. cochinchinensis* and *Ca. heveicola*, and can be distinguished from these three species by the dimensions of its macroconidia. The macroconidia of *Ca. indonesiae* [(av. 50.5 × 4 µm); Crous *et al.* 2004] are longer than those of *Ca. chinensis* [(av. 45 × 4 µm); Crous *et al.* 2004], *Ca. cochinchinensis* [(av. 46 × 4 µm); Pham *et al.* 2019] and *Ca. heveicola* [(av. 44.5 × 4 µm); Pham *et al.* 2019] (Supplementary Table S4).

indonesiana Calonectria L. Lombard & Crous, Stud. Mycol. 85: 179. 2016.

(see ***Calonectria sumatrensis***)

In: *Calonectria kyotensis* species complex.

Typus: CBS H-22757 holotype.

Ex-type culture: CBS 112936 = CMW 51207 = CPC 4504.

Type locality: **Indonesia**, Northern Sumatra.

Type substrate: Soil.

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Barcodes: *act* = MT335143; *cmdA* = MT335380; *his3* = MT335620; *rpb2* = MT412672; *tef1* = MT412911 (alternative markers: ITS = MT359841; LSU = MT359601).

Notes: *Calonectria indonesiana* was treated as a synonym of *Ca. sumatrensis* in this study. In comparisons of DNA sequences for seven available gene regions, the only differences between the ex-type isolate of *Ca. indonesiana* (CBS 112936) and the ex-type isolate of *Ca. sumatrensis* (CMW 23698) were two base differences in the *his3* gene region. Both species produce sphaeropedunculate vesicles with overlapping dimensions (*Ca. indonesiana*: 8–10 µm; *Ca. sumatrensis*: 8–13 µm) and 1-septate macroconidia. Macroconidia of *Ca. indonesiana* (av. 43 × 5 µm) are shorter than those of *Ca. sumatrensis* (av. 58 × 5 µm), which was considered to represent intraspecific variation (Crous *et al.* 2004, Lombard *et al.* 2016) (Supplementary Table S4).

indusiata Calonectria (Seaver) Crous, Taxonomy and pathology of *Cylindrocladium* (*Calonectria*) and allied genera: 94. 2002.

Basionym: *Nectria indusiata* Seaver, Mycologia 20: 58. 1928.

Synonyms: *Cercosporella theae* Petch, Ann. Roy. Bot. Gard. Peradeniya. 6: 246. 1917.

Candelospora theae (Petch) Wakef. ex Gadd, Monographs on Tea Production in Ceylon: 59. 1949.

Cylindrocladium theae (Petch) Subram., In: Subramnian, *Hyphomycetes*, an account of Indian species, except *Cercosporae*: 731. 1971.

Cylindrocladium theae (Petch) Alfieri & sobers, Phytopathology 62: 650. 1972 (homonym).

Calonectria theae Loos, Trans. Brit. Mycol. Soc. 33: 17. 1950.

In: *Calonectria colhounii* species complex.

Typus: No. 3176 holotype.

Ex-type culture: CBS 144.36 = CMW 23699.

Type locality: **Sri Lanka**.

Type substrate: *Camellia sinensis*.

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Barcodes: *act* = GQ280536; *cmdA* = GQ267453; *his3* = GQ267262; *rpb2* = KY653396; *tef1* = GQ267332; *tub2* = GQ267239 (alternative markers: ITS = GQ280658; LSU = GQ280780).

Notes: Phylogenetically, *Ca. indusiata* forms a distinct lineage separate from other species in the *Ca. colhounii* species complex. The macroconidia of *Ca. indusiata* (av. 81 × 6 µm) are smaller than those of *Ca. macroconidialis* (av. 90 × 6.5 µm), and longer than other species in the *Ca. colhounii* species complex (Supplementary Table S4).

insularis Calonectria C.L. Schoch & Crous, Mycologia 91: 293. 1999.

Synonym: *Cylindrocladium insulare* C.L. Schoch & Crous, Mycologia 91: 293. 1999.

In: *Calonectria cylindrospora* species complex.

Typus: PREM 55760 [holotype of *Ca. insularis*; Schoch *et al.* 1999], PREM 55758 (holotype of *Cy. insulare*; Schoch *et al.* 1999).

Ex-type culture: CBS 114558 = CMW 30991 = CPC 768 (Crous 2002, Lombard *et al*. 2015a)

Type locality: **Madagascar**, Tamatave.

Type substrate: Soil.

Barcodes: *cmdA* = MT335269; *his3* = MT335509; *rpb2* = MT412567; *tef1* = MT412800; *tub2* = MT413017 (alternative markers: ITS = MT359730; LSU = MT359490).

Notes: *Calonectria insularis* is closely related to *Ca*. *cylindrospora* and *Ca*. *variabilis*, and can be distinguished from these two species by the dimensions of its ascospores and macroconidia. The ascospores of *Ca. insularis* [(av. 33 × 6 µm); Schoch *et al*. 1999] are shorter than those of *Ca. cylindrospora* [(av. 37 × 6 µm); Crous *et al*. 1993a, Lombard *et al*. 2015b] and *Ca. variabilis* [(av. 42 × 5 µm); Crous *et al*. 1993b]. The macroconidia of *Ca. insularis* [(av. 45 × 4 µm); Schoch *et al*. 1999] are smaller than those of *Ca. variabilis* [(av. 73 × 5 µm); Crous *et al*. 1993b]. *Calonectria insularis* and *Ca. cylindrospora* are characterised as being heterothallic, while *Ca. variabilis* is homothallic (Crous *et al*. 1993b, Schoch *et al*. 1999).

kyotensis Calonectria Terash., Trans. Mycol. Soc. Japan. 8: 124. 1968.

Synonyms: *Calonectria floridana* Sobers, Phytopathology 59: 366. 1969.

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Calonectria turangicola L. Lombard *et al.*, Stud. Mycol. 80: 184. 2015.

Calonectria pseudoturangicola J.Q. Li *et al*., IMA Fungus 8: 279. 2017.

In: *Calonectria kyotensis* species complex.

Typus: IFO No. 11597 holotype.

Ex-type culture: CBS 114525 = CMW 51824 = CPC 2367 = ATCC 18834.

Type locality: **Japan**.

Type substrate: *Robinia pseudoacacia*.

Barcodes: *act* = MT335039; *cmdA* = MT335271; *his3* = MT335511; *rpb2* = MT412569; *tef1* = MT412802; *tub2* = MT413019 (alternative markers: ITS = MT359732; LSU = MT359492).

Notes: *Calonectria kyotensis* is closely related to *Ca. hongkongensis*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. kyotensis* [(av. 41 × 4 µm); Terashita 1968] are shorter than those of *Ca. hongkongensis* [(av. 46.5 × 4 µm); Crous *et al.* 2004], whereas the vesicles of *Ca. kyotensis* (8.8–19 µm) are wider than those of *Ca. hongkongensis* (8–14 µm) (Sobers 1972, Crous et al. 2004). *Calonectria kyotensis* is homothallic (Terashita 1968) (Supplementary Table S4).

lageniformis Calonectria L. Lombard & Crous, Stud. Mycol. 85: 181. 2016.

In: *Calonectria cylindrospora* species complex.

Typus: CBS H-22758 holotype.

Ex-type culture: CBS 111324 = CMW 51177 = CPC 1473.

Type locality: **Mauritius**, Rivière Noire.

Type substrate: *Eucalyptus* sp.

Barcodes: *cmdA* = KX784574; *rpb2* = KY653400; *tef1* = KX784702; *tub2* = KX784632 (alternative markers: ITS = KY653256; LSU = KY653312).

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Notes: *Calonectria lageniformis* is closely related to *Ca. auriculiformis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. lageniformis* (av. 40 × 5 µm) are shorter than those of *Ca. auriculiformis* (av. 43 × 4 µm). *Calonectria lageniformis* only produces up to three branches per conidiophore, whereas *Ca. auriculiformis* can have up to five branches per conidiophore (Lombard *et al*. 2016, Pham *et al*. 2019).

lantauensis Calonectria J.Q. Li *et al*., IMA Fungus 8: 277. 2017.

In: *Calonectria kyotensis* species complex.

Typus: PREM 61946 holotype.

Ex-type culture: CBS 142888 = CMW 47252 = CERC 3302.

Type locality: **China**, Hong Kong Region, LiDao Distict.

Type substrate: Soil.

Barcodes: *act* = MT335040; *cmdA* = MT335272; *his3* = MT335512; *rpb2* = MT412570; *tef1* = MT412803 (alternative markers: ITS = MT359733; LSU = MT359493).

Notes: *Calonectria lantauensis* is phylogenetically closely related to *Ca. bumicola*. This species can be differentiated from *Ca. bumicola* by the sequences of *act*, *cmdA*, *his3*, *rpb2* and *tef1* gene regions.

lateralis Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 173. 2015.

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21469 holotype.

Ex-type culture: CBS 136629 = CMW 31412.

Type locality: **China**, GuangXi Province.

Type substrate: Soil in a *Eucalyptus* plantation.

Barcodes: *act* = MT335042; *cmdA* = MT335274; *his3* = MT335514; *rpb2* = MT412571; *tef1* = MT412805; *tub2* = MT413020 (alternative markers: ITS = MT359735; LSU = MT359495).

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Notes: *Calonectria lateralis* is closely related to *Ca. hongkongensis* and *Ca. kyotensis*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. lateralis* [(av. 39 × 4 µm); Lombard *et al*. 2015a] are shorter than those of *Ca. hongkongensis* [(av. 46.5 × 4 µm); Crous *et al.* 2004] and *Ca. kyotensis* [(av. 41 × 4 µm); Terashita 1968]. *Calonectria lateralis* is homothallic (Lombard *et al*. 2015a) (Supplementary Table S4).

lauri Calonectria Lechat & Crous, ***sp. nov.*** MycoBank MB836241.

Synonyms: *Candelospora ilicicola* Hawley, Proc. Roy. Irish Acad. 31: 11. 1912.

Cylindrocladium ilicicola (Hawley) Boedijn & Reitsma, Reinwardtia 1: 57. 1950.

Tetracytum lauri Vanderw., Parasitica 1: 145. 1945. (as *laurii*). *Nom. inval*., Arts 35.1, 39.1 (Melbourne)

Calonectria lauri (Vanderw.) Lechat & Crous, IMA Fungus 1: 103. 2010. *Nom. inval.,* Art. 39.1 (Melbourne)

In: *Calonectria mexicana* species complex.

Description and illustrations: Lechat *et al*. (2010).

Typus: **Netherlands**, South-East Limburg, Vijlenerbos, Vijlen, *Ilex aquifolium*, Aug. 1970, H.A van der Aa (**holotype** CBS H-15110, ex-type culture CBS 749.70 = CMW 23682).

Barcodes: *act* = MT335043; *cmdA* = MT335275; *his3* = MT335515; *rpb2* = MT412572; *tef1* = MT412806; *tub2* = MT413021 (alternative markers: ITS = MT359736; LSU = MT359496).

Notes: The original description of *Ca. lauri* (Lechat *et al*. 2010) is invalid, as its basionym *Tetracytum lauri* is invalid. This issue is now addressed, and the name *Ca. lauri* validated here. *Calonectria lauri* is closely related to *Ca. citri*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. lauri* [(av. 60 × 5.5 µm); Lechat *et al*. 2010] are larger than those of *Ca. citri* [(av. 58 × 4 µm); Crous 2002]. *Calonectria lauri* is homothallic (Li *et al.* 2020) (Supplementary Table S4).

leguminum Calonectria (Rehm) Crous, Taxonomy and pathology of *Cylindrocladium* (*Calonectria*) and allied genera: 107. 2002.

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Basionym: *Nectria leguminum* Rehm, Hedwigia 39: 221. 1900.

Synonyms: *Calonectria quinqueseptata* Figueiredo & Namek., Arch. Inst. Biol. (São Paulo). 34: 91. 1967.

Cylindrocladium leguminum Crous, Taxonomy and pathology of *Cylindrocladium* (*Calonectria*) and allied genera: 107. 2002.

In: *Calonectria gracilipes* species complex.

Typus: *Ule* 2282 (holotype of *Nectria leguminum*; Crous 2002), PREM 57208 (holotype of *Cy. leguminum*; Crous 2002).

Ex-type culture: CBS 728.68 = CMW 23684 (Crous 2002, Lombard *et al*. 2010a).

Type locality: **Brazil**, Sao Paulo.

Type substrate: *Annona squamosa.*

Barcodes: *act* = MT335044; *cmdA* = MT335276; *his3* = MT335516; *rpb2* = MT412573; *tef1* = MT412807; *tub2* = MT413022 (alternative markers: ITS = MT359737; LSU = MT359497).

Notes: *Calonectria leguminum* is phylogenetically closely related to *Ca. angustata*, *Ca. gracilipes*, *Ca. hurae* and *Ca. rumohrae*, and can be distinguished from these four species by the dimensions of its macroconidia. The macroconidia of *Ca. leguminum* [(av. 60 × 5 µm); Figueiredo & Namekata 1967, Crous 2002] are smaller than those of *Ca. angustata* [(av. 110 × 10 µm); Crous *et al.* 2000], *Ca. hurae* [(av. 120 × 7.5 µm); Crous 2002] and *Ca. rumohrae* [(av. 110 × 9 µm); El-Gholl *et al*. 1997], larger than those of *Ca. gracilipes* [(av. 45 × 4.5 µm); Crous *et al.* 1997a]. *Calonectria leguminum* is homothallic (Crous 2002) (Supplementary Table S4).

leucothoes Calonectria (El-Gholl *et al*.) L. Lombard *et al.* (as *leucothoës*), Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium leucothoes* El-Gholl *et al*., Canad. J. Bot. 67: 2530. 1989.

Synonym: *Cylindrocladium perseae* T.S. Schub. *et al*., Mycotaxon 73: 474. 1999.

In: *Calonectria mexicana* species complex.

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Typus: FLAS F55387 holotype.

Ex-type culture: CBS 109166 = CMW 30977 = CPC 2385 = ATCC 64824 = P88-490.

Type locality: **USA**, Florida.

Type substrate: *Leucothoe axillaris*.

Barcodes: *act* = MT335045; *cmdA* = MT335277; *his3* = MT335517; *rpb2* = MT412574; *tef1* = MT412808 (alternative markers: ITS = MT359738; LSU = MT359498).

Notes: *Calonectria leucothoes* is closely related to *Ca. citri* and *Ca. lauri*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. leucothoes* [(av. 73 × 5 µm); El-Gholl *et al*. 1989] are larger than those of *Ca. citri* [(av. 58 × 4 µm); Crous 2002] and longer than those of *Ca. lauri* [(av. 60 × 5.5 µm); Lechat *et al*. 2010]. *Calonectria leucothoes* is characterised as being heterothallic, while *Ca. lauri* is homothallic (Li *et al.* 2020) (Supplementary Table S4).

lichi Calonectria Q.L. Liu & S.F. Chen, Mycokeys 26: 45. 2017.

In: *Calonectria colhounii* species complex.

Typus: CSFF 2019 holotype.

Ex-type culture: CERC 8866.

Type locality: **China**, HeNan Province.

Type substrate: Soil.

Barcodes: *act* = MT335046; *cmdA* = MT335278; *his3* = MT335518; *rpb2* = MT412575; *tef1* = MT412809; *tub2* = MT413023 (alternative markers: ITS = MT359739; LSU = MT359499).

Notes: *Calonectria lichi* is phylogenetically closely related to *Ca. fujianensis*. The sequences of the ITS, *tef1* and *tub2* gene regions can differentiate *Ca. lichi* from that species. The macroconidia of *Ca. lichi* [(av. 65.7 × 6 µm); Liu & Chen 2017] are larger than those of *Ca. fujianensis* [(av. 52.5 × 4 µm); Chen *et al.* 2011]. *Calonectria lichi* is homothallic (Li *et al*. 2020) (Supplementary Table S4).

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lombardiana Calonectria Q.L. Liu & S.F. Chen, ***sp. nov.*** MycoBank MB835285. Fig. 2.

In: *Calonectria reteaudii* species complex.

Etymology: Named for Dr Lorenzo Lombard, recognising his significant contribution to the taxonomy of *Calonectria*.

Sexual morph unknown. *Macroconidiophores* consisting of a stipe, a suite of penicillate arranged fertile branches, a stipe extension, and a terminal vesicle; stipe septate, hyaline, smooth, 43–139 × 4–7 µm; stipe extensions septate, straight to flexuous 158–216 µm long, 2–5 µm wide at the apical septum, terminating in a narrowly clavate vesicle, 2–4 µm diam; lateral stipe extensions (90° to main axis) absent. *Conidiogenous apparatus* 34–80 µm wide, and 35–76 µm long; primary branches aseptate, 13–29 × 3–7 µm; secondary branches aseptate, 11–21 × 3–5 µm; tertiary branches aseptate, 9–19 × 2–4 µm, each terminal branch producing 3–4 phialides; phialides cylindrical to allantoid, hyaline, aseptate, 9−20 × 2–5 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at both ends, straight, (64–)74–86(–98) × (5–)5.5–6.5(–7.5) µm, (av. 80 × 6 µm), 5-septate, lacking a visible abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies forming abundant white aerial mycelium at 25 °C on MEA, moderate sporulation; reverse cinnamon after 7 d. Chlamydospores extensive throughout the medium, forming microsclerotia. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 11.1 mm, 20.4 mm, 41.2 mm, 59.5 mm and 55.3 mm, respectively.

Typus: **Australia**, Victoria, on *Xanthorrhoea australis*, T. Baigent (**holotype** HMAS 255718, ex-type culture CBS 112634 = CMW 30602 = CPC 4233 = Lynfield 417).

Barcodes: *act* = MT335156; *cmdA* = MT335395; *his3* = MT335635; *rpb2* = MT412686; *tef1* = MT412926; *tub2* = MT413133 (alternative markers: ITS = MT359856; LSU = MT359616).

Notes: *Calonectria lombardiana* is a new species in the *Ca. reteaudii* species complex, closely related to *Ca. queenslandica* (Fig. 1). The sequences of ITS, *tef1* and *tub2* gene regions can differentiate *Ca. lombardiana* from that species. In addition, the macroconidia of *Ca.*

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lombardiana (av. 80 × 6 µm) are longer than those of *Ca. queenslandica* [(av. 69 × 6 µm); Lombard *et al*. 2010c] (Supplementary Table S4).

longiramosa Calonectria L. Lombard & Crous, Stud. Mycol. 86: 114. 2017.

(see ***Calonectria amazonica***)

In: *Calonectria pteridis* species complex.

Typus: CBS H-22759 holotype.

Ex-type culture: CBS 116319 = CMW 51832 = CPC 3761.

Type locality: **Brazil**, Amazon.

Type substrate: *Eucalyptus* sp.

Barcodes: *act* = MT334960; *cmdA* = MT335187; *his3* = MT335426; *rpb2* = MT412490; *tef1* = MT412717; *tub2* = MT412940 (alternative markers: ITS = MT359647; LSU = MT359407).

Notes: *Calonectria longiramosa* was treated as a synonym of *Ca. amazonica* in this study. In comparisons of DNA sequences for eight gene regions, the ex-type isolate of *Ca. longiramosa* (CBS 116319) were 100 % identical to the ex-type isolate of *Ca. amazonica* (CBS 116250). Both species produce clavate vesicles with overlapping dimensions (*Ca. longiramosa*: 5–8 µm; *Ca. amazonica*: 5–6 µm) and 1-septate macroconidia. The macroconidia of *Ca. longiramosa* (av. 71 × 5 µm) are shorter than those of *Ca. amazonica* (av. 79 × 5 µm) (Lombard *et al.* 2016), which was considered to represent intraspecific variation (Supplementary Table S4).

machaerinae Calonectria L. Lombard & Crous, Stud. Mycol. 85: 181. 2016.

(see ***Calonectria pauciramosa***)

In: *Calonectria candelabrum* species complex.

Typus: CBS H-22760 holotype.

Ex-type culture: CBS 123183 = CMW 51311 = CPC 15378.

Type locality: **New Zealand,** Auckland, Auckland University Campus.

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Type substrate: Foliar lesion of *Machaerina sinclairii*.

Barcodes: *act* = MT335090; *cmdA* = MT335322; *his3* = MT335562; *rpb2* = MT412615; *tef1* = MT412853; *tub2* = MT413065 (alternative markers: ITS = MT359783; LSU = MT359543).

Notes: *Calonectria machaerinae* was treated as a synonym of *Ca. pauciramosa* in this study. In comparisons of DNA sequences for eight gene regions, all the sequences of *Ca. machaerinae* (ex-type CBS 123183) were 100 % identical to those of *Ca. pauciramosa* (ex-type CBS 138824, CMW 2151, CMW 7592, CMW 9151, CMW 30823, and CMW 30875). Both species produce obpyriform to ellipsoidal vesicles with overlapping dimensions (*Ca. machaerinae*: 6–9 µm; *Ca. pauciramosa*: 5–11 µm) and 1-septate macroconidia. The macroconidia of *Ca. machaerinae* (av. 38 × 4 µm) are smaller than those of *Ca. pauciramosa* (av. 50 × 4.5 µm) (Crous 2002, Lombard *et al.* 2016), which was considered to represent intraspecific variation (Supplementary Table S4).

macroconidialis Calonectria (Crous *et al.*) Crous, Canad. J. Bot. 77: 1818. 1999.

Basionym: *Calonectria colhounii* var. *macroconidialis* Crous *et al.*, Mycotaxon 46: 222. 1993.

Synonyms: *Cylindrocladium colhounii* var. macroconidiale Crous *et al*., Mycotaxon 46: 222. 1993.

Cylindrocladium macroconidiale (Crous *et al*.) Crous, Canad. J. Bot. 77: 1818. 1999.

Calonectria parva L. Lombard & Crous, Stud. Mycol. 85: 183. 2016.

In: *Calonectria colhounii* species complex.

Typus: PREM 51036 (holotype of *Ca. macroconidialis*; Crous *et al*. 1999), PREM 51035 (holotype of *Cy. macroconidiale*; Crous *et al*. 1999).

Ex-type culture: CBS 114880 = CMW 51219 = CPC 307 = PPRI 4000 (Crous 2002, Crous *et al*. 2006).

Type locality: **South Africa**, Mpumalanga, Sabie.

Type substrate: *Eucalyptus grandis*.

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Barcodes: *act* = MT335050; *cmdA* = MT335282; *his3* = MT335522; *rpb2* = MT412579; *tef1* = MT412813; *tub2* = MT413027 (alternative markers: ITS = MT359743; LSU = MT359503).

Notes: *Calonectria macroconidialis* is closely related to *Ca. madagascariensis* and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. macroconidialis* [(av. 90 × 6.5 µm); Crous *et al.* 1999] are larger than those of *Ca. madagascariensis* [(av. 55 × 4.5 µm); Crous 2002]. Furthermore, *Ca. macroconidialis* is characterised as being heterothallic, while *Ca. madagascariensis* is homothallic (Crous *et al.* 1999, Crous 2002) (Supplementary Table S4).

madagascariensis Calonectria Crous, Taxonomy and pathology of *Cylindrocladium* (*Calonectria*) and allied genera: 112. 2002.

Synonym: *Cylindrocladium madagascariense* Crous, Taxonomy and pathology of *Cylindrocladium* (*Calonectria*) and allied genera: 112. 2002.

In: *Calonectria colhounii* species complex.

Typus: PREM 57198 (holotype of *Ca. madagascariensis*; Crous 2002), PREM 57199 (holotype of *Cy. madagascariense*; Crous 2002).

Ex-type culture: CBS 114572 = CMW 23686 = CPC 2252 (Crous *et al*. 2006).

Type locality: **Madagascar**, Rona.

Type substrate: Soil.

Barcodes: *act* = MT335052; *cmdA* = MT335284; *his3* = MT335524; *rpb2* = MT412581; *tef1* = MT412815; *tub2* = MT413029 (alternative markers: ITS = MT359745; LSU = MT359505).

Notes: *Calonectria madagascariensis* is closely related to *Ca. macroconidialis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. madagascariensis* [(av. 55 × 4.5 µm); Crous 2002] are smaller than those of *Ca. macroconidialis* [(av. 90 × 6.5 µm); Crous *et al.* 1999]. *Calonectria madagascariensis* is homothallic (Crous 2002) (Supplementary Table S4).

magnispora Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 174. 2015.

(see ***Calonectria aconidialis***)

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In: *Calonectria kyotensis* species complex.

Typus: CBS H-21471 holotype.

Ex-type culture: CBS 136249 = CMW 35184 = CERC 1860.

Type locality: **China**, GuangXi Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334947; *cmdA* = MT335174; *his3* = MT335413; *tef1* = MT412704 (alternative markers: ITS = MT359634; LSU = MT359394).

Notes: *Calonectria magnispora* was treated as a synonym of *Ca. aconidialis* in this study. In comparisons of DNA sequences for six available gene regions, one base difference in each of the *cmdA*, LSU and *tef1* sequences was found between the ex-type isolate of *Ca. magnispora* (CMW 35184) and the ex-type isolate of *Ca. aconidialis* (CMW 35174). Both species are homothallic and produce orange to orange-brown perithecia, 8-spored asci and 1-septate ascospores, the ascospores of *Ca. magnispora* (av. 40 × 6 µm) are longer than those of *Ca. aconidialis* (av. 36 × 6 µm) (Lombard *et al*. 2015a), which was considered to represent intraspecific variation (Supplementary Table S4).

malesiana Calonectria (Crous) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium malesianum* Crous, Stud. Mycol. 50: 425. 2004.

In: *Calonectria kyotensis* species complex.

Typus: CBS 9885 holotype.

Ex-type culture: CBS 112752 = CMW 23687 = CPC 4223.

Type locality: **Indonesia**, Northern Sumatra.

Type substrate: Soil.

Barcodes: *act* = MT335054; *cmdA* = MT335286; *his3* = MT335526; *rpb2* = MT412583; *tef1* = MT412817; *tub2* = MT413031 (alternative markers: ITS = MT359747; LSU = MT359507).

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Notes: *Calonectria malesiana* is closely related to *Ca. lateralis* and can be distinguished by dimensions of its macroconidia. The macroconidia of *Ca. malesiana* [(av. 47.5 × 4 µm); Crous *et al*. 2004] are longer than those of *Ca. lateralis* [(av. 39 × 4 µm); Lombard *et al*. 2015a] (Supplementary Table S4).

maranhensis Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 107. 2015.

In: *Calonectria cylindrospora* species complex.

Typus: CBS H-21360 holotype.

Ex-type culture: CBS 134811 = LPF142.

Type locality: **Brazil**, Maranhao state, Açailandia.

Type substrate: *Eucalyptus* leaf.

Barcodes: *cmdA* = KM396035; *his3* = KM396118; *tef1* = KM395861; *tub2* = KM395948.

Notes: *Calonectria maranhensis* is closely related to *Ca. brasiliensis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. maranhensis* [(av. 57 × 5 µm); Alfenas *et al.* 2015] are larger than those of *Ca. brasiliensis* [(av. 38 × 3.5 µm); Batista 1951] (Supplementary Table S4).

metrosideri Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 108. 2015.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-21146 holotype.

Ex-type culture: CBS 133603 = LPF101.

Type locality: **Brazil**, Minas Gerais state, Viçosa.

Type substrate: *Metrosideros polymorpha.*

Barcodes: *cmdA* = KC294304; *his3* = KC294307; *tef1* = KC294310; *tub2* = KC294313.

Notes: *Calonectria metrosideri* is closely related to *Ca. brasiliana*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. metrosideri*

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[(av. 45 × 4 µm); Alfenas *et al.* 2013a] are shorter than those of *Ca. brasiliana* [(av. 53 × 4 µm); Lombard *et al*. 2016] (Supplementary Table S4).

mexicana Calonectria C.L. Schoch & Crous, Mycologia 91: 294. 1999.

Synonym: *Cylindrocladium mexicanum* C.L. Schoch & Crous, Mycologia 91: 294. 1999.

In: *Calonectria mexicana* species complex.

Typus: PREM 55763 (holotype of *Ca. mexicana*; Schoch *et al*. 1999); PREM 55761 (holotype of *Cy. mexicanum*; Schoch *et al*. 1999).

Ex-type culture: CBS 110918 = CMW 9055 = STE-U 927 (Lombard *et al*. 2016).

Type locality: **Mexico**, Yucatan, Uxmal.

Type substrate: Soil.

Barcodes: *act* = GQ280474; *cmdA* = GQ267396; *his3* = FJ972460; *rpb2* = KY653412; *tef1* = FJ972526; *tub2* = AF210863 (alternative markers: ITS = GQ280596; LSU = GQ280718).

Notes: *Calonectria mexicana* is closely related to *Ca. avesiculata*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. mexicana* [(av. 45 × 4 µm); Schoch *et al*. 1999] are smaller than those of *Ca. avesiculata* [(av. 64 × 5 µm); Schubert *et al*. 1989], and the vesicles of *Ca. mexicana* (7–12 µm) are wider than those of *Ca. avesiculata* (1–4 µm). *Calonectria mexicana* is heterothallic (Schoch *et al*. 1999) (Supplementary Table S4).

microconidialis Calonectria L. Lombard *et al*., Stud. Mycol. 80: 175. 2015.

(see ***Calonectria pseudoreteaudii***)

In: *Calonectria reteaudii* species complex.

Typus: CBS H-21473 holotype.

Ex-type culture: CBS 136638 = CMW 31487 = CERC 1822.

Type locality: **China**, GuangDong Province, ZhanJiang.

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Type substrate: *Eucalyptus urophylla* × *grandis* clone seedling.

Barcodes: *act* = MT335113; *cmdA* = MT335348; *his3* = MT335588; *rpb2* = MT412641; *tef1* = MT412879; *tub2* = MT413090 (alternative markers: ITS = MT359809; LSU = MT359569).

Notes: *Calonectria microconidialis* was treated as a synonym of *Ca. pseudoreteaudii* in this study. In comparisons of DNA sequences, all eight gene sequences for the isolates of *Ca. microconidialis* (ex-type CMW 31487, CMW 31473, CMW 31475, and CMW 31492) were 100 % identical to the isolates of *Ca. pseudoreteaudii* (ex-type CMW 25310, and CMW 25292). Both species produce narrowly clavate vesicles with overlapping dimensions (*Ca. microconidialis*: 3–7 µm; *Ca. pseudoreteaudii*: 3–5 µm), they also produce multiple-septate (> 3) macroconidia and 1–3-septate microconidia. The macroconidia of *Ca. microconidialis* (av. 88 × 8 µm) are shorter than those of *Ca. pseudoreteaudii* (av. 104 × 8 µm) (Lombard *et al*. 2010c, 2015a), which was considered to represent intraspecific variation (Supplementary Table S4).

montana Calonectria Q.L. Liu & S.F. Chen, Mycokeys 26: 48. 2017.

(see ***Calonectria canadiana***)

In: *Calonectria kyotensis* species complex.

Typus: CSFF 2022 holotype.

Ex-type culture: CERC 8952.

Type locality: **China**, HeNan.

Type substrate: Soil under natural forest.

Barcodes: *act* = MT335058; *cmdA* = MT335290; *his3* = MT335530; *rpb2* = MT412587; *tef1* = MT412821; *tub2* = MT413035 (alternative markers: ITS = MT359751; LSU = MT359511).

Notes: *Calonectria montana* was treated as a synonym of *Ca. canadiana* in this study. In comparisons of DNA sequences for eight gene regions, the only difference between the ex-type isolate of *Ca. montana* (CERC 8952) and the ex-type isolate of *Ca. canadiana* (CMW 23673) was in the ITS, *rpb2* and *tub2* sequences, where there was one base difference in the ITS, one base difference in the *rpb2* and seven base differences in the *tub2* sequences. Both

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species produce pyriform to sphaeropedunculate vesicles with overlapping dimensions (*Ca. montana*: 4–12.5 µm; Liu & Chen 2017, *Ca. canadiana*: 6–10 µm; Kang *et al.* 2001b) and 1-septate macroconidia. The macroconidia of *Ca. montana* [(av. 43.2 × 4.6 µm); Liu & Chen 2017] are shorter than those of *Ca. canadiana* [(av. 50 × 4 µm); Kang *et al.* 2001b], which was considered to represent intraspecific variation (Supplementary Table S4).

monticola Calonectria L. Lombard & Crous, Persoonia 35: 293. 2015.

In: *Calonectria colhounii* species complex.

Typus: CBS H-22376 holotype.

Ex-type culture: CBS 140645 = CPC 28835.

Type locality: **Thailand**, Chiang Mai.

Type substrate: Soil.

Barcodes: *cmdA* = KT964771; *tef1* = KT964773; *tub2* = KT964769 (alternative markers: ITS = KT964775; LSU = KT983443).

Notes: *Calonectria monticola* is closely related to *Ca. honghensis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. monticola* [(av. 49 × 5 µm); Crous *et al.* 2015] are smaller than those of *Ca. honghensis* [(av. 54 × 5.5 µm); Li *et al.* 2017] (Supplementary Table S4).

mossambicensis Calonectria S. Maússe-Sitoe *et al.*, Persoonia 31: 291. 2013.

(see ***Calonectria pauciramosa***)

In: *Calonectria candelabrum* species complex.

Typus: PREM 60821 holotype.

Ex-type culture: CBS 137243 = CMW 36327.

Type locality: **Mozambique**, Manica, Bandula.

Type substrate: Cutting clones of *Eucalyptus grandis* × *E. camaldulensis*.

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Barcodes: *act* = MT335091; *cmdA* = MT335323; *his3* = MT335563; *rpb2* = MT412616; *tef1* = MT412854; *tub2* = MT413066 (alternative markers: ITS = MT359784; LSU = MT359544).

Notes: *Calonectria mossambicensis* was treated as a synonym of *Ca. pauciramosa* in this study. In comparisons of DNA sequences for eight gene regions, all the sequences of the isolates of *Ca. mossambicensis* (ex-type CBS 137243, and CMW 36329) were 100 % identical to those of the isolates of *Ca. pauciramosa* (ex-type CBS 138824, CMW 2151, CMW 7592, CMW 9151, CMW 30823, and CMW 30875). Both species produce obpyriform to ellipsoidal vesicles with overlapping dimensions (*Ca. mossambicensis*: 2–8 µm; *Ca. pauciramosa*: 5–11 µm) and 1-septate macroconidia. The macroconidia of *Ca. mossambicensis* (av. 42 × 4 µm) are smaller than those of *Ca. pauciramosa* (av. 50 × 4.5 µm) (Crous 2002, Crous *et al.* 2013), which was considered to represent intraspecific variation (Supplementary Table S4).

multilateralis Calonectria L. Lombard *et al.*, Stud. Mycol. 85: 182. 2016.

In: *Calonectria naviculata* species complex.

Typus: CBS H-22762 holotype.

Ex-type culture: CBS 110932 = CMW 51171 = CPC 957.

Type locality: **Mexico**, Uxmal.

Type substrate: Soil.

Barcodes: *act* = MT335060; *cmdA* = MT335292; *his3* = MT335532; *rpb2* = MT412589; *tef1* = MT412823; *tub2* = MT413037 (alternative markers: ITS = MT359753; LSU = MT359513).

Notes: *Calonectria multilateralis* is closely related to *Ca. multinaviculata* and *Ca. naviculata*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. multilateralis* [(av. 33 × 3 µm); Lombard *et al.* 2016] are shorter than those of *Ca. multinaviculata* [(av. 46 × 3.5 µm); Alfenas *et al.* 2015] and *Ca. naviculata* [(av. 45 × 3 µm); Crous *et al.* 1997a] (Supplementary Table S4).

multinaviculata Calonectria R.F. Alfenas *et al.*, Stud. Mycol. 80: 108. 2015.

In: *Calonectria naviculata* species complex.

Typus: CBS 134858 holotype.

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Ex-type culture: CBS 134858 = LPF233.

Type locality: **Brazil**, Bahia state, Mucuri.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *cmdA* = KM396072; *his3* = KM396155; *tef1* = KM395898; *tub2* = KM395985.

Notes: *Calonectria multinaviculata* is phylogenetically closely related to *Ca. naviculata*, *Ca. multinaviculata* can be distinguished from *Ca. naviculata* by its lateral stipe extensions, a feature not observed for the *Ca. naviculata* (Crous *et al.* 1997a, Alfenas *et al.* 2015) (Supplementary Table S4).

multiphialidica Calonectria (Crous *et al.*) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium multiphialidicum* Crous *et al.*, Stud. Mycol. 50: 425. 2004.

In: *Calonectria naviculata* species complex.

Typus: CBS 9887 holotype.

Ex-type culture: CBS 112678 = CMW 23688 = Cam 13.

Type locality: **Cameroon**.

Type substrate: Soil surrounding roots of *Musa* sp.

Barcodes: *act* = MT335066; *cmdA* = MT335298; *his3* = MT335538; *rpb2* = MT412595; *tef1* = MT412829; *tub2* = MT413043 (alternative markers: ITS = MT359759; LSU = MT359519).

Notes: *Calonectria multiphialidica* is closely related to *Ca. henricotiae* and *Ca. pseudonaviculata* and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. multiphialidica* [(av. 53 × 4.5 µm); Crous *et al.* 2004] are smaller than those of *Ca. henricotiae* [(av. 56 × 5.6 µm); Gehesquiere *et al.* 2015] and *Ca. pseudonaviculata* [(av. 60 × 5 µm); Crous *et al.* 2002] (Supplementary Table S4). Furthermore, *Ca. multiphialidica* has eight tiers of branches in its conidiogenous apparatus in comparison to the two in *Ca. henricotiae* and four in *Ca. pseudonaviculata* (Crous *et al.* 2002, 2004, Gehesquiere *et al.* 2015).

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multiseptata Calonectria Crous & M.J. Wingfield, Mycol. Res. 102: 530. 1998.

Synonym: *Cylindrocladium multiseptatum* Crous & M.J. Wingf., Mycol. Res. 102: 530. 1998.

In: *Calonectria reteaudii* species complex.

Typus: PREM 55343 (holotype of *Ca*. *multiseptata*; Crous *et al*. 1998), PREM 55344 (holotype of *Cy*. *multiseptatum*; Crous *et al*. 1998)

Ex-type culture: CBS 112682 = CMW 23692 = CPC 1589 (Crous 2002, Crous *et al*. 2006).

Type locality: **Indonesia**, North Sumatra.

Type substrate: *Eucalyptus grandis*.

Barcodes: *act* = MT335067; *cmdA* = MT335299; *his3* = MT335539; *rpb2* = MT412596; *tef1* = MT412830; *tub2* = MT413044 (alternative markers: ITS = MT359760; LSU = MT359520).

Notes: *Calonectria multiseptata* is phylogenetically closely related to *Ca. acicola*. The ability of *Ca. multiseptata* to produce megaconidiophores and megaconidia in culture distinguishes it from *Ca. acicola* (Crous 2002, Gadgil & Dick 2004). *Calonectria multiseptata* is homothallic (Crous 2002) (Supplementary Table S4).

multistipitata Calonectria N.Q. Pham *et al*., Mycologia 111: 98. 2019.

(see ***Calonectria chinensis***)

In: *Calonectria kyotensis* species complex.

Typus: PREM 62121 holotype.

Ex-type culture: CBS 143573 = CMW 47192.

Type locality: **Vietnam**, Tuyen Quang.

Type substrate: Soil in *Acacia* hybrid plantation.

Barcodes: *act* = MT335068; *cmdA* = MT335300; *his3* = MT335540; *rpb2* = MT412597; *tef1* = MT412831; *tub2* = MT413045 (alternative markers: ITS = MT359761; LSU = MT359521).

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Notes: *Calonectria multistipitata* was treated as a synonym of *Ca. chinensis* in this study. In comparisons of DNA sequences for eight gene regions, the only difference between the ex-type isolate of *Ca. multistipitata* (CMW 47192) and the ex-type isolate of *Ca. chinensis* (CMW 23674) was in the *his3*, ITS, *tef1* and *tub2* sequences, where there was one base difference in the *his3*, one base difference in the ITS, one base difference in the *tef1* and four base differences in the *tub2* sequences. Both species produce sphaeropedunculate vesicles with overlapping dimensions (*Ca. multistipitata*: 5–10 µm; *Ca. chinensis*: 6–9 µm) and 1-septate macroconidia. The macroconidia of *Ca. multistipitata* (av. 32 × 3.5 µm) are smaller than those of *Ca. chinensis* (av. 45 × 4 µm) (Crous *et al*. 2004, Pham *et al*. 2019), which was considered to represent intraspecific variation (Supplementary Table S4).

naviculata Calonectria Crous & M.J. Wingf., Mycologia 89: 654. 1997.

Synonym: *Cylindrocladium naviculatum* Crous & M.J. Wingf., Mycotaxon 50: 443. 1994.

In: *Calonectria naviculata* species complex.

Typus: PREM 54418 (holotype of *Ca. naviculata*; Crous *et al.* 1997a), PREM 51542 (holotype of *Cy. naviculatum*; Crous *et al.* 1994).

Ex-type culture: CBS 101121 = CMW 30974 (Lombard *et al*. 2010a).

Type locality: **Brazil**, Joao Pessoa.

Type substrate: Leaf litter.

Barcodes: *act* = GQ280478; *cmdA* = GQ267399; *his3* = GQ267252; *rpb2* = KM232309; *tef1* = GQ267317; *tub2* = GQ267211 (alternative markers: ITS = GQ280600; LSU = GQ280722).

Notes: *Calonectria naviculata* is phylogenetically closely related to *Ca*. *multinaviculata*, it can be distinguished from *Ca*. *multinaviculata* by its lack of lateral stipe extensions, a feature that is common in *Ca*. *multinaviculata* (Crous *et al.* 1997a, Alfenas *et al*. 2015). *Calonectria naviculata* is heterothallic (Crous *et al.* 1997a) (Supplementary Table S4).

nemoralis Calonectria L. Lombard & Crous, Stud. Mycol. 86: 114. 2017.

(see ***Calonectria ovata***)

In: *Calonectria pteridis* species complex.

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Typus: CBS H-23135 holotype.

Ex-type culture: CBS 116249 = CMW 51829 = CPC 3533.

Type locality: **Brazil**.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT335074; *cmdA* = MT335306; *his3* = MT335546; *rpb2* = MT412603; *tef1* = MT412837; *tub2* = MT413051 (alternative markers: ITS = MT359767; LSU = MT359527).

Notes: *Calonectria nemoralis* was treated as a synonym of *Ca. ovata* in this study. In comparisons of DNA sequences for seven available gene regions, the only difference between the ex-type isolate of *Ca. nemoralis* (CBS 116249) and the ex-type isolate of *Ca. ovata* (CMW 16724) was found in the *tub2* gene sequences where one base difference occurred. Both of the species produce ovoid vesicles and 1-septate macroconidia. The macroconidia of *Ca. nemoralis* [(av. 53 × 4 µm); Marin-Felix *et al.* 2017] are smaller than those of *Ca. ovata* [(av. 70 × 5 µm); Victor *et al.* 1997], which was considered to represent intraspecific variation (Supplementary Table S4).

nemoricola Calonectria R.F. Alfenas *et al*., (as *nemuricola*) Stud. Mycol. 80: 109. 2015.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-21358 holotype.

Ex-type culture: CBS 134837 = LPF085.

Type locality: **Brazil**, Minas Gerais state, Araponga.

Type substrate: Soil in tropical rainforest.

Barcodes: *cmdA* = KM396066; *his3* = KM396149; *tef1* = KM395892; *tub2* = KM395979.

Notes: *Calonectria nemoricola* is closely related to *Ca. silvicola*, and can be distinguished from *Ca. silvicola* by the dimensions of its macroconidia. The macroconidia of *Ca. nemoricola* [(av. 45 × 4 µm); Alfenas *et al*. 2015] are longer than those of *Ca. silvicola* [(av. 41 × 4.5 µm); Alfenas *et al*. 2015] (Supplementary Table S4).

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nymphaeae Calonectria Yong Wang bis *et al*., Mycotaxon 122: 181. 2013.

(see ***Calonectria fujianensis***)

In: *Calonectria colhounii* species complex.

Typus: HGUPd100003 holotype.

Ex-type culture: CBS 131802= CMW 51317 = HGUP 100003.

Type locality: **China**, Guizhou, Guiyang.

Type substrate: *Nymphaea tetragona*.

Barcodes: *act* = MT335070; *cmdA* = MT335302; *his3* = MT335542; *rpb2* = MT412599; *tef1* = MT412833; *tub2* = MT413047 (alternative markers: ITS = MT359763; LSU = MT359523).

Notes: *Calonectria nymphaeae* was treated as a synonym of *Ca. fujianensis* in this study. In comparisons of DNA sequences for eight gene regions, the only difference between the ex-type isolate of *Ca. nymphaeae* (CBS 131802) and the ex-type isolate of *Ca. fujianensis* (CMW 27257) was in the ITS, *tef1* and *tub2* sequences, where there was one base difference in the ITS, three base differences in the *tef1* and three base differences in the *tub2* sequences. Both species are homothallic and produce clavate vesicles with similar dimensions (*Ca. nymphaeae*: 3–5 µm; *Ca. fujianensis*: 3–5 µm). The macroconidia of *Ca. nymphaeae* (av. 61 × 5.9 µm) are larger than those of *Ca. fujianensis* (av. 52.5 × 4 µm) (Chen *et al.* 2011, Xu *et al*. 2012, Li *et al*. 2020), which was considered to represent intraspecific variation (Supplementary Table S4).

octoramosa Calonectria L. Lombard & Crous, Stud. Mycol. 86: 120. 2017.

In: *Calonectria brassicae* species complex.

Typus: CBS H-23136 holotype.

Ex-type culture: CBS 111423 = CMW 51819 = CPC 1650.

Type locality: **Ecuador**.

Type substrate: Soil.

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Barcodes: *act* = MT335071; *cmdA* = MT335303; *his3* = MT335543; *rpb2* = MT412600; *tef1* = MT412834; *tub2* = MT413048 (alternative markers: ITS = MT359764; LSU = MT359524).

Notes: *Calonectria octoramosa* is closely related to *Ca. ecuadorae* and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. octoramosa* [(av. 36 × 4 µm); Marin-Felix *et al*. 2017] are smaller than those of *Ca. ecuadorae* [(av. 51 × 4.5 µm); Crous *et al*. 2006] (Supplementary Table S4).

orientalis Calonectria L. Lombard *et al.*, Stud. Mycol. 66: 49. 2010.

In: *Calonectria brassicae* species complex.

Typus: PREM 60303 holotype.

Ex-type culture: CBS 125260 = CMW 20291.

Type locality: **Indonesia**, Langam.

Type substrate: Soil.

Barcodes: *act* = MT335072; *cmdA* = MT335304; *his3* = MT335544; *rpb2* = MT412601; *tef1* = MT412835; *tub2* = MT413049 (alternative markers: ITS = MT359765; LSU = MT359525).

Notes: *Calonectria orientalis* is closely related to *Ca. pini* and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. orientalis* (av. 48 × 4 µm) are longer than those of *Ca. pini* (av. 44 × 5 µm) (Lombard *et al*. 2010a) (Supplementary Table S4). Furthermore, *Ca. orientalis* produces five tiers of branches in its conidiogenous apparatus in comparison to the three in *Ca. pini* (Lombard *et al*. 2010a).

ovata Calonectria D. Victor & Crous, Syst. Appl. Microbiol. 20: 282. 1997

Synonyms: *Cylindrocladium ovatum* El-Gholl *et al*., Canad. J. Bot. 71: 469. 1993.

Calonectria tereticornis L. Lombard & Crous, Stud. Mycol. 85: 190. 2016.

Calonectria nemoralis L. Lombard & Crous, Stud. Mycol. 86: 114. 2017.

Calonectria tucuruiensis L. Lombard & Crous, Stud. Mycol. 86: 123. 2017.

In: *Calonectria pteridis* species complex.

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Typus: PREM 51726 (holotype of *Ca. ovata*; Victor *et al*. 1997), FLAS F55638 (holotype of *Cy. ovatum*; El-Gholl *et al*. 1993a).

Ex-type culture: CBS 111299 = CMW 16724 = ATCC 76225 = UFV 89 (Lombard *et al.* 2010a).

Type locality: **Brazil**, Pará, Monte Dourado.

Type substrate: *Eucalyptus urophylla*.

Barcodes: *act* = MT335075; *cmdA* = MT335307; *his3* = MT335547; *tef1* = MT412838; *tub2* = MT413052 (alternative markers: ITS = MT359768; LSU = MT359528).

Notes: *Calonectria ovata* is phylogenetically closely related to *Ca*. *pseudovata* and *Ca*. *terricola*. The macroconidia of *Ca. ovata* [(av. 70 × 5 µm); Victor *et al.* 1997] are larger than those of *Ca. terricola* [(av. 46 × 4.5 µm); Lombard *et al*. 2016]. Furthermore, the ability of *Ca. ovata* to produce miconidiophores and microconidia in culture distinguishes it from *Ca. terricola* (Victor *et al.* 1997, Lombard *et al*. 2016). Morphologically, *Ca*. *ovata* shows some overlap with *Ca. pseudovata*, while the sequences of *cmdA*, *his3*, *tef1* and *tub2* gene regions can differentiate *Ca*. *ovata* from *Ca. pseudovata* (Victor *et al.* 1997, Alfenas *et al*. 2015). *Calonectria ovata* is heterothallic (Li *et al*. 2020).

pacifica Calonectria (J.C. Kang *et al*.) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium pacificum* J.C. Kang *et al*., Syst. Appl. Microbiol. 24: 213. 2001.

In: *Calonectria kyotensis* species complex.

Typus: PREM 57209 holotype.

Ex-type culture: CBS 109063 = CMW 16726 = IMI 354528 = STE-U 2534 = A1568.

Type locality: **USA**, Hawaii.

Type substrate: *Araucaria heterophylla*.

Barcodes: *act* = MT335079; *cmdA* = MT335311; *his3* = MT335551; *rpb2* = MT412604; *tef1* = MT412842 (alternative markers: ITS = MT359772; LSU = MT359532).

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Notes: *Calonectria pacifica* is phylogenetically closely related to *Ca. aconidialis* and can be differentiated from that species by the sequences of *act*, *cmdA*, *his3*, *rpb2*, ITS, LSU and *tef1* gene regions.

papillata Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 175. 2015.

(see ***Calonectria cerciana***)

In: *Calonectria cylindrospora* species complex.

Typus: CBS H-21487 holotype.

Ex-type culture: CBS 136097 = CMW 37976 = CPC 23517 = CERC 1939.

Type locality: **China**, GuangDong.

Type substrate: Soil in a *Eucalyptus* plantation.

Barcodes: *act* = MT334983; *cmdA* = MT335213; *his3* = MT335453; *rpb2* = MT412517; *tef1* = MT412744; *tub2* = MT412965 (alternative markers: ITS = MT359674; LSU = MT359434).

Notes: *Calonectria papillata* was treated as a synonym of *Ca. cerciana* in this study. In comparisons of DNA sequences for eight gene regions, there were differences between the ex-type isolate of *Ca. papillata* (CMW 37976) and the ex-type isolate of *Ca. cerciana* (CMW 25309) in the ITS, *rpb2* and *tub2* sequences. These included one base difference in the ITS sequences, one base difference in the *rpb2* and two base differences in the *tub2* sequences. Both species produce obpyriform vesicles and 1-septate macroconidia, and have similar vesicle dimensions (*Ca. papillata*: 8–14 µm; *Ca. cerciana*: 8–13 µm) and macroconidia (*Ca. papillata*: av. 45 × 4 µm; *Ca. cerciana*: av. 44 × 5 µm) (Lombard *et al.* 2010c, 2015a) (Supplementary Table S4).

paracolhounii Calonectria L. Lombard & Crous, Stud. Mycol. 85: 183. 2016.

In: *Calonectria colhounii* species complex.

Typus: CBS H-22763 holotype.

Ex-type culture: CBS 114679 = CMW 51212 = CPC 2445.

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Type locality: **USA**.

Type substrate: Unknown.

Barcodes: *cmdA* = KX784582; *rpb2* = KY653423; *tef1* = KX784714; *tub2* = KX784644 (alternative markers: ITS = KY653268; LSU = KY653324).

Notes: *Calonectria paracolhounii* is closely related to *Ca. colhounii* and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. colhounii* [(av. 65 × 5 µm); Peerally 1973] are longer than those of *Ca. paracolhounii* [(av. 41 × 5 µm); Lombard *et al.* 2016] (Supplementary Table S4).

paraensis Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 111. 2015.

Synonym: *Calonectria telluricola* R.F. Alfenas *et al*., Stud. Mycol. 80: 125. 2015.

In: *Calonectria brassicae* species complex.

Typus: CBS H-21379 holotype.

Ex-type culture: CBS 134669 = LPF430.

Type locality: **Brazil**, Pará state, Monte Dourado.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *cmdA* = KM396011; *his3* = KM396094; *tef1* = KM395837; *tub2* = KM395924.

Notes: *Calonectria paraensis* is closely related to *Ca. orientalis*, *Ca. pini* and *Ca. pseudobrassicae*. The macroconidia of *Ca. paraensis* [(av. 42 × 5 µm); Alfenas *et al*. 2015] are shorter than those of *Ca. orientalis* [(av. 48 × 4 µm); Lombard *et al*. 2010a] and *Ca. pini* [(av. 44 × 5 µm); Lombard *et al*. 2010a]. *Calonectria paraensis* has two tiers of branches in its conidiogenous apparatus in comparison to the five in *Ca. orientalis*, three in *Ca. pini* and *Ca. pseudobrassicae* (Lombard *et al*. 2010a, Alfenas *et al*. 2015) (Supplementary Table S4).

parakyotensis Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 176. 2015.

(see ***Calonectria aconidialis***)

In: *Calonectria kyotensis* species complex.

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Typus: CBS H-21470 holotype.

Ex-type culture: CBS 136085 = CMW 35169 = CERC 1845.

Type locality: **China**, GuangDong Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334948; *cmdA* = MT335175; *his3* = MT335414; *rpb2* = MT412483; *tef1* = MT412705 (alternative markers: ITS = MT359635; LSU = MT359395).

Notes: *Calonectria parakyotensis* was treated as a synonym of *Ca. aconidialis* in this study. In comparisons of DNA sequences for seven available gene regions, all seven gene sequences for the isolates of *Ca. parakyotensis* (ex-type CMW 35169, and CMW 35413) were 100 % identical to those of the ex-type isolate of *Ca. aconidialis* (CMW 35174). Both species are homothallic but no sexual morph was observed for *Ca. parakyotensis* (Lombard *et al*. 2015a, Li *et al*. 2020; Supplementary Table S4).

parva Calonectria L. Lombard & Crous, Stud. Mycol. 85: 183. 2016.

(see ***Calonectria macroconidialis***)

In: *Calonectria colhounii* species complex.

Typus: CBS H-22764 holotype.

Ex-type culture: CBS 110798 = CMW 51817 = CPC 410.

Type locality: **South Africa**, Mpumalanga, Sabie.

Type substrate: *Eucalyptus grandis* (roots).

Barcodes: *act* = MT335051; *cmdA* = MT335283; *his3* = MT335523; *rpb2* = MT412580; *tef1* = MT412814; *tub2* = MT413028 (alternative markers: ITS = MT359744; LSU = MT359504).

Notes: *Calonectria parva* was treated as a synonym of *Ca. macroconidialis* in this study. In comparisons of DNA sequences for eight gene regions, the only differences between the ex-type isolate of *Ca. parva* (CBS 110798) and the ex-type isolate of *Ca. macroconidialis* (CBS 114880) was found in the *tef1* gene sequences. Both species produce clavate vesicles of similar

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dimensions (*Ca. parva*: 3–5 µm; *Ca. macroconidialis*: 3–5 µm) and 3-septate macroconidia (Crous *et al.* 1999, Lombard *et al*. 2016). The macroconidia of *Ca. parva* (av. 72 × 6 µm) are smaller than those of *Ca. macroconidialis* (av. 90 × 6.5 µm) (Crous *et al.* 1999, Lombard *et al*. 2016), which was considered to represent intraspecific variation (Supplementary Table S4).

parvispora Calonectria L. Lombard & Crous, Stud. Mycol. 86: 120. 2017.

In: *Calonectria brassicae* species complex.

Typus: CBS H-22765 holotype.

Ex-type culture: CBS 111465 = CPC 1902.

Type locality: **Brazil**.

Type substrate: Soil.

Barcodes: *act* = MT335082; *cmdA* = MT335314; *his3* = MT335554; *rpb2* = MT412607; *tef1* = MT412845; *tub2* = MT413057 (alternative markers: ITS = MT359775; LSU = MT359535).

Notes: *Calonectria parvispora* is closely related to *Ca. brachiatica*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. parvispora* [(av. 29 × 4 µm); Marin-Felix *et al*. 2017] are smaller than those of *Ca. brachiatica* [(av. 44 × 5 µm); Lombard *et al*. 2009] (Supplementary Table S4).

pauciphialidica Calonectria Q.L. Liu & S.F. Chen, ***sp. nov.*** MycoBank MB835284. Fig. 3.

In: *Calonectria brassicae* species complex.

Etymology: Name refers to the macroconidiophores that produce few phialides.

Sexual morph unknown. *Macroconidiophores* consisting of a stipe bearing a penicillate arrangement of fertile branches, stipe extension and vesicle not observed; stipe septate, hyaline, smooth, 40–80 × 3–4 µm; Conidiogenous apparatus 8.6–20 µm wide, and 14.3–25 µm long; primary branches aseptate, 11–18 × 2–3 µm, each terminal produces two to four phialides, phialides doliiform to reniform, hyaline, aseptate, 6−9 × 2–3 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at both ends, straight, (25–)27–32(–36) × (2–)2.5–3.5(–4) µm, (av. 29.5 × 3 µm), 1-septate, lacking a visible

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abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies white on the surface and buff in reverse after 7 d at 25 °C on MEA; abundant wooly aerial mycelium with moderate sporulation on the medium surface; chlamydospores not observed. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 15.1 mm, 21.4 mm, 45.1 mm, 58.2 mm and 42.1 mm, respectively.

Typus: **Ecuador**, soil, 20 Jun. 1997, M.J. Wingfield (**holotype** HMAS 255717, ex-type culture CBS 111394 = CMW 30980 = CPC 1628).

Barcodes: *act* = MT335083; *cmdA* = MT335315; *his3* = MT335555; *rpb2* = MT412608; *tef1* = MT412846; *tub2* = MT413058 (alternative markers: ITS = MT359776; LSU = MT359536).

Notes: *Calonectria pauciphialidica* is a novel species in the *Ca. brassicae* species complex, closely related to *Ca. ecuadorae* (Fig. 1, Supplementary Table S4). The sequences of *cmdA*, *his3*, *rpb2*, *tef1* and *tub2* gene regions can differentiate *Ca. pauciphialidica* from that species. The smaller number of branches and phialides of *Ca. pauciphialidica* distinguish it from *Ca. ecuadorae*; in addition, macroconidia of *Ca. pauciphialidica* (av. 29.5 × 3 µm) are smaller than those of *Ca. ecuadorae* [(av. 51 × 4.5 µm); Crous *et al*. 2006] (Supplementary Table S4).

pauciramosa Calonectria C.L. Schoch & Crous, Mycologia 91: 289. 1999.

Synonyms: *Cylindrocladium pauciramosum* C.L. Schoch & Crous, Mycologia 91: 289. 1999.

Calonectria polizzii L. Lombard *et al.*, Stud. Mycol. 66: 25. 2010.

Calonectria zuluensis L. Lombard & Crous, Stud. Mycol. 66: 25. 2010.

Calonectria mossambicensis S. Maússe-Sitoe *et al.*, Persoonia 31: 291. 2013.

Calonectria seminaria L. Lombard *et al.*, Stud. Mycol. 80: 179. 2015.

Calonectria tetraramosa L. Lombard *et al.*, Stud. Mycol. 80: 183. 2015.

Calonectria cliffordiicola L. Lombard & Crous, Stud. Mycol. 85: 177. 2016.

Calonectria ericae L. Lombard & Crous, Stud. Mycol. 85: 178. 2016.

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Calonectria machaerinae L. Lombard & Crous, Stud. Mycol. 85: 181. 2016.

In: *Calonectria candelabrum* species complex.

Typus: PREM 55754 [holotype of *Ca. pauciramosa*; Schoch *et al*. 1999], PREM 55752 (holotype of *Cy. pauciramosum*; Schoch *et al*. 1999).

Ex-type culture: CBS 138824 = CMW 5683 = CPC 971 (Crous 2002, Lombard *et al.* 2010a).

Type locality: **South Africa**, Knysna.

Type substrate: Soil/*Eucalyptus grandis* (Crous 2002, Lombard *et al.* 2015a)

Barcodes: *act* = MT335093; *cmdA* = MT335325; *his3* = MT335565; *rpb2* = MT412618; *tef1* = MT412856; *tub2* = MT413068 (alternative markers: ITS = MT359786; LSU = MT359546).

Notes: *Calonectria pauciramosa* is closely related to *Ca*. *nemoricola* and *Ca*. *silvicola*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. pauciramosa* [(av. 50 × 4.5 µm); Crous 2002] are longer than those of *Ca. nemoricola* [(av. 45 × 4 µm); Alfenas *et al*. 2015] and *Ca*. *silvicola* [(av. 41 × 4.5 µm); Alfenas *et al*. 2015] (Supplementary Table S4). *Calonectria pauciramosa* is heterothallic (Crous 2002, Li *et al*. 2020). *Calonectria pauciramosa* is an important plant pathogen that has been reported as the dominant species in many countries such as Australia, Brazil, Italy, South Africa and the USA (Koike *et al.* 1999, Polizzi & Crous 1999, Schoch *et al.* 1999, Crous 2002), while Lombard *et al.* (2010c) and Chen *et al.* (2011) also confirmed its occurrence in China. In this study, the eight species reduced to synonymy with *Ca. pauciramosa* were originally collected in different climatic zones on five continents (Africa, Asia, Europe, North America and Oceania), supporting the view that *Ca. pauciramosa* is a cosmopolitan species with the ability to exist in areas with a range of climatic conditions.

penicilloides Calonectria (Tubaki) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Candelospora penicilloides* Tubaki, Nogaoa 2: 58. 1952.

Synonym: *Cylindrocladium penicilloides* (Tubaki) Tubaki, J. Hattori Bot. Lab. 20: 154. 1958.

In: *Calonectria kyotensis* species complex.

Typus: type specimen lost (Tubaki 1958).

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Ex-type culture: CBS 174.55 = CMW 23696= STE-U 2388.

Type locality: **Japan**, Hatizyo Island.

Type substrate: *Prunus* sp.

Barcodes: *act* = MT335106; *cmdA* = MT335338; *his3* = MT335578; *rpb2* = MT412631; *tef1* = MT412869; *tub2* = MT413081 (alternative markers: ITS = MT359799; LSU = MT359559).

Notes: Phylogenetically, *Ca. penicilloides* forms a distinct lineage separate from other species in this species complex.

pentaseptata Calonectria L. Lombard *et al*., Persoonia 29: 157. 2012.

(see ***Calonectria pseudoreteaudii***)

In: *Calonectria reteaudii* species complex.

Typus: CBS H-21062 holotype.

Ex-type culture: CBS 133349 = CMW 51318.

Type locality: **Vietnam**, Bavi, Hanoi.

Type substrate: *Eucalyptus* hybrid.

Barcodes: *act* = MT335117; *cmdA* = MT335352; *his3* = MT335592; *rpb2* = MT412645; *tef1* = MT412883; *tub2* = MT413094 (alternative markers: ITS = MT359813; LSU = MT359573).

Notes: *Calonectria pentaseptata* was treated as a synonym of *Ca. pseudoreteaudii* in this study. In comparison of DNA sequences, all eight gene sequences for the isolates of *Ca. pentaseptata* (ex-type CBS 133349, and CBS 133351) were 100 % identical to the isolates of *Ca. pseudoreteaudii* (ex-type CMW 25310, and CMW 25292). Both species produce narrowly clavate vesicles with similar dimensions (*Ca. pentaseptata*: 2–6 µm; *Ca. pseudoreteaudii*: 3–5 µm) and multiple-septate (> 3) macroconidia. The macroconidia of *Ca. pentaseptata* (av. 98 × 7 µm) are smaller than those of *Ca. pseudoreteaudii* (av. 104 × 8 µm) (Lombard *et al*. 2010c, Crous *et al*. 2012), which was considered to represent intraspecific variation (Supplementary Table S4).

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piauiensis Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 112. 2015.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-21375 holotype.

Ex-type culture: CBS 134850 = LPF377.

Type locality: **Brazil**, Piauí state, Teresina.

Type substrate: Soil in *Eucalyptus brassiana* plantation.

Barcodes: *cmdA* = KM396060; *his3* = KM396143; *tef1* = KM395886; *tub2* = KM395973.

Notes: Phylogenetically, *Ca. piauiensis* forms a distinct lineage separate from other species in this species complex.

pini Calonectria L. Lombard *et al.*, Stud. Mycol. 66: 52. 2010.

In: *Calonectria brassicae* species complex.

Typus: PREM 60304 holotype.

Ex-type culture: CBS 123698 = CMW 31209.

Type locality: **Colombia**, Valle del Cauca, Buga.

Type substrate: *Pinus patula*.

Barcodes: *act* = MT335107; *cmdA* = MT335339; *his3* = MT335579; *rpb2* = MT412632; *tef1* = MT412870; *tub2* = MT413082 (alternative markers: ITS = MT359800; LSU = MT359560).

Notes: *Calonectria pini* is closely related to *Ca. orientalis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. pini* [(av. 44 × 5 µm); Lombard *et al*. 2010a] are shorter than those of *Ca. orientalis* [(av. 48 × 4 µm); Lombard *et al*. 2010a] (Supplementary Table S4). Furthermore, the small number of branches (−3) in the conidiogenous apparatus also distinguishes it from *Ca. orientalis* (−5) (Lombard *et al*. 2010a).

plurilateralis Calonectria L. Lombard & Crous, Stud. Mycol. 85: 184. 2016.

In: *Calonectria cylindrospora* species complex.

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Typus: CBS H-22766 holotype.

Ex-type culture: CBS 111401 = CMW 51178 = CPC 1637.

Type locality: **Ecuador**.

Type substrate: Soil.

Barcodes: *cmdA* = MT335340; *his3* = MT335580; *rpb2* = MT412633; *tef1* = MT412871; *tub2* = MT413083 (alternative markers: ITS = MT359801; LSU = MT359561).

Notes: *Calonectria plurilateralis* is phylogenetically closely related to *Ca. brasiliensis*, *Ca. hawksworthii* and *Ca. maranhensis*, and can be distinguished from these species by the dimensions of its macroconidia. The macroconidia of *Ca. plurilateralis* [(av. 34 × 4 µm); Lombard *et al*. 2016] are shorter than those of *Ca. brasiliensis* [(av. 38 × 3.5 µm); Batista 1951], *Ca. hawksworthii* [(av. 56 × 4 µm); Lombard *et al*. 2010a] and *Ca. maranhensis* [(av. 57 × 5 µm); Alfenas *et al*. 2015] (Supplementary Table S4).

pluriramosa Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 178. 2015.

(see ***Calonectria aconidialis***)

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21485 holotype.

Ex-type culture: CBS 136976 = CMW 31440 = CERC 1775.

Type locality: **China**, GuangXi Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334950; *cmdA* = MT335177; *his3* = MT335416; *tef1* = MT412707 (alternative markers: ITS = MT359637; LSU = MT359397).

Notes: *Calonectria pluriramosa* was treated as a synonym of *Ca. aconidialis* in this study. In comparisons of DNA sequences for six available gene regions (*rpb2* and *tub2* are not available for *Ca. pluriramosa*, *tub2* not available for *Ca. aconidialis*), all six gene sequences for the ex-type isolates of *Ca. pluriramosa* were 100 % identical to the ex-type isolate of *Ca. aconidialis*

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(CMW 35174). No sexual morph has been observed for *Ca. pluriramosa* (Lombard *et al*. 2015a, Supplementary Table S4).

polizzii Calonectria L. Lombard *et al.*, Stud. Mycol. 66: 25. 2010.

(see ***Calonectria pauciramosa***)

In: *Calonectria candelabrum* species complex.

Typus: PREM 60297 holotype.

Ex-type culture: CBS 123402 = CMW 30872.

Type locality: **Italy**, Sicily, Carrubba.

Type substrate: *Arbutus unedo*.

Barcodes: *act* = MT335099; *cmdA* = MT335331; *his3* = MT335571; *rpb2* = MT412624; *tef1* = MT412862; *tub2* = MT413074 (alternative markers: ITS = MT359792; LSU = MT359552).

Notes: *Calonectria polizzii* was treated as a synonym of *Ca. pauciramosa* in this study. In comparisons of DNA sequences for eight gene regions, the only differences between the ex-type isolate of *Ca. polizzii* (CBS 123402) and the ex-type isolate of *Ca. pauciramosa* (CBS 138824) were five base differences in the *tub2* sequence. Both species are heterothallic and produce obpyriform to ellipsoidal vesicles with overlapping dimensions (*Ca. polizzii*: 6–9 µm; *Ca. pauciramosa*: 5–11 µm) and 1-septate macroconidia. The macroconidia of *Ca. polizzii* (av. 37 × 4 µm) are shorter than those of *Ca. pauciramosa* (av. 50 × 4.5 µm) (Crous 2002, Lombard *et al.* 2010b, Li *et al*. 2020), which was considered to represent intraspecific variation (Supplementary Table S4).

propaginicola Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 115. 2015.

Synonym: *Calonectria pseudocerciana* R.F. Alfenas *et al*., Stud. Mycol. 80: 117. 2015.

In: *Calonectria cylindrospora* species complex.

Typus: CBS H-21366 holotype.

Ex-type culture: CBS 134815 = LPF220.

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Type locality: **Brazil**, Pará state, Santana.

Type substrate: *Eucalyptus* seedling.

Barcodes: *cmdA* = KM396040; *his3* = KM396123; *tef1* = KM395866; *tub2* = KM395953.

Notes: *Calonectria propaginicola* is closely related to *Ca*. *cerciana* and *Ca*. *tonkinensis*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. propaginicola* [(av. 49 × 4 µm); Alfenas *et al*. 2015] are longer than those of *Ca. cerciana* [(av. 44 × 5 µm); Lombard *et al*. 2010c] and *Ca*. *tonkinensis* [(av. 41.5 × 4 µm); Pham *et al*. 2019] (Supplementary Table S4).

pseudobrassicae Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 116. 2015.

In: *Calonectria brassicae* species complex.

Typus: CBS H-21371 holotype.

Ex-type culture: CBS 134662 = LPF280.

Type locality: **Brazil**, Pará state, Santana.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *cmdA* = KM396023; *his3* = KM396106; *tef1* = KM395849; *tub2* = KM395936.

Notes: *Calonectria pseudobrassicae* is closely related to *Ca. orientalis*, *Ca. paraensis* and *Ca. pini.* The macroconidia of *Ca. pseudobrassicae* [(av. 41 × 5 µm); Alfenas *et al*. 2015] are shorter than those of *Ca. orientalis* [(av. 48 × 4 µm); Lombard *et al*. 2010a] and *Ca. pini* [(av. 44 × 5 µm); Lombard *et al*. 2010a]. *Calonectria pseudobrassicae* has three tiers of branches in its conidiogenous apparatus in comparison to the two in *Ca. paraensis* (Alfenas *et al*. 2015) (Supplementary Table S4).

pseudocerciana Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 117. 2015.

(see ***Calonectria propaginicola***)

In: *Calonectria cylindrospora* species complex.

Typus: CBS H-21366 holotype.

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Ex-type culture: CBS 134824 = LPF367.

Type locality: **Brazil**, Pará state, Santana.

Type substrate: *Eucalyptus* seedling.

Barcodes: *cmdA* = KM396049; *his3* = KM396132; *tef1* = KM395875; *tub2* = KM395962.

Notes: *Calonectria pseudocerciana* was treated as a synonym of *Ca. propaginicola* in this study. In comparisons of DNA sequences for four available gene regions, the only differences between the ex-type isolate of *Ca. pseudocerciana* (CBS 134824) and the ex-type isolate of *Ca. propaginicola* (CBS 134815) was in the *cmdA*, *his3* and *tub2* sequences, where there were eight base differences in the *cmdA*, one base difference in the *his3* and one base difference in the *tub2* sequences. Both species produce obpyriform to sphaeropedunculate vesicles with similar dimensions (*Ca. pseudocerciana*: 7–12 µm; *Ca. propaginicola*: 5–12 µm) and 1-septate macroconidia, the macroconidia of *Ca. pseudocerciana* (av. 45 × 4 µm) are shorter than those of *Ca. propaginicola* (av. 49 × 4 µm) (Alfenas *et al*. 2015), which was considered to represent intraspecific variation (Supplementary Table S4).

pseudocolhounii Calonectria S.F. Chen *et al*., Persoonia 26: 7. 2011.

(see ***Calonectria eucalypti***)

In: *Calonectria colhounii* species complex.

Typus: PREM 60456 holotype.

Ex-type culture: CBS 127195 = CMW 27209.

Type locality: **China**, FuJian Province.

Type substrate: *Eucalyptus dunnii*.

Barcodes: *act* = MT335108; *cmdA* = MT335341; *his3* = MT335581; *rpb2* = MT412634; *tef1* = MT412872; *tub2* = MT413084 (alternative markers: ITS = MT359802; LSU = MT359562).

Notes: *Calonectria pseudocolhounii* was treated as a synonym of *Ca. eucalypti* in this study. In comparisons of DNA sequences for eight gene regions, the only difference between the ex-type isolate of *Ca. pseudocolhounii* (CMW 27209) and the ex-type isolate of *Ca. eucalypti*

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(CMW 18444) was in the *his3*, ITS and *tub2* sequences, where there were three base differences in the *his3*, one base difference in the ITS and four base differences in the *tub2* sequences. Both species are homothallic and produce clavate vesicles with similar dimensions (*Ca. pseudocolhounii*: 3.5–6 µm; *Ca. eucalypti*: 4–6 µm) and 3-septate macroconidia (Lombard *et al*. 2010a, Chen *et al*. 2011, Li *et al*. 2020). The macroconidia of *Ca. pseudocolhounii* (av. 60 × 4.5 µm) are smaller than those of *Ca. eucalypti* (av. 72 × 6 µm) (Lombard *et al*. 2010a, Chen *et al*. 2011), which was considered to represent intraspecific variation (Supplementary Table S4).

pseudoecuadoriae Calonectria L. Lombard & Crous, Stud. Mycol. 85: 185. 2016.

In: *Calonectria brassicae* species complex.

Typus: CBS H-22768 holotype.

Ex-type culture: CBS 111402 = CMW 51179 = CPC 1639.

Type locality: **Ecuador**.

Type substrate: Soil.

Barcodes: *cmdA* = KX784589; *rpb2* = KY653432; *tef1* = KX784723; *tub2* = KX784652 (alternative markers: ITS = KY653273; LSU = KY653329).

Notes: *Calonectria pseudoecuadoriae* forms a single lineage closely related to *Ca. robigophila*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. pseudoecuadoriae* [(av. 38 × 3.5µm); Lombard *et al.* 2016] are smaller than those of *Ca. robigophila* [(av. 50 × 4 µm); Alfenas *et al.* 2015] (Supplementary Table S4).

pseudohodgesii Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 118. 2015.

(see ***Calonectria brasiliensis***)

In: *Calonectria cylindrospora* species complex.

Typus: CBS H-21368 holotype.

Ex-type culture: CBS 134818 = LPF262.

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Type locality: **Brazil**, Minas Gerais state, Viçosa.

Type substrate: Leaf of rooted *Azadirachta indica* cutting.

Barcodes: *cmdA* = KM395991; *his3* = KM396079; *tef1* = KM395817; *tub2* = KM395905.

Notes: *Calonectria pseudohodgesii* was treated as a synonym of *Ca. brasiliensis* in this study. In comparisons of DNA sequences for four available gene regions, the only difference between the ex-type isolate of *Ca. pseudohodgesii* (CBS 134818) and the ex-type isolate of *Ca. brasiliensis* (CBS 230.51) was in the *cmdA*, *his3*, *tef1* and *tub2* sequences, where there were three base differences in the *cmdA*, two base differences in the *his3*, two base differences in the *tef1* and one base difference in the *tub2* sequences. Both species produce ellipsoidal to obpyriform vesicles of similar dimensions (*Ca. pseudohodgesii*: 4–10 µm; *Ca. brasiliensis*: 7–11 µm) and 1-septate macroconidia, the macroconidia of *Ca. pseudohodgesii* (av. 54 × 4.5 µm) are larger than those of *Ca. brasiliensis* (av. 38 × 3.5 µm) (Batista 1951, Lombard *et al*. 2010b, Alfenas *et al*. 2015), which was considered to represent intraspecific variation (Supplementary Table S4).

pseudokyotensis Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 178. 2015.

(see ***Calonectria aconidialis***)

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21774 holotype.

Ex-type culture: CBS 137332 = CMW 31439 = CERC 1774.

Type locality: **China**, GuangXi Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334951; *cmdA* = MT335178; *his3* = MT335417; *tef1* = MT412708 (alternative markers: ITS = MT359638; LSU = MT359398).

Notes: *Calonectria pseudokyotensis* was treated as a synonym of *Ca. aconidialis* in this study. In comparisons of DNA sequences for six available gene regions (*rpb2* and *tub2* are not available for *Ca. pseudokyotensis*, *tub2* not available for *Ca. aconidialis*), all six gene sequences for the ex-type isolate of *Ca. pseudokyotensis* (CMW 31439) were 100 % identical

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to the ex-type isolate of *Ca. aconidialis* (CMW 35174). No sexual morph was observed for *Ca. pseudokyotensis* (Lombard *et al*. 2015a, Supplementary Table S4).

pseudometrosideri Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 118. 2015.

In: *Calonectria candelabrum* species complex.

Typus: CBS 134845 (preserved as metabolically inactive culture, Alfenas *et al*. 2015).

Ex-type culture: CBS 134845 = LPF210.

Type locality: **Brazil**, Alagoas state, Maceió.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *cmdA* = KM395995; *his3* = KM396083; *tef1* = KM395821; *tub2* = KM395909.

Notes: *Calonectria pseudometrosideri* is closely related to *Ca. putriramosa* and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. pseudometrosideri* (av. 51 × 4.5 µm) are longer than those of *Ca. putriramosa* (av. 43 × 5 µm), while the vesicles of *Ca. pseudometrosideri* (5–7 µm) are narrower than those of *Ca. putriramosa* (7–10 µm) (Alfenas *et al.* 2015, Lombard *et al*. 2016) (Supplementary Table S4).

pseudomexicana Calonectria L. Lombard *et al*., Persoonia 27: 76. 2011.

Synonym: *Calonectria tunisiana* L. Lombard *et al*., Persoonia 27: 77. 2011.

In: *Calonectria mexicana* species complex.

Typus: CBS H-20685 holotype.

Ex-type culture: CBS 130354 = CMW 51313 = DISTEF-TCROU1.

Type locality: **Tunisia**, Carthage, Tunis.

Type substrate: *Callistemon* sp.

Barcodes: *act* = MT335110; *cmdA* = MT335343; *his3* = MT335583; *rpb2* = MT412636; *tef1* = MT412874; *tub2* = MT413086 (alternative markers: ITS = MT359804; LSU = MT359564).

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Notes: *Calonectria pseudomexicana* is closely related to *Ca. pseudouxmalensis* and *Ca. uxmalensis*, and can be distinguished from these two species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. pseudomexicana* (av. 45 × 5 µm) are larger than those of *Ca. pseudouxmalensis* (av. 29 × 3 µm) and *Ca. uxmalensis* (av. 30 × 3 µm), and vesicles of *Ca. pseudomexicana* (9–14 µm) are wider than those of *Ca. pseudouxmalensis* (5–9 µm) and *Ca. uxmalensis* (5–8 µm) (Lombard *et al*. 2011, 2016) (Supplementary Table S4).

pseudonaviculata Calonectria (Crous *et al*.) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010.

Basionym: *Cylindrocladium pseudonaviculatum* Crous *et al*., Sydowia 54: 26. 2002.

Synonym: *Cylindrocladium buxicola* Henricot, Mycologia 94: 993. 2002.

In: *Calonectria naviculata* species complex.

Typus: PREM 57313 holotype.

Ex-type culture: CBS 116251 = CMW 51235 = CPC 3399 = Lynfield 824.

Type locality: **New Zealand**.

Type substrate: *Buxus sempervirens.*

Barcodes: *cmdA* = MT335345; *his3* = MT335585; *rpb2* = MT412638; *tef1* = MT412876; *tub2* = MT413088 (alternative markers: ITS = MT359806; LSU = MT359566).

Notes: *Calonectria pseudonaviculata* is closely related to *Ca. henricotiae*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. pseudonaviculata* [(av. 60 × 5 µm); Crous *et al.* 2002] are longer than those of *Ca. henricotiae* [(av. 56 × 5.6 µm); Gehesquiere *et al.* 2015]. *Calonectria pseudonaviculata* is heterothallic (Li *et al*. 2020) (Supplementary Table S4).

pseudopteridis Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 118. 2015.

Basionym: *Cylindrocladium macrosporum* Sherb., Phytopathology 18: 219. 1928.

In: *Calonectria pteridis* species complex.

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Typus: BPI 414558 holotype.

Ex-type culture: CBS 163.28 = CMW 51159 = IMI 299579.

Type locality: **USA**.

Type substrate: *Washingtonia robusta*.

Barcodes: *act* = MT335112; *cmdA* = MT335347; *his3* = MT335587; *rpb2* = MT412640; *tef1* = MT412878; (alternative markers: ITS = MT359808; LSU = MT359568).

Notes: *Calonectria pseudopteridis* is closely related to *Ca. pteridis*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. pseudopteridis* [(av. 87.5 × 5.7 µm) are longer than those of *Ca. pteridis* [(av. 82 × 5.5 µm); Sobers 1968, Crous *et al*. 1993c, Alfenas *et al*. 2015] (Supplementary Table S4).

pseudoreteaudii Calonectria L. Lombard *et al.*, Persoonia 24: 8. 2010.

Synonyms: *Calonectria pentaseptata* L. Lombard *et al*., Persoonia 29: 157. 2012.

Calonectria microconidialis L. Lombard *et al*., Stud. Mycol. 80: 175. 2015.

In: *Calonectria reteaudii* species complex.

Typus: PREM 60290 holotype.

Ex-type culture: CBS 123694 = CMW 25310.

Type locality: **China**, GuangDong.

Type substrate: *Eucalyptus urophylla* × *E. grandis* hybrid cutting.

Barcodes: *act* = MT335119; *cmdA* = MT335354; *his3* = MT335594; *rpb2* = MT412647; *tef1* = MT412885; *tub2* = MT413096 (alternative markers: ITS = MT359815; LSU = MT359575).

Notes: *Calonectria pseudoreteaudii* is phylogenetically closely related to *Ca. acaciicola* and *Ca. reteaudii*. The sequences of *his3*, ITS, *rpb2*, *tef1* and *tub2* gene regions can differentiate *Ca. pseudoreteaudii* from these two species. The macroconidia of *Ca. pseudoreteaudii* [(av. 104 × 8 µm); Lombard *et al.* 2010c] are larger than those of *Ca. acaciicola* [(av. 94 × 7 µm);

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Pham *et al*. 2019] and *Ca. reteaudii* [(av. 84 × 6.5 µm); Kang *et al*. 2001a]. *Calonectria pseudoreteaudii* is heterothallic (Li *et al*. 2020) (Supplementary Table S4).

pseudoscoparia Calonectria L. Lombard *et al.*, Stud. Mycol. 66: 53. 2010.

(see ***Calonectria candelabrum***)

In: *Calonectria candelabrum* species complex.

Typus: PREM 60305 holotype.

Ex-type culture: CBS 125257 = CMW 15218.

Type locality: **Ecuador**, Pichincha Province, Las Golondrinas.

Type substrate: *Eucalyptus grandis* cutting.

Barcodes: *act* = MT334979; *cmdA* = MT335209; *his3* = MT335449; *rpb2* = MT412513; *tef1* = MT412740; *tub2* = MT412961 (alternative markers: ITS = MT359670; LSU = MT359430).

Notes: *Calonectria pseudoscoparia* was treated as a synonym of *Ca. candelabrum* in this study. In comparisons of DNA sequences for eight gene regions, only one base difference in the *tub2* gene sequences was found between the ex-type isolate of *Ca. pseudoscoparia* (CMW 15218) and the isolates of *Ca. candelabrum* (CMW 31000, and CMW 31001). Both species produce ellipsoidal to obpyriform vesicles with overlapping dimensions (*Ca. pseudoscoparia*: 6–10 µm; *Ca. candelabrum*: 5–8 µm) and 1-septate macroconidia. The macroconidia of *Ca. pseudoscoparia* (av. 48 × 4 µm) are smaller than those of *Ca. candelabrum* (av. 60 × 4.5 µm) (Viégas 1946, Crous 2002, Lombard *et al.* 2010a, 2015b), which was considered to represent intraspecific variation (Supplementary Table S4).

pseudospathiphylli Calonectria J.C. Kang *et al*., Syst. Appl. Microbiol. 24: 215. 2001.

Synonym: *Cylindrocladium pseudospathiphylli* J.C. Kang *et al*., Syst. Appl. Microbiol. 24: 215. 2001.

In: *Calonectria spathiphylli* species complex.

Typus: PREM 57196 (holotype of *Ca. pseudospathiphylli*; Kang *et al*. 2001b), PREM 57197 (holotype of *Cy. pseudospathiphylli*; Kang *et al*. 2001b).

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Ex-type culture: CBS 109165 = CMW 30976 = CPC 1623 (Alfenas *et al*. 2015, Lombard *et al*. 2016).

Type locality: **Ecuador**.

Type substrate: Soil.

Barcodes: *act* = GQ280493; *cmdA* = GQ267412; *his3* = AF348241; *rpb2* = KY653435; *tef1* = FJ918562; *tub2* = FJ918513 (alternative markers: ITS = GQ280615; LSU = GQ280737).

Notes: *Calonectria pseudospathiphylli* forms a single lineage closely related to *Ca. densa*, *Ca. humicola* and *Ca. spathiphylli*. No lateral stipe extension was observed in *Ca. pseudospathiphylli*, whereas these are common in *Ca. densa*. *Calonectria pseudospathiphylli* produce stipe extensions (up to 250 µm) longer than those of *Ca. humicola* (up to 157 µm). The macroconidia of *Ca. pseudospathiphylli* (av. 52 × 4 µm) obviously smaller than those of *Ca. spathiphylli* (av. 70 × 6µm) (El-Gholl *et al.* 1992, Kang *et al.* 2001b, Lombard *et al.* 2010a). *Calonectria pseudospathiphylli* is characterised as being homothallic, while *Ca. spathiphylli* is heterothallic (El-Gholl *et al.* 1992, Kang *et al.* 2001b) (Supplementary Table S4).

pseudospathulata Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 118. 2015.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-21356 holotype.

Ex-type culture: CBS 134841 = LPF072.

Type locality: **Brazil**, Minas Gerais state, Araponga.

Type substrate: Soil in tropical rainforest.

Barcodes: *cmdA* = KM396070; *his3* = KM396153; *tef1* = KM395896; *tub2* = KM395983.

Notes: *Calonectria pseudospathulata* is closely related to *Ca. fragariae* and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. pseudospathulata* [(av. 43 × 4 µm); Alfenas *et al*. 2015] are longer than those of *Ca. fragariae* [(av. 39 × 4 µm); Lopes *et al*. 2017] (Supplementary Table S4).

pseudoturangicola Calonectria J.Q. Li *et al*., IMA Fungus 8: 279. 2017.

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(see ***Calonectria kyotensis***)

In: *Calonectria kyotensis* species complex.

Typus: PREM 61948 holotype.

Ex-type culture: CBS 142890 = CMW 47496 = CERC 7126.

Type locality: **China**, FuJian Province, FuZhou City.

Type substrate: Soil.

Barcodes: *act* = MT335121; *cmdA* = MT335356; *his3* = MT335596; rpb2 = MT412649; *tef1* = MT412887; *tub2* = MT413098 (alternative markers: ITS = MT359817; LSU = MT359577).

Notes: *Calonectria pseudoturangicola* was treated as a synonym of *Ca. kyotensis* in this study. In comparisons of DNA sequences for eight gene regions, the only difference between the ex-type isolate of *Ca. pseudoturangicola* (CERC 7126) and the ex-type isolate of *Ca. kyotensis* (CBS 114525) was in the *cmdA*, ITS, LSU, and *tub2* sequences, where there was one base difference in the *cmdA*, one base difference in the ITS, one base difference in the LSU and three base differences in the *tub2* sequences. Both species are homothallic and produce sphaeropedunculate (globose) vesicles and 1-septate macroconidia of similar dimensions (*Ca. pseudoturangicola*: av. 40 × 3.5 µm, *Ca. kyotensis*: av. 41 × 4 µm) (Terashita 1968, Li *et al.* 2017, 2020; Supplementary Table S4).

pseudovata Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 120. 2015.

In: *Calonectria pteridis* species complex.

Typus: CBS H-21370 holotype.

Ex-type culture: CBS 134674 = LPF267.

Type locality: **Brazil**, Pará state, Santana.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *cmdA* = KM396032; *his3* = KM396115; *tef1* = KM395858; *tub2* = KM395945.

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Notes: *Calonectria pseudovata* is phylogenetically closely related to *Ca. ovata* and *Ca. terricola*. Morphologically, *Ca. pseudovata* shows some overlap with *Ca. ovata*, while the sequences of *cmdA*, *his3*, *tef1*, and *tub2* gene regions can differentiate *Ca. pseudovata* from *Ca. ovata*. The macroconidia of *Ca. pseudovata* [(av. 69 × 5 µm); Alfenas *et al*. 2015] are larger than those of *Ca. terricola* [(av. 46 × 4.5 µm); Lombard *et al*. 2016]. Furthermore, the ability of *Ca. pseudovata* and *Ca. ovata* to produce miconidiophores and microconidia in culture distinguishes it from *Ca. terricola*.

pseudouxmalensis Calonectria L. Lombard & Crous, Stud. Mycol. 85: 187. 2016.

In: *Calonectria mexicana* species complex.

Typus: CBS H-22769 holotype.

Ex-type culture: CBS 110924 = CMW 51166 = CPC 942.

Type locality: **Mexico**.

Type substrate: Soil.

Barcodes: *act* = MT335123; *cmdA* = MT335358; *his3* = MT335598; *rpb2* = MT412651; *tef1* = MT412889; *tub2* = MT413100 (alternative markers: ITS = MT359819; LSU = MT359579).

Notes: *Calonectria pseudouxmalensis* is closely related to *Ca. uxmalensis*, the sequences of *cmdA*, *his3*, *tef1*, and *tub2* gene regions can distinguish *Ca. pseudouxmalensis* from *Ca. uxmalensis*. Morphologically, these two species are similar to each other. However, no lateral stipe extensions were observed in *Ca. pseudouxmalensis*, a feature that has been reported in *Ca. uxmalensis* (Lombard *et al.* 2016) (Supplementary Table S4).

pseudoyunnanensis Calonectria J.Q. Li *et al*., IMA Fungus 8: 279. 2017.

(see ***Calonectria yunnanensis***)

In: *Calonectria kyotensis* species complex.

Typus: PREM 61950 holotype.

Ex-type culture: CBS 142892 = CMW 47655 = CERC 5376.

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Type locality: **China**, YunNan, PuEr Region.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT335126; *cmdA* = MT335361; *his3* = MT335601; *rpb2* = MT412654; *tef1* = MT412892; *tub2* = MT413103 (alternative markers: ITS = MT359822; LSU = MT359582).

Notes: *Calonectria pseudoyunnanensis* was treated as a synonym of *Ca. yunnanensis* in this study. In comparisons of DNA sequences for eight gene regions, the only difference between the ex-type isolate of *Ca. pseudoyunnanensis* (CERC 5376) and the ex-type isolate of *Ca. yunnanensis* (CERC 5339) was in the *his3* and *tub2* sequences, where there were three base differences in the *his3* and four base differences in the *tub2* sequences. Both species are homothallic and produce sphaeropedunculate vesicles and 1-septate macroconidia (Li *et al*. 2017, 2020), and share vesicles of similar dimensions (*Ca. pseudoyunnanensis*: 2.5–5 µm; *Ca. yunnanensis*: 2–4.5 µm). The macroconidia of *Ca. pseudoyunnanensis* [(av. 47.5 × 5 µm); Li *et al*. 2017] are larger than those of *Ca. yunnanensis* [(av. 43 × 4.5 µm); Li *et al*. 2017] which was considered to represent intraspecific variation (Supplementary Table S4).

pteridis Calonectria Crous *et al*., Mycotaxon 46: 228. 1993.

Synonym: *Cylindrocladium pteridis* F.A. Wolf, J. Elisha Mitchell Sci. Soc. 42: 59. 1926.

In: *Calonectria pteridis* species complex.

Typus: PREM 51033 (holotype of *Ca. pteridis*; Crous *et al.* 1993c), BPI 414564 (holotype of *Cy. pteridis*; Wolf 1926).

Ex-type culture: CBS 111793 = CMW 16736 = CPC 2372 = ATCC 34395 (Crous *et al*. 2006).

Type locality: **USA**.

Type substrate: *Arachniodes adiantiformis*.

Barcodes: *act* = GQ280494; *cmdA* = GQ267413; *his3* = DQ190679; *rpb2* = KY653438; *tef1* = FJ918563; *tub2* = DQ190578 (alternative markers: ITS = GQ280616; LSU = GQ280738).

Notes: *Calonectria pteridis* is closely related to *Ca. pseudopteridis* and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. pteridis* [(av.

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82 × 5.5 µm); Crous *et al*. 1993c] are shorter than those of *Ca*. *pseudopteridis* [(av. 87.5 × 5.7 µm); Sobers 1968, Alfenas *et al*. 2015]. (Supplementary Table S4).

putriramosa Calonectria L. Lombard & Crous, Stud. Mycol. 85: 188. 2016.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-22770 holotype.

Ex-type culture: CBS 111449 = CMW 51181 = CPC 1951.

Type locality: **Brazil**.

Type substrate: *Eucalyptus* cuttings.

Barcodes: *act* = MT335129; *cmdA* = MT335364; *his3* = MT335604; *rpb2* = MT412657; *tef1* = MT412895; *tub2* = MT413105 (alternative markers: ITS = MT359825; LSU = MT359585).

Notes: *Calonectria putriramosa* is closely related to *Ca. pseudometrosideri*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. putriramosa* (av. 43 × 5 µm) are shorter than those of *Ca. pseudometrosideri* (av. 51 × 4.5 µm), while the vesicles of *Ca. putriramosa* (7–10 µm) are wider than those of *Ca. pseudometrosideri* (5–7 µm) (Alfenas *et al.* 2015, Lombard *et al*. 2016) (Supplementary Table S4).

queenslandica Calonectria L. Lombard *et al*., Persoonia 24: 8. 2010.

Synonym: *Calonectria terrae-reginae* L. Lombard *et al*., Persoonia 24: 8. 2010.

In: *Calonectria reteaudii* species complex.

Typus: PREM 60243 holotype.

Ex-type culture: CBS 112146 = CMW 30604 = CPC 3213.

Type locality: **Australia**, Queensland, Lannercost.

Type substrate: *Eucalyptus urophylla.*

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Barcodes: *act* = MT335132; *cmdA* = MT335367; *his3* = MT335607; *rpb2* = MT412660; *tef1* = MT412898; *tub2* = MT413108 (alternative markers: ITS = MT359828; LSU = MT359588).

Notes: *Calonectria queenslandica* is phylogenetically closely related to *Ca. lombardiana* (Fig. 1). Sequences of ITS, *tef1* and *tub2* gene regions can differentiate *Ca. queenslandica* from *Ca. lombardiana*. In addition, the macroconidia of *Ca. queenslandica* [(av. 69 × 6 µm); Lombard *et al*. 2010c] are shorter than those of *Ca. lombardiana* (av. 80 × 6 µm) (Supplementary Table S4).

quinqueramosa Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 123. 2015.

In: *Calonectria brassicae* species complex.

Typus: CBSH-21355 holotype.

Ex-type culture: CBS 134654 = LPF065.

Type locality: **Brazil**, Pará state, Monte Dourado.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *cmdA* = KM396029; *his3* = KM396112; *tef1* = KM395855; *tub2* = KM395942.

Notes: *Calonectria quinqueramosa* is closely related to *Ca. gracilis*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. quinqueramosa* (av. 59 × 5 µm) are larger than those of *Ca. gracilis* (av. 56 × 4.5 µm), while the vesicles of *Ca. quinqueramosa* [(3–5 µm); Alfenas *et al*. 2015] are narrower than those of *Ca. gracilis* [(2–11 µm); Crous *et al.* 1993c]. *Calonectria quinqueramosa* is homothallic (Alfenas *et al*. 2015) (Supplementary Table S4).

reteaudii Calonectria (Bugnic.) C. Booth, Mycol. Pap. 104: 41. 1966.

Basionym: *Neonectria reteaudii* Bugnic., Encycl. Mycol. 11: 189. 1939.

Synonyms: *Cylindrocarpon reteaudii* Bugnic., Encycl. Mycol. 11: 189. 1939.

Cylindrocladium reteaudii (Bugnic.) Boesew., Trans. Brit. Mycol. Soc. 78: 553. 1982.

Cylindrocladium quinqueseptatum Boedijn & Reitsma, Reinwardtia 1: 59. 1950.

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Calonectria baviensis N.Q. Pham *et al*., Mycologia 111: 90. 2019.

In: *Calonectria reteaudii* species complex.

Typus: PREM 57211 (neotype of *Ca*. *reteaudii*; Crous 2002), PREM 57212 (neotype of *Cy. reteaudii*; Crous 2002).

Ex-type culture: CBS 112144 = CMW 30984 = CPC 3201 (Crous 2002, Crous *et al*. 2006).

Type locality: **Vietnam**, Binh Phuoc, Chon Thanh.

Type substrate: *Eucalyptus camaldulensis.*

Barcodes: *act* = MT335135; *cmdA* = MT335370; *his3* = MT335610; *rpb2* = MT412663; *tef1* = MT412901; *tub2* = MT413111 (alternative markers: ITS = MT359831; LSU = MT359591).

Notes: *Calonectria reteaudii* is phylogenetically closely related to *Ca*. *acaciicola* and *Ca. pseudoreteaudii*. The sequences of the *his3*, *rpb2*, *tef1*, and *tub2* gene regions can differentiate *Ca. reteaudii* from these two species. The macroconidia of *Ca. reteaudii* [(av. 84 × 6.5 µm); Kang *et al*. 2001a] are smaller than those of *Ca. acaciicola* [(av. 94 × 7 µm); Pham *et al*. 2019] and *Ca. pseudoreteaudii* [(av. 104 × 8 µm); Lombard *et al.* 2010c]. *Calonectria reteaudii* is heterothallic (Kang *et al.* 2001a) (Supplementary Table S4).

robigophila Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 123. 2015.

In: *Calonectria brassicae* species complex.

Typus: CBS H-21361 holotype.

Ex-type culture: CBS 134652 = LPF192.

Type locality: **Brazil**, Maranhao state, Açailandia.

Type substrate: *Eucalyptus* sp.

Barcodes: *cmdA* = KM396024; *his3* = KM396107; *tef1* = KM395850; *tub2* = KM395937.

Notes: *Calonectria robigophila* forms a single lineage closely related to *Ca. duoramosa*, and it produce six tiers of branches in its conidiogenous apparatus in comparison to the two in *Ca. duoramosa*. The macroconidia of *Ca. robigophila* [(av. 50 × 4 µm); Alfenas *et al.* 2015] are

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longer than those of *Ca. duoramosa* [(av. 46 × 4 µm); Alfenas *et al.* 2015] (Supplementary Table S4).

rumohrae Calonectria El-Gholl & Alfenas, Mycotaxon 64: 478. 1997.

Synonym: *Cylindrocladium rumohrae* El-Gholl & Alfenas, Mycotaxon 64: 478. 1997.

In: *Calonectria gracilipes* species complex.

Typus: FLAS F56116a & b (holotypes of *Ca. rumohrae* and *Cy. rumohrae*; El-Gholl *et al.* 1997).

Ex-type culture: CBS 111431 = CMW 23697 = CPC 1716 = UFV 218 (Crous 2002, Crous *et al*. 2006).

Type locality: **Panama**, Volkan.

Type substrate: *Rumohra adiantiformis.*

Barcodes: *act* = MT335137; *cmdA* = MT335372; *his3* = MT335612; *tef1* = MT412903; *tub2* = MT413113 (alternative markers: ITS = MT359833; LSU = MT359593).

Notes: *Calonectria rumohrae* is phylogenetically closely related to *Ca. hurae*, and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. rumohrae* [(av. 110 × 9 µm); El-Gholl *et al.* 1997] are shorter but wider than those of *Ca. hurae* [(av. 120 × 7.5 µm); Crous 2002]. *Calonectria rumohrae* is homothallic (El-Gholl *et al.* 1997) (Supplementary Table S4).

seminaria Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 179. 2015.

(see ***Calonectria pauciramosa***)

In: *Calonectria candelabrum* species complex.

Typus: CBS H-21475 holotype.

Ex-type culture: CBS 136632 = CMW 31450 = CERC 1785.

Type locality: **China**, GuangDong Province, ZhanJiang.

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Type substrate: *Eucalyptus urophylla* × *E. grandis* clone seedling leaf.

Barcodes: *act* = MT335102; *cmdA* = MT335334; *his3* = MT335574; *rpb2* = MT412627; *tef1* = MT412865; *tub2* = MT413077 (alternative markers: ITS = MT359795; LSU = MT359555).

Notes: *Calonectria seminaria* was treated as a synonym of *Ca. pauciramosa* in this study. In comparisons of DNA sequences for eight gene regions, all the sequences of the isolates of *Ca. seminaria* (ex-type CMW 31450, and CMW 31489) were 100 % identical to those of the isolates of *Ca. pauciramosa* (ex-type CBS 138824, CMW 2151, CMW 7592, CMW 9151, CMW 30823, and CMW 30875). Both species produce obpyriform to ellipsoidal vesicles, 1-septate macroconidia and shared the similar vesicles (*Ca. seminaria*: 6–11 µm; *Ca. pauciramosa*: 5–11 µm) and macroconidial dimensions (*Ca. seminaria*: av. 47 × 5 µm; *Ca. pauciramosa*: av. 50 × 4.5 µm) (Crous 2002, Lombard *et al.* 2015a) (Supplementary Table S4).

silvicola Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 123. 2015.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-21357 holotype.

Ex-type culture: CBS 135237 = LPF081.

Type locality: **Brazil**, Bahia state, Mucuri.

Type substrate: Soil in tropical rainforest.

Barcodes: *cmdA* = KM396065; *his3* = KM396148; *tef1* = KM395891; *tub2* = KM395978.

Notes: *Calonectria silvicola* is closely related to *Ca*. *nemoricola* and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca*. *silvicola* [(av. 41 × 4.5 µm); Alfenas *et al*. 2015] are shorter than those of *Ca. nemoricola* [(av. 45 × 4 µm); Alfenas *et al*. 2015] (Supplementary Table S4).

spathiphylli Calonectria El-Gholl *et al*., Mycotaxon 45: 296. 1992.

Synonym: *Cylindrocladium spathiphylli* Schoult., *et al*., Mycotaxon 16: 268. 1982.

In: *Calonectria spathiphylli* species complex.

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Typus: FLAS 55655 [holotype of *Ca. spathiphylli*; El-Gholl *et al*. 1992), ATCC 44730 (holotype of *Cy. spathiphylli*; Schoulties *et al*. 1982, Crous 2002).

Ex-type culture: CBS 114540 = CMW 16742 =ATCC 44730 = STE-U 2185 (Crous 2002, Alfenas *et al*. 2015).

Type locality: **USA**, Florida.

Type substrate: *Spathiphyllum* sp.

Barcodes: *cmdA* = MT335374; *his3* = MT335614; *rpb2* = MT412666; *tef1* = MT412905; *tub2* = MT413115 (alternative markers: ITS = MT359835; LSU = MT359595).

Notes: *Calonectria spathiphylli* is closely related to *Ca. densa* and *Ca. humicola* and can be distinguished from these two species by the dimensions of its macroconidia. Macroconidia of *Ca. spathiphylli* [(av. 70 × 6 µm); El-Gholl *et al*. 1992] are longer than those of *Ca. densa* [(av. 54 × 6 µm); Lombard *et al.* 2010a] and larger than those of *Ca. humicola* [(av. 51 × 5 µm); Lombard *et al.* 2010a]. *Calonectria spathiphylli* is characterised as being heterothallic (El-Gholl *et al*. 1992) (Supplementary Table S4).

spathulata Calonectria El-Gholl *et al.*, Mycotaxon 26: 159. 1986 *emend*. Crous, Mycoscience 42: 55. 2001.

Synonyms: *Cylindrocladium spathulatum* El-Gholl *et al.*, Mycotaxon 26: 159. 1986 *emend*. Crous, Mycoscience 42: 55. 2001.

Calonectria stipitata L. Lombard & Crous, Stud. Mycol. 85: 188. 2016.

In: *Calonectria candelabrum* species complex.

Typus: FLAS F54257a (holotype of *Ca. spathulata*; Crous & Kang 2001), FLAS F54257b (holotype of *Cy. spathulatum*; Crous & Kang 2001).

Ex-type culture: CBS 555.92 = CMW 16744 (Lombard *et al*. 2010a).

Type locality: **Brazil**.

Type substrate: *Eucalyptus viminalis*.

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Barcodes: *act* = MT335139; *cmdA* = MT335376; *his3* = MT335616; *rpb2* = MT412668; *tef1* = MT412907; *tub2* = MT413117 (alternative markers: ITS = MT359837; LSU = MT359597).

Notes: *Calonectria spathulata* is closely related to *Ca. colombiana* and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. spathulata* (av. 80 × 6 µm) are larger than those of *Ca. colombiana* (av. 37 × 3 µm). Furthermore, *Ca. spathulata* can produce both microconidiophores and microconidia, a feature not observed for *Ca. colombiana* (Crous & Kang 2001, Lombard *et al*. 2010b). *Calonectria spathulata* is homothallic (Crous & Kang 2001) (Supplementary Table S4). This species is commonly associated with leaf spots and cutting rot of *Eucalyptus* cultivated in plantations and nurseries, and has a wide geographic distribution in South America (Argentina, Brazil, Colombia and Ecuador) (El-Gholl *et al*. 1986, Crous & Kang 2001, Rodas *et al.* 2005).

sphaeropedunculata Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 180. 2015.

(see ***Calonectria aconidialis***)

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21486 holotype.

Ex-type culture: CBS 136081 = CMW 31390 = CERC 1725.

Type locality: **China**, GuangXi Province.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT334952; *cmdA* = MT335179; *his3* = MT335418; *rpb2* = MT412485; *tef1* = MT412709 (alternative markers: ITS = MT359639; LSU = MT359399).

Notes: *Calonectria sphaeropedunculata* was treated as a synonym of *Ca. aconidialis* in this study. In comparisons of DNA sequences for seven available gene regions, a single base difference in the *cmdA* and two base differences in the LSU sequences occurred between the ex-type isolate of *Ca. sphaeropedunculata* (CMW 31390) and the ex-type isolate of *Ca. aconidialis* (CMW 35174). Both species are homothallic and produce orange to orange-brown perithecia, 8-spored asci and 1-septate ascospores, and share the similar ascospores dimensions (*Ca. sphaeropedunculata*: av. 37 × 6 µm; *Ca. aconidialis*: av. 36 × 6 µm) (Lombard *et al*. 2015a, Li *et al*. 2020; Supplementary Table S4).

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stipitata Calonectria L. Lombard & Crous, Stud. Mycol. 85: 188. 2016.

(see ***Calonectria spathulata***)

In: *Calonectria candelabrum* species complex.

Typus: CBS H-22771 holotype.

Ex-type culture: CBS 112513 = CMW 51197 = CPC 3851.

Type locality: **Colombia**.

Type substrate: *Eucalyptus* sp.

Barcodes: *act* = MT335140; *cmdA* = MT335377; *his3* = MT335617; *rpb2* = MT412669; *tef1* = MT412908; *tub2* = MT413118 (alternative markers: ITS = MT359838; LSU = MT359598).

Notes: *Calonectria stipitata* was treated as a synonym of *Ca. spathulata* in this study. In comparisons of DNA sequences for eight gene regions, the ex-type isolate of *Ca. stipitata* (CBS 112513) and the isolate of *Ca. spathulata* (CMW 16744) only had one base difference in the *his3* gene sequence. Both species produce ellipsoidal to obpyriform vesicles of similar dimensions (*Ca. stipitata*: 7–11 µm; *Ca. spathulata*: 6–10 µm). The macroconidia of *Ca. stipitata* (av. 32 × 4 µm) are smaller than those of *Ca. spathulata* (av. 80 × 6 µm) (El-Gholl *et al*. 1986, Crous & Kang 2001, Lombard *et al.* 2016), which was considered to represent intraspecific variation.

sulawesiensis Calonectria L. Lombard *et al.*, Stud. Mycol. 66: 53.2010.

(see ***Calonectria hawksworthii***)

In: *Calonectria cylindrospora* species complex.

Typus: PREM 60300 holotype.

Ex-type culture: CBS 125277 = CMW 14878.

Type locality: **Indonesia**, Sulawesi.

Type substrate: Leaf of *Eucalyptus* sp.

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Barcodes: *act* = MT335141; *cmdA* = MT335378; *his3* = MT335618; *rpb2* = MT412670; *tef1* = MT412909; *tub2* = MT413119 (alternative markers: ITS = MT359839; LSU = MT359599).

Notes: *Calonectria sulawesiensis* was treated as a synonym of *Ca. hawksworthii* in this study. In comparisons of DNA sequences for eight gene regions, the only difference between the ex-type isolate of *Ca. sulawesiensis* (CMW 14878) and the ex-type isolate of *Ca. hawksworthii* (CBS 111870) was in the *act*, *tef1* and *tub2* sequences, where there were four base differences in the *act*, one base difference in the *tef1* and four base differences in the *tub2* sequences. Both species produce ellipsoidal vesicles with overlapping dimensions (*Ca. sulawesiensis*: 5–7 µm; *Ca. hawksworthii*: 6–9 µm) and 1-septate macroconidia. The macroconidia of *Ca. sulawesiensis* (av. 48 × 4 µm) are shorter than those of *Ca. hawksworthii* (av. 56 × 4 µm) (Crous 2002, Lombard *et al*. 2010a), which was considered to represent intraspecific variation (Supplementary Table S4).

sumatrensis Calonectria (Crous) L. Lombard *et al.*, Stud. Mycol. 66: 56. 2010

Basionym: *Cylindrocladium sumatrense* Crous, Stud. Mycol. 50: 426. 2004.

Synonym: *Calonectria indonesiana* L. Lombard & Crous, Stud. Mycol. 85: 179. 2016.

In: *Calonectria kyotensis* species complex.

Typus: CBS 9888 holotype.

Ex-type culture: CBS 112829 = CMW 23698 = CPC 4518.

Type locality: **Indonesia**, Northern Sumatra.

Type substrate: Soil.

Barcodes: *act* = MT335145; *cmdA* = MT335382; *his3* = MT335622; *rpb2* = MT412674; *tef1* = MT412913 (alternative markers: ITS = MT359843; LSU = MT359603).

Notes: *Calonectria sumatrensis* is closely related to *Ca. brassicicola* and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. sumatrensis* [(av. 58 × 5 µm); Crous *et al*. 2004] are longer than those of *Ca. brassicicola* [(av. 42 × 5 µm); Lombard *et al*. 2016], and the vesicles of *Ca. sumatrensis* (8–13 µm) are wider than those of *Ca. brassicicola* (3−5 µm) (Supplementary Table S4).

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syzygiicola Calonectria L. Lombard & Crous, Stud. Mycol. 85: 190. 2016.

In: *Calonectria kyotensis* species complex.

Typus: CBS H-22772 holotype.

Ex-type culture: CBS 112831 = CMW 51204 = CPC 4511.

Type locality: **Indonesia**, Sumatra.

Type substrate: Soil under *Syzygium aromaticum*.

Barcodes: ITS = KX784736; LSU = KX784663.

Notes: *Calonectria syzygiicola* is closely related to *Ca*. *asiatica* and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. syzygiicola* [(av. 45 × 5 µm); Lombard *et al*. 2016] are shorter than those of *Ca. asiatica* [(av. 53 × 5 µm); Crous *et al*. 2004], and the vesicles of *Ca. syzygiicola* (3–6 µm) are narrower than those of *Ca. asiatica* (12–17 µm) (Crous *et al*. 2004, Lombard *et al*. 2016) (Supplementary Table S4).

telluricola Calonectria R.F. Alfenas *et al*., Stud. Mycol. 80: 125. 2015.

(see ***Calonectria paraensis***)

In: *Calonectria brassicae* species complex.

Typus: CBS H-21365 holotype.

Ex-type culture: CBS 134664 = LPF217.

Type locality: **Brazil**, Bahia state, Mucuri.

Type substrate: Soil in tropical rainforest.

Barcodes: *cmdA* = KM396017; *his3* = KM396100; *tef1* = KM395843; *tub2* = KM395930.

Notes: *Calonectria telluricola* was treated as a synonym of *Ca. paraensis* in this study. In comparisons of DNA sequences for the four available gene regions, the only difference between the ex-type isolate of *Ca. telluricola* (CBS 134664) and the ex-type isolate of *Ca.*

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paraensis (CBS 134669) was in the *cmdA*, *his3*, *tef1*, and *tub2* sequences, where there was one base difference in the *cmdA*, two base differences in the *his3*, one base difference in the *tef1* and two base differences in the *tub2* sequences. Both species produce clavate vesicles and 1-septate macroconidia, and shared the similar vesicle (*Ca. telluricola*: 3–6 µm; *Ca. paraensis*: 4–6 µm) and macroconidial dimensions (*Ca. telluricola*: av. 41 × 5 µm; *Ca. paraensis*: av. 42 × 5 µm) (Alfenas *et al*. 2015) (Supplementary Table S4).

tereticornis Calonectria L. Lombard & Crous, Stud. Mycol. 85: 190. 2016.

(see ***Calonectria ovata***)

In: *Calonectria pteridis* species complex.

Typus: CBS H-22773 holotype.

Ex-type culture: CBS 111301 = CMW 51176 = CPC 1429.

Type locality: **Brazil**, Pará, Tucuruí.

Type substrate: *Eucalyptus tereticornis*.

Barcodes: *act* = MT335077; *cmdA* = MT335309; *his3* = MT335549; *tef1* = MT412840; *tub2* = MT413054 (alternative markers: ITS = MT359770; LSU = MT359530).

Notes: *Calonectria tereticornis* was treated as a synonym of *Ca. ovata* in this study. In comparisons of DNA sequences for seven available gene regions, the only differences between the ex-type isolate of *Ca. tereticornis* (CBS 111301) and the ex-type isolate of *Ca. ovata* (CMW 16724) was in the LSU and *tub2* sequences where there was one base difference in the LSU and one base difference in the *tub2* sequences. Both of the species produce ovoid vesicles of similar dimensions (*Ca. tereticornis*: 8–14 µm; *Ca. ovata*: 8–14 µm) and 1-septate macroconidia. The macroconidia of *Ca. tereticornis* [(av. 59 × 5 µm); Lombard *et al.* 2016] are shorter than those of *Ca. ovata* [(av. 70 × 5 µm); Victor *et al.* 1997], which was considered to represent intraspecific variation (Supplementary Table S4).

terrae-reginae Calonectria L. Lombard *et al*., Persoonia 24: 8. 2010.

(see ***Calonectria queenslandica***)

In: *Calonectria reteaudii* species complex.

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Typus: PREM 60239 holotype.

Ex-type culture: CBS 112151 = CMW 30601 = CPC 3202 = DFRI00150.

Type locality: **Australia**, Queensland, Cardwell.

Type substrate: *Eucalyptus urophylla.*

Barcodes: *act* = MT335134; *cmdA* = MT335369; *his3* = MT335609; *rpb2* = MT412662; *tef1* = MT412900; *tub2* = MT413110 (alternative markers: ITS = MT359830; LSU = MT359590).

Notes: *Calonectria terrae-reginae* was treated as a synonym of *Ca. queenslandica* in this study. In comparisons of DNA sequences for eight gene regions, only a single base difference in the *tub2* gene sequence was found between the ex-type isolate of *Ca. terrae-reginae* (CMW 30601) and the ex-type isolate of *Ca. queenslandica* (CMW 30604). Both species produce narrowly clavate vesicles of similar dimensions (*Ca. terrae-reginae*: 3–5 µm; *Ca. queenslandica*: 3–4 µm) and 4–6-septate macroconidia. The macroconidia of *Ca. terrae-reginae* (av. 76 × 6 µm) are longer than those of *Ca. queenslandica* (av. 69 × 6 µm) (Lombard *et al*. 2010c), which was considered to represent intraspecific variation (Supplementary Table S4).

terrestris Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 182. 2015.

(see ***Calonectria cerciana***)

In: *Calonectria cylindrospora* species complex.

Typus: CBS H-21478 holotype.

Ex-type culture: CBS 136642 = CMW 35180 = CERC 1856.

Type locality: **China**, GuangDong.

Type substrate: Soil in a *Eucalyptus* plantation.

Barcodes: *act* = MT334986; *cmdA* = MT335216; *his3* = MT335456; *rpb2* = MT412520; *tef1* = MT412747; *tub2* = MT412968 (alternative markers: ITS = MT359677; LSU = MT359437).

Notes: *Calonectria terrestris* was treated as a synonym of *Ca. cerciana* in this study. In comparisons of DNA sequences for eight gene regions, the only differences between the ex-

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type isolate *Ca. terrestris* (CMW 35180) and the ex-type isolate of *Ca. cerciana* (CMW 25309) was in the ITS and *tef1* sequences, where there was one base difference in the ITS and three base differences in the *tef1* sequences. Both species produce obpyriform vesicles with overlapping dimensions (*Ca. terrestris*: 5–12 µm; *Ca. cerciana*: 8–13 µm) and 1-septate macroconidia. The macroconidia of *Ca. terrestris* (av. 38.5 × 4.5 µm) are smaller than those of *Ca. cerciana* (av. 44 × 5 µm) (Lombard *et al.* 2010c, 2015a), which was considered to represent intraspecific variation (Supplementary Table S4).

terricola Calonectria L. Lombard & Crous, Stud. Mycol. 85: 191. 2016.

In: *Calonectria pteridis* species complex.

Typus: CBS H-22774 holotype.

Ex-type culture: CBS 116247 = CMW 51232 = CPC 3583.

Type locality: **Brazil**.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *tef1* = KX784738; *tub2* = KX784665.

Notes: *Calonectria terricola* is closely related to *Ca. ovata* and *Ca. pseudovata*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. terricola* [(av. 46 × 4.5 µm); Lombard *et al.* 2016] are smaller than those of *Ca. ovata* [(av. 70 × 5 µm); Victor *et al.* 1997] and *Ca. pseudovata* [(av. 69 × 5 µm); Alfenas *et al.* 2015]. In addition, no microconidiophores and microconidia were reported in *Ca. terricola*, a feature that is common in *Ca. ovata* and *Ca. pseudovata* (Victor *et al.* 1997, Alfenas *et al.* 2015, Lombard *et al.* 2016) (Supplementary Table S4).

tetraramosa Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 183. 2015.

(see ***Calonectria pauciramosa***)

In: *Calonectria candelabrum* species complex.

Typus: CBS H-21477 holotype.

Ex-type culture: CBS 136635 = CMW 31474 = CERC 1809.

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Type locality: **China**, GuangDong Province, ZhanJiang.

Type substrate: *Eucalyptus urophylla* × *E. grandis* clone seedling leaf.

Barcodes: *act* = MT335104; *cmdA* = MT335336; *his3* = MT335576; *rpb2* = MT412629; *tef1* = MT412867; *tub2* = MT413079 (alternative markers: ITS = MT359797; LSU = MT359557).

Notes: *Calonectria tetraramosa* was treated as a synonym of *Ca. pauciramosa* in this study. In comparisons of DNA sequences for eight gene regions, all the sequences of the isolates of *Ca. tetraramosa* (ex-type CMW 31474, and CMW 31476) were 100 % identical to those of the isolates of *Ca. pauciramosa* (ex-type CBS 138824, CMW 2151, CMW 7592, CMW 9151, CMW 30823, and CMW 30875). Both species produce obpyriform vesicles and 1-septate macroconidia, and shared similar vesicle (*Ca. tetraramosa*: 4–10 µm; *Ca. pauciramosa*: 5–11 µm) and macroconidial dimensions (*Ca. tetraramosa*: av. 48 × 5 µm; *Ca. pauciramosa*: av. 50 × 4.5 µm) (Crous 2002, Lombard *et al.* 2015a) (Supplementary Table S4).

tonkinensis Calonectria N.Q. Pham *et al*., Mycologia 111: 87. 2019.

In: *Calonectria cylindrospora* species complex.

Typus: PREM 62124 holotype.

Ex-type culture: CBS 143576 = CMW 47430.

Type locality: **Vietnam**, Hanoi, Bavi.

Type substrate: Soil in a *Eucalyptus* plantation.

Barcodes: *act* = MT335147; *cmdA* = MT335384; *his3* = MT335624; *rpb2* = MT412676; *tef1* = MT412915; *tub2* = MT413122 (alternative markers: ITS = MT359845; LSU = MT359605).

Notes: *Calonectria tonkinensis* is closely related to *Ca*. *cerciana*, and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. tonkinensis* (av. 41.5 × 4 µm) are smaller than those of *Ca. cerciana* (av. 44 × 5 µm), and the vesicles of *Ca. tonkinensis* (3–7 µm) are narrower than those of *Ca. cerciana* (8–13 µm) (Lombard *et al*. 2010c, Pham *et al*. 2019) (Supplementary Table S4).

tropicalis Calonectria L. Lombard & Crous, Stud. Mycol. 85: 192. 2016.

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(see ***Calonectria amazonica***)

In: *Calonectria pteridis* species complex.

Typus: CBS H-22776 holotype.

Ex-type culture: CBS 116271 = CMW 51236 = CPC 3559.

Type locality: **Brazil**, Amazon.

Type substrate: *Eucalyptus* sp.

Barcodes: *act* = MT335148; *cmdA* = MT335385; *his3* = MT335625; *rpb2* = MT412677; *tef1* = MT412916; *tub2* = MT413123 (alternative markers: ITS = MT359846; LSU = MT359606).

Notes: *Calonectria tropicalis* was treated as a synonym of *Ca. amazonica* in this study. In comparisons of DNA sequences for eight gene regions, the only differences between the ex-type isolate of *Ca. tropicalis* (CBS 116271) and the ex-type isolate of *Ca. amazonica* (CBS 116250) was in the ITS, *rpb2* and *tub2* sequences, where there was one base difference in the ITS, one base difference in the *rpb2* and three base differences in the *tub2* sequences. Both species produce clavate vesicles and 1(–3)-septate macroconidia, and shared similar vesicle (*Ca. tropicalis*: 5–6 µm; *Ca. amazonica*: 5–6 µm) and macroconidial dimensions (*Ca. tropicalis*: av. 80 × 5 µm; *Ca. amazonica*: av. 79 × 5 µm) (Lombard *et al.* 2016) (Supplementary Table S4).

tucuruiensis Calonectria L. Lombard & Crous, Stud. Mycol. 86: 123. 2017.

(see ***Calonectria ovata***)

In: *Calonectria pteridis* species complex.

Typus: CBS H-22777 holotype.

Ex-type culture: CBS 114755 = CMW 51827 = CPC 1403.

Type locality: **Brazil**, Pará, Tucuruí.

Type substrate: *Eucalyptus tereticornis*.

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Barcodes: *act* = MT335078; *cmdA* = MT335310; *his3* = MT335550; *tef1* = MT412841; *tub2* = MT413055 (alternative markers: ITS = MT359771; LSU = MT359531).

Notes: *Calonectria tucuruiensis* was treated as a synonym of *Ca. ovata* in this study. In comparisons of DNA sequences for seven available gene regions, there was one base difference between the ex-type isolate of *Ca. tucuruiensis* (CBS 114755) and the ex-type isolate of *Ca. ovata* (CMW 16724) in each of the LSU and *tub2* sequences. Both species produce ovoid vesicles with overlapping dimensions (*Ca. tucuruiensis*: 9–12 µm; *Ca. ovata*: 8–14 µm) and 1-septate macroconidia. The macroconidia of *Ca. tucuruiensis* [(av. 63 × 5 µm); Marin-Felix *et al.* 2017] are shorter than those of *Ca. ovata* [(av. 70 × 5 µm); Victor *et al.* 1997], which was considered to represent intraspecific variation (Supplementary Table S4).

tunisiana Calonectria L. Lombard *et al*., Persoonia 27: 77. 2011.

(see ***Calonectria pseudomexicana***)

In: *Calonectria mexicana* species complex.

Typus: CBS H-20684 holotype.

Ex-type culture: CBS 130357 = CMW 51316 = DISTEF-TCL1.

Type locality: **Tunisia**, Carthage, Tunis.

Type substrate: *Callistemon laevis*.

Barcodes: *act* = MT335149; *cmdA* = MT335386; *his3* = MT335626; *rpb2* = MT412678; *tef1* = MT412917; *tub2* = MT413124 (alternative markers: ITS = MT359847; LSU = MT359607).

Notes: *Calonectria tunisiana* was treated as a synonym of *Ca. pseudomexicana* in this study. In comparisons of DNA sequences for eight gene regions, the only differences between the ex-type isolate of *Ca. tunisiana* (CBS 130357) and the ex-type isolate of *Ca. pseudomexicana* (CBS 130354) was in the LSU and *tef1* sequences, where there was one base difference in the LSU and six base differences in the *tef1* sequences. Both species produce fusiform to broadly ellipsoidal vesicles with papillate apex and 1-septate macroconidia, and similar vesicles (*Ca. tunisiana*: 8–14 µm; *Ca. pseudomexicana*: 9–14 µm). The macroconidia of *Ca. tunisiana* (av. 49 × 5 µm) are longer than those of *Ca. pseudomexicana* (av. 45 × 5 µm) (Lombard *et al.* 2011), which was considered to represent intraspecific variation (Supplementary Table S4).

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turangicola Calonectria L. Lombard *et al.*, Stud. Mycol. 80: 184. 2015.

(see ***Calonectria kyotensis***)

In: *Calonectria kyotensis* species complex.

Typus: CBS H-21488 holotype.

Ex-type culture: CBS 136077 = CMW 31411.

Type locality: **China**, GuangXi Province.

Type substrate: Soil in a *Eucalyptus* plantation.

Barcodes: *act* = MT335151; *cmdA* = MT335388; *his3* = MT335628; *tef1* = MT412919; *tub2* = MT413126 (alternative markers: ITS = MT359849; LSU = MT359609).

Notes: *Calonectria turangicola* was treated as a synonym of *Ca. kyotensis* in this study. In comparison of DNA sequences for seven available gene regions, the only difference between the ex-type isolate of *Ca. turangicola* (CMW 31411) and the ex-type isolate of *Ca. kyotensis* (CBS 114525) was in the LSU, *tef1* and *tub2* sequences, where there was one base difference in the LSU, two base differences in the *tef1* and two base differences in the *tub2* sequences. Both species are homothallic and produce sphaeropedunculate (globose) vesicles and 1-septate macroconidia of similar dimensions (*Ca. turangicola*: av. 44 × 4 µm, *Ca. kyotensis*: av. 41 × 4 µm) (Terashita 1968, Lombard *et al*. 2015a, Li *et al.* 2020; Supplementary Table S4).

uniseptata Calonectria Gerlach, Phytopathol. Z. 61: 379. 1968.

In: *Calonectria kyotensis* species complex.

Typus: No. 10759 holotype.

Ex-type culture: CBS 413.67 = CMW 23678 = CPC 2391 = IMI 299577.

Type locality: **Germany**, Celle.

Type substrate: *Paphiopedilum callosum*.

Barcodes: *act* = GQ280451; *cmdA* = GQ267379; *his3* = GQ267248; *tef1* = GQ267307; *tub2* = GQ267208 (alternative markers: ITS = GQ280573; LSU = GQ280695).

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Notes: *Calonectria uniseptata* is closely related to *Ca*. *asiatica* and *Ca. syzygiicola*, and can be distinguished from these two species by the dimensions of its ascospores and vesicles. The ascospores of *Ca. uniseptata* [(av. 41.5 × 6.3 µm); Gerlach 1968] are longer than those of *Ca. asiatica* [(av. 33 × 6 µm); Crous *et al*. 2004], and the vesicles of *Ca. uniseptata* (8.2–20.4 µm) are wider than those of *Ca. syzygiicola* (3–6 µm) (Gerlach 1968, Lombard *et al*. 2016) (Supplementary Table S4).

uxmalensis Calonectria L. Lombard & Crous, Stud. Mycol. 85: 193. 2016.

In: *Calonectria mexicana* species complex.

Typus: CBS H-22761 holotype.

Ex-type culture: CBS 110925 = CMW 51167 = CPC 945.

Type locality: **Mexico**, Uxmal.

Type substrate: Soil.

Barcodes: *act* = MT335153; *cmdA* = MT335390; *his3* = MT335630; *rpb2* = MT412681; *tef1* = MT412921; *tub2* = MT413128 (alternative markers: ITS = MT359851; LSU = MT359611).

Notes: *Calonectria uxmalensis* is closely related to *Ca. pseudouxmalensis*, and sequences of *cmdA*, *his3*, *tef1* and *tub2* gene regions can distinguish *Ca*. *uxmalensis* from *Ca. pseudouxmalensis*. Morphologically, these two species are similar to each other, while the ability of *Ca*. *uxmalensis* to produce lateral stipe extensions can differentiate *Ca*. *uxmalensis* from *Ca. pseudouxmalensis* (Lombard *et al.* 2016) (Supplementary Table S4).

variabilis Calonectria Crous *et al*., Syst. Appl. Microbiol. 16: 270. 1993.

Synonym: *Cylindrocladium variabile* Crous *et al*., Syst. Appl. Microbiol. 16: 270. 1993.

In: *Calonectria cylindrospora* species complex.

Typus: PREM 51039 (holotype of *Ca. variabilis*; Crous *et al*. 1993b), PREM 51041 (holotype of *Cy. variabile*; Crous *et al*. 1993b).

Ex-type culture: CBS 114677 = CMW 3187 = CPC 2436= AR2675 (Crous *et al*. 1993b, Crous 2002)

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Type locality: **Brazil**, Pará.

Type substrate: *Schefflera morototoni*.

Barcodes: *cmdA* = MT335392; *his3* = MT335632; *rpb2* = MT412683; *tef1* = MT412923; *tub2* = MT413130 (alternative markers: ITS = MT359853; LSU = MT359613).

Notes: *Calonectria variabilis* is phylogenetically closely related to *Ca. cylindrospora* and can be distinguished from that species by the dimensions of its macroconidia. The macroconidia of *Ca. variabilis* [(av. 73 × 5 µm); Crous *et al*. 1993b] are larger than those of *Ca. cylindrospora* [(av. 45 × 4 µm); Crous *et al*. 1993a, Lombard *et al*. 2015b]. *Calonectria variabilis* readily produces a microconidial morph in culture on CLA (Crous *et al*. 1993b), a feature not observed for *Ca. cylindrospora* (Crous *et al*. 1993a). *Calonectria variabilis* is characterised as being homothallic, while *Ca. cylindrospora* is heterothallic (Crous *et al*. 1993b).

vegrandis Calonectria N.Q. Pham & M.J. Wingfield, Mycologia 111: 99. 2019.

(see ***Calonectria curvispora***)

In: *Calonectria kyotensis* species complex.

Typus: PREM 62113 holotype.

Ex-type culture: CBS 143565 = CMW 48245.

Type locality: **Indonesia**, North Sumatra, Aek Nauli.

Type substrate: Soil in *Eucalyptus* plantation.

Barcodes: *act* = MT335003; *cmdA* = MT335233; *his3* = MT335473; *rpb2* = MT412537; *tef1* = MT412764 (alternative markers: ITS = MT359694; LSU = MT359454).

Notes: *Calonectria vegrandis* was treated as a synonym of *Ca. curvispora* in this study. In comparisons of DNA sequences for seven available gene regions, all seven gene sequences for the isolates of *Ca. vegrandis* (ex-type CMW 48245, and CMW 48246) were 100 % identical to the ex-type isolate of *Ca. curvispora* (CMW 23693). Both species produce sphaeropedunculate vesicles and 1-septate macroconidia, whereas *Ca. curvispora* typically produce curved macroconidia which are straight in *Ca. vegrandis* (Victor *et al*. 1997, Lombard *et al.* 2010a, Pham *et al.* 2019), suggesting that curved or straight macroconidia may be not a

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reliable feature to distinguish between these species. The macroconidia of *Ca. vegrandis* (av. 41 × 4.5 µm) are smaller than those of *Ca. curvispora* (av. 60 × 5 µm) (Victor *et al*. 1997, Lombard *et al.* 2010a, Pham *et al.* 2019), which was considered to represent intraspecific variation (Supplementary Table S4).

venezuelana Calonectria L. Lombard *et al.*, Stud. Mycol. 85: 195. 2016.

In: *Calonectria candelabrum* species complex.

Typus: CBS H-22778 holotype.

Ex-type culture: CBS 111052 = CMW 51173 = CPC 1183.

Type locality: **Venezuela**, Acarigua.

Type substrate: Soil.

Barcodes: *act* = MT335155; *cmdA* = MT335394; *his3* = MT335634; *rpb2* = MT412685; *tef1* = MT412925; *tub2* = MT413132 (alternative markers: ITS = MT359855; LSU = MT359615).

Notes: *Calonectria venezuelana* is closely related to *Ca. candelabrum* and *Ca. eucalypticola*, and can be distinguished from these two species by the dimensions of its macroconidia. The macroconidia of *Ca. venezuelana* [(av. 58 × 5 µm); Lombard *et al*. 2016] are shorter than those of *Ca. candelabrum* [(av. 60 × 4.5 µm); Crous 2002], and larger than those of *Ca. eucalypticola* [(av. 50 × 4 µm); Alfenas *et al*. 2015] (Supplementary Table S4).

yunnanensis Calonectria J.Q. Li *et al*., IMA Fungus 8: 282. 2017.

Synonym: *Calonectria pseudoyunnanensis* J.Q. Li *et al*., IMA Fungus 8: 279. 2017.

In: *Calonectria kyotensis* species complex.

Typus: PREM 61955 holotype.

Ex-type culture: CBS 142897 = CMW 47644 = CERC 5339.

Type locality: **China**, YunNan.

Type substrate: Soil in *Eucalyptus* plantation.

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Barcodes: *act* = MT335157; *cmdA* = MT335396; *his3* = MT335636; *rpb2* = MT412687; *tef1* = MT412927; *tub2* = MT413134 (alternative markers: ITS = MT359857; LSU = MT359617).

Notes: *Calonectria yunnanensis* is closely related to *Ca. asiatica* and can be distinguished from that species by the dimensions of its macroconidia and vesicles. The macroconidia of *Ca. yunnanensis* [(av. 43 × 4.5 µm); Li *et al*. 2017] are smaller than those of *Ca. asiatica* [(av. 53 × 5 µm); Crous *et al*. 2004], and the vesicles of *Ca. yunnanensis* (2–4.5 µm) are narrower than those of *Ca. asiatica* (12–17 µm). *Calonectria yunnanensis* is homothallic (Li *et al*. 2020) (Supplementary Table S4).

zuluensis Calonectria L. Lombard & Crous, Stud. Mycol. 66: 25. 2010.

(see ***Calonectria pauciramosa***)

In: *Calonectria candelabrum* species complex.

Typus: PREM 60292 holotype.

Ex-type culture: CBS 125268 = CMW 9188.

Type locality: **South Africa**, KwaZulu-Natal, Kwambonambi.

Type substrate: *Eucalyptus grandis* clonal cutting.

Barcodes: *act* = MT335159; *cmdA* = MT335398; *his3* = MT335638; *rpb2* = MT412689; *tef1* = MT412929; *tub2* = MT413136 (alternative markers: ITS = MT359859; LSU = MT359619).

Notes: *Calonectria zuluensis* was treated as a synonym of *Ca. pauciramosa* in this study. In comparisons of DNA sequences for eight gene regions, the only differences between the ex-type isolate of *Ca. zuluensis* (CMW 9188) and the ex-type isolate of *Ca. pauciramosa* (CBS 138824) was in the *act* and *tub2* sequences, where there were two base differences in the *act* and three base differences in the *tub2* sequences. Both species are heterothallic and produce obpyriform to ellipsoidal vesicles of similar dimensions (*Ca. zuluensis*: 6–10 µm; *Ca. pauciramosa*: 5–11 µm) and 1-septate macroconidia. The macroconidia of *Ca. zuluensis* (av. 36 × 4 µm) are smaller than those of *Ca. pauciramosa* (av. 50 × 4.5 µm) (Crous 2002, Lombard *et al.* 2010b, Li *et al*. 2020), which was considered to represent intraspecific variation (Supplementary Table S4).

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Selection of DNA barcodes for species recognition

Phylogenetic analyses of sequences for eight gene regions resulted in the delineation of 120 clearly defined *Calonectria* species. These eight gene regions thus serve as putative DNA barcodes. As with most other fungi, it is not possible to use a single DNA barcode to identify species of *Calonectria*. Consequently, the Identification Success Rate (ISR) was calculated for each of the eight putative barcodes for all 120 species of *Calonectria* and also for species residing in each of the 11 well-defined species complexes (Supplementary Table S5).

For the genus as a whole, the results showed that sequence data for *tef1* and *tub2* had the strongest ability to correctly identify species (ISRs: 89.1 % and 88.3 %, respectively; Supplementary Table S5, Fig. 4). This was followed by *cmdA*, *his3*, *rpb2* and *act* gene regions which also provided relatively effective resolution of the *Calonectria* spp. (Supplementary Table S5, Fig. 4). The efficacy of the ITS and LSU regions to identify species was relatively low (ISRs: 29.3 % and 27.6 %, respectively; Supplementary Table S5, Fig. 4).

For the 11 species complexes, the results showed that the most effective barcodes could not be employed across all species complexes. The *tef1* sequences provided resolution power in the *Ca. candelabrum* and *Ca. cylindrospora* species complexes (Supplementary Table S5, Fig. 5). In contrast, *tub2* was the best DNA barcode for the *Ca. brassicae* and *Ca. reteaudii* species complexes (Supplementary Table S5, Fig. 5), *act* and *tub2* both the best for the *Ca. mexicana* species complex. The frequency of successful identification using the eight gene region data in the 11 species complexes also differed. Collectively, the six regions (*tef1*, *tub2*, *cmdA*, *his3*, *rpb2*, and *act*) provided stable and reliable resolution power for species in each of the 11 species complexes. Our results suggested that all 120 *Calonectria* species accepted in this study could be distinguished based on the six-region (*tef1*, *tub2*, *cmdA*, *his3*, *rpb2*, and *act*) combined phylogeny, and 118 of the 120 (98%) *Calonectria* species could be recognised based on the *tef1* and *tub2* gene region combined phylogeny.

DISCUSSION

This study represents the most comprehensive molecular phylogenetic overview of *Calonectria*, a genus that includes many important plant pathogens. Sequence data for eight gene regions of 240 isolates representing 128 species were newly generated. In the case of 44 species for which cultures could not be obtained, sequence data were sourced from GenBank so as to consider all 169 previously described species. Phylogenetic analyses were conducted for each of the eight

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gene regions individually as well as for a combined dataset. The results provided clear evidence that 51 species are indistinguishable from previously described taxa and synonymies have been provided for these. Two novel taxa were recognised and described as *Ca. lombardiana* and *Ca. pauciphialidica*. Furthermore, the name *Ca. lauri* was validated. The overall result of the study is the acceptance of 120 clearly defined species of *Calonectria*. The eight sequenced gene regions were then evaluated individually to identify the most useful DNA barcodes to accurately identify these species. These analyses showed that six gene regions (*tef1*, *tub2*, *cmdA*, *his3*, *rpb2*, and *act*) provide effective barcodes for the genus.

The combined eight-gene phylogenetic tree emerging from this study placed the 120 accepted *Calonectria* species in the two major groups; the Prolate Group and the Sphaero-Naviculate Group. This is consistent with the results of previous studies (Lombard *et al*. 2016, Jayawardena *et al*. 2019), showing a clear phylogenetic distinction between these two groups in *Calonectria*. The previously recognised 10 species complexes (Lombard *et al*. 2016) were also well resolved. Interestingly, the results of this study also revealed a new species complex, that we have defined as the *Calonectria gracilipes* species complex. Delimitation of this new species complex was supported by both phylogenetic placement and morphological characteristics.

Species in the *Ca. brassicae* species complex typically have clavate vesicles and 1-septate macroconidia, producing orange to red-brown perithecia, 8-spored asci and 1-septate ascospores. The species complex also includes both heterothallic and homothallic species, and these are primarily distributed in South America (Crous 2002, Crous *et al*. 2006, Lombard *et al*. 2009, 2010a, 2016, Alfenas *et al*. 2015, Marin-Felix *et al*. 2017, Li *et al.* 2020). In the present study, two species were reduced to synonymy based on phylogenetic inference; *Ca. ecuadorensis* reduced to synonymy with *Ca. ecuadorae*, and *Ca. telluricola* with *Ca. paraensis*. The description of *Ca. pauciphialidica* adds a novel species to this species complex, and it is closely related to, but morphologically distinct from *Ca. ecuadorae*. Sixteen species are now recognised in the *Ca. brassicae* species complex.

Species in the *Ca. candelabrum* species complex are characterised by ellipsoidal to obpyriform vesicles and 1-septate macroconidia, producing orange to red-brown perithecia, 8-spored asci and 1-septate ascospores. The species complex includes both heterothallic and homothallic species that are known from Africa, Asia, Europe, North and South America, Oceania (Viégas 1946, Schoch *et al.* 1999, Crous & Kang 2001, Crous 2002, Lombard *et al*. 2010a, b, 2015a, b,

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2016, Alfenas *et al*. 2013a, 2015, Lopes *et al.* 2017, Li *et al.* 2020). The *Ca. candelabrum* species complex includes important plant pathogens some of which pose a serious threat to global forestry and agricultural industries (Schoch *et al.* 1999, Crous 2002, Lombard *et al.* 2010b, 2015a, Crous *et al.* 2013, Alfenas *et al.* 2015). In the present study, 10 species were reduced to synonymy based on phylogenetic inference, eight (*Ca. cliffordiicola*, *Ca. ericae*, *Ca. machaerinae*, *Ca. mossambicensis*, *Ca. polizzii*, *Ca. seminaria*, *Ca. tetraramosa* and *Ca. zuluensis*) of which were reduced to synonymy with *Ca. pauciramosa*. In addition, one species (*Ca. pseudoscoparia*) was reduced to synonymy with *Ca. candelabrum*, and one species (*Ca. stipitata*) with *Ca. spathulata*. Eighteen species are now included in the *Ca. candelabrum* species complex.

Species in the *Ca. colhounii* species complex typically have clavate vesicles and 3-septate macroconidia, producing yellow perithecia, which is considered as the most characteristic feature of the species complex. They include 4-spored asci and 3-septate ascospores and both heterothallic and homothallic species. Homothallism is the dominant mating system (Crous 2002, Lombard *et al*. 2010a, Chen *et al*. 2011, Li *et al*. 2017, 2020) and the majority of species have been collected from Asia (Peerally 1973, Crous *et al.* 1999, Crous 2002, Lombard *et al*. 2010a, 2016, Chen *et al*. 2011, Xu *et al.* 2012, Li *et al*. 2017, 2020, Liu & Chen 2017). In the present study, three species were reduced to synonymy based on phylogenetic inference. These include *Ca. pseudocolhounii* reduced to synonymy with *Ca. eucalypti*, *Ca. nymphaeae* was synonymized with *Ca. fujianensis*, and *Ca. parva* with *Ca. macroconidialis*. In addition, *Ca. madagascariensis* with typical clavate vesicles was shown to reside in the *Ca. colhounii* species complex, consistent with the findings of Lombard *et al*. (2010a). This result is in contrast to the phylogeny presented by Jayawardena *et al*. (2019) who suggested that the species formed a distinct lineage apart from species in the 11 species complexes. Based on our results, 11 species reside in the *Ca. colhounii* species complex, including *Ca. madagascariensis*.

In the *Ca. cylindrospora* species complex, species have variable vesicle shapes, including clavate, ellipsoidal, fusiform, obpyriform to sphaeropedunculate, and they typically produce 1-septate macroconidia, orange to red-brown perithecia, 8-spored asci and 1-septate ascospores. The species complex includes both heterothallic and homothallic species (Crous *et al*. 1993b, Schoch *et al*. 1999, Crous 2002, Li *et al*. 2020). Species in the *Ca. cylindrospora* species complex exhibit a broad geographic distribution including Africa, Asia, Europe, North and South America (Crous *et al.* 1993c, 2013, Crous 2002, Lombard *et al*. 2010a, b, c, 2015a, 2016,

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Alfenas *et al*. 2013b, 2015, Pham *et al.* 2019, Li *et al.* 2020). In the present study, eight species were reduced to synonymy based on phylogenetic inference including two species (*Ca. hodgesii* and *Ca. pseudohodgesii*) as synonyms of *Ca. brasiliensis*, two species (*Ca. papillata* and *Ca. terrestris*) as synonyms of *Ca. cerciana*, two species (*Ca. foliicola* and *Ca. sulawesiensis*) as synonyms of *Ca. hawksworthii*, one species (*Ca. blephiliae*) as a synonym of *Ca. cylindrospora* and one species (*Ca. pseudocerciana*) as a synonym of *Ca. propaginicola*. As a consequence, 12 species are now accepted in the *Ca. cylindrospora* species complex.

In the *Ca. gracilipes* species complex, species are characterised by narrowly clavate vesicles and multi-septate (> 3) macroconidia, producing orange to red-brown perithecia and 8-spored asci. Species in this species complex have a homothallic mating system (Crous *et al*. 1997a, El-Gholl *et al*. 1997, Crous 2002) and they have been reported from both North and South America (Figueiredo & Namekata 1967, Crous *et al.* 1997a, 2000, El-Gholl *et al.* 1997, Crous 2002). Five species are now included in the *Ca. gracilipes* species complex.

Species in the *Ca. kyotensis* species complex typically have sphaeropedunculate vesicles and 1-septate macroconidia, producing orange to red-brown perithecia, 8-spored asci and 1-septate ascospores. Both heterothallic and homothallic species are known in the species complex and a majority of the members have been described from Asia (Boedijn & Reitsma 1950, Tubaki 1958, Sobers & Seymour 1967, Gerlach 1968, Terashita 1968, Sobers 1969, Alfieri *et al.* 1982, Victor *et al.* 1997, Kang *et al.* 2001b, Crous 2002, Crous *et al*. 2004, Lombard *et al*. 2015a, 2016, Li *et al*. 2017, 2020, Liu & Chen 2017, Pham *et al.* 2019). Results of the present study have shown that 17 species in this complex are the same as earlier described taxa. Of these, nine species (*Ca. arbusta*, *Ca. expansa*, *Ca. guangxiensis*, *Ca. hainanensis*, *Ca. magnispora*, *Ca. parakyotensis*, *Ca. pluriramosa*, *Ca. pseudokyotensis* and *Ca. sphaeropedunculata*) were reduced to synonymy with *Ca. aconidialis*, three (*Ca. floridana*, *Ca. pseudoturangicola* and *Ca. turangicola*) with *Ca. kyotensis*, one (*Ca. montana*) with *Ca. canadiana*, one (*Ca. multistipitata*) with *Ca. chinensis*, one (*Ca. vegrandis*) with *Ca. curvispora*, one (*Ca. indonesiana*) with *Ca. sumatrensis* and one (*Ca. pseudoyunnanensis*) with *Ca. yunnanensis*. Consequently, 24 species are now accommodated in the *Ca. kyotensis* species complex, making it the largest *Calonectria* species complex.

Species in the *Ca. mexicana* species complex typically have ellipsoidal vesicles with a papillate apex and 1-septate macroconidia. The species complex includes both heterothallic and homothallic species, although the heterothallic mating system is dominant (El-Gholl *et al*. 1989,

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Schubert *et al*. 1989, Schoch *et al*. 1999, Crous 2002). Species in the *Ca. mexicana* complex have been collected from many continents, including Africa, Europe and North America (El-Gholl *et al.* 1989, Schubert *et al.* 1989, Schoch *et al.* 1999, Crous 2002, Lechat *et al.* 2010, Lombard *et al.* 2011, 2016, Li *et al.* 2020). In the present study, *Ca. tunisiana* was reduced to synonymy with *Ca. pseudomexicana*. Consequently, eight species are now accommodated in this species complex.

In the *Ca. naviculata* species complex, species typically have naviculate vesicles and 1-septate macroconidia. Species in the species complex have a heterothallic mating system (Crous *et al*. 1997a, 2002, Gehesquiere *et al*. 2015, Li *et al*. 2020) and they have been collected from Africa, Asia, Europe, North and South America and Oceania (Crous *et al.* 1997a, 2002, 2004, Crous 2002, Alfenas *et al*. 2015, Gehesquiere *et al*. 2015, Lombard *et al.* 2016, LeBlanc *et al.* 2019, Li *et al.* 2020). In the study of Jayawardena *et al*. (2019), *Ca. pseudonaviculata* formed a distinct lineage and did not reside in any of the previously defined species complexes. Results of the present study have shown that this species resides comfortably in the *Ca. naviculata* species complex, consistent with the results of Lombard *et al*. (2010a, 2016). Currently, six species are included in the *Ca. naviculata* species complex.

In the *Ca. pteridis* species complex, species typically have clavate or ovate vesicles and 1-septate macroconidia. Species have a heterothallic mating system (El-Gholl *et al*. 1993a, Li *et al*. 2020) and have commonly been collected in North and South America (Sobers 1968, Crous *et al.* 1993c, El-Gholl *et al.* 1993a, Leahy *et al.* 2000, Crous 2002, Alfenas *et al*. 2015, Lombard *et al.* 2016, Marin-Felix *et al*. 2017, Li *et al.* 2020). Results of the present study have shown that six species in this complex are synonyms of earlier described taxa. Three species (*Ca. amazoniensis*, *Ca. longiramosa* and *Ca. tropicalis*) have thus been reduced to synonymy with *Ca. amazonica* and three species (*Ca. nemoralis*, *Ca. tereticornis* and *Ca. tucuruiensis*) with *Ca. ovata*. Consequently, seven species are now accommodated in the *Ca. pteridis* species complex.

In the *Ca. reteaudii* species complex, species are characterised by having narrowly clavate vesicles, multi-septate (> 3) macroconidia and they produce orange to red-brown perithecia, 8-spored asci and multi-septate (> 3) ascospores. Both heterothallic and homothallic *Calonectria* species have been described in this species complex (Kang *et al*. 2001a, Crous 2002, Gadgil & Dick 2004, Lombard *et al*. 2010c, Chen *et al*. 2011, Li *et al*. 2020) and species have been reported in Asia and Oceania (Kang *et al.* 2001a, Crous 2002, Gadgil & Dick 2004, Crous *et*

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al. 2006, 2012, Lombard *et al*. 2010c, 2015a, 2016, Chen *et al*. 2011, Li *et al*. 2017, 2020, Pham *et al*. 2019). Four species in this species complex were reduced to synonymy, including two species (*Ca. microconidialis* and *Ca. pentaseptata*) with *Ca. pseudoreteaudii*, one species (*Ca. terrae-reginae*) with *Ca. queenslandica* and one species (*Ca. baviensis*) with *Ca. reteaudii*. The description of *Ca. lombardiana* adds a new member to the *Ca. reteaudii* species complex and its larger macroconidial dimensions easily distinguish it from *Ca. queenslandica*, its closest phylogenetic relative. Nine species are now accepted as residing in the *Ca. reteaudii* species complex.

Calonectria species in the *Ca. reteaudii* species complex incorporate many important causal agents of plant disease, resulting in mainly leaf blights on a wide range of hosts in several countries including Australia, China, India, Laos and Vietnam (Old *et al*. 2003, Chen *et al*. 2011, Pham *et al*. 2019). *Calonectria pentaseptata*, initially described from Vietnam, has been reported from the GuangDong, GuangXi and HaiNan provinces of China (Crous *et al*. 2012, Lombard *et al*. 2015a, Li *et al*. 2017), causing severe leaf blight diseases on *Eucalyptus* in plantations and nurseries. In the present study, *Ca. pentaseptata* and *Ca. microconidialis* (Crous *et al*. 2012, Lombard *et al*. 2015a) were reduced to synonymy with *Ca. pseudoreteaudii*. *Calonectria pseudorateaudii* was originally described by Lombard *et al*. (2010c) from stems of *E. urophylla* × *E. grandis* hybrid cuttings in GuangDong Province, China. The results of the present study suggest that this species has been in China at least for 10 yr and continues to pose a serious threat to the *Eucalyptus* industry.

In the *Ca. spathiphylli* species complex, species typically have sphaeropedunculate vesicles and 1-spetate macroconidia and produce orange to red-brown perithecia, 8-spored asci and 1-septate ascospores. Both heterothallic and homothallic *Calonectria* species have been described in this species complex (El-Gholl *et al*. 1992, Kang *et al*. 2001b) and species are commonly collected in North and South America (El-Gholl *et al.* 1992, Kang *et al.* 2001b, Crous 2002, Lombard *et al*. 2010a). Four species are now accommodated in the *Ca. spathiphylli* species complex.

Results of this study have revealed interesting patterns regarding the geographic distribution of various groups of *Calonectria* spp. For example, more than 75% of the species in the *Ca. brassicae* and *Ca. candelabrum* species complexes have been described from South American countries such as Brazil, Colombia, Ecuador and Venezuela (Alfenas *et al*. 2013a, b, 2015). Likewise, species in the *Ca. kyotensis* species complex appear to represent an Asian

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assemblage, with 19 of the 24 species collected in Asian countries such as China, Indonesia, Japan, Malaysia, and Vietnam (Crous 2002, Crous *et al*. 2004, Lombard *et al*. 2015a, Li *et al*. 2017, Liu & Chen 2017, Pham *et al*. 2019). Of those species, 14 were isolated from soil collected in Asia, suggesting this geographic region could be their centre of origin. There are, however, few studies that have considered the centres of origin of *Calonectria* species (Wright *et al*. 2010, Freitas *et al*. 2019, LeBlanc *et al*. 2019, Malapi-Wight *et al*. 2019), emphasizing a need for population biology studies on these fungi in the future.

The synonymized species in this study were generally from regions adjacent to those from which the validated taxa were originally collected. For example, *Ca. cerciana*, together with its now recognised synonyms *Ca. papillata* and *Ca. terrestris* were isolated from adjacent sites in GuangDong Province in southern China (Lombard *et al.* 2010c, 2015a). However, there were also some cases where species reduced to synonymy were from different continents where the climates differed significantly. For example, *Ca. pauciramosa* and the eight species (*Ca. cliffordiicola*, *Ca. ericae*, *Ca. machaerinae*, *Ca. mossambicensis*, *Ca. polizzii*, *Ca. seminaria*, *Ca. tetraramosa* and *Ca. zuluensis*) reduced to synonymy with it, thus were isolated from Africa, Asia, Europe and North America (Schoch *et al.* 1999, Crous & Kang 2001, Crous *et al.* 2013, Lombard *et al.* 2010b, 2015a, 2016, Alfenas *et al.* 2015). The present study further supports the fact that *Ca. pauciramosa* has a worldwide distribution and that it is able to exist under various climatic conditions (Schoch *et al.* 1999, Crous 2002, Lombard *et al.* 2010b, 2015a, 2016, Crous *et al.* 2013).

Results of this study showed that six loci (*act*, *cmdA*, *his3*, *rpb2*, *tef1*, and *tub2*) can serve as reliable DNA barcodes for species delimitation in *Calonectria*. A similar six gene approach has been established for *Colletotrichum*, where the *act*, *chs-1*, *gapdh*, *his3*, ITS and *tub2* regions have been employed to reveal the phylogenetic relationships of species with curved conidia from herbaceous hosts (Damm *et al*. 2009). Likewise, six markers (*act*, *cmdA*, *gapdh*, *gs*, ITS and *tub2*) were utilised to characterise the species of *Colletotrichum* associated with coffee berries in northern Thailand (Prihastuti *et al*. 2009). A six gene (*act*, ITS, LSU, *rpb1*, *tef1* and *tub2*) approach has also been used for the phylogenetic analyses of *Allantonectria*, *Nectria*, and *Pleonectria* (Hirooka *et al*. 2012). The present study has revealed that optimal barcodes for taxon delimitation differs for the various *Calonectria* species complexes. This is similar to the case in *Fusarium*, where five barcodes (*cmdA*, IGS, *rpb2*, *tef1*, and *tub2*) were applied to stabilise the taxonomic position of species in the *Fusarium oxysporum* species

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complex (Lombard *et al*. 2019). Similarly, Wang *et al*. (2019) utilised five loci (*cmdA*, ITS, *rpb1*, *rpb2*, and *tef1*) to evaluate and clarify the phylogenetic relationships of the *F. incarnatum-equiseti* species complex. Although the ideal set of barcodes differed among the various species complexes in *Calonectria*, six loci (*act*, *cmdA*, *his3*, *rpb2*, *tef1*, and *tub2*) served as the most phylogenetically informative markers. These are consequently recommended as the universal DNA barcodes for species delimitation in *Calonectria*.

Multi-gene phylogenetic analyses combined with morphological features provides a robust means to delimit fungal species boundaries (James *et al*. 2006, Hibbett *et al*. 2007, Liu *et al*. 2015, Chen *et al*. 2017, Woudenberg *et al*. 2017). This polyphasic approach has been widely employed in the taxonomy of *Calonectria* species (Lombard *et al*. 2010a, Chen *et al*. 2011, Crous *et al*. 2012, Alfenas *et al*. 2015, Lombard *et al*. 2016, Marin-Felix *et al*. 2017, Pham *et al*. 2019). However, a problem pertaining to the taxonomy of this group is that studies have used different markers and gene regions to identify species. This lack of consistency has resulted in confusion, and the many synonyms identified in the present study also arise, at least to some extent, from an inconsistency of taxonomic approaches.

In an attempt to provide a unified taxonomic system for *Calonectria*, we have evaluated the sequence data for eight gene regions that are available for all 120 species. These results showed that sequences of *tef1* and *tub2* provide markers that can recognise the majority of *Calonectria* species. The *tef1* and *tub2* combined phylogeny made it possible to recognise 118 of the 120 (98 %) species, indicating that combinations of *tef1* and *tub2* gene sequences are suitable for preliminary identification of *Calonectria* species. Results of this study indicated that the *tef1* region provided the best barcode, which contrasts with the study of Lombard *et al*. (2010a), who suggested that the *cmdA* region provides the best signal for species recognition in these fungi. Results of the present study also indicated that the *rpb2* region provides stable and reliable taxonomic signal for *Calonectria* identification and this is the first study where that gene region has been sequenced for a large collection of species in this genus.

Overall, the results of this study have provided a robust overview of the species boundaries in *Calonectria*. This is based largely on phylogenetic inference using DNA sequences for eight gene regions. It is evident that, over a period of approximately 10 yr (Lombard *et al*. 2010a, 2015a, 2016, Li *et al*. 2017, Marin-Felix *et al*. 2017, Pham *et al*. 2019), numerous species have been described in *Calonectria* that are synonyms of existing species. This is a common problem in many groups of fungi where species were described based on relatively limited DNA

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sequence data. As time has passed, new and more informative gene regions have become available to define phylogenetic species boundaries more clearly. The DNA sequence backbone emerging and reliable DNA barcodes resulting from the present study provides a robust foundation for future taxonomic studies on the group. It is recognised that in many cases, species identity in this study is based on only a single or a small number of isolates. Clearly, larger collections of isolates will help to further confirm species boundaries and provide a better understanding of species delineation. However, the framework presented here will provide an ideal basis on which to explore this further. Furthermore, the genomes of numerous *Calonectria* spp. have now been sequenced (Malapi-Wight *et al*. 2016a, b, Ye *et al*. 2018, Liu *et al*. 2019). In time, it is likely that phylogenomic studies will increase the clarity of species boundaries and provide even more robust DNA barcodes for *Calonectria.*

ACKNOWLEDGEMENTS

This study was provided with financial support by the National Key R&D Program of China, China (project no. 2017YFD0600103), the Fundamental Research Funds for the Central Non-Profit Research Institution of CAF, China (Project No. CAFYBB2018QC003), the National Natural Science Foundation of China, China (NSFC) (project no. 31622019), the National Ten-thousand Talents Program, China (project No. W03070115) and the GuangDong Top Young Talents Program, China (project No. 20171172).

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Table 1. Accepted *Calonectria* species emerging from the results of this study.

Code B[1]	Accepted species name[2]	Isolates representing the species [3,4,5]	Other collection number[5]	Hosts	Area of occurrence	Collector	GenBank accession Numbers[6] *act*; *cmdA*; *his3*; ITS; LSU; *rpb2*; *tef1*; *tub2*	References or source of data
B1	***Calonectria acaciicola***	CMW 47173[T]	CBS 143557	Soil (*Acacia auriculiformis* plantation)	Do Luong, Nghe An, Vietnam	N.Q. Pham & T.Q. Pham	**MT334933[7]; MT335160; MT335399; MT359620; MT359380; MT412474; MT412690; MT412930**	Pham *et al.* (2019), this study
		CMW 47174	CBS 143558	Soil (*A. auriculiformis* plantation)	Do Luong, Nghe An, Vietnam	N.Q. Pham & T.Q. Pham	**MT334934; MT335161; MT335400; MT359621; MT359381; MT412475; MT412691; MT412931**	Pham *et al.* (2019), this study
B2	***Ca. acicola***	CMW 30996[T]	–	*Phoenix canariensis*	Northland, New Zealand	H. Pearson	**MT334935; MT335162; MT335401; MT359622; MT359382; MT412476; MT412692; MT412932**	Gadgil & Dick (2004), Lombard *et al.* (2010a), this study
		CBS 114812	CMW 51216	*P. canariensis*	Northland, New Zealand	H. Pearson	**MT334936; MT335163; MT335402; MT359623; MT359383; MT412477; MT412693; MT412933**	Gadgil & Dick (2004), Lombard *et al.* (2010a), this study
B3	***Ca. aciculata***	CERC 5342[T]	CBS 142883; CMW 47645	*Eucalyptus urophylla* × *E. grandis*	YunNan, China	S.F. Chen & J.Q. Li	**MT334937; MT335164; MT335403; MT359624; MT359384; MT412478; MT412694; MT412934**	Li *et al.* (2017), this study
B4	***Ca. aconidialis***	CMW 35174[T]	CBS 136086; CERC 1850	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou & S.F. Chen	**MT334938; MT335165; MT335404; MT359625; MT359385; MT412479; MT412695; N/A[8]**	Lombard *et al.* (2015a), this study
		CMW 35384	CBS 136091; CERC 1886	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou & S.F. Chen	**MT334939; MT335166; MT335405; MT359626; MT359386; N/A; MT412696; N/A**	Lombard *et al.* (2015a), this study
		CMW 31370	CBS 136079; CERC 1705	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	**MT334940; MT335167; MT335406; MT359627; MT359387; MT412480; MT412697; N/A**	Lombard *et al.* (2015a), this study

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		CMW 31390	CBS 136081; CERC 1725	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	**MT334952; MT335179; MT335418; MT359639; MT359399; MT412485; MT412709; N/A**	Lombard *et al.* (2015a), this study
		CMW 31392	CBS 136247; CERC 1727	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	**MT334942; MT335169; MT335408; MT359629; MT359389; MT412481; MT412699; N/A**	Lombard *et al.* (2015a), this study
		CMW 31439	CBS 137332; CERC 1774	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	**MT334951; MT335178; MT335417; MT359638; MT359398; N/A; MT412708; N/A**	Lombard *et al.* (2015a), this study
		CMW 31440	CBS 136976; CERC 1775	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	**MT334950; MT335177; MT335416; MT359637; MT359397; N/A; MT412707; N/A**	Lombard *et al.* (2015a), this study
		CMW 35169	CBS 136085; CERC 1845	Soil (*Eucalyptus* plantation)	GuangDong, China	X. Mou & R. Chang	**MT334948; MT335175; MT335414; MT359635; MT359395; MT412483; MT412705; N/A**	Lombard *et al.* (2015a), this study
		CMW 35184	CBS 136249; CERC 1860	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Mou & R. Chang	**MT334947; MT335174; MT335413; MT359634; MT359394; N/A; MT412704; N/A**	Lombard *et al.* (2015a), this study
		CMW 35187	CBS 136248; CERC 1863	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou & S.F. Chen	**MT334946; MT335173; MT335412; MT359633; MT359393; N/A; MT412703; N/A**	Lombard *et al.* (2015a), this study
		CMW 35409	CBS 136092; CERC 1900	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Mou & R. Chang	**MT334944; MT335171; MT335410; MT359631; MT359391; N/A; MT412701; N/A**	Lombard *et al.* (2015a), this study
B5	***Ca. aeknauliensis***	CMW 48253^{T}	CBS 143559	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	**MT334953; MT335180; MT335419; MT359640; MT359400; MT412486; MT412710; N/A**	Pham *et al.* (2019), this study
		CMW 48254	CBS 143560	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	**MT334954; MT335181; MT335420; MT359641; MT359401; MT412487; MT412711; N/A**	Pham *et al.* (2019), this study

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B6	***Ca. amazonica***	CBS116250^{T}	CMW 51234; CPC 3534	*E. tereticornis*	Amazon, Brazil	P.W. Crous & A.C. Alfenas	**MT334955; MT335182; MT335421; MT359642; MT359402; MT412488; MT412712; MT412935**	Lombard *et al.* (2016), this study
		CBS 115486	CMW 51223; CPC 3894	*E. tereticornis*	Amazon, Brazil	P.W. Crous & A.C. Alfenas	**MT334956; MT335183; MT335422; MT359643; MT359403; MT412489; MT412713; MT412936**	Lombard *et al.* (2016), this study
		CBS 115440	CMW 51222; CPC 3885	*E. tereticornis*	Amazon, Brazil	P.W. Crous & A.C. Alfenas	**MT334957; MT335184; MT335423; MT359644; MT359404; N/A; MT412714; MT412937**	Lombard *et al.* (2016), this study
		CBS 116271	CMW 51236; CPC 3559	*Eucalyptus* sp.	Amazon, Brazil	P.W. Crous & A.C. Alfenas	**MT335148; MT335385; MT335625; MT359846; MT359606; MT412677; MT412916; MT413123**	Lombard *et al.* (2016), this study
		CBS 116319	CMW 51832; CPC 3761	*Eucalyptus* sp.	Amazon, Brazil	P.W. Crous & A.C. Alfenas	**MT334960; MT335187; MT335426; MT359647; MT359407; MT412490; MT412717; MT412940**	Marin-Felix *et al.* (2017), this study
B7	***Ca. angustata***	CMW 30990^{T}	CBS 114544; CPC 2347; P99-0454	*Tillandsia capitata*	Sarasota nursery, Florida, USA	R.M. Leahy	**MT334963; N/A; MT335429; MT359650; MT359410; MT412493; MT412720; MT412943**	Crous *et al.* (2000, 2006), Lombard *et al.* (2010a), this study
		CBS 112133	CMW 30983; CPC 3152; P99-1321	*Tillandsia capitata*	USA	R.M. Leahy	GQ280427; GQ267362; DQ190695; GQ280549; GQ280670; KY653360; FJ918552; DQ190593	Crous *et al.* (2000, 2006), Lombard *et al.* (2010a), Marin-Felix *et al.* (2017)
B8	***Ca. asiatica***	CBS 114073^{T}	CMW 23782; CPC 3900	Debris (leaf litter)	Prathet Thai, Thailand	N.L. Hywel-Jones	GQ280428; AY725741; AY725658; GQ280550; GQ280672; N/A; AY725705; AY725616	Crous *et al.* (2004), Lombard *et al.* (2010a)
B9	***Ca. auriculiformis***	CMW 47178^{T}	CBS 143561	Soil (*A. auriculiformis* plantation)	Hau Loc, Thanh Hoa, Vietnam	N.Q. Pham & T.Q. Pham	**MT334964; MT335190; MT335430; MT359651; MT359411; MT412494; MT412721; MT412944**	Pham *et al.* (2019), this study
		CMW 47179	CBS 143562	Soil (*A. auriculiformis* plantation)	Hau Loc, Thanh Hoa, Vietnam	N.Q. Pham & T.Q. Pham	**N/A; MT335191; MT335431; MT359652; MT359412; MT412495; MT412722; MT412945**	Pham *et al.* (2019), this study

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B10	***Ca. australiensis***	CMW 23669^{T}	CBS 112954; CPC 4714	*Ficus pleurocarpa*	Queensland, Australia	C. Pearce & B. Paulus	**MT334965; MT335192; MT335432; MT359653; MT359413; MT412496; MT412723; MT412946**	Crous *et al.* (2006), Lombard *et al.* (2010a), this study
B11	***Ca. avesiculata***	CBS 313.92^{T}	ATCC 38226; CMW 23670; CPC 2373	*Ilex vomitoria*	Cairo, Georgia, USA	S.A. Alfieri	GQ280431; GQ267364; DQ190620; GQ280553; GQ280675; N/A; GQ267294; AF333392	Schubert *et al.* (1989), Crous (2002), Lombard *et al.* (2010a)
B12	***Ca. brachiatica***	CMW 25298^{T}	CBS 123700	*Pinus maximinoi*	Buga, Colombia	M.J. Wingfield	**N/A; MT335195; MT335435; MT359656; MT359416; MT412499; MT412726; MT412948**	Lombard *et al.* (2009), this study
		CMW 25302	–	*Pi. tecunumanii*	Buga, Colombia	M.J. Wingfield	**N/A; MT335196; MT335436; MT359657; MT359417; MT412500; MT412727; MT412949**	Lombard *et al.* (2009), this study
		CMW 25307	–	*Pi. tecunumanii*	Buga, Colombia	M.J. Wingfield	**N/A; MT335197; MT335437; MT359658; MT359418; MT412501; MT412728; MT412950**	Lombard *et al.* (2009), this study
B13	***Ca. brasiliana***	CBS 111484^{T}	CMW 51187; CPC 1924	Soil	Brazil	A.C. Alfenas	**MT334968; MT335198; MT335438; MT359659; MT359419; MT412502; MT412729; MT412951**	Lombard *et al.* (2016), this study
		CBS 111485	CMW 51188; CPC 1929	Soil	Brazil	A.C. Alfenas	**MT334969; MT335199; MT335439; MT359660; MT359420; MT412503; MT412730; MT412952**	Lombard *et al.* (2016), this study
B14	***Ca. brasiliensis***	CBS 230.51^{T}	IMI 299576	*Eucalyptus* sp.	Ceara state, Brazil	T.R. Ciferri	**MT334970; MT335200; MT335440; MT359661; MT359421; MT412504; MT412731; MT412953**	Batista (1951), Crous (2002), Lombard *et al.* (2010b), this study
		CMW 32949	CBS 114257; CPC 1944	*Eucalyptus* sp.	Aracruz, Brazil	A.C. Alfenas	**MT334971; MT335201; MT335441; MT359662; MT359422; MT412505; MT412732; MT412954**	Lombard *et al.* (2010a), this study
		CBS 133609	LPF245	*Anadenanthera peregrina*	Viçosa, Minas Gerais, Brazil	R.F. Alfenas	N/A; KC491222; N/A; N/A; N/A; N/A; KC491225; KC491228	Alfenas *et al.* (2013b, 2015)

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		CBS 134818	LPF262	*Azadirachta indica* (leaf)	Viçosa, Minas Gerais, Brazil	R.F. Alfenas	N/A; KM395991; KM396079; N/A; N/A; N/A; KM395817; KM395905	Alfenas *et al.* (2015)
B15	***Ca. brassiana***	CBS 134855^{T}	LPF378	Soil (*Eucalyptus brassiana* plantation)	Teresina, Piauí, Brazil	R.F. Alfenas	N/A; KM396056; KM396139; N/A; N/A; N/A; KM395882; KM395969	Alfenas *et al.* (2015)
		CBS 134856	LPF379	Soil (*E. brassiana* plantation)	Teresina, Piauí, Brazil	R.F. Alfenas	N/A; KM396057; KM396140; N/A; N/A; N/A; KM395883; KM395970	Alfenas *et al.* (2015)
B16	***Ca. brassicae***	CBS 111869^{T}	CPC 2409	*Argyreia splendens*	Indonesia	F. Bugnicourt	**MT334972; MT335202; MT335442; MT359663; MT359423; MT412506; MT412733; MT412955**	Crous (2002), Lombard *et al.* (2010a, 2016), this study
B17	***Ca. brassicicola***	CBS 112841^{T}	CMW 51206; CPC 4552	Soil (*Brassica* sp.)	Indonesia	M.J. Wingfield	N/A; KX784561; N/A; N/A; N/A; N/A; KX784689; KX784619	Lombard *et al.* (2016)
B18	***Ca. brevistipitata***	CBS 115671^{T}	CMW 51226; CPC 949	Soil	Mexico	P.W. Crous	**MT334973; MT335203; MT335443; MT359664; MT359424; MT412507; MT412734; MT412956**	Lombard *et al.* (2016), this study
		CBS 110928	CMW 51170; CPC 951	Soil	Mexico	P.W. Crous	**MT334974; MT335204; MT335444; MT359665; MT359425; MT412508; MT412735; MT412957**	Lombard *et al.* (2016), this study
		CBS 110837	CMW 51163; CPC 913	Soil	Mexico	P.W. Crous	**MT335057; MT335289; MT335529; MT359750; MT359510; MT412586; MT412820; MT413034**	Lombard *et al.* (2016), this study
B19	***Ca. bumicola***	CMW 48257^{T}	CBS 143575	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	**MT334975; MT335205; MT335445; MT359666; MT359426; MT412509; MT412736; N/A**	Pham *et al.* (2019), this study
B20	***Ca. canadiana***	CMW 23673^{T}	CBS 110817; STE-U 499	*Picea* sp.	Canada	S. Greifenhagen	**MT334976; MT335206; MT335446; MT359667; MT359427; MT412510; MT412737; MT412958**	Kang *et al.* (2001b), Crous (2002), Lechat *et al.* (2010), this study

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		CERC 8952	–	Soil	HeNan, China	S.F. Chen	**MT335058; MT335290; MT335530; MT359751; MT359511; MT412587; MT412821; MT413035**	Liu & Chen (2017), this study
B21	***Ca. candelabrum***	CMW 31000	CPC 1675; UFV 117	*Eucalyptus* sp.	Amazonas, Brazil	A.C. Alfenas	**MT334977; MT335207; MT335447; MT359668; MT359428; MT412511; MT412738; MT412959**	Crous (2002), Lombard *et al.* (2010a, 2015b), this study
		CMW 31001	STE-U 1679; UFV 126	*Eucalyptus* sp.	Amazonas, Brazil	A.C. Alfenas	**MT334978; MT335208; MT335448; MT359669; MT359429; MT412512; MT412739; MT412960**	Crous (2002), Lombard *et al.* (2010a, 2015b), this study
		CMW 15218	CBS 125257	*E. grandis*	Las Golondrinas, Pichincha, Ecuador	M.J. Wingfield	**MT334979; MT335209; MT335449; MT359670; MT359430; MT412513; MT412740; MT412961**	Lombard *et al.* (2010a), this study
B22	***Ca. cerciana***	CMW 25309^{T}	CBS 123693	*E. urophylla* × *E. grandis* hybrid cutting	CERC nursery, GuangDong, China	M.J. Wingfield & X.D. Zhou	**MT334981; MT335211; MT335451; MT359672; MT359432; MT412515; MT412742; MT412963**	Lombard *et al.* (2010c), this study
		CMW 25290	CBS 123695	*E. urophylla* × *E. grandis* hybrid cutting	CERC nursery, GuangDong, China	M.J. Wingfield & X.D. Zhou	**MT334982; MT335212; MT335452; MT359673; MT359433; MT412516; MT412743; MT412964**	Lombard *et al.* (2010c), this study
		CMW 35180	CBS 136642; CERC 1856	Soil (*Eucalyptus* plantation)	GuangDong, China	X. Mou & R. Chang	**MT334986; MT335216; MT335456; MT359677; MT359437; MT412520; MT412747; MT412968**	Lombard *et al.* (2015a), this study
		CMW 37976	CBS 136097; CERC 1939; CPC 23517	Soil (*Eucalyptus* plantation)	GuangDong, China	X. Mou & R. Chang	**MT334983; MT335213; MT335453; MT359674; MT359434; MT412517; MT412744; MT412965**	Lombard *et al.* (2015a), this study
B23	***Ca. chinensis***	CMW 23674^{T}	CBS 114827; CPC 4101	Soil	Hong Kong, China	E.C.Y. Liew	**MT334990; MT335220; MT335460; MT359681; MT359441; MT412524; MT412751; MT412972**	Crous *et al.* (2004), Lombard *et al.* (2010a), this study
		CMW 30986	CBS 112744; CPC 4104	Soil	Hong Kong, China	E.C.Y. Liew	**MT334991; MT335221; MT335461; MT359682; MT359442; MT412525; MT412752; MT412973**	Crous *et al.* (2004), Lombard *et al.* (2010a), this study

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		CMW 47192	CBS 143573	Soil (*Acacia* hybrid plantation)	Tuyen Quang, Vietnam	N.Q. Pham & T.Q. Pham	**MT335068; MT335300; MT335540; MT359761; MT359521; MT412597; MT412831; MT413045**	Pham *et al.* (2019), this study
B24	***Ca. citri***	CMW 23675^{T}	CBS 186.36	*Citrus sinensis*	Florida, USA	H.S. Fawcett	**MT334992; MT335222; MT335462; MT359683; MT359443; MT412526; MT412753; MT412974**	Fawcett & Klotz (1937), Crous (2002), this study
B25	***Ca. clavata***	CMW 23690^{T}	ATCC 66389; CBS 114557; CPC 2536; P078-1543	*Callistemon viminalis*	Lake Placid, Florida, USA	C.P. Seymour & E.L. Barnard	**MT334993; MT335223; MT335463; MT359684; MT359444; MT412527; MT412754; MT412975**	El-Gholl *et al.* (1993b), Crous (2002), Lombard *et al.* (2010a), this study
		CMW 30994	CBS 114666; CPC 2537; P078-1261	Root debris in peat	Lee County, Florida, USA	D. Ferrin	**MT334994; MT335224; MT335464; MT359685; MT359445; MT412528; MT412755; MT412976**	El-Gholl *et al.* (1993b), Crous (2002), Lombard *et al.* (2010a), this study
B26	***Ca. cochinchinensis***	CMW 49915^{T}	CBS 143567	Soil (*Hevea brasiliensis* plantation)	Duong Minh Chau, Tay Ninh, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	**MT334995; MT335225; MT335465; MT359686; MT359446; MT412529; MT412756; MT412977**	Pham *et al.* (2019), this study
		CMW 47186	CBS 143568	Soil (*A. auriculiformis* plantation)	Song May, Dong Nai, Vietnam	N.Q. Pham & T.Q. Pham	**MT334996; MT335226; MT335466; MT359687; MT359447; MT412530; MT412757; MT412978**	Pham *et al.* (2019), this study
		CMW 47187	CBS 143569	Soil (*A. auriculiformis* plantation)	Song May, Dong Nai, Vietnam	N.Q. Pham & T.Q. Pham	**MT334997; MT335227; MT335467; MT359688; MT359448; MT412531; MT412758; MT412979**	Pham *et al.* (2019), this study
B27	***Ca. colhounii***	CBS 293.79T	CMW 30999	*Camellia sinensis*	Mauritius	A. Peerally	GQ280443; GQ267373; DQ190639; GQ280565; GQ280687; KY653376; GQ267301; DQ190564	Peerally (1973), Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010a)
B28	***Ca. colombiana***	CBS 115127^{T}	CMW 30871; CPC 1160	Soil	La Selva, Colombia	M.J. Wingfield	GQ280538; GQ267455; FJ972442; GQ280660; GQ280782; N/A; FJ972492; FJ972423	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a, b)

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		CBS 115638	CMW 30766; CPC 1161	Soil	La Selva, Colombia	M.J. Wingfield	GQ280539; GQ267456; FJ972441; GQ280661; GQ280783; N/A; FJ972491; FJ972422	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a, b)
B29	***Ca. colombiensis***	CMW 23676^{T}	CBS 112220; CPC 723	Soil (*E. grandis* trees)	La Selva, Colombia	M.J. Wingfield	**MT334998; MT335228; MT335468; MT359689; MT359449; MT412532; MT412759; MT412980**	Crous *et al.* (2004), this study
		CMW 30985	CBS 112221; CPC 724	Soil (*E. grandis* trees)	La Selva, Colombia	M.J. Wingfield	**MT334999; MT335229; MT335469; MT359690; MT359450; MT412533; MT412760; MT412981**	Crous *et al.* (2004), this study
B30	***Ca. crousiana***	CMW 27249^{T}	CBS 127198	*E. grandis*	FuJian, China	M.J. Wingfield	**MT335000; MT335230; MT335470; MT359691; MT359451; MT412534; MT412761; MT412982**	Chen *et al.* (2011), this study
		CMW 27253	CBS 127199	*E. grandis*	FuJian, China	M.J. Wingfield	**MT335001; MT335231; MT335471; MT359692; MT359452; MT412535; MT412762; MT412983**	Chen *et al.* (2011), this study
B31	***Ca. curvispora***	CMW 23693^{T}	CBS 116159; CPC 765	Soil	Tamatave, Madagascar	P.W. Crous	**MT335002; MT335232; MT335472; MT359693; MT359453; MT412536; MT412763; N/A**	Victor *et al.* (1997), Crous (2002), Lombard *et al.*(2010a, 2015a), this study
		CMW 48245	CBS 143565	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	**MT335003; MT335233; MT335473; MT359694; MT359454; MT412537; MT412764; N/A**	Pham *et al.* (2019), this study
B32	***Ca. cylindrospora***	CBS 119670	CMW 51310; CPC 12766	*Pistacia lentiscus*	Italy	N/A	**MT335006; MT335236; MT335476; MT359697; MT359457; MT412540; MT412767; MT412985**	Lombard *et al.* (2015a,b, 2016), this study
		CMW 30978	CBS 110666; P90.1479; STE-U 497	*Ilex vomitoria*	Florida, USA	N.E. El-Gholl	**MT335007; MT335237; MT335477; MT359698; MT359458; MT412541; MT412768; MT412986**	Crou (2002), Lombard *et al.* (2010a, 2015b), this study
		CBS 136425	CMW 51321; CPC 21859	*Blephilia ciliata*	Ellerbe, North Carolina, USA	T. Sharp	**MT335005; MT335235; MT335475; MT359696; MT359456; MT412539; MT412766; MT412984**	Crous *et al.* (2013), this study

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B33	***Ca. densa***	CMW 31182^{T}	CBS 125261	Soil	Las Golondrinas, Pichincha, Ecuador	M.J. Wingfield	**MT335008; MT335238; MT335478; MT359699; MT359459; N/A; MT412769; MT412987**	Lombard *et al.* (2010a), this study
		CMW 31184	CBS 125249	Soil	Las Golondrinas, Pichincha, Ecuador	M.J. Wingfield	**MT335009; MT335239; MT335479; MT359700; MT359460; N/A; MT412770; MT412988**	Lombard *et al.* (2010a), this study
B34	***Ca. duoramosa***	CBS 134656^{T}	LPF434	Soil (tropical rainforest)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396027; KM396110; N/A; N/A; N/A; KM395853; KM395940	Alfenas *et al.* (2015)
		LPF453	–	Soil (*Eucalyptus* plantation)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396028; KM396111; N/A; N/A; N/A; KM395854; KM395941	Alfenas *et al.* (2015)
B35	***Ca. ecuadorae***	CMW 23677^{T}	CBS 111406; CPC 1635	Soil	Ecuador	M.J. Wingfield	**MT335012; MT335242; MT335482; MT359703; MT359463; MT412544; MT412773; MT412991**	Crous *et al.* (2006), Lombard *et al.* (2010a), this study
		CBS 111706	CMW 51821; CPC 1636	Soil	Ecuador	M.J. Wingfield	**MT335010; MT335240; MT335480; MT359701; MT359461; MT412542; MT412771; MT412989**	Marin-Felix *et al.* (2017), this study
B36	***Ca. eucalypti***	CMW 18444^{T}	CBS 125275	*E. grandis*	Aek Nauli, Sumatra Utara, Indonesia	M.J. Wingfield	**MT335013; MT335243; MT335483; MT359704; MT359464; MT412545; MT412774; MT412992**	Lombard *et al.* (2010a), this study
		CMW 18445	CBS 125276	*E. grandis*	Aek Nauli, Sumatra Utara, Indonesia	M.J. Wingfield	**MT335014; MT335244; MT335484; MT359705; MT359465; MT412546; MT412775; MT412993**	Lombard *et al.* (2010a), this study
		CMW 27209	CBS 127195	*E. dunnii*	FuJian, China	M.J. Wingfield	**MT335108; MT335341; MT335581; MT359802; MT359562; MT412634; MT412872; MT413084**	Chen *et al.* (2011), this study
B37	***Ca. eucalypticola***	CBS 134847^{T}	LPF124	*Eucalyptus* sp. (seeding)	Santa Barbara, Minas Gerais state, Brazil	A.C. Alfenas	N/A; KM396051; KM396134; N/A; N/A; N/A; KM395877; KM395964	Alfenas *et al.* (2015)

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		CBS 134846	LPF121	*Eucalyptus* sp. (leaf)	Eunapolis, Bahia, Brazil	A.C. Alfenas	N/A; KM396050; KM396133; N/A; N/A; N/A; KM395876; KM395963	Alfenas *et al.* (2015)
B38	***Ca. fragariae***	CBS 133607^{T}	LPP040	*Fragaria* × *ananassa*	Santa Maria do Jetibá, Espírito Santo, Brazil	U.P. Lopes	N/A; KM998966; KM998964; N/A; N/A; N/A; KM998963; KM998965	Lopes *et al.* (2017)
		LPF141.1	–	*Fragaria* × *ananassa*	Santa Maria do Jetibá, Espírito Santo, Brazil	U.P. Lopes	N/A; KX500191; KX500194; N/A; N/A; N/A; KX500197; KX500195	Lopes *et al.* (2017)
		LPF141.2	–	*Fragaria* × *ananassa*	Santa Maria do Jetibá, Espírito Santo, Brazil	U.P. Lopes	N/A; KX500192; KX500193; N/A; N/A; N/A; KX500198; KX500196	Lopes *et al.* (2017)
B39	***Ca. fujianensis***	CMW 27257^{T}	CBS 127201	*E. grandis*	FuJian, China	M.J. Wingfield	**MT335019; MT335249; MT335489; MT359710; MT359470; MT412551; MT412780; MT412998**	Chen *et al.* (2011), this study
		CMW 27254	CBS 127200	*E. grandis*	FuJian, China	M.J. Wingfield	**MT335020; MT335250; MT335490; MT359711; MT359471; MT412552; MT412781; MT412999**	Chen *et al.* (2011), this study
		CBS 131802	CMW 51317; HGUP 100003	*Nymphaea tetragona*	Guiyang, Guizhou, China	S.Y. Qin	**MT335070; MT335302; MT335542; MT359763; MT359523; MT412599; MT412833; MT413047**	Xu *et al.* (2012), this study
B40	***Ca. glaebicola***	CBS 134852^{T}	LPF406	Soil (*Eucalyptus* plantation)	Martinho Campos, Minas Gerais, Brazil	A.C. Alfenas	N/A; KM396053; KM396136; N/A; N/A; N/A; KM395879; KM395966	Alfenas *et al.* (2015)
		CBS 134853	LPF407	*Eucalyptus* sp. (leaf)	Tocantins, Bico do Papagaio, Brazil	R.F. Alfenas	N/A; KM396054; KM396137; N/A; N/A; N/A; KM395880; KM395967	Alfenas *et al.* (2015)
B41	***Ca. gordoniae***	CMW 23694^{T}	ATCC 201837; CBS 112142; P97-2567; STE-U 3136	*Gordonia lasianthus*	Florida, USA	D. Chiappini	**MT335021; MT335251; MT335491; MT359712; MT359472; MT412553; MT412782; MT413000**	Leahy *et al.* (2000), Crous (2002), Lombard *et al.* (2010a), this study

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B42	***Ca. gracilipes***	CBS 115674^{T}	CMW 51227; STE-U 1153	Soil	La Selva, Colombia	M.J. Wingfield	**MT335022; MT335252; MT335492; MT359713; MT359473; MT412554; MT412783; MT413001**	Crous *et al.* (1997a, 2006), Crous (2002), this study
		CBS 111141	CMW 51174; CPC 1211	Soil	La Selva, Colombia	M.J. Wingfield	**MT335023; MT335253; MT335493; MT359714; MT359474; MT412555; MT412784; MT413002**	Crous (2002), Crous *et al.* (2006), this study
B43	***Ca. gracilis***	CBS 111807^{T}	AR2677; CMW 51189; PPRI 4176; STE-U 2634	*Manilkara zapota*	Pará, Brazil	F. Carneiro de Albuquerque	GQ280488; GQ267407; DQ190646; GQ280610; GQ280732; KY653390; GQ267323; AF232858	Crous *et al.* (1993c, 2006), Crous (2002), Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
		CBS 111284	CMW 51175; CPC 1483	Soil	Imbrapa, Brazil	P.W. Crous	GQ280489; GQ267408; DQ190647; GQ280611; GQ280733; KY653389; GQ267324; DQ190567	Crous *et al.* (1993c, 2006), Crous (2002), Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
B44	***Ca. hawksworthii***	CBS 111870^{T}	CMW 51194; CPC 2405	*Nelumbo nucifera*	Pamplemousses garden, Mauritius	A. Peerally	**MT335024; MT335254; MT335494; MT359715; MT359475; MT412556; MT412785; MT413003**	Crous (2002), this study
		CMW 14878	CBS 125277	*Eucalyptus* sp.	Sulawesi, Indonesia	M.J. Wingfield	**MT335141; MT335378; MT335618; MT359839; MT359599; MT412670; MT412909; MT413119**	Lombard *et al.* (2010a), this study
		CMW 31393	CBS 136641	*E. urophylla* × *E. grandis*	GuangXi, China	X. Zhou & G. Zhao	**MT335017; MT335247; MT335487; MT359708; MT359468; MT412549; MT412778; MT412996**	Lombard *et al*. (2015a), this study
B45	***Ca. henricotiae***	CBS 138102^{T}	CB045	*Buxus sempervirens*	Lokeren, East Flanders, Belgium	B. Gehesquiere & K. Heungens	N/A; KF815157; KF815185; JX535322; N/A; N/A; N/A; JX535308	Gehesquiere *et al.* (2015)
		CB041	–	*B. sempervirens*	Lokeren, East Flanders, Belgium	B. Gehesquiere & K. Heungens	N/A; KF815156; KF815184; N/A; N/A; N/A; N/A; KF815129	Gehesquiere *et al.* (2015)

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B46	***Ca. heveicola***	CMW 49913^{T}	CBS 143570	Soil (*Hevea brasiliensis* plantation)	Bau Bang, Binh Duong, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	**MT335025; MT335255; MT335495; MT359716; MT359476; N/A; MT412786; MT413004**	Pham *et al.* (2019), this study
		CMW 49928	CBS 143571	Soil	Bu Gia Map National Park, Binh Phuoc, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	**MT335048; MT335280; MT335520; MT359741; MT359501; MT412577; MT412811; MT413025**	Pham *et al.* (2019), this study
		CMW 49935	CBS 143572	Soil	Bu Gia Map National Park, Binh Phuoc, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	**MT335049; MT335281; MT335521; MT359742; MT359502; MT412578; MT412812; MT413026**	Pham *et al.* (2019), this study
B47	***Ca. honghensis***	CERC 5572^{T}	CBS 142885; CMW 47669	Soil (*Eucalyptus* plantation)	HongHe, YunNan, China	S.F. Chen & J.Q. Li	**MT335026; MT335256; MT335496; MT359717; MT359477; MT412557; MT412787; MT413005**	Li *et al.* (2017), this study
		CERC 5571	CBS 142884; CMW 47668	Soil (*Eucalyptus* plantation)	HongHe, YunNan, China	S.F. Chen & J.Q. Li	**MT335027; MT335257; MT335497; MT359718; MT359478; MT412558; MT412788; MT413006**	Li *et al.* (2017), this study
B48	***Ca. hongkongensis***	CBS 114828^{T}	CMW 51217; CPC 4670	Soil	Hong Kong, China	M.J. Wingfield	**MT335028; MT335258; MT335498; MT359719; MT359479; MT412559; MT412789; MT413007**	Crous *et al.* (2004), this study
		CERC 7132	CMW 47499	Soil	FuJian, China	S.F. Chen	**MT335031; MT335261; MT335501; MT359722; MT359482; MT412562; MT412792; MT413010**	Li *et al.* (2017), this study
B49	***Ca. humicola***	CMW 31183^{T}	CBS 125251	Soil	Las Golondrinas, Pichincha, Ecuador	M.J. Wingfield	**MT335032; MT335262; MT335502; MT359723; MT359483; N/A; MT412793; MT413011**	Lombard *et al.* (2010a), this study
		CMW 31186	CBS 125252	Soil	Las Golondrinas, Pichincha, Ecuador	L. Lombard	**MT335033; MT335263; MT335503; MT359724; MT359484; N/A; MT412794; MT413012**	Lombard *et al.* (2010a), this study
		CMW 31187	CBS 125269	Soil	Las Golondrinas, Pichincha, Ecuador	L. Lombard	**MT335034; MT335264; MT335504; MT359725; MT359485; N/A; MT412795; MT413013**	Lombard *et al.* (2010a), this study

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B50	***Ca. hurae***	CBS 114182	CMW 51823; CPC 1714; UFV 216	*Rumohra adiantiformis*	Brazil	A.C. Alfenas	**MT335035; MT335265; MT335505; MT359726; MT359486; MT412563; MT412796; MT413014**	Crous (2002), Crous *et al.* (2006), this study
B51	***Ca. ilicicola***	CMW 30998^{T}	CBS 190.50; IMI 299389; STE-U 2482	*Solanum tuberosum*	Bogor, Java, Indonesia	K.B. Boedijn & J. Reitsma	**MT335036; MT335266; MT335506; MT359727; MT359487; MT412564; MT412797; N/A**	Boedijn & Reitsma (1950), Crous (2002), Lombard *et al.* (2010a), this study
B52	***Ca. indonesiae***	CMW 23683^{T}	CBS 112823; CPC 4508	*Syzygium aromaticum*	Warambunga, Indonesia	M.J. Wingfield	**MT335037; MT335267; MT335507; MT359728; MT359488; MT412565; MT412798; MT413015**	Crous *et al.* (2004), this study
		CBS 112840	CMW 51205; CPC 4554	*S. aromaticum*	Warambunga, Indonesia	M.J. Wingfield	**MT335038; MT335268; MT335508; MT359729; MT359489; MT412566; MT412799; MT413016**	Crous *et al.* (2004), this study
B53	***Ca. indusiata***	CBS 144.36^{T}	CMW 23699	*Camellia sinensis*	Sri lanka	N/A	GQ280536; GQ267453; GQ267262; GQ280658; GQ280780; KY653396; GQ267332; GQ267239	Crous (2002), Lombard *et al.* (2010a, 2016), Marin-Felix *et al.* (2017)
		CBS 114684	CMW 51213; CPC 2446; UFV16	*Rhododendron* sp.	Florida, USA	N.E. El-Gholl	GQ280537; GQ267454; DQ190653; GQ280659; GQ280781; N/A; GQ267333; AF232862	Crous *et al.* (1999, 2006), Crous (2002)
B54	***Ca. insularis***	CMW 30991^{T}	CBS 114558; CPC 768	Soil	Tamatave, Madagascar	P.W. Crous	**N/A; MT335269; MT335509; MT359730; MT359490; MT412567; MT412800; MT413017**	Schoch *et al.* (1999), Lombard *et al.* (2010a, 2016), this study
		CMW 30992	CBS 114559; CPC 954	Soil	Conejos, Veracruz, Mexico	M.J. Wingfield	**N/A; MT335270; MT335510; MT359731; MT359491; MT412568; MT412801; MT413018**	Lombard *et al.* (2010a, 2016), this study
B55	***Ca. kyotensis***	CBS 114525^{T}	ATCC 18834; CMW 51824; CPC 2367	*Robinia pseudoacacia*	Japan	T. Terashita	**MT335039; MT335271; MT335511; MT359732; MT359492; MT412569; MT412802; MT413019**	Terashita (1968), Crous (2002), Lombard *et al.* (2016), this study

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		CBS 114550	CMW 51825; CPC 2351	Soil	China	M.J. Wingfield	**MT335016; MT335246; MT335486; MT359707; MT359467; MT412548; MT412777; MT412995**	Lombard *et al.* (2016), this study
		CBS 114692	ATCC18882; CMW 51826	*Prunus persica*	Georgia, USA	N/A	**MT335015; MT335245; MT335485; MT359706; MT359466; MT412547; MT412776; MT412994**	Sobers (1969), Crous (2002), Marin-Felix *et al.* (2017), this study
		CERC 7126	CBS 142890; CMW 47496	Soil	FuZhou, FuJian, China	S.F. Chen	**MT335121; MT335356; MT335596; MT359817; MT359577; MT412649; MT412887; MT413098**	Li *et al.* (2017), this study
		CMW 31411	CBS 136077	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	**MT335151; MT335388; MT335628; MT359849; MT359609; N/A; MT412919; MT413126**	Lombard *et al.* (2015a), this study
B56	***Ca. lageniformis***	CBS 111324^{T}	CMW 51177; CPC 1473	*Eucalyptus* sp. (leaf)	Rivière Noire, Mauritius	H. Smith	N/A; KX784574; N/A; KY653256; KY653312; KY653400; KX784702; KX784632	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
B57	***Ca. lantauensis***	CERC 3302^{T}	CBS 142888; CMW 47252	Soil	LiDao, Hong Kong, China	M.J. Wingfield & S.F. Chen	**MT335040; MT335272; MT335512; MT359733; MT359493; MT412570; MT412803; N/A**	Li *et al.* (2017), this study
		CERC 3301	CBS 142887; CMW 47251	Soil	LiDao, Hong Kong, China	M.J. Wingfield & S.F. Chen	**MT335041; MT335273; MT335513; MT359734; MT359494; N/A; MT412804; N/A**	Li *et al.* (2017), this study
B58	***Ca. lateralis***	CMW 31412^{T}	CBS 136629	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	**MT335042; MT335274; MT335514; MT359735; MT359495; MT412571; MT412805; MT413020**	Lombard *et al.* (2015a), this study
B59	***Ca. lauri sp. nov.***	CMW 23682^{T}	CBS 749.70	*Ilex aquifolium*	Vijlen, Vijlenerbos, South-East Limburg, Netherlands	H.A. van der Aa	**MT335043; MT335275; MT335515; MT359736; MT359496; MT412572; MT412806; MT413021**	Lechat *et al.* (2010), Lombard *et al.* (2010a), this study

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B60	***Ca. leguminum***	CMW 23684^{T}	CBS 728.68	*Annona squamosa*	Sao Paulo, Brazil	M.B. Figueiredo	**MT335044; MT335276; MT335516; MT359737; MT359497; MT412573; MT412807; MT413022**	Figueiredo & Namekata (1967), Crous (2002), Lombard *et al.* (2010a), this study
B61	***Ca. leucothoes***	CMW 30977^{T}	ATCC 64824; CBS 109166; CPC 2385; P88-490	*Leucothoe axillaris*	Florida, USA	N.E. El-Gholl	**MT335045; MT335277; MT335517; MT359738; MT359498; MT412574; MT412808; N/A**	El-Gholl *et al.* (1989), Crous (2002), Lombard *et al.* (2015a), this study
B62	***Ca. lichi***	CERC 8866^{T}	–	Soil	HeNan, China	S.F. Chen	**MT335046; MT335278; MT335518; MT359739; MT359499; MT412575; MT412809; MT413023**	Liu & Chen (2017), this study
		CERC 8850	–	Soil	HeNan, China	S.F. Chen	**MT335047; MT335279; MT335519; MT359740; MT359500; MT412576; MT412810; MT413024**	Liu & Chen (2017), this study
B63	***Ca. lombardiana sp. nov.***	CMW 30602^{T}	CBS 112634; CPC 4233; Lynfield 417	*Xanthorrhoea australis*	Victoria, Australia	T. Baigent	**MT335156; MT335395; MT335635; MT359856; MT359616; MT412686; MT412926; MT413133**	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010c), this study
B64	***Ca. macroconidialis***	CBS 114880^{T}	CMW 51219; CPC 307; PPRI 4000	*E. grandis*	Sabie, Mpumalanga, South Africa	P.W. Crous	**MT335050; MT335282; MT335522; MT359743; MT359503; MT412579; MT412813; MT413027**	Crous *et al.* (1993c), Crous (2002), Lombard *et al.* (2010a), this study
		CBS 110798	CMW 51817; CPC 410	*E. grandis* (roots)	Sabie, Mpumalanga, South Africa	P.W. Crous	**MT335051; MT335283; MT335523; MT359744; MT359504; MT412580; MT412814; MT413028**	Lombard *et al.* (2016), this study
B65	***Ca. madagascariensis***	CMW 23686^{T}	CBS 114572; CPC 2252	Soil	Rona, Madagascar	J.E. Taylor	**MT335052; MT335284; MT335524; MT359745; MT359505; MT412581; MT412815; MT413029**	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010a), this study
		CMW 30993	CBS 114571; CPC 2253	Soil	Rona, Madagascar	J.E. Taylor	**MT335053; MT335285; MT335525; MT359746; MT359506; MT412582; MT412816; MT413030**	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010a), this study
B66	***Ca. malesiana***	CMW 23687^{T}	CBS 112752; CPC 4223	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	**MT335054; MT335286; MT335526; MT359747; MT359507; MT412583; MT412817; MT413031**	Crous *et al.* (2004), this study

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		CBS 112710	CMW 51199; CPC 3899	Leaf litter	Prathet, Thailand	N.L. Hywel-Jones	**MT335055; MT335287; MT335527; MT359748; MT359508; MT412584; MT412818; MT413032**	Crous *et al.* (2004), this study
B67	***Ca. maranhensis***	CBS 134811^{T}	LPF142	*Eucalyptus* sp. (leaf)	Açailandia, Maranhao, Brazil	A.C. Alfenas	N/A; KM396035; KM396118; N/A; N/A; N/A; KM395861; KM395948	Alfenas *et al.* (2015)
		CBS 134812	LPF143	*Eucalyptus* sp. (leaf)	Açailandia, Maranhao, Brazil	A.C. Alfenas	N/A; KM396036; KM396119; N/A; N/A; N/A; KM395862; KM395949	Alfenas *et al.* (2015)
B68	***Ca. metrosideri***	CBS 133603^{T}	LPF101	*Metrosideros polymorpha*	Viçosa, Minas Gerais state, Brazil	R.F. Alfenas	N/A; KC294304; KC294307; N/A; N/A; N/A; KC294310; KC294313	Alfenas *et al.* (2013a, 2015)
		CBS 133604	CMW 51320; LPF103	*Metrosideros polymorpha*	Viçosa, Minas Gerais state, Brazil	R.F. Alfenas	**MT335056; MT335288; MT335528; MT359749; MT359509; MT412585; MT412819; MT413033**	Alfenas *et al.* (2013a, 2015), this study
B69	***Ca. mexicana***	CBS 110918^{T}	CMW 9055; STE-U 927	Soil	Uxmal, Yucatan, Mexico	M.J. Wingfield	GQ280474; GQ267396; FJ972460; GQ280596; GQ280718; KY653412; FJ972526; AF210863	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a), Marin-Felix *et al.* (2017)
B70	***Ca. monticola***	CBS 140645^{T}	CPC 28835	Soil	Chiang Mai, Thailand	P.W. Crous	N/A; KT964771; N/A; KT964775; KT983443; N/A; KT964773; KT964769	Crous *et al.* (2015)
		CPC 28836	–	Soil	Chiang Mai, Thailand	P.W. Crous	N/A; KT964772; N/A; KT964776; KT983444; N/A; KT964774; KT964770	Crous *et al.* (2015)
B71	***Ca. multilateralis***	CBS 110932^{T}	CMW 51171; CPC 957	Soil	Uxmal, Mexico	P.W. Crous	**MT335060; MT335292; MT335532; MT359753; MT359513; MT412589; MT412823; MT413037**	Lombard *et al.* (2016), this study
		CBS 110926	CMW 51168; CPC 947	Soil	Uxmal, Mexico	P.W. Crous	**MT335061; MT335293; MT335533; MT359754; MT359514; MT412590; MT412824; MT413038**	Lombard *et al.* (2016), this study

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		CBS 110927	CMW 51169; CPC 948	Soil	Uxmal, Mexico	P.W. Crous	**MT335062; MT335294; MT335534; MT359755; MT359515; MT412591; MT412825; MT413039**	Lombard *et al.* (2016), this study
B72	***Ca. multinaviculata***	CBS 134858^{T}	LPF233	Soil (*Eucalyptus* plantation)	Mucuri, Bahia, Brazil	E. Zauza	N/A; KM396072; KM396155; N/A; N/A; N/A; KM395898; KM395985	Alfenas *et al.* (2015)
		CBS 134859	LPF418	Soil (*Eucalyptus* plantation)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396073; KM396156; N/A; N/A; N/A; KM395899; KM395986	Alfenas *et al.* (2015)
B73	***Ca. multiphialidica***	CMW 23688^{T}	Cam 13; CBS 112678	Soil (roots of *Musa* sp.)	Cameroon	Abadie	**MT335066; MT335298; MT335538; MT359759; MT359519; MT412595; MT412829; MT413043**	Crous *et al.* (2004), Lombard *et al.* (2010a), this study
B74	***Ca. multiseptata***	CMW 23692^{T}	CBS 112682; CPC 1589	*E. grandis*	North Sumatra, Indonesia	M.J. Wingfield	**MT335067; MT335299; MT335539; MT359760; MT359520; MT412596; MT412830; MT413044**	Crous *et al.* (1998, 2006), Crous (2002), this study
B75	***Ca. naviculata***	CBS 101121^{T}	CMW 30974	Leaf litter	Joao Pessoa, Brazil	R.F. Castaneda	GQ280478; GQ267399; GQ267252; GQ280600; GQ280722; KM232309; GQ267317; GQ267211	Lombard *et al.* (2010a, 2015b)
		CBS 116080	CMW 16723; STE-U 627	Soil	Manaus, Amazonas, Brazil	M.J. Wingfield	GQ280477; GQ267398; GQ267251; GQ280599; GQ280721; KY653417; GQ267316; AF333409	Crous *et al.* (1997a), Crous (2002), Lombard *et al.* (2010a), Marin-Felix *et al.* (2017)
B76	***Ca. nemoricola***	CBS 134837^{T}	LPF085	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396066; KM396149; N/A; N/A; N/A; KM395892; KM395979	Alfenas *et al.* (2015)
		CBS 134838	LPF090	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396067; KM396150; N/A; N/A; N/A; KM395893; KM395980	Alfenas *et al.* (2015)
B77	***Ca. octoramosa***	CBS 111423^{T}	CMW 51819; CPC 1650	Soil	Ecuador	M.J. Wingfield	**MT335071; MT335303; MT335543; MT359764; MT359524; MT412600; MT412834; MT413048**	Marin-Felix *et al.* (2017), this study

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B78	***Ca. orientalis***	CMW 20291^{T}	CBS 125260	Soil	Langam, Indonesia	M.J. Wingfield	**MT335072; MT335304; MT335544; MT359765; MT359525; MT412601; MT412835; MT413049**	Lombard *et al.* (2010a), this study
		CMW 20273	CBS 125259	Soil	Teso East, Indonesia	M.J. Wingfield	**MT335073; MT335305; MT335545; MT359766; MT359526; MT412602; MT412836; MT413050**	Lombard *et al.* (2010a), this study
B79	***Ca. ovata***	CMW 16724^{T}	CBS 111299; ATCC 76225; UFV 89	*E. urophylla*	Monte Dourado, Pará, Brazil	N.E. El-Gholl	**MT335075; MT335307; MT335547; MT359768; MT359528; N/A; MT412838; MT413052**	El-Gholl *et al.* (1993a), Crous (2002), Marin-Felix *et al.* (2017), this study
		CMW 30979	CBS 111307; UFV 90	*E. tereticornis*	Tucuruí, Pará, Brazil	P.W. Crous	**MT335076; MT335308; MT335548; MT359769; MT359529; N/A; MT412839; MT413053**	Crous (2002), Lombard *et al.* (2010a), this study
		CBS 111301	CMW 51176; CPC 1429	*E. tereticornis*	Tucuruí, Pará, Brazil	P.W. Crous	**MT335077; MT335309; MT335549; MT359770; MT359530; N/A; MT412840; MT413054**	Lombard *et al.* (2016), this study
		CBS 114755	CMW 51827; CPC 1403	*E. tereticornis*	Tucuruí, Pará, Brazil	P.W. Crous	**MT335078; MT335310; MT335550; MT359771; MT359531; N/A; MT412841; MT413055**	Marin-Felix *et al.* (2017), this study
		CBS 116249	CMW 51829; CPC 3533	Soil (*Eucalyptus* plantation)	Brazil	P.W. Crous	**MT335074; MT335306; MT335546; MT359767; MT359527; MT412603; MT412837; MT413051**	Marin-Felix *et al.* (2017), this study
B80	***Ca. pacifica***	CMW 16726^{T}	A1568; CBS 109063; IMI 354528; STE-U 2534	*Araucaria heterophylla*	Hawaii, USA	M. Aragaki	**MT335079; MT335311; MT335551; MT359772; MT359532; MT412604; MT412842; N/A**	Kang *et al.* (2001b), Crous (2002), Crous *et al.* (2004), this study
		CMW 30988	CBS 114038	*Ipomoea aquatica*	Auckland, New Zealand	C.F. Hill	**MT335080; MT335312; MT335552; MT359773; MT359533; MT412605; MT412843; N/A**	Crous (2002), Crous *et al.* (2004), Lombard *et al.* (2010a), this study

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B81	***Ca. paracolhounii***	CBS 114679^{T}	CMW 51212; CPC 2445	N/A	USA	A.Y. Rossman	N/A; KX784582; N/A; KY653268; KY653324; KY653423; KX784714; KX784644	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
		CBS 114705	CMW 51215; CPC 2423	*Annona reticulata* (fruit)	Australia	D. Hutton	N/A; N/A; N/A; KY653269; KY653325; KY653424; KX784715; KX784645	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
B82	***Ca. paraensis***	CBS 134669^{T}	LPF430	Soil (*Eucalyptus* plantation)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396011; KM396094; N/A; N/A; N/A; KM395837; KM395924	Alfenas *et al.* (2015)
		LPF429	–	Soil (tropical rainforest)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396015; KM396098; N/A; N/A; N/A; KM395841; KM395928	Alfenas *et al.* (2015)
		CBS 134664	LPF217	Soil (tropical rainforest)	Mucuri, Bahia, Brazil	E. Zauza	N/A; KM396017; KM396100; N/A; N/A; N/A; KM395843; KM395930	Alfenas *et al.* (2015)
B83	***Ca. parvispora***	CBS 111465^{T}	CPC 1902	Soil	Brazil	A.C. Alfenas	**MT335082; MT335314; MT335554; MT359775; MT359535; MT412607; MT412845; MT413057**	Marin-Felix *et al.* (2017), this study
		CMW 30981	CBS 111478; CPC 1921	Soil	Brazil	A.C. Alfenas	**MT335081; MT335313; MT335553; MT359774; MT359534; MT412606; MT412844; MT413056**	Lombard *et al.* (2010a, 2016), this study
B84	***Ca. pauciphialidica sp. nov.***	CMW 30980^{T}	CBS 111394; CPC 1628	Soil	Ecuador	M.J. Wingfield	**MT335083; MT335315; MT335555; MT359776; MT359536; MT412608; MT412846; MT413058**	Crous *et al.* (2006), Lombard *et al.* (2010a), this study
B85	***Ca. pauciramosa***	CBS 138824^{T}	CMW 5683; CPC 971	Soil	Knysna, South Africa	P.W. Crous	**MT335093; MT335325; MT335565; MT359786; MT359546; MT412618; MT412856; MT413068**	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a), this study
		CMW 9151	–	*A. mearnsii*	South Africa	L. Lombard	**MT335096; MT335328; MT335568; MT359789; MT359549; MT412621; MT412859; MT413071**	Lombard *et al.* (2010b), this study

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		CBS 111812	CMW 51190; CPC 2631	*Cliffordia feruginea*	George, Western Cape Province, South Africa	P.W. Crous	**MT335084; MT335316; MT335556; MT359777; MT359537; MT412609; MT412847; MT413059**	Lombard *et al.* (2016), this study
		CBS 114458	CMW 51211; CPC 2019	*Erica capensis*	California, USA	S.T. Koike	**MT335087; MT335319; MT335559; MT359780; MT359540; MT412612; MT412850; MT413062**	Lombard *et al.* (2016), this study
		CBS 123183	CMW 51311; CPC 15378	*Machaerina sinclairii*	Auckland University Campus, Auckland, New Zealand	C.F. Hill	**MT335090; MT335322; MT335562; MT359783; MT359543; MT412615; MT412853; MT413065**	Lombard *et al.* (2016), this study
		CBS 123402	CMW 30872	*Arbutus unedo*	Carrubba, Sicily, Italy	G. Polizzi	**MT335099; MT335331; MT335571; MT359792; MT359552; MT412624; MT412862; MT413074**	Lombard *et al.* (2010b), this study
		CBS 137243	CMW 36327	*E. grandis* × *E. camaldulensis*	Bandula, Manica, Mozambique	J. Roux & S. Maússe-Sitoe	**MT335091; MT335323; MT335563; MT359784; MT359544; MT412616; MT412854; MT413066**	Crous *et al.* (2013), Lombard *et al.* (2016), this study
		CMW 9188	CBS 125268	*E. grandis*	Kwambonambi, KwaZulu-Natal, South Africa	L. Lombard	**MT335159; MT335398; MT335638; MT359859; MT359619; MT412689; MT412929; MT413136**	Lombard *et al.* (2010b), this study
		CMW 31450	CBS 136632; CERC 1785	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	**MT335102; MT335334; MT335574; MT359795; MT359555; MT412627; MT412865; MT413077**	Lombard *et al.* (2015a), this study
		CMW 31474	CBS 136635; CERC 1809	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	**MT335104; MT335336; MT335576; MT359797; MT359557; MT412629; MT412867; MT413079**	Lombard *et al.* (2015a), this study
B86	***Ca. penicilloides***	CMW 23696^{T}	CBS 174.55; STE-U 2388	*Prunus* sp.	Hatizyo Island, Japan	M. Ookubu	**MT335106; MT335338; MT335578; MT359799; MT359559; MT412631; MT412869; MT413081**	Tubaki (1958), Crous (2002), this study

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B87	***Ca. piauiensis***	CBS 134850^{T}	LPF377	Soil (*Eucalyptus* plantation)	Teresina, Piauí, Brazil	R.F. Alfenas	N/A; KM396060; KM396143; N/A; N/A; N/A; KM395886; KM395973	Alfenas *et al.* (2015)
		CBS 134851	LPF381	Soil (tropical rainforest)	Teresina, Piauí, Brazil	R.F. Alfenas	N/A; KM396061; KM396144; N/A; N/A; N/A; KM395887; KM395974	Alfenas *et al.* (2015)
B88	***Ca. pini***	CMW 31209^{T}	CBS 123698	*Pinus patula*	Buga, Valle del Cauca, Colombia	C.A. Rodas	**MT335107; MT335339; MT335579; MT359800; MT359560; MT412632; MT412870; MT413082**	Lombard *et al.* (2010a), this study
		CBS 125523	CMW 31210	*Pinus patula*	Buga, Valle del Cauca, Colombia	C.A. Rodas	GQ280518; GQ267437; GQ267274; GQ280640; GQ280762; N/A; GQ267345; GQ267225	Lombard *et al.* (2010a)
B89	***Ca. plurilateralis***	CBS 111401^{T}	CMW 51178; CPC 1637	Soil	Ecuador	M.J. Wingfield	**N/A; MT335340; MT335580; MT359801; MT359561; MT412633; MT412871; MT413083**	Lombard *et al.* (2016), this study
B90	***Ca. propaginicola***	CBS 134815^{T}	LPF220	*Eucalyptus* sp. (seeding)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396040; KM396123; N/A; N/A; N/A; KM395866; KM395953	Alfenas *et al.* (2015)
		CBS 134816	LPF222	*Eucalyptus* sp. (seeding)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396041; KM396124; N/A; N/A; N/A; KM395867; KM395954	Alfenas *et al.* (2015)
		CBS 134824	LPF367	*Eucalyptus* sp. (seeding)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396049; KM396132; N/A; N/A; N/A; KM395875; KM395962	Alfenas *et al.* (2015)
B91	***Ca. pseudobrassicae***	CBS 134662^{T}	LPF280	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396023; KM396106; N/A; N/A; N/A; KM395849; KM395936	Alfenas *et al.* (2015)
		CBS 134661	LPF260	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396022; KM396105; N/A; N/A; N/A; KM395848; KM395935	Alfenas *et al.* (2015)

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B92	***Ca. pseudoecuadoriae***	CBS 111402^{T}	CMW 51179; CPC 1639	Soil	Ecuador	M.J. Wingfield	N/A; KX784589; N/A; KY653273; KY653329; KY653432; KX784723; KX784652	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
B93	***Ca. pseudometrosideri***	CBS 134845^{T}	LPF210	Soil (*Eucalyptus* plantation)	Maceió, Alagoas, Brazil	M.M. Coutinho	N/A; KM395995; KM396083; N/A; N/A; N/A; KM395821; KM395909	Alfenas *et al.* (2015)
		CBS 134843	LPF100	*Metrosideros polymorpha*	Viçosa, Minas Gerais, Brazil	A.C. Alfenas	N/A; KM395993; KM396081; N/A; N/A; N/A; KM395819; KM395907	Alfenas *et al.* (2015)
B94	***Ca. pseudomexicana***	CBS 130354^{T}	CMW 51313; DISTEF-TCROU1	*Callistemon* sp.	Tunis, Carthage, Tunisia	G. Polizzi	**MT335110; MT335343; MT335583; MT359804; MT359564; MT412636; MT412874; MT413086**	Lombard *et al.* (2011), this study
		CBS 130355	CMW 51314; DISTEF-TCROU3	*Callistemon* sp.	Tunis, Carthage, Tunisia	G. Polizzi	**MT335111; MT335344; MT335584; MT359805; MT359565; MT412637; MT412875; MT413087**	Lombard *et al.* (2011), this study
		CBS 130357	CMW 51316; DISTEF-TCL1	*Ca. laevis*	Tunis, Carthage, Tunisia	G. Polizzi	**MT335149; MT335386; MT335626; MT359847; MT359607; MT412678; MT412917; MT413124**	Lombard *et al.* (2011), this study
B95	***Ca. pseudonaviculata***	CBS 116251^{T}	CMW 51235; CPC 3399; Lynfield 824	*Buxus sempervirens*	Kumeu, West Auckland, New Zealand	R. MacDiarmid	**N/A; MT335345; MT335585; MT359806; MT359566; MT412638; MT412876; MT413088**	Crous *et al.* (2002), Lombard *et al.* (2016), this study
		CMW 23672	CBS 114417; CPC 10926	*B. sempervirens*	New Zealand	C. Crepel	**N/A; MT335346; MT335586; MT359807; MT359567; MT412639; MT412877; MT413089**	Lombard *et al.* (2010a, 2016), this study
B96	***Ca. pseudopteridis***	CBS 163.28^{T}	CMW 51159; IMI 299579	*Washingtonia robusta*	USA	C.D. Sherbakoff	**MT335112; MT335347; MT335587; MT359808; MT359568; MT412640; MT412878; N/A**	Sherbakoff (1928), Alfenas *et al.* (2015), Lombard *et al.* (2016), this study
B97	***Ca. pseudoreteaudii***	CMW 25310^{T}	CBS 123694	*E. urophylla* × *E. grandis*	GuangDong, China	M.J. Wingfield & X.D. Zhou	**MT335119; MT335354; MT335594; MT359815; MT359575; MT412647; MT412885; MT413096**	Lombard *et al.* (2010c), this study

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		CMW 25292	CBS 123696	*E. urophylla* × *E. grandis*	GuangDong, China	M.J. Wingfield & X.D. Zhou	**MT335120; MT335355; MT335595; MT359816; MT359576; MT412648; MT412886; MT413097**	Lombard *et al.* (2010c), this study
		CMW 31487	CBS 136638; CERC 1822	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	**MT335113; MT335348; MT335588; MT359809; MT359569; MT412641; MT412879; MT413090**	Lombard *et al*. (2015a), this study
		CBS 133349	CMW 51318	*Eucalyptus* hybrid	Hanoi, Bavi, Vietnam	P.Q. Thu	**MT335117; MT335352; MT335592; MT359813; MT359573; MT412645; MT412883; MT413094**	Crous *et al.* (2012), this study
B98	***Ca. pseudospathiphylli***	CBS 109165^{T}	CMW 30976; CPC 1623	Soil	Ecuador	M.J. Wingfield	GQ280493; GQ267412; AF348241; GQ280615; GQ280737; KY653435; FJ918562; FJ918513	Kang *et al.* (2001b), Crous (2002), Lombard *et al.* (2010a, c), Marin-Felix *et al.* (2017)
B99	***Ca. pseudospathulata***	CBS 134841^{T}	LPF072	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396070; KM396153; N/A; N/A; N/A; KM395896; KM395983	Alfenas *et al.* (2015)
		CBS 134840	LPF066	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396069; KM396152; N/A; N/A; N/A; KM395895; KM395982	Alfenas *et al.* (2015)
B100	***Ca. pseudouxmalensis***	CBS 110924^{T}	CMW 51166; CPC 942	Soil	Mexico	P.W. Crous	**MT335123; MT335358; MT335598; MT359819; MT359579; MT412651; MT412889; MT413100**	Lombard *et al.* (2016), this study
		CBS 110923	CMW 51165; CPC 941	Soil	Mexico	P.W. Crous	**MT335124; MT335359; MT335599; MT359820; MT359580; MT412652; MT412890; MT413101**	Lombard *et al.* (2016), this study
		CBS 115677	CMW 51228; CPC 943	Soil	Mexico	P.W. Crous	**MT335125; MT335360; MT335600; MT359821; MT359581; MT412653; MT412891; MT413102**	Lombard *et al.* (2016), this study
B101	***Ca. pseudovata***	CBS 134674^{T}	LPF267	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396032; KM396115; N/A; N/A; N/A; KM395858; KM395945	Alfenas *et al.* (2015)

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		CBS 134675	LPF285	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396033; KM396116; N/A; N/A; N/A; KM395859; KM395946	Alfenas *et al.* (2015)
B102	***Ca. pteridis***	CBS 111793^{T}	ATCC 34395; CMW 16736; CPC 2372	*Arachniodes adiantiformis*	USA	F. Schickedanz	GQ280494; GQ267413; DQ190679; GQ280616; GQ280738; KY653438; FJ918563; DQ190578	Crous *et al.* (1993c, 2006), Crous (2002), Lombard *et al.* (2010a), Marin-Felix *et al.* (2017)
B103	***Ca. putriramosa***	CBS 111449^{T}	CMW 51181; CPC 1951	*Eucalyptus* cutting	Brazil	A.C. Alfenas	**MT335129; MT335364; MT335604; MT359825; MT359585; MT412657; MT412895; MT413105**	Lombard *et al.* (2016), this study
		CBS 111470	CMW 51182; CPC 1940	Soil	Brazil	A.C. Alfenas	**MT335130; MT335365; MT335605; MT359826; MT359586; MT412658; MT412896; MT413106**	Lombard *et al.* (2016), this study
		CBS 111477	CMW 51183; CPC 1928	Soil	Brazil	A.C. Alfenas	**MT335131; MT335366; MT335606; MT359827; MT359587; MT412659; MT412897; MT413107**	Lombard *et al.* (2016), this study
B104	***Ca. queenslandica***	CMW 30604^{T}	CBS 112146; CPC 3213	*E. urophylla*	Lannercost, Queensland, Australia	B. Brown	**MT335132; MT335367; MT335607; MT359828; MT359588; MT412660; MT412898; MT413108**	Kang *et al.* (2001a), Lombard *et al.* (2010c), this study
		CMW 30603	CBS 112155; CPC 3210	*E. pellita*	Lannercost, Queensland, Australia	P.Q Thu & K.M. Old	**MT335133; MT335368; MT335608; MT359829; MT359589; MT412661; MT412899; MT413109**	Kang *et al.* (2001a), Lombard *et al.* (2010c), this study
		CMW 30601	CBS 112151; CPC 3202; DFRI00150	*E. urophylla*	Cardwell, Queensland, Australia	C. Hanwood	**MT335134; MT335369; MT335609; MT359830; MT359590; MT412662; MT412900; MT413110**	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010c), this study
B105	***Ca. quinqueramosa***	CBS 134654^{T}	LPF065	Soil (*Eucalyptus* plantation)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396029; KM396112; N/A; N/A; N/A; KM395855; KM395942	Alfenas *et al.* (2015)
		CBS 134655	LPF281	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396030; KM396113; N/A; N/A; N/A; KM395856; KM395943	Alfenas *et al.* (2015)

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B106	***Ca. reteaudii***	CMW 30984^{T}	CBS 112144; CPC 3201	*E. camaldulensis*	Chon Thanh, Binh Phuoc, Vietnam	M.J. Dudzinski & P.Q. Thu	**MT335135; MT335370; MT335610; MT359831; MT359591; MT412663; MT412901; MT413111**	Kang *et al.* (2001a), Crous (2002), Crous *et al.* (2006), this study
		CMW 16738	CBS 112143; CPC 3200	*Eucalyptus* sp. (leaves)	Binh Phuoc, Vietnam	M.J. Dudzinski & P.Q. Thu	**MT335136; MT335371; MT335611; MT359832; MT359592; MT412664; MT412902; MT413112**	Kang *et al.* (2001a), Crous (2002), Crous *et al.* (2006), this study
		CMW 47410	CBS 143563	*E. urophylla* (leaf)	Bavi, Hanoi, Vietnam	N.Q. Pham & T.Q. Pham	**MT334966; MT335193; MT335433; MT359654; MT359414; MT412497; MT412724; N/A**	Pham *et al.* (2019), this study
B107	***Ca. robigophila***	CBS 134652^{T}	LPF192	*Eucalyptus* sp. (leaf)	Açailandia, Maranhao, Brazil	R.F. Alfenas	N/A; KM396024; KM396107; N/A; N/A; N/A; KM395850; KM395937	Alfenas *et al.* (2015)
		CBS 134653	LPF193	*Eucalyptus* sp. (leaf)	Açailandia, Maranhao, Brazil	R.F. Alfenas	N/A; KM396025; KM396108; N/A; N/A; N/A; KM395851; KM395938	Alfenas *et al.* (2015)
B108	***Ca. rumohrae***	CMW 23697^{T}	CBS 111431; CPC 1716; UFV 218	*Rumohra adiantiformis*	Volkan, Panama	J.W. Miller & R.M. leahy	**MT335137; MT335372; MT335612; MT359833; MT359593; N/A; MT412903; MT413113**	El-Gholl *et al.* (1997), Crous (2002), Crous *et al.* (2006), this study
		CMW 30989	CBS 109062; CPC 1603	*Adiantum* sp.	The Netherlands	R. Pieters	**MT335138; MT335373; MT335613; MT359834; MT359594; MT412665; MT412904; MT413114**	El-Gholl *et al.* (1997), Crous (2002), Crous *et al.* (2006), this study
B109	***Ca. silvicola***	CBS 135237^{T}	LPF081	Soil (tropical rainforest)	Mucuri, Bahia, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396065; KM396148; N/A; N/A; N/A; KM395891; KM395978	Alfenas *et al.* (2015)
		CBS 134836	LPF079	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396062; KM396145; N/A; N/A; N/A; KM395888; KM395975	Alfenas *et al.* (2015)
	***Calonectria* sp.**	CBS 112152	CPC 3203	*E. camaldulensis*	Vietnam	N/A	N/A; KX784602; N/A; KY653291; KY653347; KY653463; KX784745; KX784672	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)

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	***Calonectria* sp.**	CBS 112753	CPC 4225	N/A	Indonesia	N/A	N/A; KX784598; N/A; KY653292; KY653348; KY653464; KX784740; KX784667	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
B110	***Ca. spathiphylli***	CMW 16742^{T}	ATCC 44730; CBS 114540; STE-U 2185	*Spathiphyllum* sp.	Florida, USA	C.L. Schoulties	**N/A; MT335374; MT335614; MT359835; MT359595; MT412666; MT412905; MT413115**	El-Gholl *et al.* (1992), Crous (2002), Lombard *et al.* (2010a, 2016), this study
		CMW 30997	CBS 116168; CPC 789	*Spathiphyllum* sp.	Switzerland	L. Petrini	**N/A; MT335375; MT335615; MT359836; MT359596; MT412667; MT412906; MT413116**	El-Gholl *et al.* (1992), Crous (2002), Lombard *et al.* (2016), this study
B111	***Ca. spathulata***	CMW 16744^{T}	CBS 555.92	*E. viminalis*	Brazil	N.E. El-Gholl	**MT335139; MT335376; MT335616; MT359837; MT359597; MT412668; MT412907; MT413117**	Crous & Kang (2001), Crous (2002), Lombard *et al.* (2016), this study
		CBS 112513	CMW 51197; CPC 3851	*Eucalyptus* sp.	Colombia	M.J. Wingfield	**MT335140; MT335377; MT335617; MT359838; MT359598; MT412669; MT412908; MT413118**	Lombard *et al.* (2016), this study
B112	***Ca. sumatrensis***	CMW 23698^{T}	CBS 112829; CPC 4518	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	**MT335145; MT335382; MT335622; MT359843; MT359603; MT412674; MT412913; N/A**	Crous *et al.* (2004), this study
		CMW 30987	CBS 112934; CPC 4516	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	**MT335146; MT335383; MT335623; MT359844; MT359604; MT412675; MT412914; N/A**	Crous *et al.* (2004), this study
		CBS 112936	CMW 51207; CPC 4504	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	**MT335143; MT335380; MT335620; MT359841; MT359601; MT412672; MT412911; N/A**	Lombard *et al.* (2016), this study
B113	***Ca. syzygiicola***	CBS 112831^{T}	CMW 51204; CPC 4511	*Syzygium aromaticum*	Sumatra, Indonesia	M.J. Wingfield	N/A; N/A; N/A; N/A; N/A; N/A; KX784736; KX784663	Lombard *et al*. (2016)
B114	***Ca. terricola***	CBS 116247^{T}	CMW 51232; CPC 3583	Soil (*Eucalyptus* plantation)	Brazil	P.W. Crous	N/A; N/A; N/A; N/A; N/A; N/A; KX784738; KX784665	Lombard *et al.* (2016)

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B115	***Ca. tonkinensis***	CMW 47430^{T}	CBS 143576	Soil (*Eucalyptus* plantation)	Bavi, Hanoi, Vietnam	N.Q. Pham & T.Q. Pham	**MT335147; MT335384; MT335624; MT359845; MT359605; MT412676; MT412915; MT413122**	Pham *et al.* (2019), this study
B116	***Ca. uniseptata***	CBS 413.67^{T}	CMW 23678; CPC 2391; IMI 299577	*Paphiopedilum callosum*	Celle, Germany	W. Gerlach	GQ280451; GQ267379; GQ267248; GQ280573; GQ280695; N/A; GQ267307; GQ267208	Lombard *et al.* (2016)
B117	***Ca. uxmalensis***	CBS 110925^{T}	CMW 51167; CPC 945	Soil	Uxmal, Mexico	P.W. Crous	**MT335153; MT335390; MT335630; MT359851; MT359611; MT412681; MT412921; MT413128**	Lombard *et al.* (2016), this study
		CBS 110919	CMW 51164; CPC 928	Soil	Uxmal, Mexico	P.W. Crous	**MT335154; MT335391; MT335631; MT359852; MT359612; MT412682; MT412922; MT413129**	Lombard *et al.* (2016), this study
B118	***Ca. variabilis***	CMW 3187^{T}	AR2675; CBS 114677; CPC 2436	*Schefflera morototoni*	Pará, Brazil	F.C. de Albuquerque	**N/A; MT335392; MT335632; MT359853; MT359613; MT412683; MT412923; MT413130**	Crous *et al.* (1993b), Crous (2002), Lombard *et al.* (2010a, 2016), this study
		CMW 2914	CBS 112691; CPC 2506	*Theobroma grandiflorum*	Pará, Brazil	F. Carneiro	**N/A; MT335393; MT335633; MT359854; MT359614; MT412684; MT412924; MT413131**	Crous *et al.* (1993b), Crous (2002), Lombard *et al.* (2010a, 2016), this study
B119	***Ca. venezuelana***	CBS 111052^{T}	CMW 51173; CPC 1183	Soil	Acarigua, Venezuela	M.J. Wingfield	**MT335155; MT335394; MT335634; MT359855; MT359615; MT412685; MT412925; MT413132**	Lombard *et al.* (2016), this study
B120	***Ca. yunnanensis***	CERC 5339^{T}	CBS 142897; CMW 47644	Soil (*Eucalyptus* plantation)	YunNan, China	S.F. Chen & J.Q. Li	**MT335157; MT335396; MT335636; MT359857; MT359617; MT412687; MT412927; MT413134**	Li *et al.* (2017), this study
		CERC 5337	CBS 142895; CMW 47642	Soil (*Eucalyptus* plantation)	YunNan, China	S.F. Chen & J.Q. Li	**MT335158; MT335397; MT335637; MT359858; MT359618; MT412688; MT412928; MT413135**	Li *et al.* (2017), this study
		CERC 5376	CBS 142892; CMW 47655	Soil (*Eucalyptus* plantation)	PuEr, YunNan, China	S.F. Chen & J.Q. Li	**MT335126; MT335361; MT335601; MT359822; MT359582; MT412654; MT412892; MT413103**	Li *et al.* (2017), this study

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Curvicladiella cignea	CBS 109167[T]	CPC 1595; MUCL 40269	Decaying leaf	French Guiana	C. Decock	KM231122; KM231287; KM231461; AF220973; AY793431; KM232311; KM231867; KM232002	Decock & Crous (1998), Crous *et al.* (2006), Lombard *et al.* (2015b)
	CBS 109168	CPC 1594; MUCL 40268	Decaying seed	French Guiana	C. Decock	KM231121; KM231286; KM231460; KM231745; JQ666074; KM232312; KM231868; KM232003	Decock & Crous (1998), Crous *et al.* (2006), Lombard *et al.* (2015b)

[1] Codes (B1 to B120) of the 120 accepted *Calonectria* species resulting from the present study.

[2] One hundred and twenty accepted species resulting from the present study.

[3] Key isolates of the 120 *Calonectria* species after revision.

[4] T: ex-type isolates of the *Calonectria* species after revision.

[5] AR: Amy Y. Rossman working collection; ATCC: American Type Culture Collection, Virginia, USA; CBS: Westerdijk Fungal Biodiversity Institute, Utrecht, The Netherlands; CERC: China Eucalypt Research Centre, ZhanJiang, GuangDong Province, China; CMW: Culture collection of the Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa; CPC: Pedro Crous working collection housed at Westerdijk Fungal Biodiversity Institute; HGUP: Plant Pathology Herbarium of Gui Zhou University, GuiYang 550025, China; IMI: International Mycological Institute, CABI Bioscience, Egham, Bakeham Lane, UK; LPF: Laboratorio de Patologia Florestal, Universidade Federal de Viçosa, Viçosa, Brazil; MUCL: Mycotheque, Laboratoire de Mycologie Systematique st Appliqee, I'Universite, Louvian-la-Neuve, Belgium; PPRI: Plant Protection Research Institute, Pretoria, South Africa; STE-U: Department of Plant Pathology, University of Stellenbosch, South Africa; UFV: Universidade Federal de Viçosa, Viçosa, Brazil.

[6] *act*: actin; *cmdA*: calmodulin; *his3*: histone H3; ITS: the internal transcribed spacer regions 1 and 2 and the 5.8S gene of the ribosomal RNA; LSU: 28S large subunit RNA gene; *rpb2*: the second largest subunit of RNA polymerase; *tef1*: translation elongation factor 1-alpha; *tub2*: β-tubulin.

[7] GenBank accession number obtained in this study are in bold.

[8] N/A: information are not available.

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Table 2. Morphological characteristics, thallism and area of occurrence of the 11 *Calonectria* species complexes.

Species complex	Vesicle shape		Macroconidia septation		Perithecial colour		Ascospore numbers in asci		Ascospores septation		Thallism[6]	Area of occurrence
	Typical or dominant[1]	Additional or minor	Typical or dominant[2]	Additional or minor	Typical or dominant[3]	Additional or minor	Typical or dominant[4]	Additional or minor	Typical or dominant[5]	Additional or minor		
1. *Calonectria brassicae* species complex	**Clavate**	Acicular, broadly clavate, narrowly clavate	**1**	1(–2), 1(–3)	**Orange to red-brown**	Brown, red	**8**		**1**	1(–3), (1–)3	Heterothallic or homothallic	Asia, North and South America
3. *Calonectria colhounii* species complex	**Clavate**	Acicular, broadly clavate, narrowly clavate	**3**	(1–)3, (1–)3(–4), 3–4	**Yellow**	Bright yellow, brown, dull yellow, orange, red, red-brown	**4**	(2–)4, 8	**3**	(1–)3, 2–3	Heterothallic or homothallic	Africa, Asia, North America
5. *Calonectria gracilipes* species complex	**Narrowly clavate**	Clavate	**>3**	1, 3, up to 12	**Orange to red-brown**	Brown, orange-brown	**8**		**Varied**	1, (1–)3, 3–6(–9)	Homothallic	North and South America
10. *Calonectria reteaudii* species complex	**Narrowly clavate**	Clavate	**>3**	(1–)3, up to 8	**Orange to red-brown**	Orange-red, red	**8**		**3**	(1–)3, (1–)3(–5), 3–4, (1–)3–6(–9)	Heterothallic or homothallic	Asia, Oceania
8. *Calonectria naviculata* species complex	**Naviculate**	Clavate, ellipsoidal, sphaero-pedunculate	**1**	1(–3)	**Orange to red-brown**		**2–8**		**3**		Heterothallic	Africa, Asia, Europe, North and South America, Oceania

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2. *Calonectria candelabrum* species complex	**Ellipsoidal to obpyriform**	Broadly ellipsoidal, clavate, fusiform, narrowly obpyriform, ovoid, spathulate	**1**	(1–)3(–6)	**Orange to red-brown**	Red	**8**	4–8	**1**	(1–)3	Heterothallic or homothallic	Africa, Asia, Europe, North and South America, Oceania
7. *Calonectria mexicana* species complex	**Ellipsoidal with papillate apex**	Acicular, clavate, fusiform, narrowly ellipsoidal, obpyriform, obovoid, pyriform, sphaero-pedunculate	**1**	1(–3), (1–)3, (1–)3(–6)	**Orange to red-brown**	Brownish-yellow, red, yellow	**8**		**1**	1(–3), 3	Heterothallic or homothallic	Africa, Europe, North America
6. *Calonectria kyotensis* species complex	**Sphaero-pedunculate**	Globose, pyriform	**1**	1(–3), (1–)3, 3	**Orange to red-brown**	Orange-brown, red, reddish brown	**8**		**1**	1(–3), 2–3	Heterothallic or homothallic	Africa, Asia, Europe, North and South America
11. *Calonectria spathiphylli* species complex	**Sphaero-pedunculate**	Globose, ovoid, ellipsoidal, obpyriform	**1**	1(–3)	**Orange to red-brown**	Red	**8**	2–8	**1**	1(–3)	Heterothallic or homothallic	North and South America
4. *Calonectria cylindrospora* species complex	**Clavate, ellipsoidal, ellipsoidal with papillate apex, fusiform, obpyriform, ovoid, pyriform, sphaero-pedunculate**		**1**	(1–)3(–4)	**Orange to red-brown**	Orange-brown, red, yellow	**8**	(2–)8	**1**	1(–3)	Heterothallic or homothallic	Africa, Asia, Europe, North and South America

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9. *Calonectria pteridis* species complex	**Clavate or ovate**	Fusiform, narrowly clavate, ellipsoidal	**1**	1(–3)	**Orange to red-brown**		**8**		**1**	1(–3), 1–3(–7)	Heterothallic	North and South America

[1] Typical vesicle shape for each species complex were marked in different colour: clavate or narrowly clavate vesicle/light green, naviculate vesicle/green, ellipsoidal to obpyriform vesicle/dark green, ellipsoidal vesicle with papillate apex/yellow, sphaeropedunculate vesicle/orange; species complexes with varied vesicle shapes were not marked in any colour.

[2] Typical macroconidial septation number for each species complex were marked in different colour: 1-septate/light green, 3-septate/green, > 3-septate/dark green.

[3] Typical perithecial colour for each species complex were marked in different colour: orange to red-brown perithecia/light green, yellow perithecia/green.

[4] Typical ascospores number produced in the ascus for each species complex were marked in different colour: 4-spored asci/light green, 8-spored asci/green, not 4-spored or 8-spored asci were not marked in any colour.

[5] Typical ascospores septation number for each species complex were marked in different colour: 1-septate/light green, 3-septate/green, varied number of ascospores septation were not mark in any colour.

[6] Different mating system for each species complex were marked in different colour; heterothallic/light green, homothallic/green, heterothallic or homothallic/dark green.

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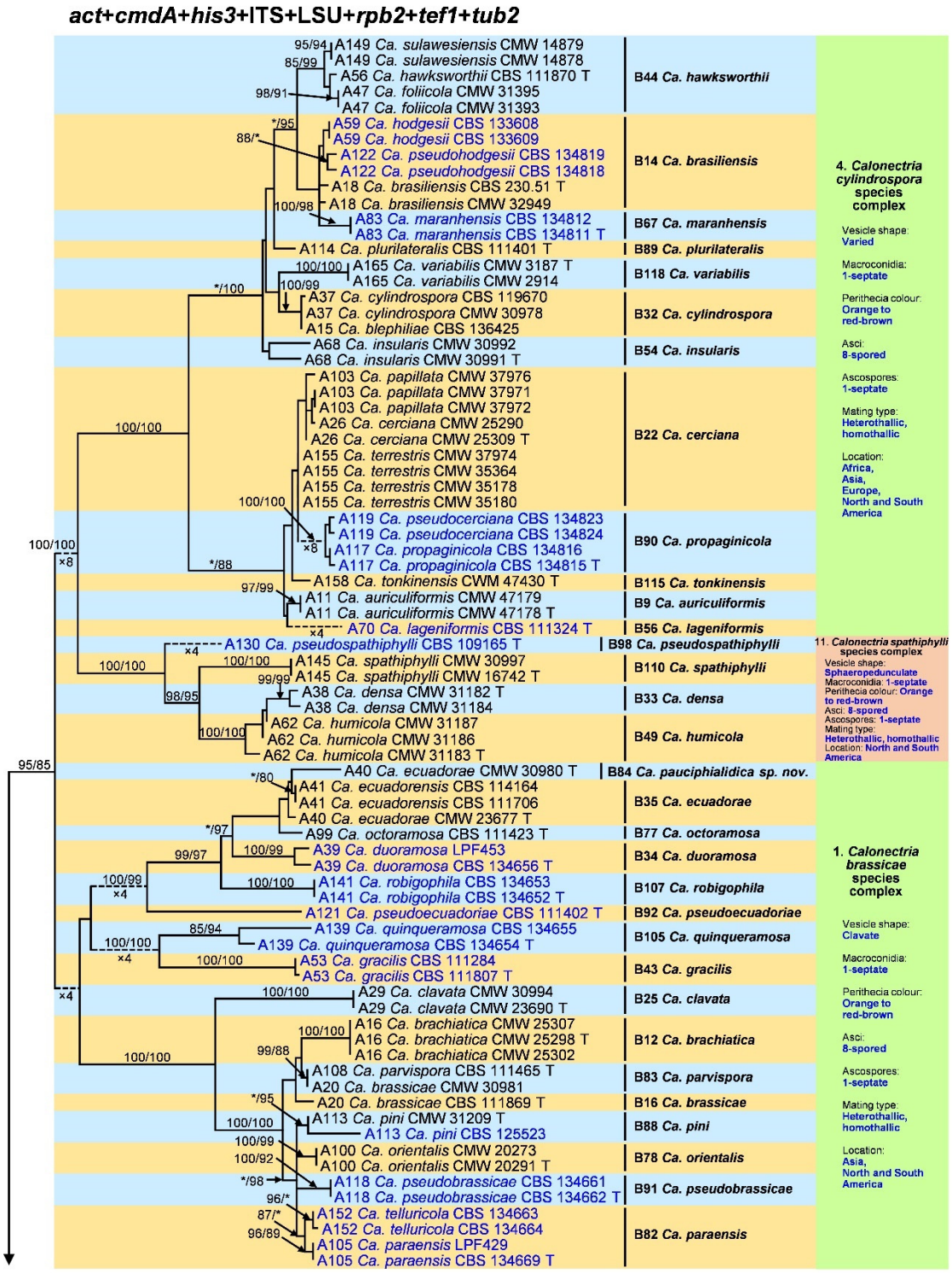


Fig. 1. Phylogenetic tree of the genus *Calonectria* based on maximum likelihood (ML) analyses of combined DNA dataset of *act*, *cmdA*, *his3*, ITS, LSU, *rpb2*, *tef1* and *tub2* gene sequences. Codes A1 to A169 showed the 169 *Calonectria* species before their taxonomic reconsideration in this study, codes B1 to B120 indicated the 120 accepted *Calonectria* species after the revision emerging from this study. Seventy-six isolates unable to obtain in this study were marked in blue, their sequences were downloaded from NCBI. Bootstrap values ≥ 80 %

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for ML and MP analyses are presented at the branches. Bootstrap values lower than 80 % are marked with "*", and absent analyses values are marked with "-". Ex-type isolates of *Calonectria* species after revision are marked with "T". The tree is rooted to *Curvicladiella cignea* (CBS 109167, and CBS 109168). *Calonectria* species grouped in 11 species complexes. Typical morphological characteristics, mating type and location (geographic regions where isolates have been identified) of the 11 species complexes are shown at the right side of the phylogenetic tree.

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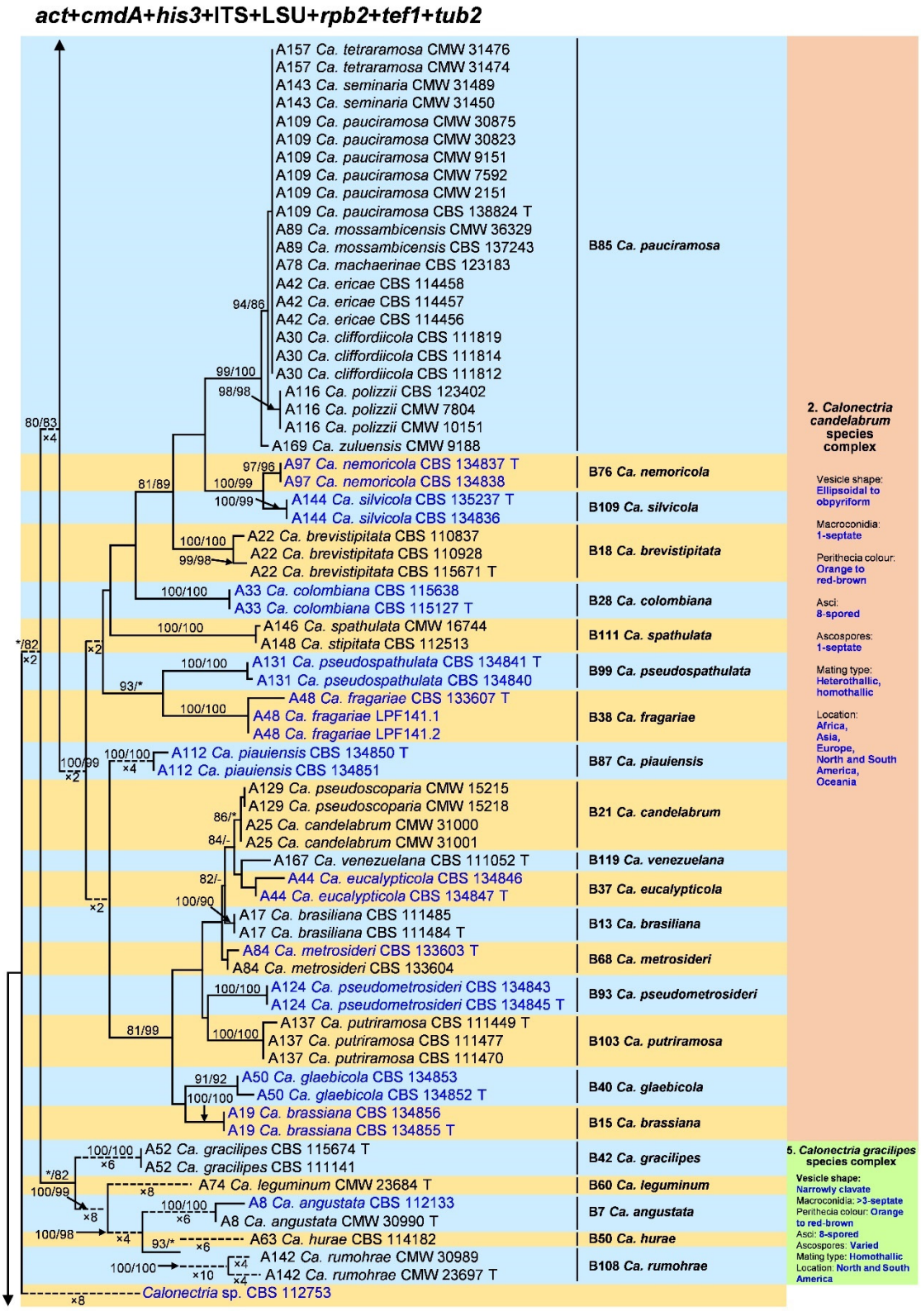


Fig. 1. (Continued).

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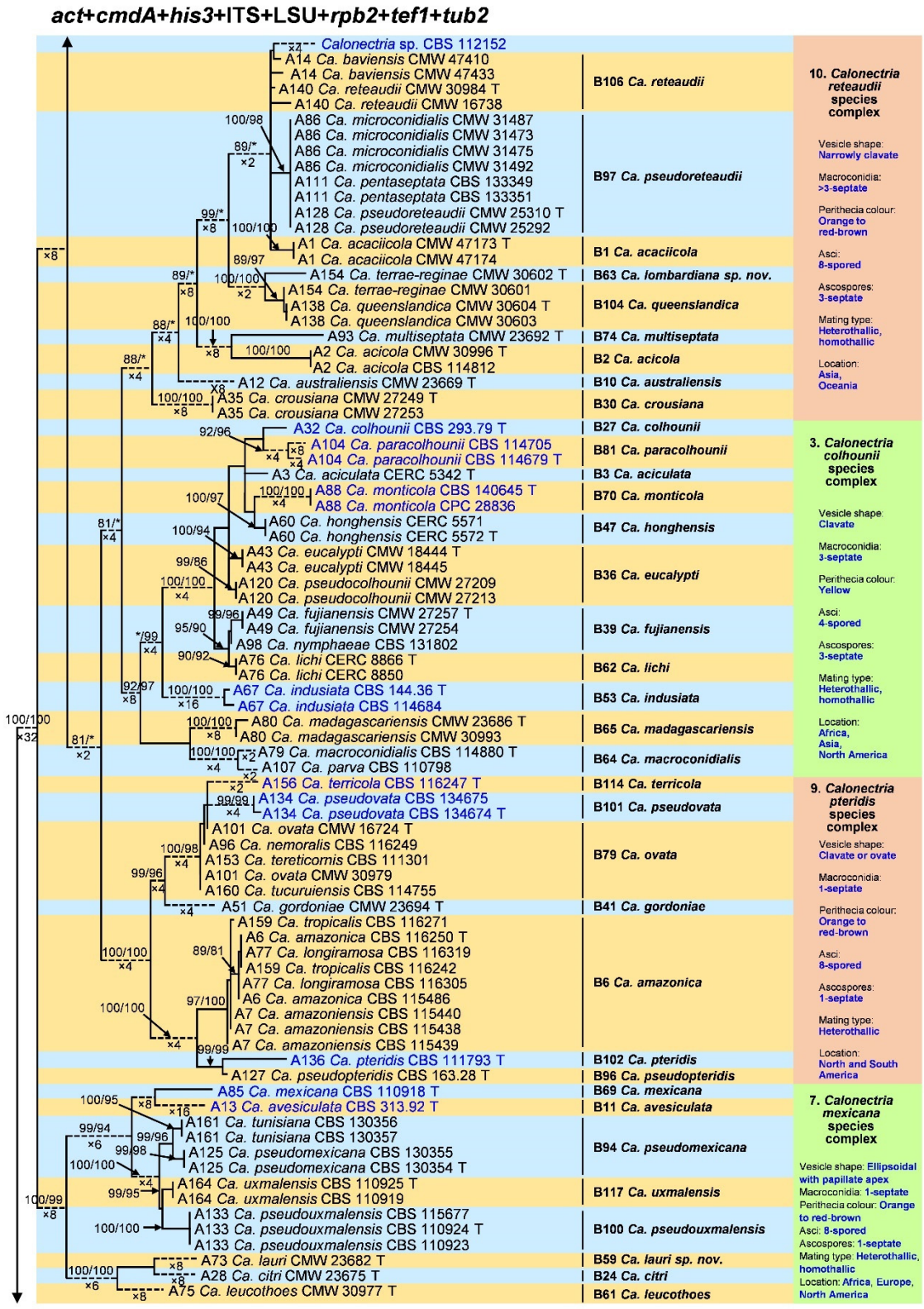


Fig. 1. (Continued).

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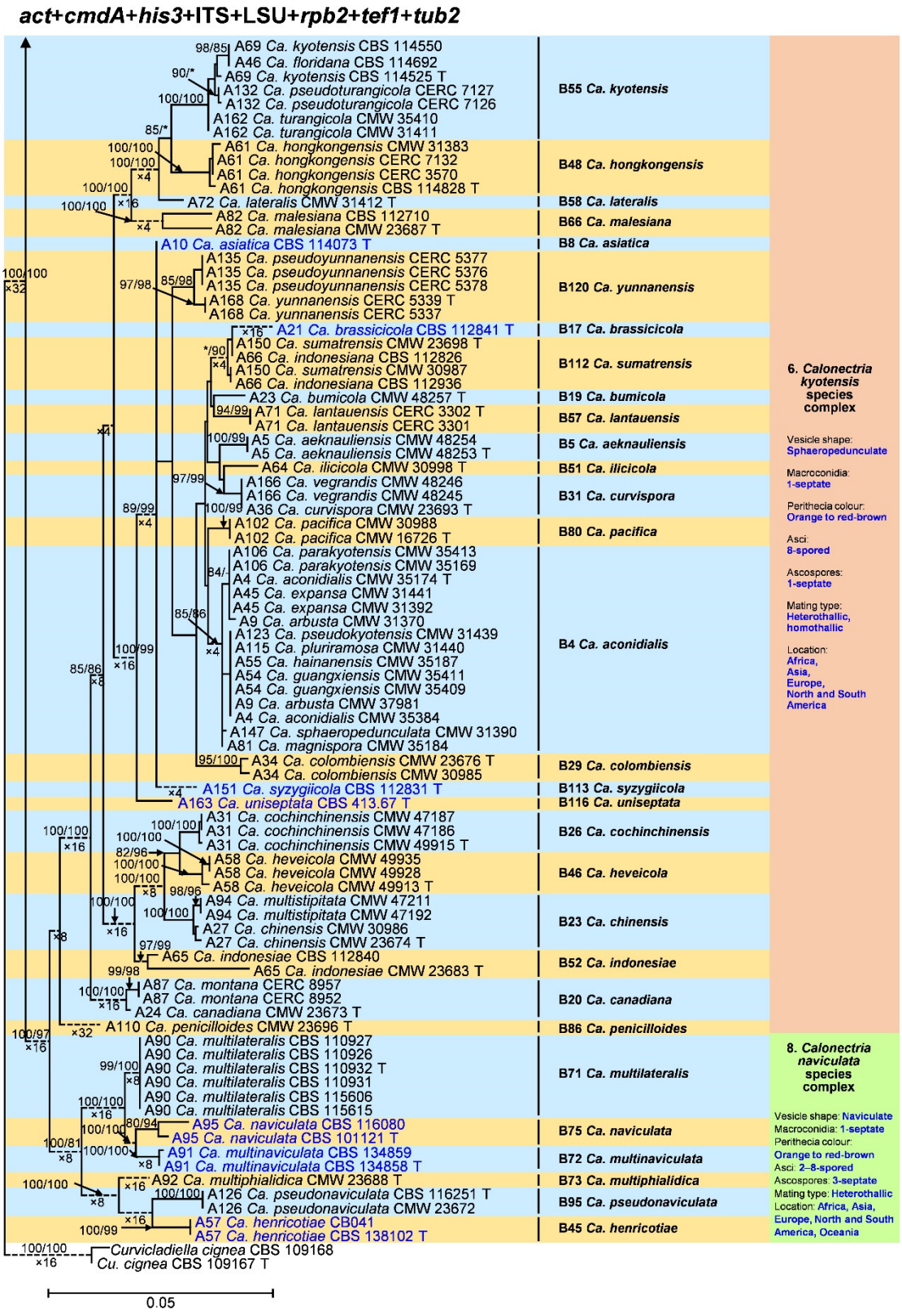


Fig. 1. (Continued).

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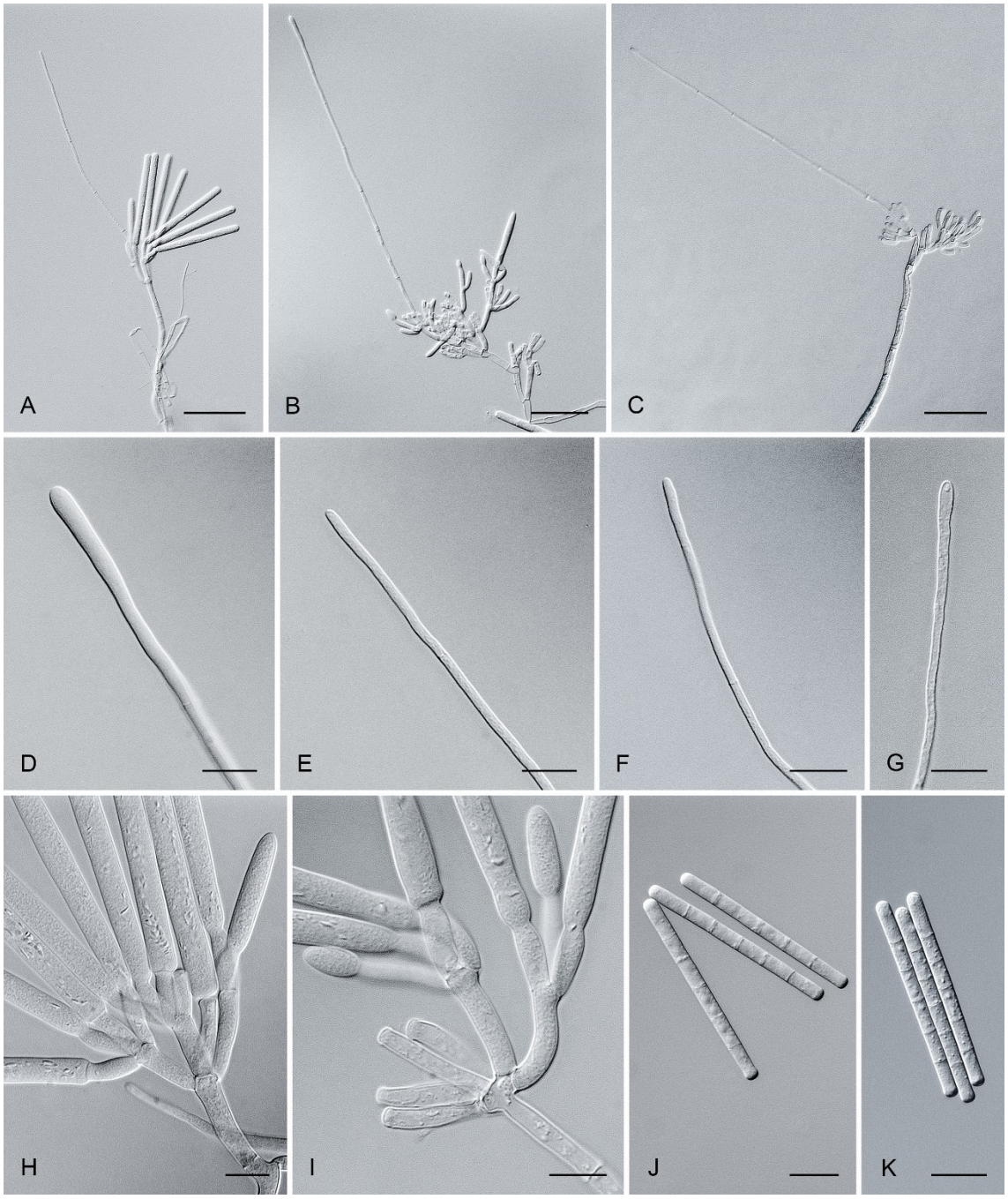


Fig. 2. *Calonectria lombardiana*. **A–C**. Macroconidiophore. **D–G**. Narrowly clavate vesicles. **H, I**. Conidiogenous apparatus with conidiophore branches and cylindrical to allantiod phialides. **J, K**. Macroconidia. Scale bars: A–C = 50 µm, D–I = 10 µm, J, K = 20 µm.

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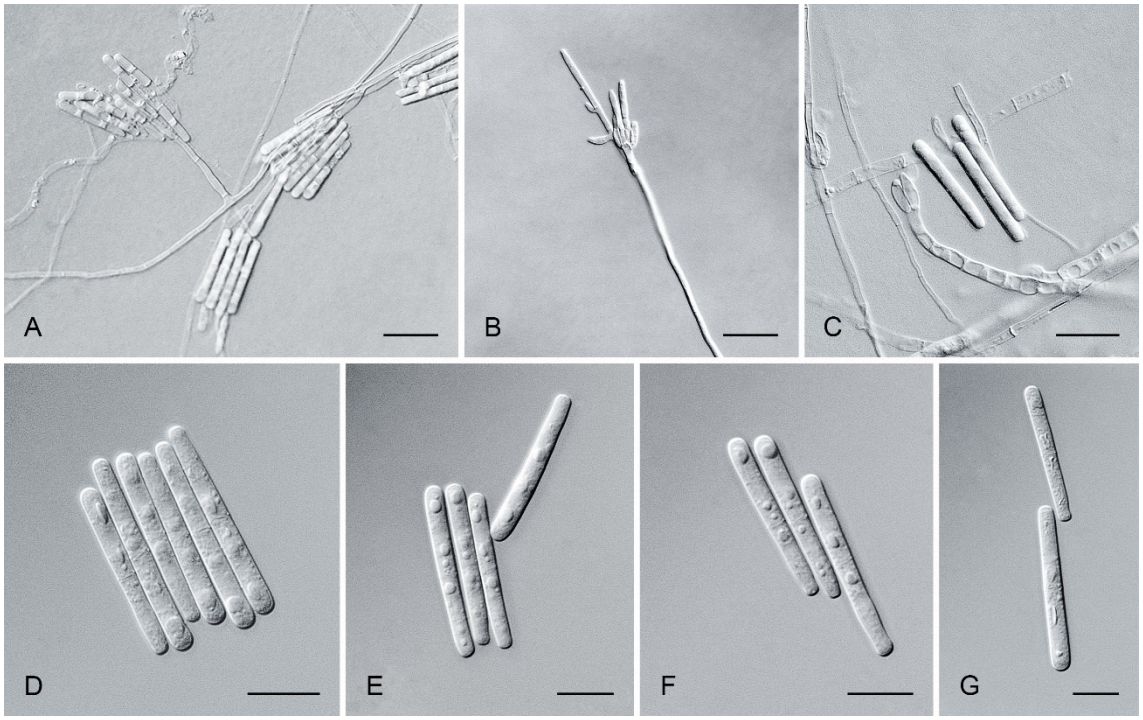


Fig. 3. *Calonectria pauciphialidica*. **A–C**. Macroconidiophore. **D–G**. Macroconidia. Scale bars: A–C = 20 µm, D–G = 10 µm.

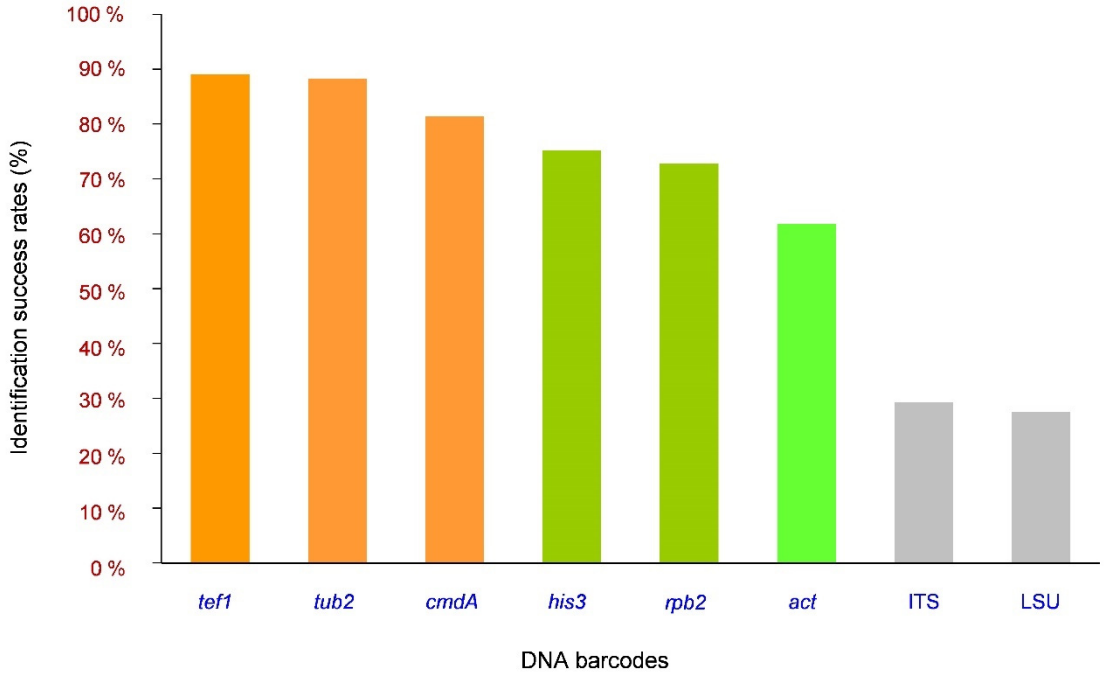


Fig. 4. The identification success rates of the eight candidate DNA barcodes for the genus *Calonectria*.

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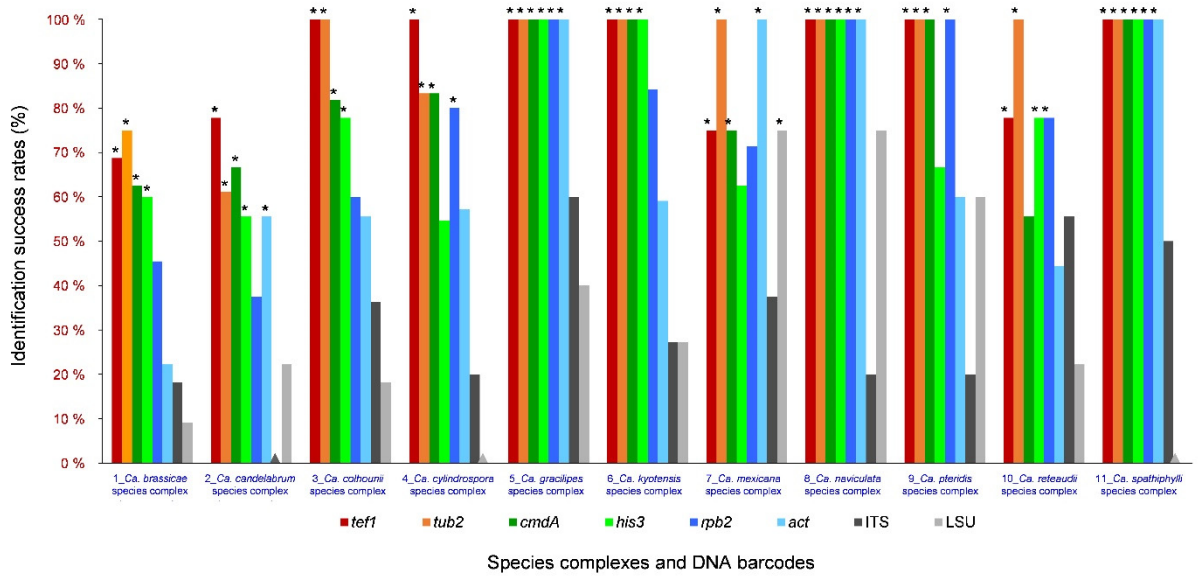


Fig. 5. The identification success rates of the eight candidate DNA barcodes for each of the 11 species complex; "*" above the histogram indicate four of the barcodes with highest identification success rates within each of the 11 species complexes; Triangle indicate the identification success rate of the candidate DNA barcodes is zero.

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SUPPLEMENTARY FILES

Table S1. Isolates obtained, re-sequenced and used in the phylogenetic analyses in this study.

Code A[1]	Previous species name[2]	Isolates numbers [3,4,5]	Other collection number[3]	Code B[6]	Accepted species name[7]	Isolates after species revision [8,9]	Hosts	Area of occurrence	Collector	GenBank accession Numbers[10] *act*; *cmdA*; *his3*; ITS; LSU; *rpb2*; *tef1*; *tub2*	References or source of data
A1	*Calonectria acaciicola*	CMW 47173^{T}	CBS 143557	B1	***Ca. acaciicola***	CMW 47173^{T}	Soil (*Acacia auriculiformis* plantation)	Do Luong, Nghe An, Vietnam	N.Q. Pham & T.Q. Pham	MT334933; MT335160; MT335399; MT359620; MT359380; MT412474; MT412690; MT412930	Pham *et al.* (2019), this study
		CMW 47174	CBS 143558	B1	***Ca. acaciicola***	CMW 47174	Soil (*A. auriculiformis* plantation)	Do Luong, Nghe An, Vietnam	N.Q. Pham & T.Q. Pham	MT334934; MT335161; MT335400; MT359621; MT359381; MT412475; MT412691; MT412931	Pham *et al.* (2019), this study
A2	*Ca. acicola*	CMW 30996^{T}	–	B2	***Ca. acicola***	CMW 30996^{T}	*Phoenix canariensis*	Northland, New Zealand	H. Pearson	MT334935; MT335162; MT335401; MT359622; MT359382; MT412476; MT412692; MT412932	Gadgil & Dick (2004), Lombard *et al.* (2010a), this study
		CBS 114812	CMW 51216	B2	***Ca. acicola***	CBS 114812	*P. canariensis*	Northland, New Zealand	H. Pearson	MT334936; MT335163; MT335402; MT359623; MT359383; MT412477; MT412693; MT412933	Gadgil & Dick (2004), Lombard *et al.* (2010a), this study
A3	*Ca. aciculata*	CERC 5342^{T}	CBS 142883; CMW 47645	B3	***Ca. aciculata***	CERC 5342^{T}	*Eucalyptus urophylla* × *E. grandis*	YunNan, China	S.F. Chen & J.Q. Li	MT334937; MT335164; MT335403; MT359624; MT359384; MT412478; MT412694; MT412934	Li *et al.* (2017), this study
A4	*Ca. aconidialis*	CMW 35174^{T}	CBS 136086; CERC 1850	B4	***Ca. aconidialis***	CMW 35174^{T}	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou & S.F. Chen	MT334938; MT335165; MT335404; MT359625; MT359385; MT412479; MT412695; N/A[11]	Lombard *et al.* (2015a), this study
		CMW 35384	CBS 136091; CERC 1886	B4	***Ca. aconidialis***	CMW 35384	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou & S.F. Chen	MT334939; MT335166; MT335405; MT359626; MT359386; N/A; MT412696; N/A	Lombard *et al.* (2015a), this study
A5	*Ca. aeknauliensis*	CMW 48253^{T}	CBS 143559	B5	***Ca. aeknauliensis***	CMW 48253^{T}	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT334953; MT335180; MT335419; MT359640; MT359400; MT412486; MT412710; N/A	Pham *et al.* (2019), this study

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		CMW 48254	CBS 143560	B5	***Ca. aeknauliensis***	CMW 48254	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT334954; MT335181; MT335420; MT359641; MT359401; MT412487; MT412711; N/A	Pham *et al.* (2019), this study
A6	*Ca. amazonica*	CBS 116250^{T}	CMW 51234; CPC 3534	B6	***Ca. amazonica***	CBS116250^{T}	*E. tereticornis*	Amazon, Brazil	P.W. Crous & A.C. Alfenas	MT334955; MT335182; MT335421; MT359642; MT359402; MT412488; MT412712; MT412935	Lombard *et al.* (2016), this study
		CBS 115486	CMW 51223; CPC 3894	B6	***Ca. amazonica***	CBS 115486	*E. tereticornis*	Amazon, Brazil	P.W. Crous & A.C. Alfenas	MT334956; MT335183; MT335422; MT359643; MT359403; MT412489; MT412713; MT412936	Lombard *et al.* (2016), this study
A7	*Ca. amazoniensis**	CBS 115440^{T}	CMW 51222; CPC 3885	B6	*Ca. amazonica*$^{\#}$	CBS 115440	*E. tereticornis*	Amazon, Brazil	P.W. Crous & A.C. Alfenas	MT334957; MT335184; MT335423; MT359644; MT359404; N/A; MT412714; MT412937	Lombard *et al.* (2016), this study
		CBS 115438	CMW 51220; CPC 3890	B6	*Ca. amazonica*$^{\#}$	–	*E. tereticornis*	Amazon, Brazil	P.W. Crous & A.C. Alfenas	MT334958; MT335185; MT335424; MT359645; MT359405; N/A; MT412715; MT412938	Lombard *et al.* (2016), this study
		CBS 115439	CMW 51221; CPC 3889	B6	*Ca. amazonica*$^{\#}$	–	*E. tereticornis*	Amazon, Brazil	P.W. Crous & A.C. Alfenas	MT334959; MT335186; MT335425; MT359646; MT359406; N/A; MT412716; MT412939	Lombard *et al.* (2016), this study
A8	*Ca. angustata*	CMW 30990^{T}	CBS 114544; CPC 2347; P99-0454	B7	***Ca. angustata***	CMW 30990^{T}	*Tillandsia capitata*	Sarasota nursery, Florida, USA	R.M. Leahy	MT334963; N/A; MT335429; MT359650; MT359410; MT412493; MT412720; MT412943	Crous *et al.* (2000, 2006), Lombard *et al.* (2010a), this study
A9	*Ca. arbusta**	CMW 31370^{T}	CBS 136079; CERC 1705	B4	*Ca. aconidialis*$^{\#}$	CMW 31370	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT334940; MT335167; MT335406; MT359627; MT359387; MT412480; MT412697; N/A	Lombard *et al.* (2015a), this study
		CMW 37981	CBS 136098; CERC 1944	B4	*Ca. aconidialis*$^{\#}$	–	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT334941; MT335168; MT335407; MT359628; MT359388; N/A; MT412698; N/A	Lombard *et al.* (2015a), this study
A11	*Ca. auriculiformis*	CMW 47178^{T}	CBS 143561	B9	***Ca. auriculiformis***	CMW 47178^{T}	Soil (*A. auriculiformis* plantation)	Hau Loc, Thanh Hoa, Vietnam	N.Q. Pham & T.Q. Pham	MT334964; MT335190; MT335430; MT359651; MT359411; MT412494; MT412721; MT412944	Pham *et al.* (2019), this study
		CMW 47179	CBS 143562	B9	***Ca. auriculiformis***	CMW 47179	Soil (*A. auriculiformis* plantation)	Hau Loc, Thanh Hoa, Vietnam	N.Q. Pham & T.Q. Pham	N/A; MT335191; MT335431; MT359652; MT359412; MT412495; MT412722; MT412945	Pham *et al.* (2019), this study
A12	*Ca. australiensis*	CMW 23669^{T}	CBS 112954; CPC 4714	B10	***Ca. australiensis***	CMW 23669^{T}	*Ficus pleurocarpa*	Queensland, Australia	C. Pearce & B. Paulus	MT334965; MT335192; MT335432; MT359653; MT359413; MT412496; MT412723; MT412946	Crous *et al.* (2006), Lombard *et al.* (2010a), this study

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A14	*Ca. baviensis**	CMW 47410^{T}	CBS 143563	B106	*Ca. reteaudii*$^{\#}$	CMW 47410	*E. urophylla* (leaf)	Bavi, Hanoi, Vietnam	N.Q. Pham & T.Q. Pham	MT334966; MT335193; MT335433; MT359654; MT359414; MT412497; MT412724; N/A	Pham *et al.* (2019), this study
		CMW 47433	CBS 143564	B106	*Ca. reteaudii*$^{\#}$	–	*E. pellita* (leaf)	Bavi, Hanoi, Vietnam	N.Q. Pham & T.Q. Pham	MT334967; MT335194; MT335434; MT359655; MT359415; MT412498; MT412725; MT412947	Pham *et al.* (2019), this study
A15	*Ca. blephiliae**	CBS 136425^{T}	CMW 51321; CPC 21859	B32	*Ca. cylindrospora*$^{\#}$	CBS 136425	*Blephilia ciliata*	Ellerbe, North Carolina, USA	T. Sharp	MT335005; MT335235; MT335475; MT359696; MT359456; MT412539; MT412766; MT412984	Crous *et al.* (2013), this study
A16	*Ca. brachiatica*	CMW 25298^{T}	CBS 123700	B12	***Ca. brachiatica***	CMW 25298^{T}	*Pinus maximinoi*	Buga, Colombia	M.J. Wingfield	N/A; MT335195; MT335435; MT359656; MT359416; MT412499; MT412726; MT412948	Lombard *et al.* (2009), this study
		CMW 25302	–	B12	***Ca. brachiatica***	CMW 25302	*Pi. tecunumanii*	Buga, Colombia	M.J. Wingfield	N/A; MT335196; MT335436; MT359657; MT359417; MT412500; MT412727; MT412949	Lombard *et al.* (2009), this study
		CMW 25307	–	B12	***Ca. brachiatica***	CMW 25307	*Pi. tecunumanii*	Buga, Colombia	M.J. Wingfield	N/A; MT335197; MT335437; MT359658; MT359418; MT412501; MT412728; MT412950	Lombard *et al.* (2009), this study
A17	*Ca. brasiliana*	CBS 111484^{T}	CMW 51187; CPC 1924	B13	***Ca. brasiliana***	CBS 111484^{T}	Soil	Brazil	A.C. Alfenas	MT334968; MT335198; MT335438; MT359659; MT359419; MT412502; MT412729; MT412951	Lombard *et al.* (2016), this study
		CBS 111485	CMW 51188; CPC 1929	B13	***Ca. brasiliana***	CBS 111485	Soil	Brazil	A.C. Alfenas	MT334969; MT335199; MT335439; MT359660; MT359420; MT412503; MT412730; MT412952	Lombard *et al.* (2016), this study
A18	*Ca. brasiliensis*	CBS 230.51^{T}	IMI 299576	B14	***Ca. brasiliensis***	CBS 230.51^{T}	*Eucalyptus* sp.	Ceara state, Brazil	T.R. Ciferri	MT334970; MT335200; MT335440; MT359661; MT359421; MT412504; MT412731; MT412953	Batista (1951), Crous (2002), Lombard *et al.* (2010b), this study
		CMW 32949	CBS 114257; CPC 1944	B14	***Ca. brasiliensis***	CMW 32949	*Eucalyptus* sp.	Aracruz, Brazil	A.C. Alfenas	MT334971; MT335201; MT335441; MT359662; MT359422; MT412505; MT412732; MT412954	Lombard *et al.* (2010a), this study
A20	*Ca. brassicae*	CBS 111869^{T}	CPC 2409	B16	***Ca. brassicae***	CBS 111869^{T}	*Argyreia splendens*	Indonesia	F. Bugnicourt	MT334972; MT335202; MT335442; MT359663; MT359423; MT412506; MT412733; MT412955	Crous (2002), Lombard *et al.* (2010a, 2016), this study
		CMW 30981	CBS 111478; CPC 1921	B83	*Ca. parvispora*$^{\&}$	–	Soil	Brazil	A.C. Alfenas	MT335081; MT335313; MT335553; MT359774; MT359534; MT412606; MT412844; MT413056	Lombard *et al.* (2010a, 2016), this study

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A22	*Ca. brevistipitata*	CBS 115671^{T}	CMW 51226; CPC 949	B18	***Ca. brevistipitata***	CBS 115671^{T}	Soil	Mexico	P.W. Crous	MT334973; MT335203; MT335443; MT359664; MT359424; MT412507; MT412734; MT412956	Lombard *et al.* (2016), this study
		CBS 110928	CMW 51170; CPC 951	B18	***Ca. brevistipitata***	CBS 110928	Soil	Mexico	P.W. Crous	MT334974; MT335204; MT335444; MT359665; MT359425; MT412508; MT412735; MT412957	Lombard *et al.* (2016), this study
		CBS 110837	CMW 51163; CPC 913	B18	***Ca. brevistipitata***	CBS 110837	Soil	Mexico	P.W. Crous	MT335057; MT335289; MT335529; MT359750; MT359510; MT412586; MT412820; MT413034	Lombard *et al.* (2016), this study
A23	*Ca. bumicola*	CMW 48257^{T}	CBS 143575	B19	***Ca. bumicola***	CMW 48257^{T}	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT334975; MT335205; MT335445; MT359666; MT359426; MT412509; MT412736; N/A	Pham *et al.* (2019), this study
A24	*Ca. canadiana*	CMW 23673^{T}	CBS 110817; STE-U 499	B20	***Ca. canadiana***	CMW 23673^{T}	*Picea* sp.	Canada	S. Greifenhagen	MT334976; MT335206; MT335446; MT359667; MT359427; MT412510; MT412737; MT412958	Kang *et al.* (2001b), Crous (2002), Lechat *et al.* (2010), this study
A25	*Ca. candelabrum*	CMW 31000	CPC 1675; UFV 117	B21	***Ca. candelabrum***	CMW 31000	*Eucalyptus* sp.	Amazonas, Brazil	A.C. Alfenas	MT334977; MT335207; MT335447; MT359668; MT359428; MT412511; MT412738; MT412959	Crous (2002), Lombard *et al.* (2010a, 2015b), this study
		CMW 31001	STE-U 1679; UFV 126	B21	***Ca. candelabrum***	CMW 31001	*Eucalyptus* sp.	Amazonas, Brazil	A.C. Alfenas	MT334978; MT335208; MT335448; MT359669; MT359429; MT412512; MT412739; MT412960	Crous (2002), Lombard *et al.* (2010a, 2015b), this study
A26	*Ca. cerciana*	CMW 25309^{T}	CBS 123693	B22	***Ca. cerciana***	CMW 25309^{T}	*E. urophylla* × *E. grandis* hybrid cutting	CERC nursery, GuangDong, China	M.J. Wingfield & X.D. Zhou	MT334981; MT335211; MT335451; MT359672; MT359432; MT412515; MT412742; MT412963	Lombard *et al.* (2010c), this study
		CMW 25290	CBS 123695	B22	***Ca. cerciana***	CMW 25290	*E. urophylla* × *E. grandis* hybrid cutting	CERC nursery, GuangDong, China	M.J. Wingfield & X.D. Zhou	MT334982; MT335212; MT335452; MT359673; MT359433; MT412516; MT412743; MT412964	Lombard *et al.* (2010c), this study
A27	*Ca. chinensis*	CMW 23674^{T}	CBS 114827; CPC 4101	B23	***Ca. chinensis***	CMW 23674^{T}	Soil	Hong Kong, China	E.C.Y. Liew	MT334990; MT335220; MT335460; MT359681; MT359441; MT412524; MT412751; MT412972	Crous *et al.* (2004), Lombard *et al.* (2010a), this study
		CMW 30986	CBS 112744; CPC 4104	B23	***Ca. chinensis***	CMW 30986	Soil	Hong Kong, China	E.C.Y. Liew	MT334991; MT335221; MT335461; MT359682; MT359442; MT412525; MT412752; MT412973	Crous *et al.* (2004), Lombard *et al.* (2010a), this study
A28	*Ca. citri*	CMW 23675^{T}	CBS 186.36	B24	***Ca. citri***	CMW 23675^{T}	*Citrus sinensis*	Florida, USA	H.S. Fawcett	MT334992; MT335222; MT335462; MT359683; MT359443; MT412526; MT412753; MT412974	Fawcett & Klotz (1937), Crous (2002), this study

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A29	*Ca. clavata*	CMW 23690^{T}	ATCC 66389; CBS 114557; CPC 2536; P078-1543	B25	***Ca. clavata***	CMW 23690^{T}	*Callistemon viminalis*	Lake Placid, Florida, USA	C.P. Seymour & E.L. Barnard	MT334993; MT335223; MT335463; MT359684; MT359444; MT412527; MT412754; MT412975	El-Gholl *et al.* (1993b), Crous (2002), Lombard *et al.* (2010a), this study
		CMW 30994	CBS 114666; CPC 2537; P078-1261	B25	***Ca. clavata***	CMW 30994	Root debris in peat	Lee County, Florida, USA	D. Ferrin	MT334994; MT335224; MT335464; MT359685; MT359445; MT412528; MT412755; MT412976	El-Gholl *et al.* (1993b), Crous (2002), Lombard *et al.* (2010a), this study
A30	*Ca. cliffordiicola**	CBS 111812^{T}	CMW 51190; CPC 2631	B85	*Ca. pauciramosa*$^{\#}$	CBS 111812	*Cliffordia feruginea*	George, Western Cape Province, South Africa	P.W. Crous	MT335084; MT335316; MT335556; MT359777; MT359537; MT412609; MT412847; MT413059	Lombard *et al.* (2016), this study
		CBS 111814	CMW 51191; CPC 2617	B85	*Ca. pauciramosa*$^{\#}$	–	*Prunus avium*	Stellenbosch, South Africa	C. Linde	MT335085; MT335317; MT335557; MT359778; MT359538; MT412610; MT412848; MT413060	Lombard *et al.* (2016), this study
		CBS 111819	CMW 51192; CPC 2604	B85	*Ca. pauciramosa*$^{\#}$	–	*Pr. avium*	Stellenbosch, South Africa	C. Linde	MT335086; MT335318; MT335558; MT359779; MT359539; MT412611; MT412849; MT413061	Lombard *et al.* (2016), this study
A31	*Ca. cochinchinensis*	CMW 49915^{T}	CBS 143567	B26	***Ca. cochinchinensis***	CMW 49915^{T}	Soil (*Hevea brasiliensis* plantation)	Duong Minh Chau, Tay Ninh, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	MT334995; MT335225; MT335465; MT359686; MT359446; MT412529; MT412756; MT412977	Pham *et al.* (2019), this study
		CMW 47186	CBS 143568	B26	***Ca. cochinchinensis***	CMW 47186	Soil (*A. auriculiformis* plantation)	Song May, Dong Nai, Vietnam	N.Q. Pham & T.Q. Pham	MT334996; MT335226; MT335466; MT359687; MT359447; MT412530; MT412757; MT412978	Pham *et al.* (2019), this study
		CMW 47187	CBS 143569	B26	***Ca. cochinchinensis***	CMW 47187	Soil (*A. auriculiformis* plantation)	Song May, Dong Nai, Vietnam	N.Q. Pham & T.Q. Pham	MT334997; MT335227; MT335467; MT359688; MT359448; MT412531; MT412758; MT412979	Pham *et al.* (2019), this study
A34	*Ca. colombiensis*	CMW 23676^{T}	CBS 112220; CPC 723	B29	***Ca. colombiensis***	CMW 23676^{T}	Soil (*E. grandis* trees)	La Selva, Colombia	M.J. Wingfield	MT334998; MT335228; MT335468; MT359689; MT359449; MT412532; MT412759; MT412980	Crous *et al.* (2004), this study
		CMW 30985	CBS 112221; CPC 724	B29	***Ca. colombiensis***	CMW 30985	Soil (*E. grandis* trees)	La Selva, Colombia	M.J. Wingfield	MT334999; MT335229; MT335469; MT359690; MT359450; MT412533; MT412760; MT412981	Crous *et al.* (2004), this study
A35	*Ca. crousiana*	CMW 27249^{T}	CBS 127198	B30	***Ca. crousiana***	CMW 27249^{T}	*E. grandis*	FuJian, China	M.J. Wingfield	MT335000; MT335230; MT335470; MT359691; MT359451; MT412534; MT412761; MT412982	Chen *et al.* (2011), this study

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		CMW 27253	CBS 127199	B30	***Ca. crousiana***	CMW 27253	*E. grandis*	FuJian, China	M.J. Wingfield	MT335001; MT335231; MT335471; MT359692; MT359452; MT412535; MT412762; MT412983	Chen *et al.* (2011), this study
A36	*Ca. curvispora*	CMW 23693^{T}	CBS 116159; CPC 765	B31	***Ca. curvispora***	CMW 23693^{T}	Soil	Tamatave, Madagascar	P.W. Crous	MT335002; MT335232; MT335472; MT359693; MT359453; MT412536; MT412763; N/A	Victor *et al.* (1997), Crous (2002), Lombard *et al.*(2010a, 2015a), this study
A37	*Ca. cylindrospora*	CBS 119670	CMW 51310; CPC 12766	B32	***Ca. cylindrospora***	CBS 119670	*Pistacia lentiscus*	Italy	N/A	MT335006; MT335236; MT335476; MT359697; MT359457; MT412540; MT412767; MT412985	Lombard *et al.* 2015a,b, 2016), this study
		CMW 30978	CBS 110666; P90.1479; STE-U 497	B32	***Ca. cylindrospora***	CMW 30978	*Ilex vomitoria*	Florida, USA	N.E. El-Gholl	MT335007; MT335237; MT335477; MT359698; MT359458; MT412541; MT412768; MT412986	Crou (2002), Lombard *et al.* (2010a, 2015b), this study
A38	*Ca. densa*	CMW 31182^{T}	CBS 125261	B33	***Ca. densa***	CMW 31182^{T}	Soil	Las Golondrinas, Pichincha, Ecuador	M.J. Wingfield	MT335008; MT335238; MT335478; MT359699; MT359459; N/A; MT412769; MT412987	Lombard *et al.* (2010a), this study
		CMW 31184	CBS 125249	B33	***Ca. densa***	CMW 31184	Soil	Las Golondrinas, Pichincha, Ecuador	M.J. Wingfield	MT335009; MT335239; MT335479; MT359700; MT359460; N/A; MT412770; MT412988	Lombard *et al.* (2010a), this study
A40	*Ca. ecuadorae*	CMW 23677^{T}	CBS 111406; CPC 1635	B35	***Ca. ecuadorae***	CMW 23677^{T}	Soil	Ecuador	M.J. Wingfield	MT335012; MT335242; MT335482; MT359703; MT359463; MT412544; MT412773; MT412991	Crous *et al.* (2006), Lombard *et al.* (2010a), this study
		CMW 30980	CBS 111394; CPC 1628	B84	***Ca. pauciphialidica sp. nov.***	CMW 30980^{T}	Soil	Ecuador	M.J. Wingfield	MT335083; MT335315; MT335555; MT359776; MT359536; MT412608; MT412846; MT413058	Crous *et al.* (2006), Lombard *et al.* (2010a), this study
A41	*Ca. ecuadorensis**	CBS 111706^{T}	CMW 51821; CPC 1636	B35	*Ca. ecuadorae*$^{\#}$	CBS 111706	Soil	Ecuador	M.J. Wingfield	MT335010; MT335240; MT335480; MT359701; MT359461; MT412542; MT412771; MT412989	Marin-Felix *et al.* (2017), this study
		CBS 114164	CMW 51822; CPC 1634	B35	*Ca. ecuadorae*$^{\#}$	–	Soil	Ecuador	M.J. Wingfield	MT335011; MT335241; MT335481; MT359702; MT359462; MT412543; MT412772; MT412990	Marin-Felix *et al.* (2017), this study
A42	*Ca. ericae**	CBS 114458^{T}	CMW 51211; CPC 2019	B85	*Ca. pauciramosa*$^{\#}$	CBS 114458	*Erica capensis*	California, USA	S.T. Koike	MT335087; MT335319; MT335559; MT359780; MT359540; MT412612; MT412850; MT413062	Lombard *et al.* (2016), this study
		CBS 114456	CMW 51209; CPC 1984	B85	*Ca. pauciramosa*$^{\#}$	–	*Er. capensis*	California, USA	S.T. Koike	MT335088; MT335320; MT335560; MT359781; MT359541; MT412613; MT412851; MT413063	Lombard *et al.* (2016), this study

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		CBS 114457	CMW 51210; CPC 1985	B85	*Ca. pauciramosa*[#]	–	*Er. capensis*	California, USA	S.T. Koike	MT335089; MT335321; MT335561; MT359782; MT359542; MT412614; MT412852; MT413064	Lombard *et al.* (2016), this study
A43	*Ca. eucalypti*	CMW 18444[T]	CBS 125275	B36	***Ca. eucalypti***	CMW 18444[T]	*E. grandis*	Aek Nauli, Sumatra Utara, Indonesia	M.J. Wingfield	MT335013; MT335243; MT335483; MT359704; MT359464; MT412545; MT412774; MT412992	Lombard *et al.* (2010a), this study
		CMW 18445	CBS 125276	B36	***Ca. eucalypti***	CMW 18445	*E. grandis*	Aek Nauli, Sumatra Utara, Indonesia	M.J. Wingfield	MT335014; MT335244; MT335484; MT359705; MT359465; MT412546; MT412775; MT412993	Lombard *et al.* (2010a), this study
A45	*Ca. expansa**	CMW 31392[T]	CBS 136247; CERC 1727	B4	*Ca. aconidialis*[#]	CMW 31392	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT334942; MT335169; MT335408; MT359629; MT359389; MT412481; MT412699; N/A	Lombard *et al.* (2015a), this study
		CMW 31441	CBS 136078; CERC 1776	B4	*Ca. aconidialis*[#]	–	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT334943; MT335170; MT335409; MT359630; MT359390; MT412482; MT412700; N/A	Lombard *et al.* (2015a), this study
A46	*Ca. floridana**	CBS 114692[T]	ATCC18882; CMW 51826	B55	*Ca. kyotensis*[#]	CBS 114692	*Prunus persica*	Georgia, USA	N/A	MT335015; MT335245; MT335485; MT359706; MT359466; MT412547; MT412776; MT412994	Sobers (1969), Crous (2002), Marin-Felix *et al.* (2017), this study
A47	*Ca. foliicola**	CMW 31393[T]	CBS 136641	B44	*Ca. hawksworthii*[#]	CMW 31393	*E. urophylla* × *E. grandis*	GuangXi, China	X. Zhou & G. Zhao	MT335017; MT335247; MT335487; MT359708; MT359468; MT412549; MT412778; MT412996	Lombard *et al.* (2015a), this study
		CMW 31395	–	B44	*Ca. hawksworthii*[#]	–	*E. urophylla* × *E. grandis*	GuangXi, China	X. Zhou & G. Zhao	MT335018; MT335248; MT335488; MT359709; MT359469; MT412550; MT412779; MT412997	Lombard *et al.* (2015a), this study
A49	*Ca. fujianensis*	CMW 27257[T]	CBS 127201	B39	***Ca. fujianensis***	CMW 27257[T]	*E. grandis*	FuJian, China	M.J. Wingfield	MT335019; MT335249; MT335489; MT359710; MT359470; MT412551; MT412780; MT412998	Chen *et al.* (2011), this study
		CMW 27254	CBS 127200	B39	***Ca. fujianensis***	CMW 27254	*E. grandis*	FuJian, China	M.J. Wingfield	MT335020; MT335250; MT335490; MT359711; MT359471; MT412552; MT412781; MT412999	Chen *et al.* (2011), this study
A51	*Ca. gordoniae*	CMW 23694[T]	ATCC 201837; CBS 112142; P97-2567; STE-U 3136	B41	***Ca. gordoniae***	CMW 23694[T]	*Gordonia lasianthus*	Florida, USA	D. Chiappini	MT335021; MT335251; MT335491; MT359712; MT359472; MT412553; MT412782; MT413000	Leahy *et al.* (2000), Crous (2002), Lombard *et al.* (2010a), this study
A52	*Ca. gracilipes*	CBS 115674[T]	CMW 51227; STE-U 1153	B42	***Ca. gracilipes***	CBS 115674[T]	Soil	La Selva, Colombia	M.J. Wingfield	MT335022; MT335252; MT335492; MT359713; MT359473; MT412554; MT412783; MT413001	Crous *et al.* (1997a, 2006), Crous (2002), this study

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		CBS 111141	CMW 51174; CPC 1211	B42	***Ca. gracilipes***	CBS 111141	Soil	La Selva, Colombia	M.J. Wingfield	MT335023; MT335253; MT335493; MT359714; MT359474; MT412555; MT412784; MT413002	Crous (2002), Crous *et al.* (2006), this study
A54	*Ca. guangxiensis**	CMW 35409^{T}	CBS 136092; CERC 1900	B4	*Ca. aconidialis*$^{\#}$	CMW 35409	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Mou & R. Chang	MT334944; MT335171; MT335410; MT359631; MT359391; N/A; MT412701; N/A	Lombard *et al.* (2015a), this study
		CMW 35411	CBS 136094; CERC 1902	B4	*Ca. aconidialis*$^{\#}$	–	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Mou & R. Chang	MT334945; MT335172; MT335411; MT359632; MT359392; N/A; MT412702; N/A	Lombard *et al.* (2015a), this study
A55	*Ca. hainanensis**	CMW 35187^{T}	CBS 136248; CERC 1863	B4	*Ca. aconidialis*$^{\#}$	CMW 35187	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou & S.F. Chen	MT334946; MT335173; MT335412; MT359633; MT359393; N/A; MT412703; N/A	Lombard *et al.* (2015a), this study
A56	*Ca. hawksworthii*	CBS 111870^{T}	CMW 51194; CPC 2405	B44	***Ca. hawksworthii***	CBS 111870^{T}	*Nelumbo nucifera*	Pamplemousses garden, Mauritius	A. Peerally	MT335024; MT335254; MT335494; MT359715; MT359475; MT412556; MT412785; MT413003	Crous (2002), this study
A58	*Ca. heveicola*	CMW 49913^{T}	CBS 143570	B46	***Ca. heveicola***	CMW 49913^{T}	Soil (*Hevea brasiliensis* plantation)	Bau Bang, Binh Duong, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	MT335025; MT335255; MT335495; MT359716; MT359476; N/A; MT412786; MT413004	Pham *et al.* (2019), this study
		CMW 49928	CBS 143571	B46	***Ca. heveicola***	CMW 49928	Soil	Bu Gia Map National Park, Binh Phuoc, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	MT335048; MT335280; MT335520; MT359741; MT359501; MT412577; MT412811; MT413025	Pham *et al.* (2019), this study
		CMW 49935	CBS 143572	B46	***Ca. heveicola***	CMW 49935	Soil	Bu Gia Map National Park, Binh Phuoc, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	MT335049; MT335281; MT335521; MT359742; MT359502; MT412578; MT412812; MT413026	Pham *et al.* (2019), this study
A60	*Ca. honghensis*	CERC 5572^{T}	CBS 142885; CMW 47669	B47	***Ca. honghensis***	CERC 5572^{T}	Soil (*Eucalyptus* plantation)	HongHe, YunNan, China	S.F. Chen & J.Q. Li	MT335026; MT335256; MT335496; MT359717; MT359477; MT412557; MT412787; MT413005	Li *et al.* (2017), this study
		CERC 5571	CBS 142884; CMW 47668	B47	***Ca. honghensis***	CERC 5571	Soil (*Eucalyptus* plantation)	HongHe, YunNan, China	S.F. Chen & J.Q. Li	MT335027; MT335257; MT335497; MT359718; MT359478; MT412558; MT412788; MT413006	Li *et al.* (2017), this study
A61	*Ca. hongkongensis*	CBS 114828^{T}	CMW 51217; CPC 4670	B48	***Ca. hongkongensis***	CBS 114828^{T}	Soil	Hong Kong, China	M.J. Wingfield	MT335028; MT335258; MT335498; MT359719; MT359479; MT412559; MT412789; MT413007	Crous *et al.* (2004), this study

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		CMW 31383	–	B48	***Ca. hongkongensis***	–	Soil (*Eucalyptus* plantation)	GuangXi, China	N/A	MT335029; MT335259; MT335499; MT359720; MT359480; MT412560; MT412790; MT413008	Lombard *et al.* (2015a), this study
		CERC 3570	CMW 47271	B48	***Ca. hongkongensis***	–	Soil (*Eucalyptus* plantation)	BeiHai, GuangXi, China	S.F. Chen, J.Q. Li & G.Q. Li	MT335030; MT335260; MT335500; MT359721; MT359481; MT412561; MT412791; MT413009	Li *et al.* (2017), this study
		CERC 7132	CMW 47499	B48	***Ca. hongkongensis***	CERC 7132	Soil	FuJian, China	S.F. Chen	MT335031; MT335261; MT335501; MT359722; MT359482; MT412562; MT412792; MT413010	Li *et al.* (2017), this study
A62	*Ca. humicola*	CMW 31183^{T}	CBS 125251	B49	***Ca. humicola***	CMW 31183^{T}	Soil	Las Golondrinas, Pichincha, Ecuador	M.J. Wingfield	MT335032; MT335262; MT335502; MT359723; MT359483; N/A; MT412793; MT413011	Lombard *et al.* (2010a), this study
		CMW 31186	CBS 125252	B49	***Ca. humicola***	CMW 31186	Soil	Las Golondrinas, Pichincha, Ecuador	L. Lombard	MT335033; MT335263; MT335503; MT359724; MT359484; N/A; MT412794; MT413012	Lombard *et al.* (2010a), this study
		CMW 31187	CBS 125269	B49	***Ca. humicola***	CMW 31187	Soil	Las Golondrinas, Pichincha, Ecuador	L. Lombard	MT335034; MT335264; MT335504; MT359725; MT359485; N/A; MT412795; MT413013	Lombard *et al.* (2010a), this study
A63	*Ca. hurae*	CBS 114182	CMW 51823; CPC 1714; UFV 216	B50	***Ca. hurae***	CBS 114182	*Rumohra adiantiformis*	Brazil	A.C. Alfenas	MT335035; MT335265; MT335505; MT359726; MT359486; MT412563; MT412796; MT413014	Crous (2002), Crous *et al.* (2006), this study
A64	*Ca. ilicicola*	CMW 30998^{T}	CBS 190.50; IMI 299389; STE-U 2482	B51	***Ca. ilicicola***	CMW 30998^{T}	*Solanum tuberosum*	Bogor, Java, Indonesia	K.B. Boedijn & J. Reitsma	MT335036; MT335266; MT335506; MT359727; MT359487; MT412564; MT412797; N/A	Boedijn & Reitsma (1950), Crous (2002), Lombard *et al.* (2010a), this study
A65	*Ca. indonesiae*	CMW 23683^{T}	CBS 112823; CPC 4508	B52	***Ca. indonesiae***	CMW 23683^{T}	*Syzygium aromaticum*	Warambunga, Indonesia	M.J. Wingfield	MT335037; MT335267; MT335507; MT359728; MT359488; MT412565; MT412798; MT413015	Crous *et al.* (2004), this study
		CBS 112840	CMW 51205; CPC 4554	B52	***Ca. indonesiae***	CBS 112840	*S. aromaticum*	Warambunga, Indonesia	M.J. Wingfield	MT335038; MT335268; MT335508; MT359729; MT359489; MT412566; MT412799; MT413016	Crous *et al.* (2004), this study
A66	*Ca. indonesiana**	CBS 112936^{T}	CMW 51207; CPC 4504	B112	*Ca. sumatrensis*[#]	CBS 112936	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335143; MT335380; MT335620; MT359841; MT359601; MT412672; MT412911; N/A	Lombard *et al.* (2016), this study
		CBS 112826	CMW 51202; CPC 4519	B112	*Ca. sumatrensis*[#]	–	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335144; MT335381; MT335621; MT359842; MT359602; MT412673; MT412912; MT413121	Lombard *et al.* (2016), this study

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A68	*Ca. insularis*	CMW 30991^{T}	CBS 114558; CPC 768	B54	***Ca. insularis***	CMW 30991^{T}	Soil	Tamatave, Madagascar	P.W. Crous	N/A; MT335269; MT335509; MT359730; MT359490; MT412567; MT412800; MT413017	Schoch *et al.* (1999), Lombard *et al.* (2010a, 2016), this study
		CMW 30992	CBS 114559; CPC 954	B54	***Ca. insularis***	CMW 30992	Soil	Conejos, Veracruz, Mexico	M.J. Wingfield	N/A; MT335270; MT335510; MT359731; MT359491; MT412568; MT412801; MT413018	Lombard *et al.* (2010a, 2016), this study
A69	*Ca. kyotensis*	CBS 114525^{T}	ATCC 18834; CMW 51824; CPC 2367	B55	***Ca. kyotensis***	CBS 114525^{T}	*Robinia pseudoacacia*	Japan	T. Terashita	MT335039; MT335271; MT335511; MT359732; MT359492; MT412569; MT412802; MT413019	Terashita (1968), Crous (2002), Lombard *et al.* (2016), this study
		CBS 114550	CMW 51825; CPC 2351	B55	***Ca. kyotensis***	CBS 114550	Soil	China	M.J. Wingfield	MT335016; MT335246; MT335486; MT359707; MT359467; MT412548; MT412777; MT412995	Lombard *et al.* (2016), this study
A71	*Ca. lantauensis*	CERC 3302^{T}	CBS 142888; CMW 47252	B57	***Ca. lantauensis***	CERC 3302^{T}	Soil	LiDao, Hong Kong, China	M.J. Wingfield & S.F. Chen	MT335040; MT335272; MT335512; MT359733; MT359493; MT412570; MT412803; N/A	Li *et al.* (2017), this study
		CERC 3301	CBS 142887; CMW 47251	B57	***Ca. lantauensis***	CERC 3301	Soil	LiDao, Hong Kong, China	M.J. Wingfield & S.F. Chen	MT335041; MT335273; MT335513; MT359734; MT359494; N/A; MT412804; N/A	Li *et al.* (2017), this study
A72	*Ca. lateralis*	CMW 31412^{T}	CBS 136629	B58	***Ca. lateralis***	CMW 31412^{T}	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT335042; MT335274; MT335514; MT359735; MT359495; MT412571; MT412805; MT413020	Lombard *et al.* (2015a), this study
A73	*Ca. lauri*	CMW 23682^{T}	CBS 749.70	B59	***Ca. lauri sp. nov.***	CMW 23682^{T}	*Ilex aquifolium*	Vijlen, Vijlenerbos, South-East Limburg, Netherlands	H.A. van der Aa	MT335043; MT335275; MT335515; MT359736; MT359496; MT412572; MT412806; MT413021	Lechat *et al.* (2010), Lombard *et al.* (2010a), this study
A74	*Ca. leguminum*	CMW 23684^{T}	CBS 728.68	B60	***Ca. leguminum***	CMW 23684^{T}	*Annona squamosa*	Sao Paulo, Brazil	M.B. Figueiredo	MT335044; MT335276; MT335516; MT359737; MT359497; MT412573; MT412807; MT413022	Figueiredo & Namekata (1967), Crous (2002), Lombard *et al.* (2010a), this study
A75	*Ca. leucothoes*	CMW 30977^{T}	ATCC 64824; CBS 109166; CPC 2385; P88-490	B61	***Ca. leucothoes***	CMW 30977^{T}	*Leucothoe axillaris*	Florida, USA	N.E. El-Gholl	MT335045; MT335277; MT335517; MT359738; MT359498; MT412574; MT412808; N/A	El-Gholl *et al.* (1989), Crous (2002), Lombard *et al.* (2015a), this study
A76	*Ca. lichi*	CERC 8866^{T}	–	B62	***Ca. lichi***	CERC 8866^{T}	Soil	HeNan, China	S.F. Chen	MT335046; MT335278; MT335518; MT359739; MT359499; MT412575; MT412809; MT413023	Liu & Chen (2017), this study

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		CERC 8850	–	B62	***Ca. lichi***	CERC 8850	Soil	HeNan, China	S.F. Chen	MT335047; MT335279; MT335519; MT359740; MT359500; MT412576; MT412810; MT413024	Liu & Chen (2017), this study
A77	*Ca. longiramosa**	CBS 116319^{T}	CMW 51832; CPC 3761	B6	*Ca. amazonica*$^{\#}$	CBS 116319	*Eucalyptus* sp.	Amazon, Brazil	P.W. Crous & A.C. Alfenas	MT334960; MT335187; MT335426; MT359647; MT359407; MT412490; MT412717; MT412940	Marin-Felix *et al.* (2017), this study
		CBS 116305	CMW 51831; CPC 3765	B6	*Ca. amazonica*$^{\#}$	–	*Eucalyptus* sp.	Amazon, Brazil	P.W. Crous & A.C. Alfenas	MT334961; MT335188; MT335427; MT359648; MT359408; MT412491; MT412718; MT412941	Marin-Felix *et al.* (2017), this study
A78	*Ca. machaerinae**	CBS 123183^{T}	CMW 51311; CPC 15378	B85	*Ca. pauciramosa*$^{\#}$	CBS 123183	*Machaerina sinclairii*	Auckland University Campus, Auckland, New Zealand	C.F. Hill	MT335090; MT335322; MT335562; MT359783; MT359543; MT412615; MT412853; MT413065	Lombard *et al.* (2016), this study
A79	*Ca. macroconidialis*	CBS 114880^{T}	CMW 51219; CPC 307; PPRI 4000	B64	***Ca. macroconidialis***	CBS 114880^{T}	*E. grandis*	Sabie, Mpumalanga, South Africa	P.W. Crous	MT335050; MT335282; MT335522; MT359743; MT359503; MT412579; MT412813; MT413027	Crous *et al.* (1993c), Crous (2002), Lombard *et al.* (2010a), this study
A80	*Ca. madagascariensis*	CMW 23686^{T}	CBS 114572; CPC 2252	B65	***Ca. madagascariensis***	CMW 23686^{T}	Soil	Rona, Madagascar	J.E. Taylor	MT335052; MT335284; MT335524; MT359745; MT359505; MT412581; MT412815; MT413029	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010a), this study
		CMW 30993	CBS 114571; CPC 2253	B65	***Ca. madagascariensis***	CMW 30993	Soil	Rona, Madagascar	J.E. Taylor	MT335053; MT335285; MT335525; MT359746; MT359506; MT412582; MT412816; MT413030	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010a), this study
A81	*Ca. magnispora**	CMW 35184^{T}	CBS 136249; CERC 1860	B4	*Ca. aconidialis*$^{\#}$	CMW 35184	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Mou & R. Chang	MT334947; MT335174; MT335413; MT359634; MT359394; N/A; MT412704; N/A	Lombard *et al.* (2015a), this study
A82	*Ca. malesiana*	CMW 23687^{T}	CBS 112752; CPC 4223	B66	***Ca. malesiana***	CMW 23687^{T}	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335054; MT335286; MT335526; MT359747; MT359507; MT412583; MT412817; MT413031	Crous *et al.* (2004), this study
		CBS 112710	CMW 51199; CPC 3899	B66	***Ca. malesiana***	CBS 112710	Leaf litter	Prathet, Thailand	N.L. Hywel-Jones	MT335055; MT335287; MT335527; MT359748; MT359508; MT412584; MT412818; MT413032	Crous *et al.* (2004), this study
A84	*Ca. metrosideri*	CBS 133604	CMW 51320; LPF103	B68	***Ca. metrosideri***	CBS 133604	*Metrosideros polymorpha*	Viçosa, Minas Gerais state, Brazil	R.F. Alfenas	MT335056; MT335288; MT335528; MT359749; MT359509; MT412585; MT412819; MT413033	Alfenas *et al.* (2013a, 2015), this study

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A86	*Ca. microconidialis**	CMW 31487[T]	CBS 136638; CERC 1822	B97	*Ca. pseudoreteaudii*[#]	CMW 31487	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	MT335113; MT335348; MT335588; MT359809; MT359569; MT412641; MT412879; MT413090	Lombard *et al.* (2015a), this study
		CMW 31473	CBS 136634; CERC 1808	B97	*Ca. pseudoreteaudii*[#]	–	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	MT335114; MT335349; MT335589; MT359810; MT359570; MT412642; MT412880; MT413091	Lombard *et al.* (2015a), this study
		CMW 31475	CBS 136636; CERC 1810	B97	*Ca. pseudoreteaudii*[#]	–	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	MT335115; MT335350; MT335590; MT359811; MT359571; MT412643; MT412881; MT413092	Lombard *et al*. (2015a), this study
		CMW 31492	CBS 136640; CERC 1827	B97	*Ca. pseudoreteaudii*[#]	–	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	MT335116; MT335351; MT335591; MT359812; MT359572; MT412644; MT412882; MT413093	Lombard *et al*. (2015a), this study
A87	*Ca. montana**	CERC 8952[T]	–	B20	*Ca. canadiana*[#]	CERC 8952	Soil	HeNan, China	S.F. Chen	MT335058; MT335290; MT335530; MT359751; MT359511; MT412587; MT412821; MT413035	Liu & Chen (2017), this study
		CERC 8957	–	B20	*Ca. canadiana*[#]	–	Soil	HeNan, China	S.F. Chen	MT335059; MT335291; MT335531; MT359752; MT359512; MT412588; MT412822; MT413036	Liu & Chen (2017), this study
A89	*Ca. mossambicensis**	CBS 137243[T]	CMW 36327	B85	*Ca. pauciramosa*[#]	CBS 137243	*E. grandis* × *E. camaldulensis*	Bandula, Manica, Mozambique	J. Roux & S. Maússe-Sitoe	MT335091; MT335323; MT335563; MT359784; MT359544; MT412616; MT412854; MT413066	Crous *et al.* (2013), Lombard *et al.* (2016), this study
		CMW 36329	–	B85	*Ca. pauciramosa*[#]	–	*E. grandis* × *E. urophylla*	Bandula, Manica, Mozambique	J. Roux & S. Maússe-Sitoe	MT335092; MT335324; MT335564; MT359785; MT359545; MT412617; MT412855; MT413067	Crous *et al.* (2013), this study
A90	*Ca. multilateralis*	CBS 110932[T]	CMW 51171; CPC 957	B71	***Ca. multilateralis***	CBS 110932[T]	Soil	Uxmal, Mexico	P.W. Crous	MT335060; MT335292; MT335532; MT359753; MT359513; MT412589; MT412823; MT413037	Lombard *et al.* (2016), this study
		CBS 110926	CMW 51168; CPC 947	B71	***Ca. multilateralis***	CBS 110926	Soil	Uxmal, Mexico	P.W. Crous	MT335061; MT335293; MT335533; MT359754; MT359514; MT412590; MT412824; MT413038	Lombard *et al.* (2016), this study
		CBS 110927	CMW 51169; CPC 948	B71	***Ca. multilateralis***	CBS 110927	Soil	Uxmal, Mexico	P.W. Crous	MT335062; MT335294; MT335534; MT359755; MT359515; MT412591; MT412825; MT413039	Lombard *et al.* (2016), this study
		CBS 110931	CPC 956	B71	***Ca. multilateralis***	–	Soil	Uxmal, Mexico	P.W. Crous	MT335063; MT335295; MT335535; MT359756; MT359516; MT412592; MT412826; MT413040	Lombard *et al.* (2016), this study

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		CBS 115606	CMW 51828	B71	***Ca. multilateralis***	–	N/A	N/A	N/A	MT335064; MT335296; MT335536; MT359757; MT359517; MT412593; MT412827; MT413041	Lombard *et al.* (2016), this study
		CBS 115615	CMW 51224; CPC 915	B71	***Ca. multilateralis***	–	Soil	Uxmal, Mexico	P.W. Crous	MT335065; MT335297; MT335537; MT359758; MT359518; MT412594; MT412828; MT413042	Lombard *et al.* (2016), this study
A92	*Ca. multiphialidica*	CMW 23688^{T}	Cam 13; CBS 112678	B73	***Ca. multiphialidica***	CMW 23688^{T}	Soil (roots of *Musa* sp.)	Cameroon	Abadie	MT335066; MT335298; MT335538; MT359759; MT359519; MT412595; MT412829; MT413043	Crous *et al.* (2004), Lombard *et al.* (2010a), this study
A93	*Ca. multiseptata*	CMW 23692^{T}	CBS 112682; CPC 1589	B74	***Ca. multiseptata***	CMW 23692^{T}	*E. grandis*	North Sumatra, Indonesia	M.J. Wingfield	MT335067; MT335299; MT335539; MT359760; MT359520; MT412596; MT412830; MT413044	Crous *et al.* (1998, 2006), Crous (2002), this study
A94	*Ca. multistipitata**	CMW 47192^{T}	CBS 143573	B23	*Ca. chinensis*$^{\#}$	CMW 47192	Soil (*Acacia* hybrid plantation)	Tuyen Quang, Vietnam	N.Q. Pham & T.Q. Pham	MT335068; MT335300; MT335540; MT359761; MT359521; MT412597; MT412831; MT413045	Pham *et al.* (2019), this study
		CMW 47211	CBS 143574	B23	*Ca. chinensis*$^{\#}$	–	Soil (*Acacia* hybrid plantation)	Tuyen Quang, Vietnam	N.Q. Pham & T.Q. Pham	MT335069; MT335301; MT335541; MT359762; MT359522; MT412598; MT412832; MT413046	Pham *et al.* (2019), this study
A96	*Ca. nemoralis**	CBS 116249^{T}	CMW 51829; CPC 3533	B79	*Ca. ovata*$^{\#}$	CBS 116249	Soil (*Eucalyptus* plantation)	Brazil	P.W. Crous	MT335074; MT335306; MT335546; MT359767; MT359527; MT412603; MT412837; MT413051	Marin-Felix *et al.* (2017), this study
A98	*Ca. nymphaeae**	CBS 131802^{T}	CMW 51317; HGUP 100003	B39	*Ca. fujianensis*$^{\#}$	CBS 131802	*Nymphaea tetragona*	Guiyang, Guizhou, China	S.Y. Qin	MT335070; MT335302; MT335542; MT359763; MT359523; MT412599; MT412833; MT413047	Xu *et al.* (2012), this study
A99	*Ca. octoramosa*	CBS 111423^{T}	CMW 51819; CPC 1650	B77	***Ca. octoramosa***	CBS 111423^{T}	Soil	Ecuador	M.J. Wingfield	MT335071; MT335303; MT335543; MT359764; MT359524; MT412600; MT412834; MT413048	Marin-Felix *et al.* (2017), this study
A100	*Ca. orientalis*	CMW 20291^{T}	CBS 125260	B78	***Ca. orientalis***	CMW 20291^{T}	Soil	Langam, Indonesia	M.J. Wingfield	MT335072; MT335304; MT335544; MT359765; MT359525; MT412601; MT412835; MT413049	Lombard *et al.* (2010a), this study
		CMW 20273	CBS 125259	B78	***Ca. orientalis***	CMW 20273	Soil	Teso East, Indonesia	M.J. Wingfield	MT335073; MT335305; MT335545; MT359766; MT359526; MT412602; MT412836; MT413050	Lombard *et al.* (2010a), this study
A101	*Ca. ovata*	CMW 16724^{T}	CBS 111299; ATCC 76225; UFV 89	B79	***Ca. ovata***	CMW 16724^{T}	*E. urophylla*	Monte Dourado, Pará, Brazil	N.E. El-Gholl	MT335075; MT335307; MT335547; MT359768; MT359528; N/A; MT412838; MT413052	El-Gholl *et al.* (1993a), Crous (2002), Marin-Felix *et al.* (2017), this study

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		CMW 30979	CBS 111307; UFV 90	B79	***Ca. ovata***	CMW 30979	*E. tereticornis*	Tucuruí, Pará, Brazil	P.W. Crous	MT335076; MT335308; MT335548; MT359769; MT359529; N/A; MT412839; MT413053	Crous (2002), Lombard *et al.* (2010a), this study
A102	*Ca. pacifica*	CMW 16726^{T}	A1568; CBS 109063; IMI 354528; STE-U 2534	B80	***Ca. pacifica***	CMW 16726^{T}	*Araucaria heterophylla*	Hawaii, USA	M. Aragaki	MT335079; MT335311; MT335551; MT359772; MT359532; MT412604; MT412842; N/A	Kang *et al.* (2001b), Crous (2002), Crous *et al.* (2004), this study
		CMW 30988	CBS 114038	B80	***Ca. pacifica***	CMW 30988	*Ipomoea aquatica*	Auckland, New Zealand	C.F. Hill	MT335080; MT335312; MT335552; MT359773; MT359533; MT412605; MT412843; N/A	Crous (2002), Crous *et al.* (2004), Lombard *et al.* (2010a), this study
A103	*Ca. papillata**	CMW 37976^{T}	CBS 136097; CERC 1939; CPC 23517	B22	*Ca. cerciana*$^{\#}$	CMW 37976	Soil (*Eucalyptus* plantation)	GuangDong, China	X. Mou & R. Chang	MT334983; MT335213; MT335453; MT359674; MT359434; MT412517; MT412744; MT412965	Lombard *et al.* (2015a), this study
		CMW 37972	CBS 136096; CERC 1935; CPC 23497	B22	*Ca. cerciana*$^{\#}$	–	Soil (*Eucalyptus* plantation)	GuangDong, China	X. Mou & R. Chang	MT334984; MT335214; MT335454; MT359675; MT359435; MT412518; MT412745; MT412966	Lombard *et al.* (2015a), this study
		CMW 37971	CBS 136251; CERC 1934; CPC 23514	B22	*Ca. cerciana*$^{\#}$	–	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Mou & R. Chang	MT334985; MT335215; MT335455; MT359676; MT359436; MT412519; MT412746; MT412967	Lombard *et al.* (2015a), this study
A106	*Ca. parakyotensis**	CMW 35169^{T}	CBS 136085; CERC 1845	B4	*Ca. aconidialis*$^{\#}$	CMW 35169	Soil (*Eucalyptus* plantation)	GuangDong, China	X. Mou & R. Chang	MT334948; MT335175; MT335414; MT359635; MT359395; MT412483; MT412705; N/A	Lombard *et al.* (2015a), this study
		CMW 35413	CBS 136095; CERC 1904	B4	*Ca. aconidialis*$^{\#}$	–	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Mou & R. Chang	MT334949; MT335176; MT335415; MT359636; MT359396; MT412484; MT412706; N/A	Lombard *et al.* (2015a), this study
A107	*Ca. parva**	CBS 110798^{T}	CMW 51817; CPC 410	B64	*Ca. macroconidialis*$^{\#}$	CBS 110798	*E. grandis* (roots)	Sabie, Mpumalanga, South Africa	P.W. Crous	MT335051; MT335283; MT335523; MT359744; MT359504; MT412580; MT412814; MT413028	Lombard *et al.* (2016), this study
A108	*Ca. parvispora*	CBS 111465^{T}	CPC 1902	B83	***Ca. parvispora***	CBS 111465^{T}	Soil	Brazil	A.C. Alfenas	MT335082; MT335314; MT335554; MT359775; MT359535; MT412607; MT412845; MT413057	Marin-Felix *et al.* (2017), this study
A109	*Ca. pauciramosa*	CBS 138824^{T}	CMW 5683; CPC 971	B85	***Ca. pauciramosa***	CBS 138824^{T}	Soil	Knysna, South Africa	P.W. Crous	MT335093; MT335325; MT335565; MT359786; MT359546; MT412618; MT412856; MT413068	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a), this study

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		CMW 2151	–	B85	***Ca. pauciramosa***	–	*E. nitens*	South Africa	M.J. Wingfield	MT335094; MT335326; MT335566; MT359787; MT359547; MT412619; MT412857; MT413069	Lombard *et al.* (2010b), this study
		CMW 7592	–	B85	***Ca. pauciramosa***	–	*E. grandis*	Uruguay	M.J. Wingfield	MT335095; MT335327; MT335567; MT359788; MT359548; MT412620; MT412858; MT413070	Lombard *et al.* (2010b), this study
		CMW 9151	–	B85	***Ca. pauciramosa***	CMW 9151	*A. mearnsii*	South Africa	L. Lombard	MT335096; MT335328; MT335568; MT359789; MT359549; MT412621; MT412859; MT413071	Lombard *et al.* (2010b), this study
		CMW 30823	CPC 416	B85	***Ca. pauciramosa***	–	*E. grandis*	South Africa	P.W. Crous	MT335097; MT335329; MT335569; MT359790; MT359550; MT412622; MT412860; MT413072	Crous (2002), Lombard *et al.* (2010a), this study
		CMW 30875	CPC 415	B85	***Ca. pauciramosa***	–	*Eucalyptus* sp.	South Africa	P.W. Crous	MT335098; MT335330; MT335570; MT359791; MT359551; MT412623; MT412861; MT413073	Crous (2002), Lombard *et al.* (2010a), this study
A110	*Ca. penicilloides*	CMW 23696^{T}	CBS 174.55; STE-U 2388	B86	***Ca. penicilloides***	CMW 23696^{T}	*Prunus* sp.	Hatizyo Island, Japan	M. Ookubu	MT335106; MT335338; MT335578; MT359799; MT359559; MT412631; MT412869; MT413081	Tubaki (1958), Crous (2002), this study
A111	*Ca. pentaseptata**	CBS 133349^{T}	CMW 51318	B97	*Ca. pseudoreteaudii*[#]	CBS 133349	*Eucalyptus* hybrid	Hanoi, Bavi, Vietnam	P.Q. Thu	MT335117; MT335352; MT335592; MT359813; MT359573; MT412645; MT412883; MT413094	Crous *et al.* (2012), this study
		CBS 133351	CMW 51319	B97	*Ca. pseudoreteaudii*[#]	–	*Macadamia* sp.	Hanoi, Bavi, Vietnam	P.Q. Thu	MT335118; MT335353; MT335593; MT359814; MT359574; MT412646; MT412884; MT413095	Crous *et al.* (2012), this study
A113	*Ca. pini*	CMW 31209^{T}	CBS 123698	B88	***Ca. pini***	CMW 31209^{T}	*Pinus patula*	Buga, Valle del Cauca, Colombia	C.A. Rodas	MT335107; MT335339; MT335579; MT359800; MT359560; MT412632; MT412870; MT413082	Lombard *et al.* (2010a), this study
A114	*Ca. plurilateralis*	CBS 111401^{T}	CMW 51178; CPC 1637	B89	***Ca. plurilateralis***	CBS 111401^{T}	Soil	Ecuador	M.J. Wingfield	N/A; MT335340; MT335580; MT359801; MT359561; MT412633; MT412871; MT413083	Lombard *et al.* (2016), this study
A115	*Ca. pluriramosa**	CMW 31440^{T}	CBS 136976; CERC 1775	B4	*Ca. aconidialis*[#]	CMW 31440	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT334950; MT335177; MT335416; MT359637; MT359397; N/A; MT412707; N/A	Lombard *et al.* (2015a), this study
A116	*Ca. polizzii**	CBS 123402^{T}	CMW 30872	B85	*Ca. pauciramosa*[#]	CBS 123402	*Arbutus unedo*	Carrubba, Sicily, Italy	G. Polizzi	MT335099; MT335331; MT335571; MT359792; MT359552; MT412624; MT412862; MT413074	Lombard *et al.* (2010b), this study

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		CMW 7804	CBS 125270; CPC 2681	B85	*Ca. pauciramosa*[#]	–	*Ca. citrinus*	Sicily, Italy	G. Polizzi	MT335100; MT335332; MT335572; MT359793; MT359553; MT412625; MT412863; MT413075	Lombard *et al.* (2010b), this study
		CMW 10151	CBS 125271; CPC 2771	B85	*Ca. pauciramosa*[#]	–	*Ca. citrinus*	Sicily, Italy	G. Polizzi	MT335101; MT335333; MT335573; MT359794; MT359554; MT412626; MT412864; MT413076	Lombard *et al.* (2010b), this study
A120	*Ca. pseudocolhounii**	CMW 27209[T]	CBS 127195	B36	*Ca. eucalypti*[#]	CMW 27209	*E. dunnii*	FuJian, China	M.J. Wingfield	MT335108; MT335341; MT335581; MT359802; MT359562; MT412634; MT412872; MT413084	Chen *et al.* (2011), this study
		CMW 27213	CBS 127196	B36	*Ca. eucalypti*[#]	–	*E. dunnii*	FuJian, China	M.J. Wingfield	MT335109; MT335342; MT335582; MT359803; MT359563; MT412635; MT412873; MT413085	Chen *et al.* (2011), this study
A123	*Ca. pseudokyotensis**	CMW 31439[T]	CBS 137332; CERC 1774	B4	*Ca. aconidialis*[#]	CMW 31439	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT334951; MT335178; MT335417; MT359638; MT359398; N/A; MT412708; N/A	Lombard *et al.* (2015a), this study
A125	*Ca. pseudomexicana*	CBS 130354[T]	CMW 51313; DISTEF-TCROU1	B94	***Ca. pseudomexicana***	CBS 130354[T]	*Callistemon* sp.	Tunis, Carthage, Tunisia	G. Polizzi	MT335110; MT335343; MT335583; MT359804; MT359564; MT412636; MT412874; MT413086	Lombard *et al.* (2011), this study
		CBS 130355	CMW 51314; DISTEF-TCROU3	B94	***Ca. pseudomexicana***	CBS 130355	*Callistemon* sp.	Tunis, Carthage, Tunisia	G. Polizzi	MT335111; MT335344; MT335584; MT359805; MT359565; MT412637; MT412875; MT413087	Lombard *et al.* (2011), this study
A126	*Ca. pseudonaviculata*	CBS 116251[T]	CMW 51235; CPC 3399; Lynfield 824	B95	***Ca. pseudonaviculata***	CBS 116251[T]	*Buxus sempervirens*	Kumeu, West Auckland, New Zealand	N/A	N/A; MT335345; MT335585; MT359806; MT359566; MT412638; MT412876; MT413088	Crous *et al.* (2002), Lombard *et al.* (2016), this study
		CMW 23672	CBS 114417; CPC 10926	B95	***Ca. pseudonaviculata***	CMW 23672	*B. sempervirens*	New Zealand	C. Crepel	N/A; MT335346; MT335586; MT359807; MT359567; MT412639; MT412877; MT413089	Lombard *et al.* (2010a, 2016), this study
A127	*Ca. pseudopteridis*	CBS 163.28[T]	CMW 51159; IMI 299579	B96	***Ca. pseudopteridis***	CBS 163.28[T]	*Washingtonia robusta*	USA	C.D. Sherbakoff	MT335112; MT335347; MT335587; MT359808; MT359568; MT412640; MT412878; N/A	Sherbakoff (1928), Alfenas *et al.* (2015), Lombard *et al.* (2016), this study
A128	*Ca. pseudoreteaudii*	CMW 25310[T]	CBS 123694	B97	***Ca. pseudoreteaudii***	CMW 25310[T]	*E. urophylla* × *E. grandis*	GuangDong, China	M.J. Wingfield & X.D. Zhou	MT335119; MT335354; MT335594; MT359815; MT359575; MT412647; MT412885; MT413096	Lombard *et al.* (2010c), this study
		CMW 25292	CBS 123696	B97	***Ca. pseudoreteaudii***	CMW 25292	*E. urophylla* × *E. grandis*	GuangDong, China	M.J. Wingfield & X.D. Zhou	MT335120; MT335355; MT335595; MT359816; MT359576; MT412648; MT412886; MT413097	Lombard *et al.* (2010c), this study

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A129	*Ca. pseudoscoparia**	CMW 15218^{T}	CBS 125257	B21	*Ca. candelabrum*$^{\#}$	CMW 15218	*E. grandis*	Las Golondrinas, Pichincha, Ecuador	M.J. Wingfield	MT334979; MT335209; MT335449; MT359670; MT359430; MT412513; MT412740; MT412961	Lombard *et al.* (2010a), this study
		CMW 15215	CBS 125255	B21	*Ca. candelabrum*$^{\#}$	–	*E. grandis*	Las Golondrinas, Pichincha, Ecuador	M.J. Wingfield	MT334980; MT335210; MT335450; MT359671; MT359431; MT412514; MT412741; MT412962	Lombard *et al.* (2010a), this study
A132	*Ca. pseudoturangicola**	CERC 7126^{T}	CBS 142890; CMW 47496	B55	*Ca. kyotensis*$^{\#}$	CERC 7126	Soil	FuZhou, FuJian, China	S.F. Chen	MT335121; MT335356; MT335596; MT359817; MT359577; MT412649; MT412887; MT413098	Li *et al.* (2017), this study
		CERC 7127	CBS 142891; CMW 47497	B55	*Ca. kyotensis*$^{\#}$	–	Soil	FuZhou, FuJian, China	S.F. Chen	MT335122; MT335357; MT335597; MT359818; MT359578; MT412650; MT412888; MT413099	Li *et al.* (2017), this study
A133	*Ca. pseudouxmalensis*	CBS 110924^{T}	CMW 51166; CPC 942	B100	***Ca. pseudouxmalensis***	CBS 110924^{T}	Soil	Mexico	P.W. Crous	MT335123; MT335358; MT335598; MT359819; MT359579; MT412651; MT412889; MT413100	Lombard *et al.* (2016), this study
		CBS 110923	CMW 51165; CPC 941	B100	***Ca. pseudouxmalensis***	CBS 110923	Soil	Mexico	P.W. Crous	MT335124; MT335359; MT335599; MT359820; MT359580; MT412652; MT412890; MT413101	Lombard *et al.* (2016), this study
		CBS 115677	CMW 51228; CPC 943	B100	***Ca. pseudouxmalensis***	CBS 115677	Soil	Mexico	P.W. Crous	MT335125; MT335360; MT335600; MT359821; MT359581; MT412653; MT412891; MT413102	Lombard *et al.* (2016), this study
A135	*Ca. pseudoyunnanensis**	CERC 5376^{T}	CBS 142892; CMW 47655	B120	*Ca. yunnanensis*$^{\#}$	CERC 5376	Soil (*Eucalyptus* plantation)	PuEr, YunNan, China	S.F. Chen & J.Q. Li	MT335126; MT335361; MT335601; MT359822; MT359582; MT412654; MT412892; MT413103	Li *et al.* (2017), this study
		CERC 5377	CBS 142893; CMW 47656	B120	*Ca. yunnanensis*$^{\#}$	–	Soil (*Eucalyptus* plantation)	PuEr, YunNan, China	S.F. Chen & J.Q. Li	MT335127; MT335362; MT335602; MT359823; MT359583; MT412655; MT412893; MT413104	Li *et al.* (2017), this study
		CERC 5378	CBS 142894; CMW 47657	B120	*Ca. yunnanensis*$^{\#}$	–	Soil (*Eucalyptus* plantation)	PuEr, YunNan, China	S.F. Chen & J.Q. Li	MT335128; MT335363; MT335603; MT359824; MT359584; MT412656; MT412894; N/A	Li *et al.* (2017), this study
A137	*Ca. putriramosa*	CBS 111449^{T}	CMW 51181; CPC 1951	B103	***Ca. putriramosa***	CBS 111449^{T}	*Eucalyptus* cutting	Brazil	A.C. Alfenas	MT335129; MT335364; MT335604; MT359825; MT359585; MT412657; MT412895; MT413105	Lombard *et al.* (2016), this study
		CBS 111470	CMW 51182; CPC 1940	B103	***Ca. putriramosa***	CBS 111470	Soil	Brazil	A.C. Alfenas	MT335130; MT335365; MT335605; MT359826; MT359586; MT412658; MT412896; MT413106	Lombard *et al.* (2016), this study

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		CBS 111477	CMW 51183; CPC 1928	B103	***Ca. putriramosa***	CBS 111477	Soil	Brazil	A.C. Alfenas	MT335131; MT335366; MT335606; MT359827; MT359587; MT412659; MT412897; MT413107	Lombard *et al.* (2016), this study
A138	*Ca. queenslandica*	CMW 30604^{T}	CBS 112146; CPC 3213	B104	***Ca. queenslandica***	CMW 30604^{T}	*E. urophylla*	Lannercost, Queensland, Australia	B. Brown	MT335132; MT335367; MT335607; MT359828; MT359588; MT412660; MT412898; MT413108	Kang *et al.* (2001a), Lombard *et al.* (2010c), this study
		CMW 30603	CBS 112155; CPC 3210	B104	***Ca. queenslandica***	CMW 30603	*E. pellita*	Lannercost, Queensland, Australia	P.Q Thu & K.M. Old	MT335133; MT335368; MT335608; MT359829; MT359589; MT412661; MT412899; MT413109	Kang *et al.* (2001a), Lombard *et al.* (2010c), this study
A140	*Ca. reteaudii*	CMW 30984^{T}	CBS 112144; CPC 3201	B106	***Ca. reteaudii***	CMW 30984^{T}	*E. camaldulensis*	Chon Thanh, Binh Phuoc, Vietnam	M.J. Dudzinski & P.Q. Thu	MT335135; MT335370; MT335610; MT359831; MT359591; MT412663; MT412901; MT413111	Kang *et al.* (2001a), Crous (2002), Crous *et al.* (2006), this study
		CMW 16738	CBS 112143; CPC 3200	B106	***Ca. reteaudii***	CMW 16738	*Eucalyptus* sp. (leaves)	Binh Phuoc, Vietnam	M.J. Dudzinski & P.Q. Thu	MT335136; MT335371; MT335611; MT359832; MT359592; MT412664; MT412902; MT413112	Kang *et al.* (2001a), Crous (2002), Crous *et al.* (2006), this study
A142	*Ca. rumohrae*	CMW 23697^{T}	CBS 111431; CPC 1716; UFV 218	B108	***Ca. rumohrae***	CMW 23697^{T}	*Rumohra adiantiformis*	Volkan, Panama	J.W. Miller & R.M. leahy	MT335137; MT335372; MT335612; MT359833; MT359593; N/A; MT412903; MT413113	El-Gholl *et al.* (1997), Crous (2002), Crous *et al.* (2006), this study
		CMW 30989	CBS 109062; CPC 1603	B108	***Ca. rumohrae***	CMW 30989	*Adiantum* sp.	The Netherlands	R. Pieters	MT335138; MT335373; MT335613; MT359834; MT359594; MT412665; MT412904; MT413114	El-Gholl *et al.* (1997), Crous (2002), Crous *et al.* (2006), this study
A143	*Ca. seminaria**	CMW 31450^{T}	CBS 136632; CERC 1785	B85	*Ca. pauciramosa*$^{\#}$	CMW 31450	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	MT335102; MT335334; MT335574; MT359795; MT359555; MT412627; MT412865; MT413077	Lombard *et al.* (2015a), this study
		CMW 31489	CBS 136639; CERC 1824	B85	*Ca. pauciramosa*$^{\#}$	–	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	MT335103; MT335335; MT335575; MT359796; MT359556; MT412628; MT412866; MT413078	Lombard *et al.* (2015a), this study
A145	*Ca. spathiphylli*	CMW 16742^{T}	ATCC 44730; CBS 114540; STE-U 2185	B110	***Ca. spathiphylli***	CMW 16742^{T}	*Spathiphyllum* sp.	Florida, USA	C.L. Schoulties	N/A; MT335374; MT335614; MT359835; MT359595; MT412666; MT412905; MT413115	El-Gholl *et al.* (1992), Crous (2002), Lombard *et al.* (2010a, 2016), this study
		CMW 30997	CBS 116168; CPC 789	B110	***Ca. spathiphylli***	CMW 30997	*Spathiphyllum* sp.	Switzerland	L. Petrini	N/A; MT335375; MT335615; MT359836; MT359596; MT412667; MT412906; MT413116	El-Gholl *et al.* (1992), Crous (2002), Lombard *et al.* (2016), this study
A146	*Ca. spathulata*	CMW 16744^{T}	CBS 555.92	B111	***Ca. spathulata***	CMW 16744^{T}	*E. viminalis*	Brazil	N.E. El-Gholl	MT335139; MT335376; MT335616; MT359837; MT359597; MT412668; MT412907; MT413117	Crous & Kang (2001), Crous (2002), Lombard *et al.* (2016), this study

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A147	*Ca. sphaeropedunculata**	CMW 31390^{T}	CBS 136081; CERC 1725	B4	*Ca. aconidialis*$^{\#}$	CMW 31390	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT334952; MT335179; MT335418; MT359639; MT359399; MT412485; MT412709; N/A	Lombard *et al.* (2015a), this study
A148	*Ca. stipitata**	CBS 112513^{T}	CMW 51197; CPC 3851	B111	*Ca. spathulata*$^{\#}$	CBS 112513	*Eucalyptus* sp.	Colombia	M.J. Wingfield	MT335140; MT335377; MT335617; MT359838; MT359598; MT412669; MT412908; MT413118	Lombard *et al.* (2016), this study
A149	*Ca. sulawesiensis**	CMW 14878^{T}	CBS 125277	B44	*Ca. hawksworthii*$^{\#}$	CMW 14878	*Eucalyptus* sp.	Sulawesi, Indonesia	M.J. Wingfield	MT335141; MT335378; MT335618; MT359839; MT359599; MT412670; MT412909; MT413119	Lombard *et al.* (2010a), this study
		CMW 14879	CBS 125253	B44	*Ca. hawksworthii*$^{\#}$	–	*Eucalyptus* sp.	Sulawesi, Indonesia	M.J. Wingfield	MT335142; MT335379; MT335619; MT359840; MT359600; MT412671; MT412910; MT413120	Lombard *et al.* (2010a), this study
A150	*Ca. sumatrensis*	CMW 23698^{T}	CBS 112829; CPC 4518	B112	***Ca. sumatrensis***	CMW 23698^{T}	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335145; MT335382; MT335622; MT359843; MT359603; MT412674; MT412913; N/A	Crous *et al.* (2004), this study
		CMW 30987	CBS 112934; CPC 4516	B112	***Ca. sumatrensis***	CMW 30987	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335146; MT335383; MT335623; MT359844; MT359604; MT412675; MT412914; N/A	Crous *et al.* (2004), this study
A153	*Ca. tereticornis**	CBS 111301^{T}	CMW 51176; CPC 1429	B79	*Ca. ovata*$^{\#}$	CBS 111301	*E. tereticornis*	Tucuruí, Pará, Brazil	P.W. Crous	MT335077; MT335309; MT335549; MT359770; MT359530; N/A; MT412840; MT413054	Lombard *et al.* (2016), this study
A154	*Ca. terrae-reginae**	CMW 30601^{T}	CBS 112151; CPC 3202; DFRI00150	B104	*Ca. queenslandica*$^{\#}$	CMW 30601	*E. urophylla*	Cardwell, Queensland, Australia	C. Hanwood	MT335134; MT335369; MT335609; MT359830; MT359590; MT412662; MT412900; MT413110	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010c), this study
		CMW 30602	CBS 112634; CPC 4233; Lynfield 417	B63	***Ca. lombardiana sp. nov.***	CMW 30602^{T}	*Xanthorrhoea australis*	Victoria, Australia	T. Baigent	MT335156; MT335395; MT335635; MT359856; MT359616; MT412686; MT412926; MT413133	Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010c), this study
A155	*Ca. terrestris**	CMW 35180^{T}	CBS 136642; CERC 1856	B22	*Ca. cerciana*$^{\#}$	CMW 35180	Soil (*Eucalyptus* plantation)	GuangDong, China	X. Mou & R. Chang	MT334986; MT335216; MT335456; MT359677; MT359437; MT412520; MT412747; MT412968	Lombard *et al.* (2015a), this study
		CMW 35178	CBS 136645; CERC 1854	B22	*Ca. cerciana*$^{\#}$	–	Soil (*Eucalyptus* plantation)	GuangDong, China	X. Mou & R. Chang	MT334987; MT335217; MT335457; MT359678; MT359438; MT412521; MT412748; MT412969	Lombard *et al.* (2015a), this study

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		CMW 35364	CBS 136643; CERC 1868	B22	*Ca. cerciana*#	–	Soil (*Eucalyptus* plantation)	GuangDong, China	X. Mou & R. Chang	MT334988; MT335218; MT335458; MT359679; MT359439; MT412522; MT412749; MT412970	Lombard *et al.* (2015a), this study
		CMW 37974	CBS 136651; CERC 1937	B22	*Ca. cerciana*#	–	Soil	GuangDong, China	X. Mou & R. Chang	MT334989; MT335219; MT335459; MT359680; MT359440; MT412523; MT412750; MT412971	Lombard *et al.* (2015a), this study
A157	*Ca. tetraramosa**	CMW 31474^{T}	CBS 136635; CERC 1809	B85	*Ca. pauciramosa*#	CMW 31474	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	MT335104; MT335336; MT335576; MT359797; MT359557; MT412629; MT412867; MT413079	Lombard *et al.* (2015a), this study
		CMW 31476	CBS 136637; CERC 1811	B85	*Ca. pauciramosa*#	–	*E. urophylla* × *E. grandis*	ZhanJiang, GuangDong, China	G. Zhao	MT335105; MT335337; MT335577; MT359798; MT359558; MT412630; MT412868; MT413080	Lombard *et al.* (2015a), this study
A158	*Ca. tonkinensis*	CMW 47430^{T}	CBS 143576	B115	***Ca. tonkinensis***	CMW 47430^{T}	Soil (*Eucalyptus* plantation)	Bavi, Hanoi, Vietnam	N.Q. Pham & T.Q. Pham	MT335147; MT335384; MT335624; MT359845; MT359605; MT412676; MT412915; MT413122	Pham *et al.* (2019), this study
A159	*Ca. tropicalis**	CBS 116271^{T}	CMW 51236; CPC 3559	B6	*Ca. amazonica*#	CBS 116271	*Eucalyptus* sp.	Amazon, Brazil	P.W. Crous & A.C. Alfenas	MT335148; MT335385; MT335625; MT359846; MT359606; MT412677; MT412916; MT413123	Lombard *et al.* (2016), this study
		CBS 116242	CMW 51231; CPC 3543	B6	*Ca. amazonica*#	–	*Eucalyptus* sp.	Amazon, Brazil	P.W. Crous & A.C. Alfenas	MT334962; MT335189; MT335428; MT359649; MT359409; MT412492; MT412719; MT412942	Lombard *et al.* (2016), this study
A160	*Ca. tucuruiensis**	CBS 114755^{T}	CMW 51827; CPC 1403	B79	*Ca. ovata*#	CBS 114755	*E. tereticornis*	Tucuruí, Pará, Brazil	P.W. Crous	MT335078; MT335310; MT335550; MT359771; MT359531; N/A; MT412841; MT413055	Marin-Felix *et al.* (2017), this study
A161	*Ca. tunisiana**	CBS 130357^{T}	CMW 51316; DISTEF-TCL1	B94	*Ca. pseudomexicana*#	CBS 130357	*Ca. laevis*	Tunis, Carthage, Tunisia	G. Polizzi	MT335149; MT335386; MT335626; MT359847; MT359607; MT412678; MT412917; MT413124	Lombard *et al.* (2011), this study
		CBS 130356	CMW 51315; DISTEF-TCROU2	B94	*Ca. pseudomexicana*#	–	*Callistemon* sp.	Tunis, Carthage, Tunisia	G. Polizzi	MT335150; MT335387; MT335627; MT359848; MT359608; MT412679; MT412918; MT413125	Lombard *et al.* (2011), this study
A162	*Ca. turangicola**	CMW 31411^{T}	CBS 136077	B55	*Ca. kyotensis*#	CMW 31411	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT335151; MT335388; MT335628; MT359849; MT359609; N/A; MT412919; MT413126	Lombard *et al.* (2015a), this study
		CMW 35410	CBS 136093	B55	*Ca. kyotensis*#	–	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Mou & R. Chang	MT335152; MT335389; MT335629; MT359850; MT359610; MT412680; MT412920; MT413127	Lombard *et al.* (2015a), this study

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A164	*Ca. uxmalensis*	CBS 110925^{T}	CMW 51167; CPC 945	B117	***Ca. uxmalensis***	CBS 110925^{T}	Soil	Uxmal, Mexico	P.W. Crous	MT335153; MT335390; MT335630; MT359851; MT359611; MT412681; MT412921; MT413128	Lombard *et al.* (2016), this study
		CBS 110919	CMW 51164; CPC 928	B117	***Ca. uxmalensis***	CBS 110919	Soil	Uxmal, Mexico	P.W. Crous	MT335154; MT335391; MT335631; MT359852; MT359612; MT412682; MT412922; MT413129	Lombard *et al.* (2016), this study
A165	*Ca. variabilis*	CMW 3187^{T}	AR2675; CBS 114677; CPC 2436	B118	***Ca. variabilis***	CMW 3187^{T}	*Schefflera morototoni*	Pará, Brazil	F.C. de Albuquerque	N/A; MT335392; MT335632; MT359853; MT359613; MT412683; MT412923; MT413130	Crous *et al.* (1993b), Crous (2002), Lombard *et al.* (2010a, 2016), this study
		CMW 2914	CBS 112691; CPC 2506	B118	***Ca. variabilis***	CMW 2914	*Theobroma grandiflorum*	Pará, Brazil	F. Carneiro	N/A; MT335393; MT335633; MT359854; MT359614; MT412684; MT412924; MT413131	Crous *et al.* (1993b), Crous (2002), Lombard *et al.* (2010a, 2016), this study
A166	*Ca. vegrandis**	CMW 48245^{T}	CBS 143565	B31	*Ca. curvispora*$^{\#}$	CMW 48245	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT335003; MT335233; MT335473; MT359694; MT359454; MT412537; MT412764; N/A	Pham *et al.* (2019), this study
		CMW 48246	CBS 143566	B31	*Ca. curvispora*$^{\#}$	–	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT335004; MT335234; MT335474; MT359695; MT359455; MT412538; MT412765; N/A	Pham *et al.* (2019), this study
A167	*Ca. venezuelana*	CBS 111052^{T}	CMW 51173; CPC 1183	B119	***Ca. venezuelana***	CBS 111052^{T}	Soil	Acarigua, Venezuela	M.J. Wingfield	MT335155; MT335394; MT335634; MT359855; MT359615; MT412685; MT412925; MT413132	Lombard *et al.* (2016), this study
A168	*Ca. yunnanensis*	CERC 5339^{T}	CBS 142897; CMW 47644	B120	***Ca. yunnanensis***	CERC 5339^{T}	Soil (*Eucalyptus* plantation)	YunNan, China	S.F. Chen, J.Q. Li & G.Q. Li	MT335157; MT335396; MT335636; MT359857; MT359617; MT412687; MT412927; MT413134	Li *et al.* (2017), this study
		CERC 5337	CBS 142895; CMW 47642	B120	***Ca. yunnanensis***	CERC 5337	Soil (*Eucalyptus* plantation)	YunNan, China	S.F. Chen, J.Q. Li & G.Q. Li	MT335158; MT335397; MT335637; MT359858; MT359618; MT412688; MT412928; MT413135	Li *et al.* (2017), this study
A169	*Ca. zuluensis**	CMW 9188^{T}	CBS 125268	B85	*Ca. pauciramosa*$^{\#}$	CMW 9188	*E. grandis*	Kwambonambi, KwaZulu-Natal, South Africa	L. Lombard	MT335159; MT335398; MT335638; MT359859; MT359619; MT412689; MT412929; MT413136	Lombard *et al.* (2010b), this study

[1] Codes (A1 to A169) of the 169 *Calonectria* species before revision.

[2] *Calonectria* species names before revision.

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[3] AR: Amy Y. Rossman working collection; ATCC: American Type Culture Collection, Virginia, USA; CBS: Westerdijk Fungal Biodiversity Institute, Utrecht, The Netherlands; CERC: China Eucalypt Research Centre, ZhanJiang, GuangDong Province, China; CMW: Culture collection of the Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa; CPC: Pedro Crous working collection housed at Westerdijk Fungal Biodiversity Institute; HGUP: Plant Pathology Herbarium of Gui Zhou University, GuiYang 550025, China; IMI: International Mycological Institute, CABI Bioscience, Egham, Bakeham Lane, UK; LPF: Laboratorio de Patologia Florestal, Universidade Federal de Viçosa, Viçosa, Brazil; MUCL: Mycotheque, Laboratoire de Mycologie Systematique st Appliqee, I'Universite, Louvian-la-Neuve, Belgium; PPRI: Plant Protection Research Institute, Pretoria, South Africa; STE-U: Department of Plant Pathology, University of Stellenbosch, South Africa; UFV: Universidade Federal de Viçosa, Viçosa, Brazil.

[4] Re-sequenced isolates were obtained from culture collections of CBS, CMW and CERC, and the isolate numbers were appeared in the phylogenetic trees in this study.

[5] T: ex-type isolates of the *Calonectria* species before revision.

[6] Codes (B1 to B120) of the 120 *Calonectria* species after revision.

[7] The 120 *Calonectria* species after revision, species link to the key isolates including the ex-types are in bold.

[8] Key isolates of the 120 *Calonectria* species after revision.

[9] T: ex-type isolates of the *Calonectria* species after revision.

[10] *act*: actin; *cmdA*: calmodulin; *his3*: histone H3; ITS: the internal transcribed spacer regions 1 and 2 and the 5.8S gene of the ribosomal RNA; LSU: 28S large subunit RNA gene; *rpb2*: the second largest subunit of RNA polymerase; *tef1*: translation elongation factor 1-alpha; *tub2*: β-tubulin.

[11] N/A: information are not available.

[*] Species were synonymized.

[#] Species names after synonymizing.

[&] Species name after re-identification.

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[7] GenBank accession number obtained in this study are in bold.

[8] N/A: information are not available.

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Table S2. Isolates and sequences from previous studies used in this study.

Code A[1]	Previous species name[2]	Isolates number[3,4]	Other collection number[3]	Code B[5]	Accepted species name[6]	Isolates after species revision [7,8]	Hosts	Area of occurrence	Collector	GenBank accession Numbers[9] *act*; *cmdA*; *his3*; ITS; LSU; *rpb2*; *tef1*; *tub2*	References
A8	*Calonectria angustata*	CBS 112133	CMW 30983; CPC 3152; P99-1321	B7	***Ca. angustata***	CBS 112133	*Tillandsia capitata*	Sarasota nursery, Florida, USA	R.M. Leahy	GQ280427; GQ267362; DQ190695; GQ280549; GQ280670; KY653360; FJ918552; DQ190593	Crous *et al.* (2000, 2006), Lombard *et al.* (2010a), Marin-Felix *et al.* (2017)
A10	*Ca. asiatica*	CBS 114073^{T}	CMW 23782; CPC 3900	B8	***Ca. asiatica***	CBS 114073^{T}	Debris (leaf litter)	Prathet Thai, Thailand	N.L. Hywel-Jones	GQ280428; AY725741; AY725658; GQ280550; GQ280672; N/A[10]; AY725705; AY725616	Crous *et al.* (2004), Lombard *et al.* (2010a)
A13	*Ca. avesiculata*	CBS 313.92^{T}	ATCC 38226; CMW 23670; CPC 2373	B11	***Ca. avesiculata***	CBS 313.92^{T}	*Ilex vomitoria*	Cairo, Georgia, USA	S.A. Alfieri	GQ280431; GQ267364; DQ190620; GQ280553; GQ280675; N/A; GQ267294; AF333392	Schubert *et al.* (1989), Crous (2002), Lombard *et al.* (2010a)
A19	*Ca. brassiana*	CBS 134855^{T}	LPF378	B15	***Ca. brassiana***	CBS 134855^{T}	Soil (*Eucalyptus brassiana* plantation)	Teresina, Piauí, Brazil	R.F. Alfenas	N/A; KM396056; KM396139; N/A; N/A; N/A; KM395882; KM395969	Alfenas *et al.* (2015)
		CBS 134856	LPF379	B15	***Ca. brassiana***	CBS 134856	Soil (*E. brassiana* plantation)	Teresina, Piauí, Brazil	R.F. Alfenas	N/A; KM396057; KM396140; N/A; N/A; N/A; KM395883; KM395970	Alfenas *et al.* (2015)
A21	*Ca. brassicicola*	CBS 112841^{T}	CMW 51206; CPC 4552	B17	***Ca. brassicicola***	CBS 112841^{T}	Soil (*Brassica* sp.)	Indonesia	M.J. Wingfield	N/A; KX784561; N/A; N/A; N/A; N/A; KX784689; KX784619	Lombard *et al.* (2016)
A32	*Ca. colhounii*	CBS 293.79^{T}	CMW 30999	B27	***Ca. colhounii***	CBS 293.79T	*Camellia sinensis*	Mauritius	A. Peerally	GQ280443; GQ267373; DQ190639; GQ280565; GQ280687; KY653376; GQ267301; DQ190564	Peerally (1973), Crous (2002), Crous *et al.* (2006), Lombard *et al.* (2010a)
A33	*Ca. colombiana*	CBS 115127^{T}	CMW 30871; CPC 1160	B28	***Ca. colombiana***	CBS 115127^{T}	Soil	La Selva, Colombia	M.J. Wingfield	GQ280538; GQ267455; FJ972442; GQ280660; GQ280782; N/A; FJ972492; FJ972423	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a, b)

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		CBS 115638	CMW 30766; CPC 1161	B28	***Ca. colombiana***	CBS 115638	Soil	La Selva, Colombia	M.J. Wingfield	GQ280539; GQ267456; FJ972441; GQ280661; GQ280783; N/A; FJ972491; FJ972422	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a, b)
A39	*Ca. duoramosa*	CBS 134656^{T}	LPF434	B34	***Ca. duoramosa***	CBS 134656^{T}	Soil (tropical rainforest)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396027; KM396110; N/A; N/A; N/A; KM395853; KM395940	Alfenas *et al.* (2015)
		LPF453	–	B34	***Ca. duoramosa***	LPF453	Soil (*Eucalyptus* plantation)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396028; KM396111; N/A; N/A; N/A; KM395854; KM395941	Alfenas *et al.* (2015)
A44	*Ca. eucalypticola*	CBS 134847^{T}	LPF124	B37	***Ca. eucalypticola***	CBS 134847^{T}	*Eucalyptus* sp. (seeding)	Santa Barbara, Minas Gerais state, Brazil	A.C. Alfenas	N/A; KM396051; KM396134; N/A; N/A; N/A; KM395877; KM395964	Alfenas *et al.* (2015)
		CBS 134846	LPF121	B37	***Ca. eucalypticola***	CBS 134846	*Eucalyptus* sp. (leaf)	Eunapolis, Bahia, Brazil	A.C. Alfenas	N/A; KM396050; KM396133; N/A; N/A; N/A; KM395876; KM395963	Alfenas *et al.* (2015)
A48	*Ca. fragariae*	CBS 133607^{T}	LPP040	B38	***Ca. fragariae***	CBS 133607^{T}	*Fragaria* × *ananassa*	Santa Maria do Jetibá, Espírito Santo, Brazil	U.P. Lopes	N/A; KM998966; KM998964; N/A; N/A; N/A; KM998963; KM998965	Lopes *et al.* (2017)
		LPF141.1	–	B38	***Ca. fragariae***	LPF141.1	*Fragaria* × *ananassa*	Santa Maria do Jetibá, Espírito Santo, Brazil	U.P. Lopes	N/A; KX500191; KX500194; N/A; N/A; N/A; KX500197; KX500195	Lopes *et al.* (2017)
		LPF141.2	–	B38	***Ca. fragariae***	LPF141.2	*Fragaria* × *ananassa*	Santa Maria do Jetibá, Espírito Santo, Brazil	U.P. Lopes	N/A; KX500192; KX500193; N/A; N/A; N/A; KX500198; KX500196	Lopes *et al.* (2017)
A50	*Ca. glaebicola*	CBS 134852^{T}	LPF406	B40	***Ca. glaebicola***	CBS 134852^{T}	Soil (*Eucalyptus* plantation)	Martinho Campos, Minas Gerais, Brazil	A.C. Alfenas	N/A; KM396053; KM396136; N/A; N/A; N/A; KM395879; KM395966	Alfenas *et al.* (2015)
		CBS 134853	LPF407	B40	***Ca. glaebicola***	CBS 134853	*Eucalyptus* sp. (leaf)	Tocantins, Bico do Papagaio, Brazil	R.F. Alfenas	N/A; KM396054; KM396137; N/A; N/A; N/A; KM395880; KM395967	Alfenas *et al.* (2015)
A53	*Ca. gracilis*	CBS 111807^{T}	AR2677; CMW 51189; PPRI 4176; STE-U 2634	B43	***Ca. gracilis***	CBS 111807^{T}	*Manilkara zapota*	Pará, Brazil	F. Carneiro de Albuquerque	GQ280488; GQ267407; DQ190646; GQ280610; GQ280732; KY653390; GQ267323; AF232858	Crous *et al.* (1993c, 2006), Crous (2002), Lombard *et al.* (2016), Marin-Felix *et al.* (2017)

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		CBS 111284	CMW 51175; CPC 1483	B43	***Ca. gracilis***	CBS 111284	Soil	Imbrapa, Brazil	P.W. Crous	GQ280489; GQ267408; DQ190647; GQ280611; GQ280733; KY653389; GQ267324; DQ190567	Crous *et al.* (1993c, 2006), Crous (2002), Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
A57	*Ca. henricotiae*	CBS 138102^{T}	CB045	B45	***Ca. henricotiae***	CBS 138102^{T}	*Buxus sempervirens*	Lokeren, East Flanders, Belgium	B. Gehesquiere & K. Heungens	N/A; KF815157; KF815185; JX535322; N/A; N/A; N/A; JX535308	Gehesquiere *et al.* (2015)
		CB041	–	B45	***Ca. henricotiae***	CB041	*B. sempervirens*	Lokeren, East Flanders, Belgium	B. Gehesquiere & K. Heungens	N/A; KF815156; KF815184; N/A; N/A; N/A; N/A; KF815129	Gehesquiere *et al.* (2015)
A59	*Ca. hodgesii**	CBS 133609^{T}	LPF245	B14	*Ca. brasiliensis*$^{\#}$	CBS 133609	*Anadenanthera peregrina*	Viçosa, Minas Gerais, Brazil	R.F. Alfenas	N/A; KC491222; N/A; N/A; N/A; N/A; KC491225; KC491228	Alfenas *et al.* (2013b, 2015)
		CBS 133608	LPF244	B14	*Ca. brasiliensis*$^{\#}$	–	*Piptadenia gonoacantha*	Viçosa, Minas Gerais, Brazil	R.F. Alfenas	N/A; KC491221; N/A; N/A; N/A; N/A; KC491224; KC491227	Alfenas *et al.* (2013b, 2015)
A67	*Ca. indusiata*	CBS 144.36^{T}	CMW 23699	B53	***Ca. indusiata***	CBS 144.36^{T}	*Camellia sinensis*	Sri lanka	N/A	GQ280536; GQ267453; GQ267262; GQ280658; GQ280780; KY653396; GQ267332; GQ267239	Crous (2002), Lombard *et al.*(2010a, 2016), Marin-Felix *et al.* (2017)
		CBS 114684	CMW 51213; CPC 2446; UFV16	B53	***Ca. indusiata***	CBS 114684	*Rhododendron* sp.	Florida, USA	N.E. El-Gholl	GQ280537; GQ267454; DQ190653; GQ280659; GQ280781; N/A; GQ267333; AF232862	Crous *et al.* (1999, 2006), Crous (2002)
A70	*Ca. lageniformis*	CBS 111324^{T}	CMW 51177; CPC 1473	B56	***Ca. lageniformis***	CBS 111324^{T}	*Eucalyptus* sp. (leaf)	Rivière Noire, Mauritius	H. Smith	N/A; KX784574; N/A; KY653256; KY653312; KY653400; KX784702; KX784632	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
A83	*Ca. maranhensis*	CBS 134811^{T}	LPF142	B67	***Ca. maranhensis***	CBS 134811^{T}	*Eucalyptus* sp. (leaf)	Açailandia, Maranhao, Brazil	A.C. Alfenas	N/A; KM396035; KM396118; N/A; N/A; N/A; KM395861; KM395948	Alfenas *et al.* (2015)
		CBS 134812	LPF143	B67	***Ca. maranhensis***	CBS 134812	*Eucalyptus* sp. (leaf)	Açailandia, Maranhao, Brazil	A.C. Alfenas	N/A; KM396036; KM396119; N/A; N/A; N/A; KM395862; KM395949	Alfenas *et al.* (2015)
A84	*Ca. metrosideri*	CBS 133603^{T}	LPF101	B68	***Ca. metrosideri***	CBS 133603^{T}	*Metrosideros polymorpha*	Viçosa, Minas Gerais state, Brazil	R.F. Alfenas	N/A; KC294304; KC294307; N/A; N/A; N/A; KC294310; KC294313	Alfenas *et al.* (2013a, 2015)

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A85	*Ca. mexicana*	CBS 110918^{T}	CMW 9055; STE-U 927	B69	***Ca. mexicana***	CBS 110918^{T}	Soil	Uxmal, Yucatan, Mexico	M.J. Wingfield	GQ280474; GQ267396; FJ972460; GQ280596; GQ280718; KY653412; FJ972526; AF210863	Schoch *et al.* (1999), Crous (2002), Lombard *et al.* (2010a), Marin-Felix *et al.* (2017)
A88	*Ca. monticola*	CBS 140645^{T}	CPC 28835	B70	***Ca. monticola***	CBS 140645^{T}	Soil	Chiang Mai, Thailand	P.W. Crous	N/A; KT964771; N/A; KT964775; KT983443; N/A; KT964773; KT964769	Crous *et al.* (2015)
		CPC 28836	–	B70	***Ca. monticola***	CPC 28836	Soil	Chiang Mai, Thailand	P.W. Crous	N/A; KT964772; N/A; KT964776; KT983444; N/A; KT964774; KT964770	Crous *et al.* (2015)
A91	*Ca. multinaviculata*	CBS 134858^{T}	LPF233	B72	***Ca. multinaviculata***	CBS 134858^{T}	Soil (*Eucalyptus* plantation)	Mucuri, Bahia, Brazil	E. Zauza	N/A; KM396072; KM396155; N/A; N/A; N/A; KM395898; KM395985	Alfenas *et al.* (2015)
		CBS 134859	LPF418	B72	***Ca. multinaviculata***	CBS 134859	Soil (*Eucalyptus* plantation)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396073; KM396156; N/A; N/A; N/A; KM395899; KM395986	Alfenas *et al.* (2015)
A95	*Ca. naviculata*	CBS 101121^{T}	CMW 30974	B75	***Ca. naviculata***	CBS 101121	Leaf litter	Joao Pessoa, Brazil	R.F. Castaneda	GQ280478; GQ267399; GQ267252; GQ280600; GQ280722; KM232309; GQ267317; GQ267211	Lombard *et al.* (2010a, 2015b)
		CBS 116080	CMW 16723; STE-U 627	B75	***Ca. naviculata***	CBS 116080	Soil	Manaus, Amazonas, Brazil	M.J. Wingfield	GQ280477; GQ267398; GQ267251; GQ280599; GQ280721; KY653417; GQ267316; AF333409	Crous *et al.* (1997a), Crous (2002), Lombard *et al.* (2010a), Marin-Felix *et al.* (2017)
A97	*Ca. nemoricola*	CBS 134837^{T}	LPF085	B76	***Ca. nemoricola***	CBS 134837^{T}	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396066; KM396149; N/A; N/A; N/A; KM395892; KM395979	Alfenas *et al.* (2015)
		CBS 134838	LPF090	B76	***Ca. nemoricola***	CBS 134838	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396067; KM396150; N/A; N/A; N/A; KM395893; KM395980	Alfenas *et al.* (2015)
A104	*Ca. paracolhounii*	CBS 114679^{T}	CMW 51212; CPC 2445	B81	***Ca. paracolhounii***	CBS 114679^{T}	N/A	USA	A.Y. Rossman	N/A; KX784582; N/A; KY653268; KY653324; KY653423; KX784714; KX784644	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
		CBS 114705	CMW 51215; CPC 2423	B81	***Ca. paracolhounii***	CBS 114705	*Annona reticulata* (fruit)	Australia	D. Hutton	N/A; N/A; N/A; KY653269; KY653325; KY653424; KX784715; KX784645	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)

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A105	*Ca. paraensis*	CBS 134669^{T}	LPF430	B82	***Ca. paraensis***	CBS 134669^{T}	Soil (*Eucalyptus* plantation)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396011; KM396094; N/A; N/A; N/A; KM395837; KM395924	Alfenas *et al.* (2015)
		LPF429	–	B82	***Ca. paraensis***	LPF429	Soil (tropical rainforest)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396015; KM396098; N/A; N/A; N/A; KM395841; KM395928	Alfenas *et al.* (2015)
A112	*Ca. piauiensis*	CBS 134850^{T}	LPF377	B87	***Ca. piauiensis***	CBS 134850^{T}	Soil (*Eucalyptus* plantation)	Teresina, Piauí, Brazil	R.F. Alfenas	N/A; KM396060; KM396143; N/A; N/A; N/A; KM395886; KM395973	Alfenas *et al.* (2015)
		CBS 134851	LPF381	B87	***Ca. piauiensis***	CBS 134851	Soil (tropical rainforest)	Teresina, Piauí, Brazil	R.F. Alfenas	N/A; KM396061; KM396144; N/A; N/A; N/A; KM395887; KM395974	Alfenas *et al.* (2015)
A113	*Ca. pini*	CBS 125523	CMW 31210	B88	***Ca. pini***	CBS 125523	*Pinus patula*	Buga, Valle del Cauca, Colombia	C.A. Rodas	GQ280518; GQ267437; GQ267274; GQ280640; GQ280762; N/A; GQ267345; GQ267225	Lombard *et al.* (2010a)
A117	*Ca. propaginicola*	CBS 134815^{T}	LPF220	B90	***Ca. propaginicola***	CBS 134815^{T}	*Eucalyptus* sp. (seeding)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396040; KM396123; N/A; N/A; N/A; KM395866; KM395953	Alfenas *et al.* (2015)
		CBS 134816	LPF222	B90	***Ca. propaginicola***	CBS 134816	*Eucalyptus* sp. (seeding)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396041; KM396124; N/A; N/A; N/A; KM395867; KM395954	Alfenas *et al.* (2015)
A118	*Ca. pseudobrassicae*	CBS 134662^{T}	LPF280	B91	***Ca. pseudorassicae***	CBS 134662^{T}	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396023; KM396106; N/A; N/A; N/A; KM395849; KM395936	Alfenas *et al.* (2015)
		CBS 134661	LPF260	B91	***Ca. pseudobrassicae***	CBS 134661	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396022; KM396105; N/A; N/A; N/A; KM395848; KM395935	Alfenas *et al.* (2015)
A119	*Ca. pseudocerciana**	CBS 134824^{T}	LPF367	B90	*Ca. propaginicola*$^{\#}$	CBS 134824	*Eucalyptus* sp. (seeding)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396049; KM396132; N/A; N/A; N/A; KM395875; KM395962	Alfenas *et al.* (2015)
		CBS 134823	LPF366	B90	*Ca. propaginicola*$^{\#}$	–	*Eucalyptus* sp. (seeding)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396048; KM396131; N/A; N/A; N/A; KM395874; KM395961	Alfenas *et al.* (2015)
A121	*Ca. pseudoecuadoriae*	CBS 111402^{T}	CMW 51179; CPC 1639	B92	***Ca. pseudoecuadoriae***	CBS 111402^{T}	Soil	Ecuador	M.J. Wingfield	N/A; KX784589; N/A; KY653273; KY653329; KY653432; KX784723; KX784652	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)

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A122	*Ca. pseudohodgesii**	CBS 134818^{T}	LPF262	B14	*Ca. brasiliensis*$^{\#}$	CBS 134818	*Azadirachta indica* (leaf)	Viçosa, Minas Gerais, Brazil	R.F. Alfenas	N/A; KM395991; KM396079; N/A; N/A; N/A; KM395817; KM395905	Alfenas *et al.* (2015)
		CBS 134819	LPF265	B14	*Ca. brasiliensis*$^{\#}$	–	*Azadirachta indica* (leaf)	Viçosa, Minas Gerais, Brazil	R.F. Alfenas	N/A; KM395992; KM396080; N/A; N/A; N/A; KM395818; KM395906	Alfenas *et al.* (2015)
A124	*Ca. pseudometrosideri*	CBS 134845^{T}	LPF210	B93	***Ca. pseudometrosideri***	CBS 134845^{T}	Soil (*Eucalyptus* plantation)	Maceió, Alagoas, Brazil	M.M. Coutinho	N/A; KM395995; KM396083; N/A; N/A; N/A; KM395821; KM395909	Alfenas *et al.* (2015)
		CBS 134843	LPF100	B93	***Ca. pseudometrosideri***	CBS 134843	*Metrosideros polymorpha*	Viçosa, Minas Gerais, Brazil	A.C. Alfenas	N/A; KM395993; KM396081; N/A; N/A; N/A; KM395819; KM395907	Alfenas *et al.* (2015)
A130	*Ca. pseudospathiphylli*	CBS 109165^{T}	CMW 30976; CPC 1623	B98	***Ca. pseudospathiphylli***	CBS 109165^{T}	Soil	Ecuador	M.J. Wingfield	GQ280493; GQ267412; AF348241; GQ280615; GQ280737; KY653435; FJ918562; FJ918513	Kang *et al.* (2001b), Crous (2002), Lombard *et al.* (2010a, c), Marin-Felix *et al.* (2017)
A131	*Ca. pseudospathulata*	CBS 134841^{T}	LPF072	B99	***Ca. pseudospathulata***	CBS 134841^{T}	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396070; KM396153; N/A; N/A; N/A; KM395896; KM395983	Alfenas *et al.* (2015)
		CBS 134840	LPF066	B99	***Ca. pseudospathulata***	CBS 134840	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396069; KM396152; N/A; N/A; N/A; KM395895; KM395982	Alfenas *et al.* (2015)
A134	*Ca. pseudovata*	CBS 134674^{T}	LPF267	B101	***Ca. pseudovata***	CBS 134674^{T}	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396032; KM396115; N/A; N/A; N/A; KM395858; KM395945	Alfenas *et al.* (2015)
		CBS 134675	LPF285	B101	***Ca. pseudovata***	CBS 134675	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396033; KM396116; N/A; N/A; N/A; KM395859; KM395946	Alfenas *et al.* (2015)
A136	*Ca. pteridis*	CBS 111793^{T}	ATCC 34395; CMW 16736; CPC 2372	B102	***Ca. pteridis***	CBS 111793^{T}	*Arachniodes adiantiformis*	USA	F. Schickedanz	GQ280494; GQ267413; DQ190679; GQ280616; GQ280738; KY653438; FJ918563; DQ190578	Crous *et al.* (1993c, 2006), Crous (2002), Lombard *et al.* (2010a), Marin-Felix *et al.* (2017)
A139	*Ca. quinqueramosa*	CBS 134654^{T}	LPF065	B105	***Ca. quinqueramosa***	CBS 134654^{T}	Soil (*Eucalyptus* plantation)	Monte Dourado, Pará, Brazil	R.F. Alfenas	N/A; KM396029; KM396112; N/A; N/A; N/A; KM395855; KM395942	Alfenas *et al.* (2015)

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		CBS 134655	LPF281	B105	***Ca. quinqueramosa***	CBS 134655	Soil (*Eucalyptus* plantation)	Santana, Pará, Brazil	A.C. Alfenas	N/A; KM396030; KM396113; N/A; N/A; N/A; KM395856; KM395943	Alfenas *et al.* (2015)
A141	*Ca. robigophila*	CBS 134652^{T}	LPF192	B107	***Ca. robigophila***	CBS 134652^{T}	*Eucalyptus* sp. (leaf)	Açailandia, Maranhao, Brazil	R.F. Alfenas	N/A; KM396024; KM396107; N/A; N/A; N/A; KM395850; KM395937	Alfenas *et al.* (2015)
		CBS 134653	LPF193	B107	***Ca. robigophila***	CBS 134653	*Eucalyptus* sp. (leaf)	Açailandia, Maranhao, Brazil	R.F. Alfenas	N/A; KM396025; KM396108; N/A; N/A; N/A; KM395851; KM395938	Alfenas *et al.* (2015)
A144	*Ca. silvicola*	CBS 135237^{T}	LPF081	B109	***Ca. silvicola***	CBS 135237^{T}	Soil (tropical rainforest)	Mucuri, Bahia, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396065; KM396148; N/A; N/A; N/A; KM395891; KM395978	Alfenas *et al.* (2015)
		CBS 134836	LPF079	B109	***Ca. silvicola***	CBS 134836	Soil (tropical rainforest)	Araponga, Minas Gerais, Brazil	A.C. Alfenas & P.W. Crous	N/A; KM396062; KM396145; N/A; N/A; N/A; KM395888; KM395975	Alfenas *et al.* (2015)
	Calonectria sp.	CBS 112152	CPC 3203	–	***Calonectria* sp.**	CBS 112152	*E. camaldulensis*	Vietnam	N/A	N/A; KX784602; N/A; KY653291; KY653347; KY653463; KX784745; KX784672	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
	Calonectria sp.	CBS 112753	CPC 4225	–	***Calonectria* sp.**	CBS 112753	N/A	Indonesia	N/A	N/A; KX784598; N/A; KY653292; KY653348; KY653464; KX784740; KX784667	Lombard *et al.* (2016), Marin-Felix *et al.* (2017)
A151	*Ca. syzygiicola*	CBS 112831^{T}	CMW 51204; CPC 4511	B113	***Ca. syzygiicola***	CBS 112831^{T}	*Syzygium aromaticum*	Sumatra, Indonesia	M.J. Wingfield	N/A; N/A; N/A; N/A; N/A; N/A; KX784736; KX784663	Lombard *et al.* (2016)
A152	*Ca. telluricola**	CBS 134664^{T}	LPF217	B82	*Ca. paraensis*[#]	CBS 134664	Soil (tropical rainforest)	Mucuri, Bahia, Brazil	E. Zauza	N/A; KM396017; KM396100; N/A; N/A; N/A; KM395843; KM395930	Alfenas *et al.* (2015)
		CBS 134663	LPF214	B82	*Ca. paraensis*[#]	–	Soil (tropical rainforest)	Salinas, Minas Gerais, Brazil	D.B. Pinho	N/A; KM396016; KM396099; N/A; N/A; N/A; KM395842; KM395929	Alfenas *et al.* (2015)
A156	*Ca. terricola*	CBS 116247^{T}	CMW 51232; CPC 3583	B114	***Ca. terricola***	CBS 116247^{T}	Soil (*Eucalyptus* plantation)	Brazil	P.W. Crous	N/A; N/A; N/A; N/A; N/A; N/A; KX784738; KX784665	Lombard *et al.* (2016)
A163	*Ca. uniseptata*	CBS 413.67^{T}	CMW 23678; CPC 2391; IMI 299577	B116	***Ca. uniseptata***	CBS 413.67^{T}	*Paphiopedilum callosum*	Celle, Germany	W. Gerlach	GQ280451; GQ267379; GQ267248; GQ280573; GQ280695; N/A; GQ267307; GQ267208	Lombard *et al.* (2016)

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Curvicladiella cignea	CBS 109167[T]	CPC 1595; MUCL 40269	–	–	–	Decaying leaf	French Guiana	C. Decock	KM231122; KM231287; KM231461; AF220973; AY793431; KM232311; KM231867; KM232002	Decock & Crous (1998), Crous *et al.* (2006), Lombard *et al.* (2015b)
	CBS 109168	CPC 1594; MUCL 40268	–	–	–	Decaying seed	French Guiana	C. Decock	KM231121; KM231286; KM231460; KM231745; JQ666074; KM232312; KM231868; KM232003	Decock & Crous (1998), Crous *et al.* (2006), Lombard *et al.* (2015b)

[1] Codes (A1 to A169) of the 169 *Calonectria* species before revision.

[2] *Calonectria* species names before revision.

[3] AR: Amy Y. Rossman working collection; ATCC: American Type Culture Collection, Virginia, USA; CBS: Westerdijk Fungal Biodiversity Institute, Utrecht, The Netherlands; CERC: China Eucalypt Research Centre, ZhanJiang, GuangDong Province, China; CMW: Culture collection of the Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa; CPC: Pedro Crous working collection housed at Westerdijk Fungal Biodiversity Institute; HGUP: Plant Pathology Herbarium of Gui Zhou University, GuiYang 550025, China; IMI: International Mycological Institute, CABI Bioscience, Egham, Bakeham Lane, UK; LPF: Laboratorio de Patologia Florestal, Universidade Federal de Viçosa, Viçosa, Brazil; MUCL: Mycotheque, Laboratoire de Mycologie Systematique st Appliqee, I'Universite, Louvian-la-Neuve, Belgium; PPRI: Plant Protection Research Institute, Pretoria, South Africa; STE-U: Department of Plant Pathology, University of Stellenbosch, South Africa; UFV: Universidade Federal de Viçosa, Viçosa, Brazil.

[4] The isolate numbers were appeared in the phylogenetic trees in this study; T: ex-type isolates of the *Calonectria* species.

[5] Codes (B1 to B120) of the 120 *Calonectria* species after revision.

[6] The 120 *Calonectria* species after revision, species link to the key isolates including the ex-types are in bold.

[7] Key isolates of the 120 *Calonectria* species after revision.

[8] T: ex-type isolates of the *Calonectria* species after revision.

[9] *act*: actin; *cmdA*: calmodulin; *his3*: histone H3; ITS: the internal transcribed spacer regions 1 and 2 and the 5.8S gene of the ribosomal RNA; LSU: 28S large subunit RNA gene; *rpb2*: the second largest subunit of RNA polymerase; *tef1*: translation elongation factor 1-alpha; *tub2*: β-tubulin.

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[10] N/A: information are not available.

[*] Species were synonymized.

[#] Species names after synonymizing.

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Table S3. Statistics resulting from phylogenetic analyses in this study.

Dataset	No. of taxa	No. of bp[1]	Maximum parsimony						
			PIC[2]	No. of trees	Tree length	CI[3]	RI[4]	RC[5]	HI[6]
act	246	286	117	1000	424	0.45	0.948	0.427	0.55
cmdA	314	721	358	1000	1464	0.411	0.945	0.388	0.589
his3	305	498	200	1000	1488	0.275	0.901	0.248	0.725
ITS	268	705	58	1000	102	0.667	0.957	0.638	0.333
LSU	267	866	47	1000	88	0.568	0.965	0.548	0.432
rpb2	234	863	305	180	1451	0.331	0.927	0.307	0.669
tef1	316	563	292	1000	1385	0.393	0.936	0.368	0.607
tub2	285	652	305	1000	1422	0.411	0.921	0.378	0.589
act/cmdA/his3/ITS/LSU/*rpb2/tef1/tub2*	318	5154	1682	3000	8621	0.34	0.919	0.312	0.66

Dataset	Maximum likelihood							
	Subst. mode[7]	NST[8]	Rate matrix					Rates
act	HKY+I+G	2	–	–	–	–	–	Gamma
cmdA	TIM1+I+G	6	1.0000	4.4097	0.8264	0.8264	5.7643	Gamma
his3	TVM+I+G	6	0.7263	5.1655	1.3467	0.9374	5.1655	Gamma
ITS	TVMef+I+G	6	2.4645	3.8108	3.1850	0.0010	3.8108	Gamma
LSU	GTR+I+G	6	1.0101	2.6538	0.8767	0.0003	6.1137	Gamma
rpb2	K80+I+G	2	–	–	–	–	–	Gamma
tef1	GTR+I+G	6	1.0133	2.5411	1.1773	0.7365	3.2101	Gamma
tub2	TIM3+I+G	6	1.3734	5.7290	1.0000	1.3734	4.1494	Gamma
act/cmdA/his3/ITS/LSU/*rpb2/tef1/tub2*	TIM2+I+G	6	1.3999	5.0850	1.3999	1.0000	6.3778	Gamma

[1] bp = base pairs.

[2] PIC = number of parsimony informative characters.

[3] CI = consistency index.

[4] RI = retention index.

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[5] RC = rescaled consistency index.

[6] HI = homoplasy index.

[7] Subst. model = best fit substitution model.

[8] NST = number of substitution rate categories.

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Table S4. Morphological characteristics, thallism and location of ex-types of *Calonectria* species.

Code A[1]	Code B[2]	Species[3]	Vesicle		Macroconidia		Perithecial	Asci	Ascospores		Thallism[10]	Location of ex-type isolates[9]	References or source of data
			Shape[4]	Diam (µm)	Septation[5]	Average size (µm)	Colour[6]	Spore number[7]	Septation[8]	Average size (µm)			
1. *Calonectria brassicae* species complex													
A16	B12	*Calonectria brachiatica*	Clavate	5–7	1(–2)	44 × 5	N/A[11]	N/A	N/A	N/A	Putative heterothallic	South America, Colombia	Lombard *et al.* (2009), Li *et al.* (2020)
A20	B16	*Ca. brassicae*	Clavate	2–6	1	53 × 4.5	N/A	N/A	N/A	N/A	N/A	Asia, Indonesia	Crous (2002)
A29	B25	*Ca. clavata*	Narrowly clavate	2–5	1(–3)	65 × 5	Orange	8	1(–3)	44 × 5.5	Heterothallic	North America, USA	Crous (2002), Li *et al.* (2020)
A39	B34	*Ca. duoramosa*	Acicular to clavate	4–6	1	46 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A40	B35	***Ca. ecuadorae****	Clavate	3–5	1(–3)	51 × 4.5	N/A	N/A	N/A	N/A	N/A	South America, Ecuador	Crous *et al.* (2006)
A41	B35	***Ca. ecuadorensis***	Clavate	4–6	1	37 × 4	N/A	N/A	N/A	N/A	N/A	South America, Ecuador	Marin-Felix *et al.* (2017)
A53	B43	*Ca. gracilis*	Clavate	2–11	1(–3)	56 × 4.5	Red	8	1	37 × 5	Homothallic	South America, Brazil	Crous (2002), Li *et al.* (2020)
A99	B77	*Ca. octoramosa*	Clavate	4–8	1(–3)	36 × 4	N/A	N/A	N/A	N/A	N/A	South America, Ecuador	Marin-Felix *et al.* (2017)
A100	B78	*Ca. orientalis*	Clavate to broadly clavate	5–10	1	48 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Indonesia	Lombard *et al.* (2010a), Li *et al.* (2020)
A105	B82	***Ca. paraensis****	Clavate	4–6	1	42 × 5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A152	B82	***Ca. telluricola***	Clavate	3–6	1	41 × 5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A108	B83	*Ca. parvispora*	Clavate	4–8	1	29 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Marin-Felix *et al.* (2017)
A41	B84	*Ca. pauciphialidica sp. nov.*	N/A	N/A	1	29.5 × 3	N/A	N/A	N/A	N/A	N/A	South America, Ecuador	Crous *et al.* (2006), this study
A113	B88	*Ca. pini*	Clavate	4–6	1	44 × 5	N/A	N/A	N/A	N/A	N/A	South America, Colombia	Lombard *et al.* (2010a)
A118	B91	*Ca. pseudobrassicae*	Clavate	5–6	1	41 × 5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A121	B92	*Ca. pseudoecuadoriae*	Clavate	4–7	1	38 × 3.5	N/A	N/A	N/A	N/A	Putative heterothallic	South America, Ecuador	Lombard *et al.* (2016), Li *et al.* (2020)
A139	B105	*Ca. quinqueramosa*	Narrowly clavate to clavate	3–5	1	59 × 5	Orange to red to brown	8	(1–)3	40 × 6	Homothallic	South America, Brazil	Alfenas *et al.* (2015)
A141	B107	*Ca. robigophila*	Acicular to clavate	4–5	1	50 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
2. *Calonectria candelabrum* species complex													
A17	B13	*Ca. brasiliana*	Ellipsoidal to obpyriform	6–9	1	40 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	South America, Brazil	Lombard *et al.* (2016), Li *et al.* (2020)
A19	B15	*Ca. brassiana*	Ellipsoidal to narrowly obpyriform	3–7	1	53 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)

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A22	B18	*Ca. brevistipitata*	Fusiform to obpyriform	5–8	1	31 × 3.5	N/A	N/A	N/A	N/A	Heterothallic	North America, Mexico	Lombard *et al.* (2016), Li *et al.* (2020)
A25	B21	***Ca. candelabrum****	Ellipsoidal to narrowly obpyriform	5–8	1	60 × 4.5	Red-brown	8	1	48 × 5.5	Heterothallic	South America, Brazil	Viégas (1946), Crous (2002), Lombard *et al.* (2015b), Li *et al.* (2020)
A129	B21	***Ca. pseudoscoparia***	Obpyriform to ellipsoidal	6–10	1	48 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	South America, Ecuador	Lombard *et al.* (2010a), Li *et al.* (2020)
A33	B28	*Ca. colombiana*	Obpyriform to ellipsoidal	8–12	1	37 × 3	Orange to red to red-brown	8	1	34 × 4	Homothallic	South America, Colombia	Lombard *et al.* (2010b), Li *et al.* (2020)
A44	B37	*Ca. eucalypticola*	Ellipsoidal to obpyriform	5–7	1	50 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A48	B38	*Ca. fragariae*	Obpyriform to ellipsoidal	8–10	1	39 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Lopes *et al.* (2017)
A50	B40	*Ca. glaebicola*	Ellipsoidal to narrowly obpyriform	3–5	1	50 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A84	B68	*Ca. metrosideri*	Spathulate to obpyriform	5–9	1	45 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2013a)
A97	B76	*Ca. nemoricola*	Obpyriform	7–13	1	45 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A109	B85	***Ca. pauciramosa****	Obpyriform to broadly ellipsoidal	5–11	1	50 × 4.5	Orange to red-brown	8	1	35 × 6.5	Heterothallic	Africa, South Africa	Schoch *et al.* (1999), Crous (2002), Li *et al.* (2020)
A30	B85	***Ca. cliffordiicola***	Ellipsoidal to obpyriform	7–9	1	40 × 4	N/A	N/A	N/A	N/A	N/A	Africa, South Africa	Lombard *et al.* (2016)
A42	B85	***Ca. ericae***	Ellipsoidal to obpyriform	6–10	1	37 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	North America, USA	Lombard *et al.* (2016), Li *et al.* (2020)
A78	B85	***Ca. machaerinae***	Ellipsoidal to obpyriform	6–9	1	38 × 4	N/A	N/A	N/A	N/A	N/A	Oceania, New Zealand	Lombard *et al.* (2016)
A89	B85	***Ca. mossambicensis***	Obpyriform to ellipsoidal	2–8	1	42 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	Africa, Mozambique	Crous *et al.* (2013), Li *et al.* (2020)
A116	B85	***Ca. polizzii***	Obpyriform to ellipsoidal	6–9	1	37 × 4	N/A	N/A	N/A	N/A	Heterothallic	Europe, Italy	Lombard *et al.* (2010b), Li *et al.* (2020)
A143	B85	***Ca. seminaria***	Obpyriform to ellipsoidal	6–11	1	47 × 5	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A157	B85	***Ca. tetraramosa***	Obpyriform	4–10	1	48 × 5	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A169	B85	***Ca. zuluensis***	Ellipsoidal to obpyriform	6–10	1	36 × 4	Orange to red to red-brown	8	1	32 × 4	Heterothallic	Africa, South Africa	Lombard *et al.* (2010b), Li *et al.* (2020)
A112	B87	*Ca. piauiensis*	Ellipsoidal to narrowly obpyriform	3–7	1	49 × 4.5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A124	B93	*Ca. pseudometrosideri*	Ellipsoidal to obpyriform	5–7	1	51 × 4.5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A131	B99	*Ca. pseudospathulata*	Obpyriform	7–10	1	43 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A137	B103	*Ca. putriramosa*	Ellipsoidal to obpyriform	7–9	1	43 × 5	N/A	N/A	N/A	N/A	Putative heterothallic	South America, Brazil	Lombard *et al.* (2016), Li *et al.* (2020)
A144	B109	*Ca. silvicola*	Obpyriform	7–10	1	41 × 4.5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)

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A146	B111	***Ca. spathulata****	Ellipsoidal to obpyriform or clavate	6–10	(1–)3(–6)	80 × 6	Orange	4–8	(1–)3	50 × 5.5	Homothallic	South America, Brazil	Crous & Kang (2001), Crous (2002)
A148	B111	***Ca. stipitata***	Ellipsoidal to obpyriform	7–11	1	32 × 4	N/A	N/A	N/A	N/A	N/A	South America, Colombia	Lombard *et al.* (2016)
A167	B119	*Ca. venezuelana*	Fusiform to ovoid to ellipsoidal	5–9	1	58 × 5	N/A	N/A	N/A	N/A	N/A	South America, Venezuela	Lombard *et al.* (2016)
3. *Calonectria colhounii* species complex													
A3	B3	*Ca. aciculata*	Acicular to clavate	2–5	3	69 × 5.5	N/A	N/A	N/A	N/A	Homothallic	Asia, China	Li *et al.* (2017, 2020)
A32	B27	*Ca. colhounii*	Clavate	3–4	(1–)3	65 × 5	Bright yellow	4	(1–)3	55 × 6	Homothallic	Asia, Mauritius	Peerally (1973), Crous (2002)
A43	B36	***Ca. eucalypti****	Broadly clavate	4–6	3	72 × 6	Yellow to orange to brown	4	(1–)3	33 × 6	Homothallic	Asia, Indonesia	Lombard *et al.* (2010a), Li *et al.* (2020)
A120	B36	***Ca. pseudocolhounii***	Clavate	3.5–6	(1–)3	60 × 4.5	Bright yellow to orange	4	(1–)3	56 × 6.5	Homothallic	Asia, China	Chen *et al.* (2011), Li *et al.* (2020)
A49	B39	***Ca. fujianensis****	Clavate	3–5	(1–)3	52.5 × 4	Bright yellow to orange	4	(1–)3	55.5 × 6.8	Homothallic	Asia, China	Chen *et al.* (2011), Li *et al.* (2020)
A98	B39	***Ca. nymphaeae***	Clavate	3–5	3–4	61 × 5.9	Orange to red to red-brown	4	2–3	66 × 6	Homothallic	Asia, China	Xu *et al.* (2012)
A60	B47	*Ca. honghensis*	Clavate	2.5–5.5	3	54 × 5.5	Yellow to orange	4	3	49 × 6	Homothallic	Asia, China	Li *et al.* (2017, 2020)
A67	B53	*Ca. indusiata*	Narrowly clavate	3–6	(1–)3	81 × 6	Orange to red to red-brown	8	(1–)3	53 × 7	Homothallic	Asia, Sri lanka	Crous (2002)
A76	B62	*Ca. lichi*	Clavate	3.5–5.5	3	65.7 × 6	N/A	N/A	N/A	N/A	Homothallic	Asia, China	Liu & Chen (2017), Li *et al.* (2020)
A79	B64	***Ca. macroconidialis****	Clavate	3–5	(1–)3(–4)	90 × 6.5	Dull yellow	(2–)4	(1–)3	55 × 6	Heterothallic	Africa, South Africa	Crous *et al.* (1999); Crous (2002)
A107	B64	***Ca. parva***	Narrowly clavate	3–5	(1–)3	72 × 6	N/A	N/A	N/A	N/A	N/A	Africa, South Africa	Lombard *et al.* (2016)
A80	B65	*Ca. madagascariensis*	Clavate	3–4	(1–)3	55 × 4.5	Bright yellow	8	(1–)3	50 × 5.5	Homothallic	Africa, Madagascar	Crous (2002)
A88	B70	*Ca. monticola*	Broadly clavate	4–6	3	49 × 5	N/A	N/A	N/A	N/A	N/A	Asia, Thailand	Crous *et al.* (2015)
A104	B81	*Ca. paracolhounii*	Narrowly clavate	3–5	3	41 × 5	N/A	N/A	N/A	N/A	N/A	North America, USA	Lombard *et al.* (2016)
4. *Calonectria cylindrospora* species complex													
A11	B9	*Ca. auriculiformis*	Ellipsoidal to fusiform to obpyriform	6–12	1	43 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Vietnam	Pham *et al.* (2019), Li *et al.* (2020)
A18	B14	***Ca. brasiliensis****	Ellipsoidal to obpyriform	7–11	1	38 × 3.5	N/A	N/A	N/A	N/A	Putative heterothallic	South America, Brazil	Lombard *et al.* (2010b), Li *et al.* (2020)
A59	B14	***Ca. hodgesii***	Pyriform to ellipsoidal or ovoid to sphaeropedunculate	6–11	1	50 × 4.5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2013b)
A122	B14	***Ca. pseudohodgesii***	Clavate (rarely), ellipsoidal to obpyriform	4–10	1	54 × 4.5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A26	B22	***Ca. cerciana****	Fusiform to obpyriform	8–13	1	44 × 5	N/A	N/A	N/A	N/A	N/A	Asia, China	Lombard *et al.* (2010c)

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A103	B22	***Ca. papillata***	Obpyriform to ellipsoidal with papillate apex	8–14	1	45 × 4	Orange to orange-brown	8	1	36 × 6	Homothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A155	B22	***Ca. terrestris***	Obpyriform to pyriform to broadly clavate	5–12	1	38.5 × 4.5	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A37	B32	***Ca. cylindrospora****	Ellipsoidal to pyriform or clavate	6–8	1	45 × 4	Yellow to orange to red-brown	(2–)8	1	37 × 6	Heterothallic	Europe, Italy	Crous (2002), Lombard *et al.* (2015a)
A15	B32	***Ca. blephiliae***	Clavate to ellipsoidal	7–10	1	50 × 4.5	N/A	N/A	N/A	N/A	Putative heterothallic	North America, USA	Crous *et al.* (2013), Li *et al.* (2020)
A56	B44	***Ca. hawksworthii****	Ellipsoidal to clavate	6–9	1	56 × 4	N/A	N/A	N/A	N/A	N/A	Africa, Mauritius	Crous (2002)
A47	B44	***Ca. foliicola***	Obpyriform to ellipsoidal	6–13	1	47 × 5	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A149	B44	***Ca. sulawesiensis***	Broadly clavate to ellipsoidal	5–7	1	48 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Indonesia	Lombard *et al.* (2010a), Li *et al.* (2020)
A68	B54	*Ca. insularis*	Obpyriform to broadly ellipsoidal	4–13	1	45 × 4	Orange to red	8	1	33 × 6	Heterothallic	Africa, Madagascar	Schoch *et al.* (1999), Crous (2002)
A70	B56	*Ca. lageniformis*	Lageniform to ellipsoidal	6–10	1	40 × 5	N/A	N/A	N/A	N/A	N/A	Africa, Mauritius	Lombard *et al.* (2016)
A83	B67	*Ca. maranhensis*	Ellipsoid, obpyriform to sphaeropedunculate	7–11	1	57 × 5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A114	B89	*Ca. plurilateralis*	Obpyriform to ellipsoidal	7–11	1	34 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	South America, Ecuador	Lombard *et al.* (2016), Li *et al.* (2020)
A117	B90	***Ca. propaginicola****	Ellipsoidal, obpyriform to sphaeropedunculate	5–12	1	49 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A119	B90	***Ca. pseudocerciana***	Obpyriform to sphaeropedunculate	7–12	1	45 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A158	B115	*Ca. tonkinensis*	Ellipsoidal to obpyriform	3–7	1	41.5 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Vietnam	Pham *et al.* (2019), Li *et al.* (2020)
A165	B118	*Ca. variabilis*	Sphaeropendunculate to ovoid or ellipsoidal to clavate	6–11	(1–)3(–4)	73 × 5	Red-brown	8	1(–3)	42 × 5	Homothallic	South America, Brazil	Crous *et al.* (1993b), Crous (2002)
5. *Calonectria gracilipes* species complex													
A8	B7	*Ca. angustata*	Narrowly clavate	2–3	(1–)7–10(–12)	110 × 10	N/A	N/A	N/A	N/A	N/A	North America, USA	Crous *et al.* (2000), Crous (2002)
A52	B42	*Ca. gracilipes*	Clavate	3–4	1	45 × 4.5	Orange	8	1	35 × 6.5	Homothallic	South America, Colombia	Crous *et al.* (1997a), Crous (2002)
A63	B50	*Ca. hurae*	Narrowly clavate	3–5	(1–)7(–8)	120 × 7.5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Crous (2002)
A74	B60	*Ca. leguminum*	Narrowly clavate	2–3	(1–)3–5(–6)	60 × 5	Orange to red-brown	8	(1–)3	70 × 6.5	Homothallic	South America, Brazil	Figueiredo & Namekata (1967), Crous (2002)
A142	B108	*Ca. rumohrae*	Narrowly clavate	(3–)4–5	5(–7)	110 × 9	Orange-brown to brown	8	3–6(–9)	90 × 6.5	Homothallic	North America, Panama	El-Gholl *et al.* (1997), Crous (2002)
6. *Calonectria kyotensis* species complex													

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A4	B4	***Ca. aconidialis****	N/A	N/A	N/A	N/A	Orange to orange-brown	8	1	36 × 6	Homothallic	Asia, China	Lombard *et al.* (2015a)
A9	B4	***Ca. arbusta***	Sphaeropedunculate	7–13	1	45 × 5	Orange to orange-brown	8	1	38 × 7	Homothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A45	B4	***Ca. expansa***	Sphaeropedunculate	8–16	1	52 × 5	Orange to orange-brown	8	1	39 × 6	Homothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A54	B4	***Ca. guangxiensis***	Sphaeropedunculate	11–14	1	47 × 5	Orange to orange-brown	8	1	36 × 6	Homothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A55	B4	***Ca. hainanensis***	Sphaeropedunculate	7–14	1	46 × 5	Orange to orange-brown	8	1	34 × 6	Homothallic	Asia, China	Lombard *et al.* (2015a)
A81	B4	***Ca. magnispora***	Sphaeropedunculate	9–18	1	52 × 5	Orange to orange-brown	8	1	40 × 6	Homothallic	Asia, China	Lombard *et al.* (2015a)
A106	B4	***Ca. parakyotensis***	Sphaeropedunculate	10–14	1	44 × 5	N/A	N/A	N/A	N/A	Homothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A115	B4	***Ca. pluriramosa***	Sphaeropedunculate	6–13	1	47 × 5	N/A	N/A	N/A	N/A	N/A	Asia, China	Lombard *et al.* (2015a)
A123	B4	***Ca. pseudokyotensis***	Pyriform to sphaeropedunculate	10–13	1	48 × 6	N/A	N/A	N/A	N/A	N/A	Asia, China	Lombard *et al.* (2015a)
A147	B4	***Ca. sphaeropedunculata***	Sphaeropedunculate	10–14	1	46 × 5	Orange to orange-brown	8	1	37 × 6	Homothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A5	B5	*Ca. aeknauliensis*	Sphaeropedunculate	6–13	1	47 × 5	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Indonesia	Pham *et al.* (2019), Li *et al.* (2020)
A10	B8	*Ca. asiatica*	Sphaeropedunculate	12–17	1	53 × 5	Orange to orange-brown	8	1	33 × 6	Homothallic	Asia, Thailand	Crous *et al.* (2004)
A21	B17	*Ca. brassicicola*	Sphaeropedunculate	3–5	1	42 × 5	N/A	N/A	N/A	N/A	N/A	Asia, Indonesia	Lombard *et al.* (2016)
A23	B19	*Ca. bumicola*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Homothallic	Asia, Indonesia	Pham *et al.* (2019), Li *et al.* (2020)
A24	B20	***Ca. canadiana****	Pyriform to sphaeropedunculate	6–10	1	50 × 4	N/A	N/A	N/A	N/A	N/A	North America, Canada	Kang *et al* (2001b), Crous (2002)
A87	B20	***Ca. montana***	Pyriform to sphaeropedunculate	4–12.5	1	43.2 × 4.6	N/A	N/A	N/A	N/A	N/A	Asia, China	Liu & Chen (2017)
A27	B23	***Ca. chinensis****	Sphaeropedunculate	6–9	1	45 × 4	N/A	N/A	N/A	N/A	N/A	Asia, China	Crous *et al.* (2004)
A94	B23	***Ca. multistipitata***	Sphaeropedunculate	5–10	1	32 × 3.5	N/A	N/A	N/A	N/A	N/A	Asia, Vietnam	Pham *et al.* (2019)
A31	B26	*Ca. cochinchinensis*	Sphaeropedunculate	7–11	1	46 × 4	N/A	N/A	N/A	N/A	N/A	Asia, Vietnam	Pham *et al.* (2019)
A34	B29	*Ca. colombiensis*	Sphaeropedunculate	7–12	1(–3)	53 × 4.5	Orange to orange-brown	8	1	33 × 5	Homothallic	South America, Colombia	Crous *et al.* (2004), Li *et al.* (2020)
A36	B31	***Ca. curvispora****	Sphaeropedunculate	5–10	1(–3)	60 × 5	N/A	N/A	N/A	N/A	Putative heterothallic	Africa, Madagascar	Victor *et al.* (1997), Crous (2002), Li *et al.* (2020)
A166	B31	***Ca. vegrandis***	Sphaeropedunculate	2–4	1	41 × 4.5	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Indonesia	Pham *et al.* (2019), Li *et al.* (2020)

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A58	B46	*Ca. heveicola*	Sphaeropedunculate	7–10	1	44.5 × 4	Orange to orange-brown	8	1	34 × 5	Heterothallic	Asia, Vietnam	Pham *et al.* (2019), Li *et al.* (2020)
A61	B48	*Ca. hongkongensis*	Sphaeropedunculate	8–14	1	46.5 × 4	Orange to red-brown	8	1	31 × 6	Homothallic	Asia, China	Crous *et al.* (2004), Li *et al.* (2020)
A64	B51	*Ca. ilicicola*	Sphaeropedunculate	6–12	(1–)3	62 × 6	Orange to red	8	1(–3)	45 × 6	Homothallic	Asia, Indonesia	Boedijn & Reitsma (1950), Alfieri *et al.* (1982), Crous (2002)
A65	B52	*Ca. indonesiae*	Sphaeropedunculate	7–9	1	50.5 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Indonesia	Crous *et al.* (2004), Li *et al.* (2020)
A69	B55	***Ca. kyotensis****	Globose	8.8–19	1	41 × 4	Orange to red to red-brown	8	1	29 × 6	Homothallic	Asia, Japan	Terashita (1968), Sobers (1972), Crous (2002)
A46	B55	***Ca. floridana***	Globose to subglobose	8.3–17.9	1	46 × 4.3	Orange to reddish brown	8	1	36.6 × 7.1	Homothallic	North America, USA	Sobers & Seymour (1967), Sobers (1969), Crous (2002)
A132	B55	***Ca. pseudoturangicola***	Sphaeropedunculate	4.5–12	1	40 × 3.5	Orange to orange-brown	8	1(–3)	31 × 6.5	Homothallic	Asia, China	Li *et al.* (2017, 2020)
A162	B55	***Ca. turangicola***	Sphaeropedunculate	8–12	1	44 × 4	N/A	N/A	N/A	N/A	Homothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A71	B57	*Ca. lantauensis*	Sphaeropedunculate	7.5–17.5	1	55 × 5	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, China	Li *et al.* (2017, 2020)
A72	B58	*Ca. lateralis*	Sphaeropedunculate	9–13	1	39 × 4	N/A	N/A	N/A	N/A	Homothallic	Asia, China	Lombard *et al.* (2015a), Li *et al.* (2020)
A82	B66	*Ca. malesiana*	Sphaeropedunculate to globose	8–15	1	47.5 × 4	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Indonesia	Crous *et al.* (2004), Li *et al.* (2020)
A102	B80	*Ca. pacifica*	Sphaeropedunculate	7–15	1	55 × 4.5	N/A	N/A	N/A	N/A	N/A	North America, USA	Kang *et al.* (2001b), Crous (2002)
A110	B86	*Ca. penicilloides*	N/A	N/A	3	33-62 × 4-6	N/A	N/A	N/A	N/A	N/A	Asia, Japan	Tubaki (1958), Crous (2002)
A150	B112	***Ca. sumatrensis****	Sphaeropedunculate	8–13	1	58 × 5	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Indonesia	Crous *et al.* (2004), Li *et al.* (2020)
A66	B112	***Ca. indonesiana***	Sphaeropedunculate	8–10	1	43 × 5	N/A	N/A	N/A	N/A	N/A	Asia, Indonesia	Lombard *et al.* (2016)
A151	B113	*Ca. syzygiicola*	Sphaeropedunculate	3–6	1	45 × 5	N/A	N/A	N/A	N/A	N/A	Asia, Indonesia	Lombard *et al.* (2016)
A163	B116	*Ca. uniseptata*	Globose	8.2–20.4	1	N/A	Orange to reddish brown	N/A	2–3	41.5 × 6.3	N/A	Europe, Germany	Gerlach (1968), Sobers (1972)
A168	B120	***Ca. yunnanensis****	Sphaeropedunculate	2–4.5	1	43 × 4.5	Orange to orange-brown	8	1(–3)	36 × 6	Homothallic	Asia, China	Li *et al.* (2017, 2020)
A135	B120	***Ca. pseudoyunnanensis***	Sphaeropedunculate	2.5–5	1	47.5 × 5	N/A	N/A	N/A	N/A	Homothallic	Asia, China	Li *et al.* (2017, 2020)
7. *Calonectria mexicana* species complex													
A13	B11	*Ca. avesiculata*	Acicular to clavate	1–4	1(–3)	64 × 5	Orange to red	8	1(–3)	40 × 6	Heterothallic	North America, USA	Schubert *et al.* (1989), Crous (2002)

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A28	B24	*Ca. citri*	Narrowly ellipsoidal to pyriform or obovoid to sphaeropedunculate	4–10	(1–)3	58 × 4	N/A	N/A	N/A	N/A	N/A	North America, USA	Crous (2002)
A73	B59	*Ca. lauri sp. nov.*	Obpyriform to ellipsoidal	5–10	(1–)3	60 × 5.5	Yellow to brownish-yellow	8	3	73 × 7.5	Homothallic	Europe, Netherlands	Lechat *et al.* (2010), Li *et al.* (2020)
A75	B61	*Ca. leucothoes*	Ellipsoidal to obpyriform	6–11.5	(1–)3(–6)	73 × 5	N/A	N/A	N/A	N/A	Heterothallic	North America, USA	El-Gholl *et al.* (1989), Crous (2002), Li *et al.* (2020)
A85	B69	*Ca. mexicana*	Broadly ellipsoidal with papillate apex	7–12	1	45 × 4	Orange to red	8	1	50 × 5.5	Heterothallic	North America, Mexico	Schoch *et al.* (1999), Crous (2002)
A125	B94	***Ca. pseudomexicana****	Fusiform to broadly ellipsoidal, with papillate apex	9–14	1	45 × 5	N/A	N/A	N/A	N/A	Putative heterothallic	Africa, Tunisia	Lombard *et al.* (2011), Li *et al.* (2020)
A161	B94	***Ca. tunisiana***	Fusiform to broadly ellipsoidal, with papillate apex	8–14	1	49 × 5	N/A	N/A	N/A	N/A	N/A	Africa, Tunisia	Lombard *et al.* (2011)
A133	B100	*Ca. pseudouxmalensis*	Obpyriform to ellipsoidal, sometimes with a papillate apex	5–9	1	29 × 3	N/A	N/A	N/A	N/A	Putative heterothallic	North America, Mexico	Lombard *et al.* (2016), Li *et al.* (2020)
A164	B117	*Ca. uxmalensis*	Obpyriform to ellipsoidal, sometimes with a papillate apex	5–8	1	30 × 3	N/A	N/A	N/A	N/A	N/A	North America, Mexico	Lombard *et al.* (2016)
8. *Calonectria naviculata* species complex													
A57	B45	*Ca. henricotiae*	Naviculate	3.8–10.9	1	56 × 5.6	N/A	N/A	N/A	N/A	Heterothallic	Europe, Belgium	Gehesquiere *et al.* (2015), Li *et al.* (2020)
A90	B71	*Ca. multilateralis*	Naviculate	4–8	1	33 × 3	N/A	N/A	N/A	N/A	N/A	North America, Mexico	Lombard *et al.* (2016)
A91	B72	*Ca. multinaviculata*	Naviculate	4–7	1	46 × 3.5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A92	B73	*Ca. multiphialidica*	Clavate to sphaeropedunculate	8–16	1	53 × 4.5	N/A	N/A	N/A	N/A	N/A	Africa, Cameroon	Crous *et al.* (2004)
A95	B75	*Ca. naviculata*	Naviculate to ellipsoidal	5–11	1	45 × 3	Red-brown	2–8	3	40 × 5	Heterothallic	South America, Brazil	Crous *et al.* (1997a), Crous (2002), Li *et al.* (2020)
A126	B95	*Ca. pseudonaviculata*	Naviculate	4–8	1(–3)	60 × 5	N/A	N/A	N/A	N/A	Heterothallic	Oceania, New Zealand	Crous *et al.* (2002), Li *et al.* (2020)
9. *Calonectria pteridis* species complex													
A6	B6	***Ca. amazonica****	Clavate	5–6	1(–3)	79 × 5	N/A	N/A	N/A	N/A	Heterothallic	South America, Brazil	Lombard *et al.* (2016), Li *et al.* (2020)
A7	B6	***Ca. amazoniensis***	Clavate	5–7	1	69 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Lombard *et al.* (2016)
A77	B6	***Ca. longiramosa***	Clavate	5–8	1	71 × 5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Marin-Felix *et al.* (2017)
A159	B6	***Ca. tropicalis***	Clavate	5–6	1(–3)	80 × 5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Lombard *et al.* (2016)
A51	B41	*Ca. gordoniae*	Narrowly clavate	3–6	1(–3)	62 × 5	N/A	N/A	N/A	N/A	N/A	North America, USA	Leahy *et al.* (2000), Crous (2002)

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A101	B79	***Ca. ovata****	Ovate	8–14	1(–3)	70 × 5	Orange to red-brown	8	1–3(–7)	60 × 5.5	Heterothallic	South America, Brazil	El-Gholl *et al.* (1993a), Crous (2002), Li *et al.* (2020)
A96	B79	***Ca. nemoralis***	Fusiform to ovoid	7–9	1	53 × 4	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Marin-Felix *et al*. (2017)
A153	B79	***Ca. tereticornis***	Fusiform to ovoid	8–14	1	59 × 5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Lombard *et al.* (2016)
A160	B79	***Ca. tucuruiensis***	Fusiform to ovoid	9–12	1	63 × 5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Marin-Felix *et al*. (2017)
A127	B96	*Ca. pseudopteridis*	Clavate	5.4–7.5	1	87.5 × 5.7	N/A	N/A	N/A	N/A	Putative heterothallic	North America, USA	Sobers (1968), Alfenas *et al.* (2015), Li *et al.* (2020)
A134	B101	*Ca. pseudovata*	Fusiform, ovate to ellipsoidal	8–12	1	69 × 5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Alfenas *et al.* (2015)
A136	B102	*Ca. pteridis*	Clavate to narrowly ellipsoidal	4–6	1(–3)	82 × 5.5	Red-brown	8	1(–3)	52 × 6	N/A	North America, USA	Crous *et al.* (1993c), Crous (2002)
A156	B114	*Ca. terricola*	Fusiform to ovoid	8–12	1	46 × 4.5	N/A	N/A	N/A	N/A	N/A	South America, Brazil	Lombard *et al.* (2016)
10. *Calonectria reteaudii* species complex													
A1	B1	*Ca. acaciicola*	Narrowly clavate	4–7	5	94 × 7	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Vietnam	Pham *et al.* (2019), Li *et al.* (2020)
A2	B2	*Ca. acicola*	Narrowly clavate	N/A	5–7	75 × 7	Red to red-brown	8	3–4	70 × 6	Homothallic	Oceania, New Zealand	Gadgil & Dick (2004), Lombard *et al.* (2010a)
A12	B10	*Ca. australiensis*	Clavate	3.5–6	(1–)3	63 × 6.5	N/A	N/A	N/A	N/A	N/A	Oceania, Australia	Crous *et al.* (2006)
A35	B30	*Ca. crousiana*	Clavate	4–6	(1–)3	64 × 5	Orange to red-brown	8	(1–)3	64 × 7	Homothallic	Asia, China	Chen *et al.* (2011), Li *et al.* (2020)
A154	B63	*Ca. lombardiana sp. nov.*	Narrowly clavate	2–4	5	80 × 6	N/A	N/A	N/A	N/A	N/A	Oceania, Australia	Lombard *et al.* (2010c), this study
A93	B74	*Ca. multiseptata*	N/A	N/A	N/A	N/A	Orange to orange-red	8	(1–)3–6(–9)	70 × 6.5	Homothallic	Asia, Indonesia	Crous (2002)
A128	B97	***Ca. pseudoreteaudii****	Narrowly clavate	3–5	5–8	104 × 8	N/A	N/A	N/A	N/A	Heterothallic	Asia, China	Lombard *et al.* (2010c), Li *et al.* (2020)
A86	B97	***Ca. microconidialis***	Narrowly clavate	3–7	4–6(–7)	88 × 8	N/A	N/A	N/A	N/A	N/A	Asia, China	Lombard *et al.* (2015a)
A111	B97	***Ca. pentaseptata***	Narrowly clavate	2–6	5(–8)	98 × 7	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Vietnam	Crous *et al.* (2012), Li *et al.* (2020)
A138	B104	***Ca. queenslandica****	Narrowly clavate	3–4	4–6	69 × 6	N/A	N/A	N/A	N/A	N/A	Oceania, Australia	Lombard *et al.* (2010c)
A154	B104	***Ca. terrae-reginae***	Narrowly clavate	3–5	4–6	76 × 6	N/A	N/A	N/A	N/A	N/A	Oceania, Australia	Lombard *et al.* (2010c)
A140	B106	***Ca. reteaudii****	Clavate	3–6	(1–)5(–6)	84 × 6.5	Orange to red-brown	8	(1–)3(–5)	70 × 5.5	Heterothallic	Asia, Vietnam	Kang *et al.* (2001a), Crous (2002)
A14	B106	***Ca. baviensis***	Narrowly clavate	3–6	5	96 × 6.5	N/A	N/A	N/A	N/A	Putative heterothallic	Asia, Vietnam	Pham *et al.* (2019), Li *et al.* (2020)
11. *Calonectria spathiphylli* species complex													
A38	B33	*Ca. densa*	Ovoid to ellipsoidal to sphaeropedunculate	10–12	1	54 × 6	N/A	N/A	N/A	N/A	Putative heterothallic	South America, Ecuador	Lombard *et al.* (2010a), Li *et al.* (2020)

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A62	B49	*Ca. humicola*	Globose to ovoid to sphaeropedunculate	10–12	1	51 × 5	N/A	N/A	N/A	N/A	N/A	South America, Ecuador	Lombard *et al.* (2010a)
A130	B98	*Ca. pseudospathiphylli*	Sphaeropedunculate to ellipsoidal	8–12	1(–3)	52 × 4	Orange to red	8	1(–3)	42 × 5.5	Homothallic	South America, Ecuador	Kang *et al.* (2001b), Crous (2002)
A145	B110	*Ca. spathiphylli*	Globoid or ellipsoidal to obpyriform	8–15	1(–3)	70 × 6	Orange to red	2–8	1(–3)	45 × 5	Heterothallic	North America, USA	El-Gholl *et al.* (1992), Crous (2002)

[1] A: Represent the codes of the 169 *Calonectria* species before revision.

[2] B: Represent the codes of the 120 *Calonectria* species after revision.

[3] Synonymous species were marked in bold and blue, and the * indicated the species after synonymy.

[4] Vesicle shape within *Calonectria* genus were mainly divided into six categories and marked in different colour: clavate or narrowly clavate vesicle/light green, naviculate vesicle/green, ellipsoidal to obpyriform vesicle/dark green, ellipsoidal vesicle with papillate apex/yellow, sphaeropedunculate vesicle/orange; species complexes with varied vesicle shapes were not marked in any colour.

[5] Macroconidial septation within *Calonectria* genus were divided into three categories and marked in three colour: 1-septate/light green, 3-septate/green, > 3-septate/dark green.

[6] Perithecia colour within *Calonectria* genus were mainly divided into two categories and marked in two colour: orange to red-brown perithecia/light green, yellow perithecia/green.

[7] Number of ascospores produced in ascus within *Calonectria* genus were mainly divided into three categories and marked in different colour: 4-spored asci/light green, 8-spored asci/green, not 4-spored or 8-spored asci were not marked in any colour.

[8] Ascospores septation within *Calonectria* genus were mainly divided into three categories and marked in three colour: 1-septate/light green, 3-septate/green, > 3-septate/dark green.

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[9] The ex-type isolates of *Calonectria* spp. collected from six continents were marked in six different colour: Africa/light green, Asia/green, Europe/dark green, North America/yellow, Oceania/orange, South America/dark orange.

[10] The mating system of *Calonectria* spp. were marked in two colour: heterothallic or putative heterothallic/light green, homothallic/green.

[11] N/A: information are not available.

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Table S5. Identification success rates based on phylogenetic analyses for separate and combined DNA barcodes.

Genus or species complex code	Genus or species complex name	Species numbers and Identification success rates	Combination of eight genes[1]	Each of eight DNA barcodes[2]							
				act	*cmdA*	*his3*	ITS	LSU	*rpb2*	*tef1*	*tub2*
genus	*Calonectria* genus	Number of species (A)	120	89	118	113	99	98	88	119	111
		Number of identified species (B)	120	55	96	85	29	27	64	106	98
		Identification success rates (B/A)%	100%	61.8%	81.4%	75.2%	29.3%	27.6%	72.7%	89.1%	88.3%
1	*Ca. brassicae* species complex	Number of species (A)	16	9	16	15	11	11	11	16	16
		Number of identified species (B)	16	2	10	9	2	1	5	11	12
		Identification success rates (B/A)%	100%	22.2%	62.5%	60.0%	18.2%	9.1%	45.5%	68.8%	75.0%
2	*Ca. candelabrum* species complex	Number of species (A)	18	9	18	18	9	9	8	18	18
		Number of identified species (B)	18	5	12	10	0	2	3	14	11
		Identification success rates (B/A)%	100%	55.6%	66.7%	55.6%	0.0%	22.2%	37.5%	77.8%	61.1%
3	*Ca. colhounii* species complex	Number of species (A)	11	9	11	9	11	11	10	11	11
		Number of identified species (B)	11	5	9	7	4	2	6	11	11
		Identification success rates (B/A)%	100%	55.6%	81.8%	77.8%	36.4%	18.2%	60.0%	100.0%	100%
4	*Ca. cylindrospora* species complex	Number of species (A)	12	7	12	11	10	10	10	12	12
		Number of identified species (B)	12	4	10	6	2	0	8	12	10
		Identification success rates (B/A)%	100%	57.1%	83.3%	54.5%	20.0%	0.0%	80.0%	100.0%	83.3%
5	*Ca. gracilipes* species complex	Number of species (A)	5	5	5	5	5	5	4	5	5
		Number of identified species (B)	5	5	5	5	3	2	4	5	5
		Identification success rates (B/A)%	100%	100%	100%	100%	60.0%	40.0%	100%	100%	100%
6	*Ca. kyotensis* species complex	Number of species (A)	24	22	23	22	22	22	19	24	17
		Number of identified species (B)	24	13	23	22	6	6	16	24	17
		Identification success rates (B/A)%	100%	59.1%	100.0%	100.0%	27.3%	27.3%	84.2%	100.0%	100.0%
7	*Ca. mexicana* species complex	Number of species (A)	8	8	8	8	8	8	7	8	7
		Number of identified species (B)	8	8	6	5	3	6	5	6	7
		Identification success rates (B/A)%	100%	100.0%	75.0%	62.5%	37.5%	75.0%	71.4%	75.0%	100.0%
8	*Ca. naviculata* species complex	Number of species (A)	6	3	6	6	5	4	4	5	6

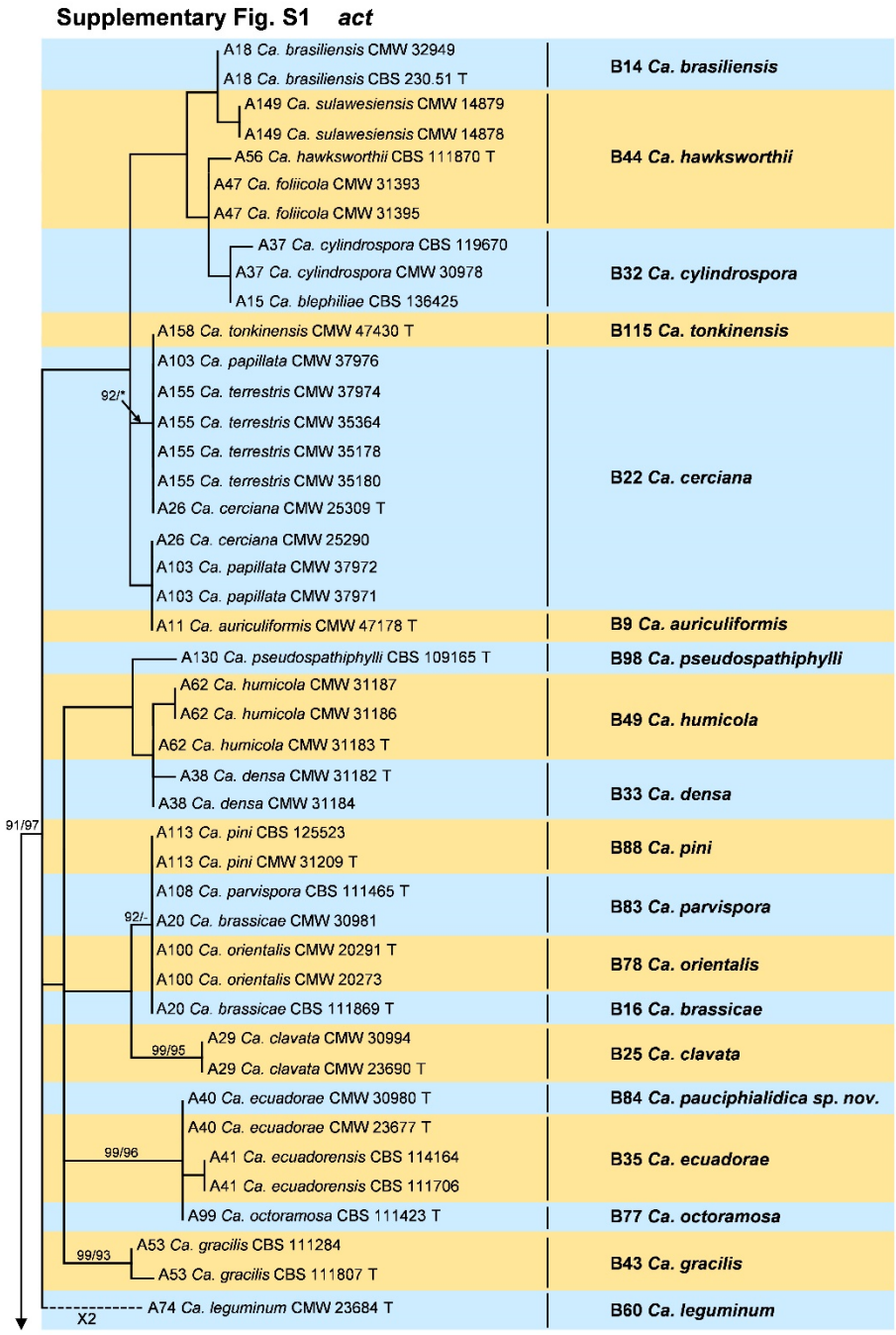
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		Number of identified species (B)	6	3	6	6	1	3	4	5	6
		Identification success rates (B/A)%	100%	100%	100%	100.0%	20.0%	75.0%	100%	100%	100%
9	*Ca. pteridis* species complex	Number of species (A)	7	5	6	6	5	5	4	7	6
		Number of identified species (B)	7	3	6	4	1	3	4	7	6
		Identification success rates (B/A)%	100%	60.0%	100.0%	66.7%	20.0%	60.0%	100%	100.0%	100%
10	*Ca. reteaudii* species complex	Number of species (A)	9	9	9	9	9	9	9	9	9
		Number of identified species (B)	9	4	5	7	5	2	7	7	9
		Identification success rates (B/A)%	100%	44.4%	55.6%	77.8%	55.6%	22.2%	77.8%	77.8%	100%
11	*Ca. spathiphylli* species complex	Number of species (A)	4	3	4	4	4	4	2	4	4
		Number of identified species (B)	4	3	4	4	2	0	2	4	4
		Identification success rates (B/A)%	100%	100.0%	100.0%	100.0%	50.0%	0.0%	100%	100%	100%

[1] Combination of eight genes: *act*. *cmdA*. *his3*. ITS. LSU. *rpb2*. *tef1* and *tub2*.

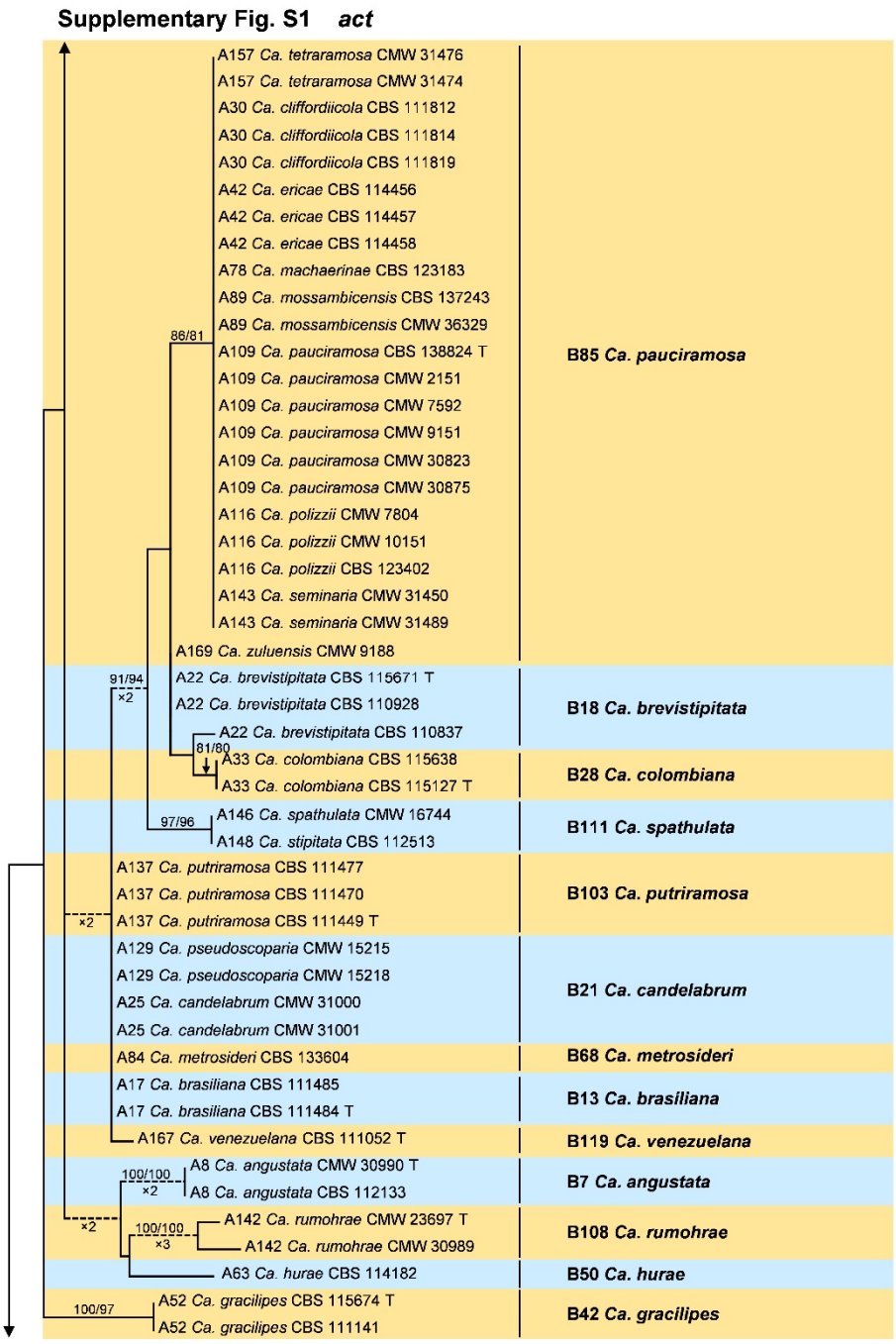
[2] Four of the most successful barcodes within *Calonectria* and each species complex were marked in colour; different colours indicate identification success rates in different ranges, 80% ≤ (B/A)% in orange, 70% ≤ (B/A)% < 80% in dark green, 60% ≤ (B/A)% < 70% in light green, 50% ≤ (B/A)% < 60% in dark blue.

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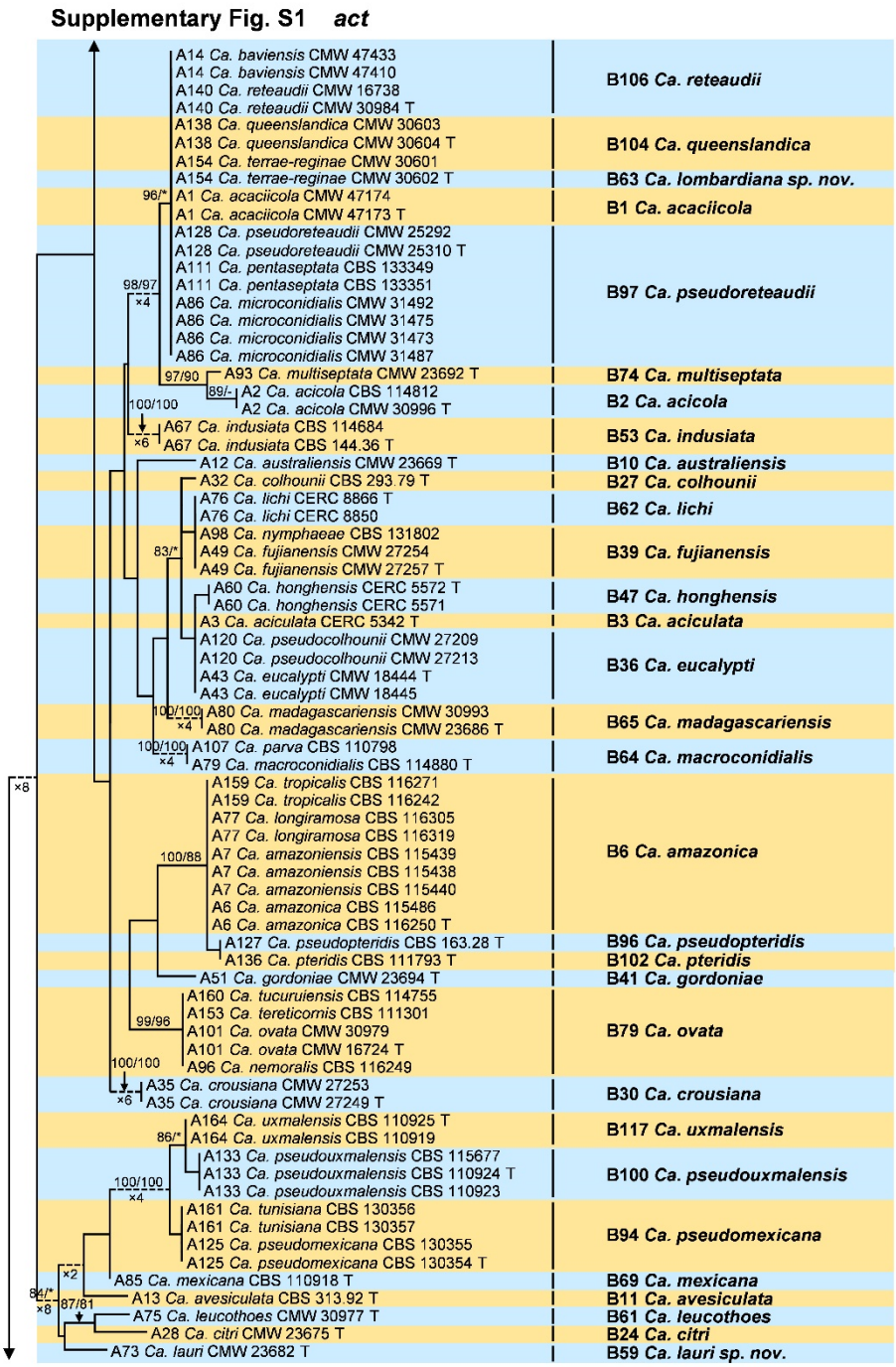
Supplementary Fig. S1. Phylogenetic tree of the genus *Calonectria* based on maximum likelihood (ML) analyses of *act* gene region. Codes A1 to A169 showed the 169 *Calonectria* species before their taxonomic reconsideration in this study, codes B1 to B120 indicated the 120 accepted *Calonectria* species after the revision emerging from this study. Bootstrap values ≥ 80 % for ML and MP analyses are presented at the branches. Bootstrap values lower than 80 % are marked with "*", and absent analyses values are marked with "-". Ex-type isolates of *Calonectria* species after revision, are marked with "T". The tree is rooted to *Curvicladiella cignea* (CBS 109167, and CBS 109168).

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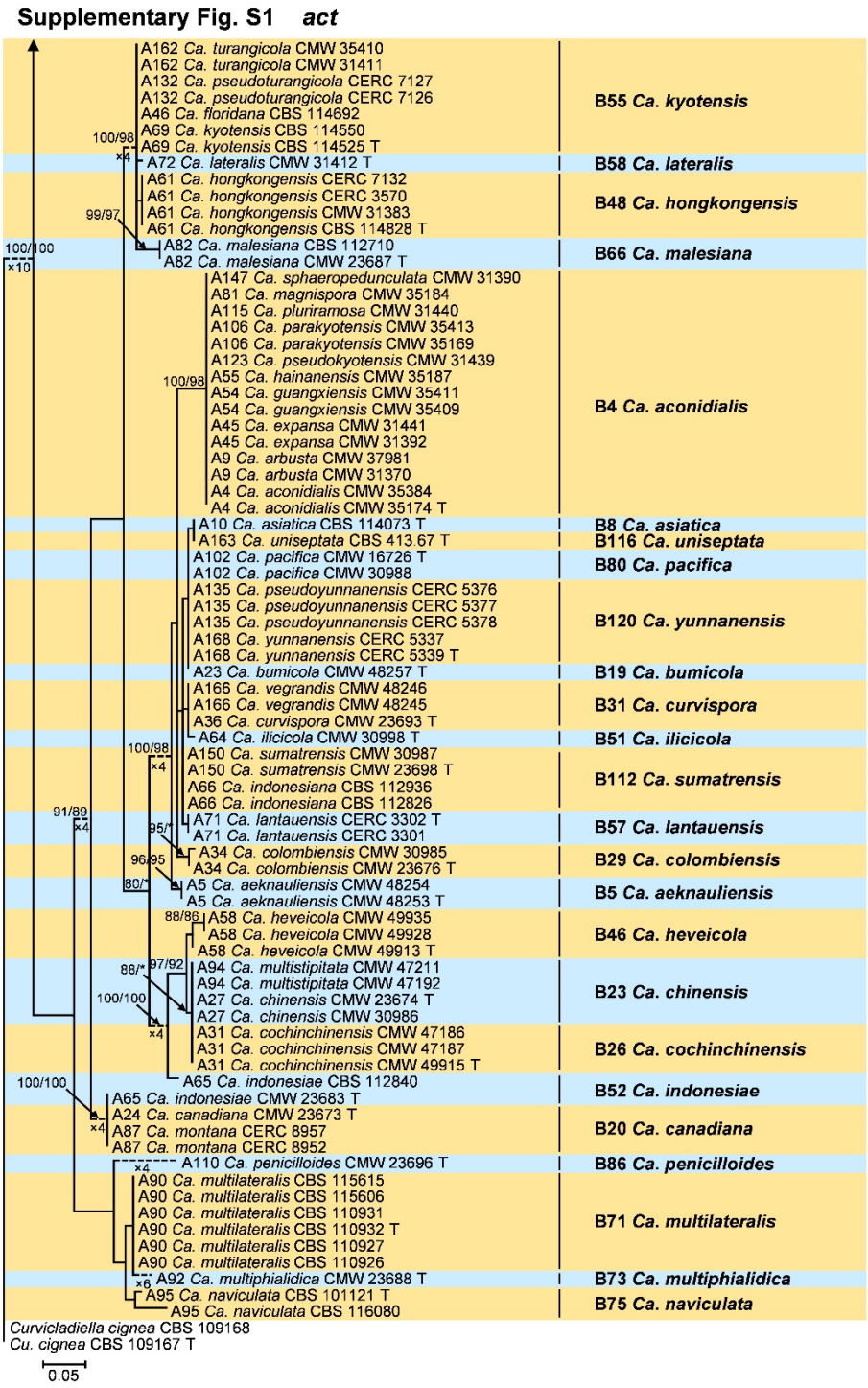
Supplementary Fig. S1. (Continued).

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Supplementary Fig. S1. (Continued).

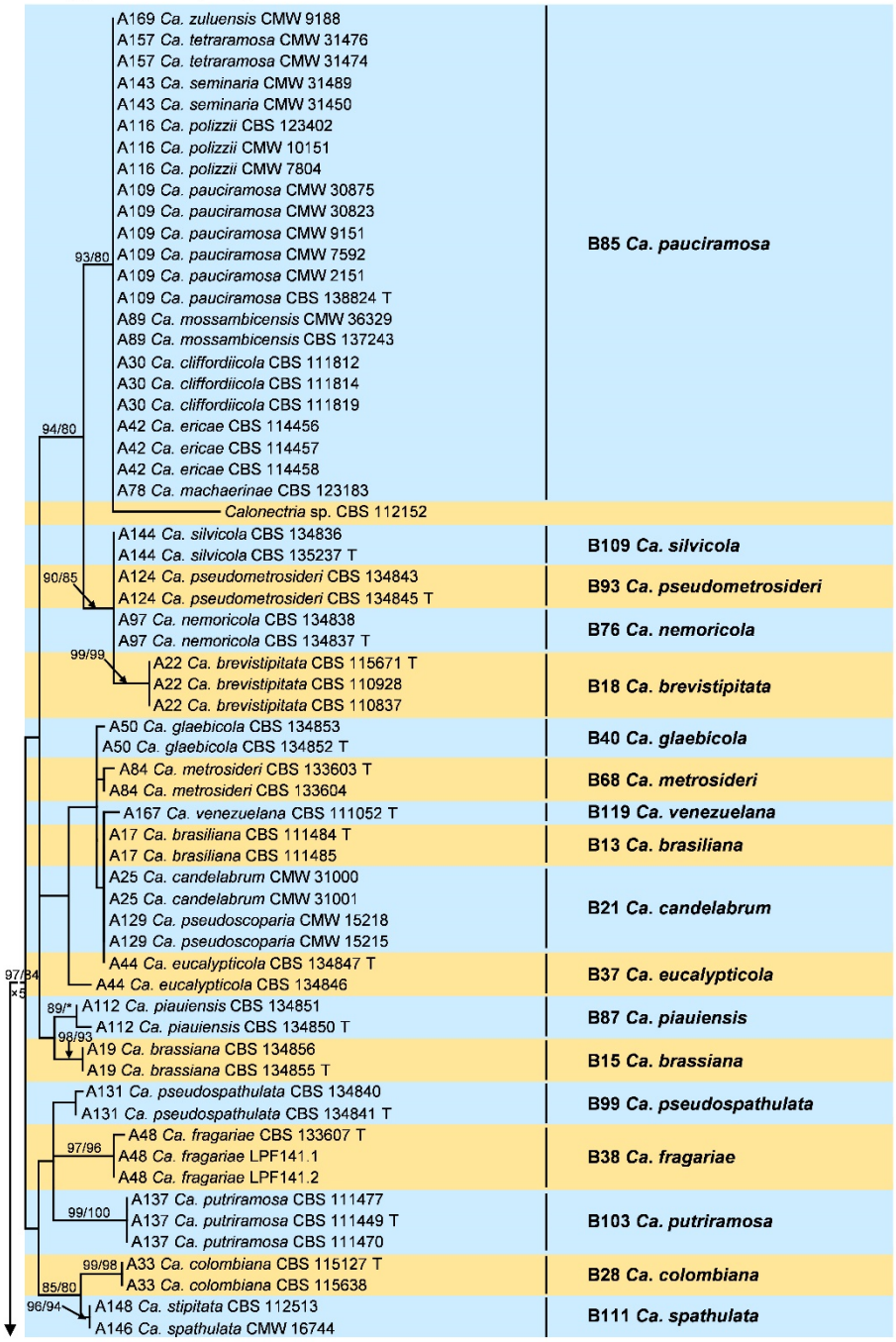
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Supplementary Fig. S1. (Continued).

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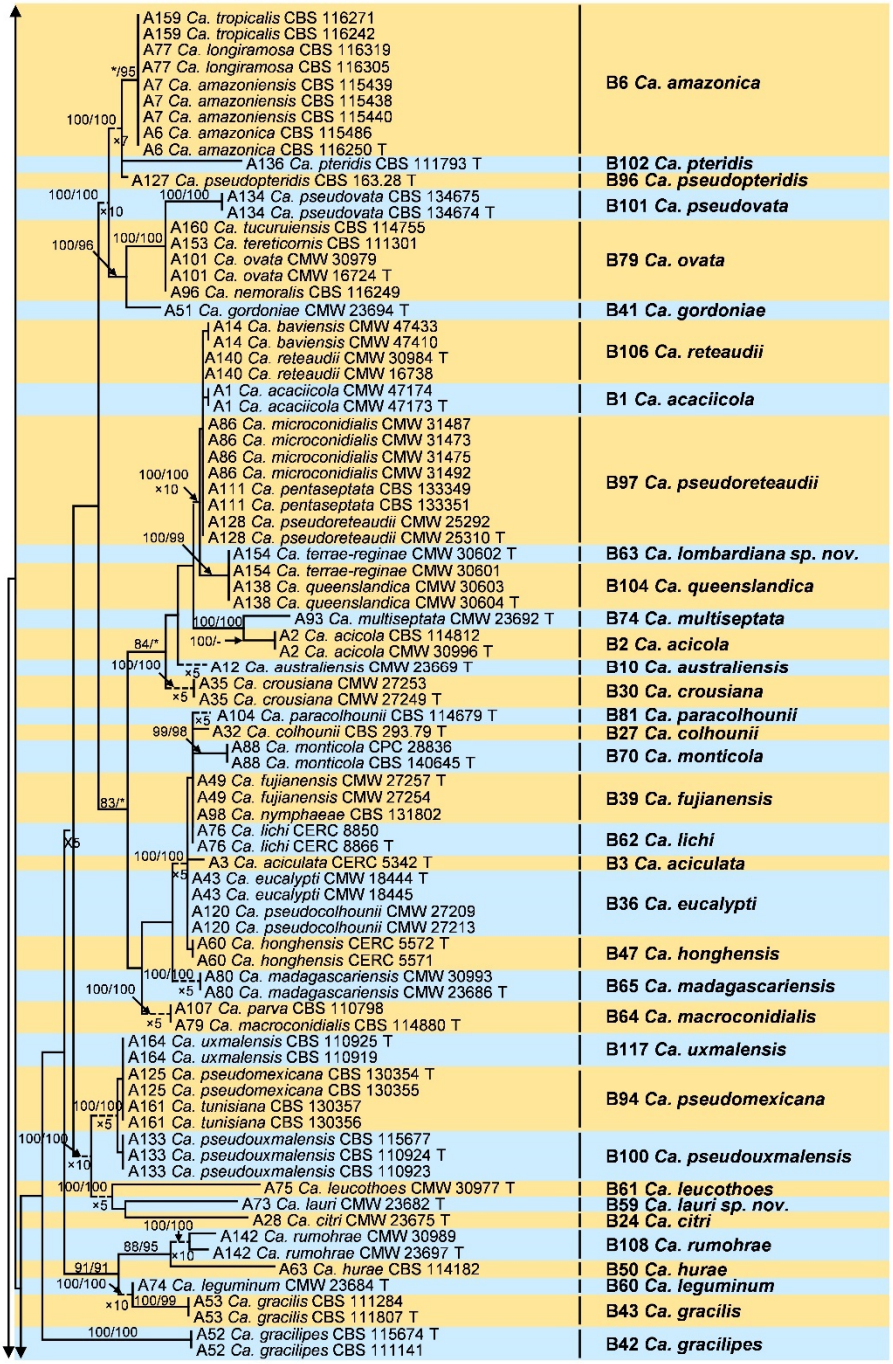
Supplementary Fig. S2 ***cmdA***



Supplementary Fig. S2. Phylogenetic tree of the genus *Calonectria* based on maximum likelihood (ML) analyses of *cmdA* gene region. Codes A1 to A169 showed the 169 *Calonectria* species before their taxonomic reconsideration in this study, codes B1 to B120 indicated the 120 accepted *Calonectria* species after the revision emerging from this study. Bootstrap values ≥ 80 % for ML and MP analyses are presented at the branches. Bootstrap values lower than 80 % are marked with "*", and absent analyses values are marked with "-". Ex-type isolates of *Calonectria* species after revision, are marked with "T". The tree is rooted to *Curvicladiella cignea* (CBS 109167, and CBS 109168).

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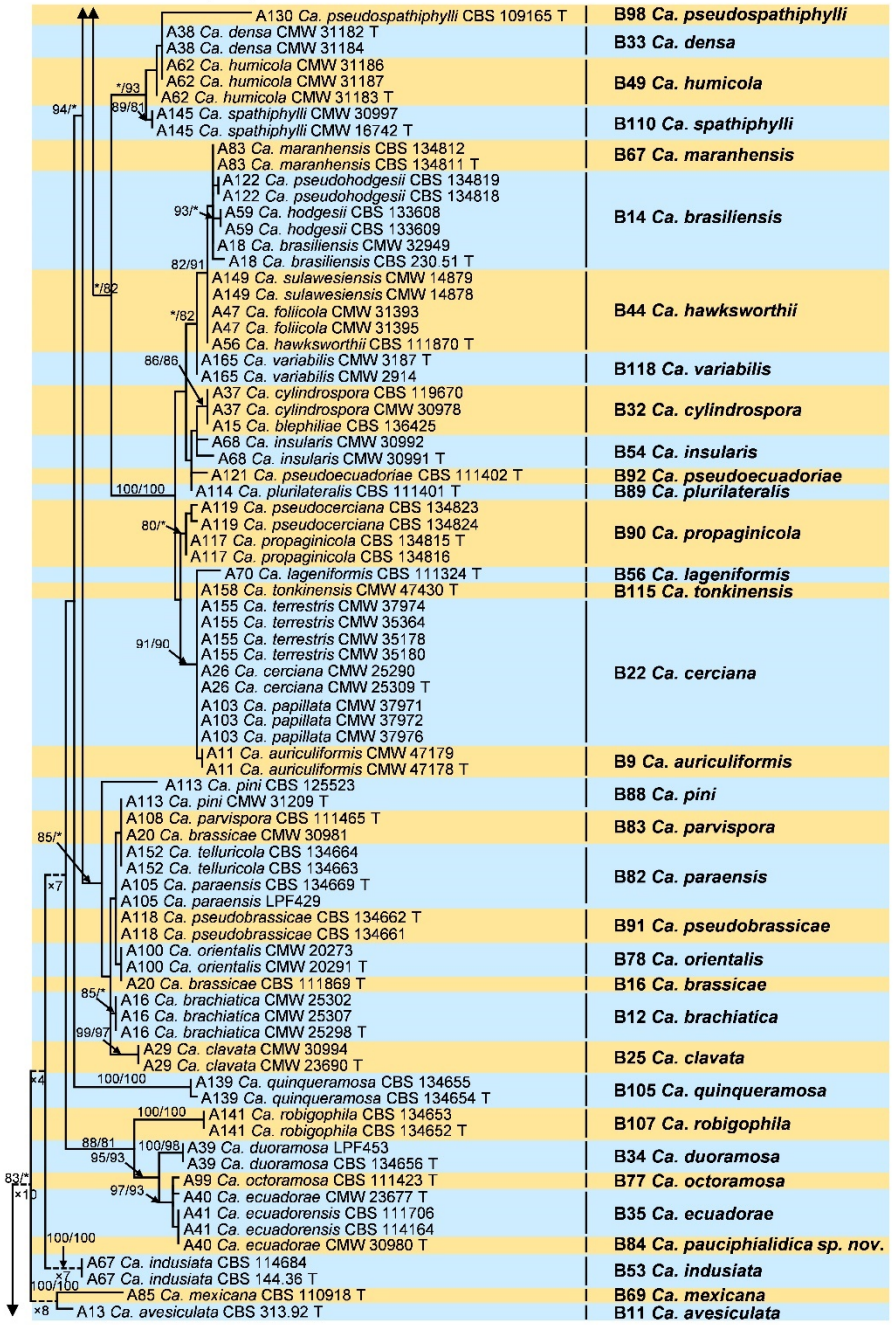
Supplementary Fig. S2 ***cmdA***



Supplementary Fig. S2. (Continued).

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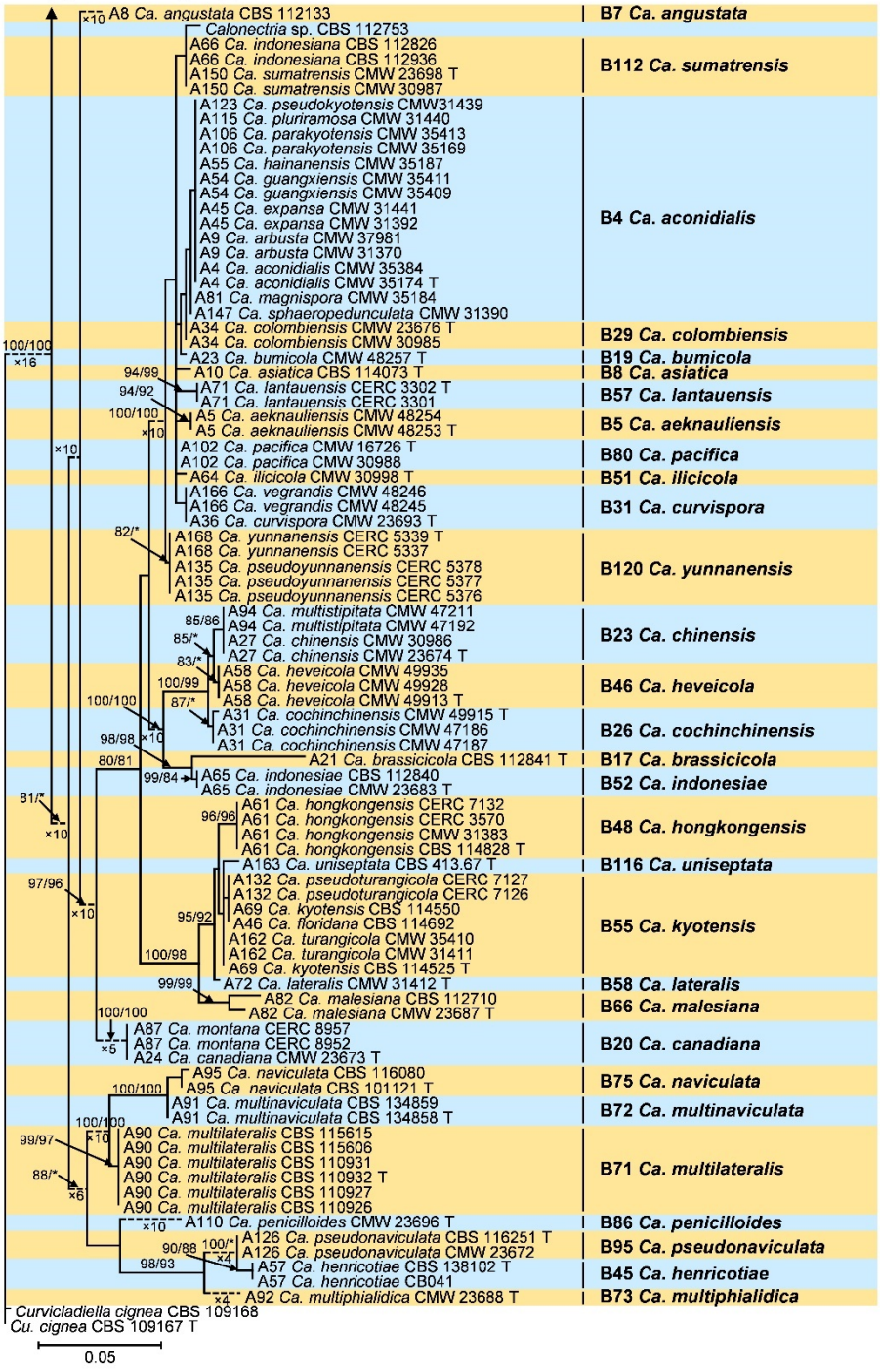
Supplementary Fig. S2 ***cmdA***



Supplementary Fig. S2. (Continued).

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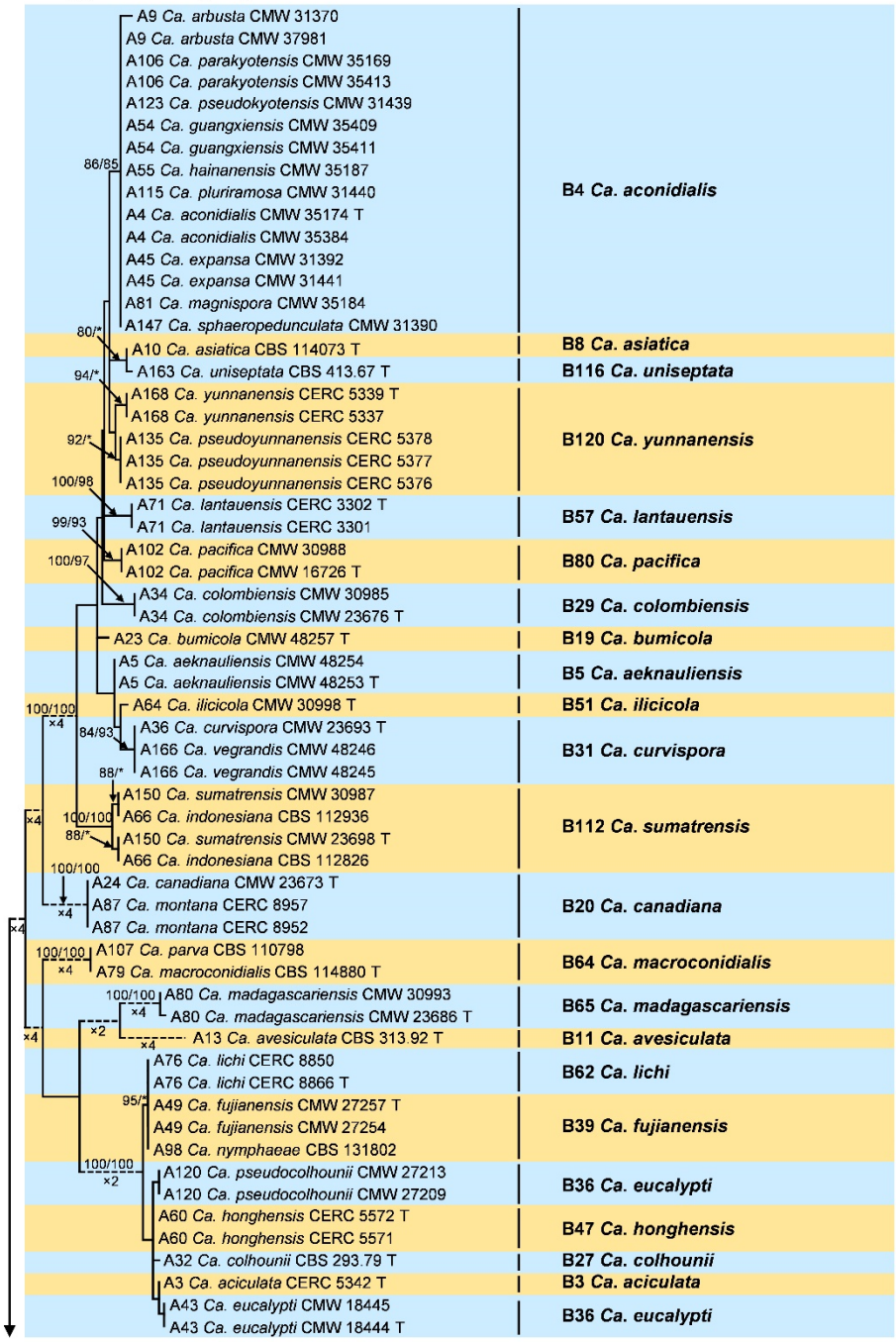
Supplementary Fig. S2 ***cmdA***



Supplementary Fig. S2. (Continued).

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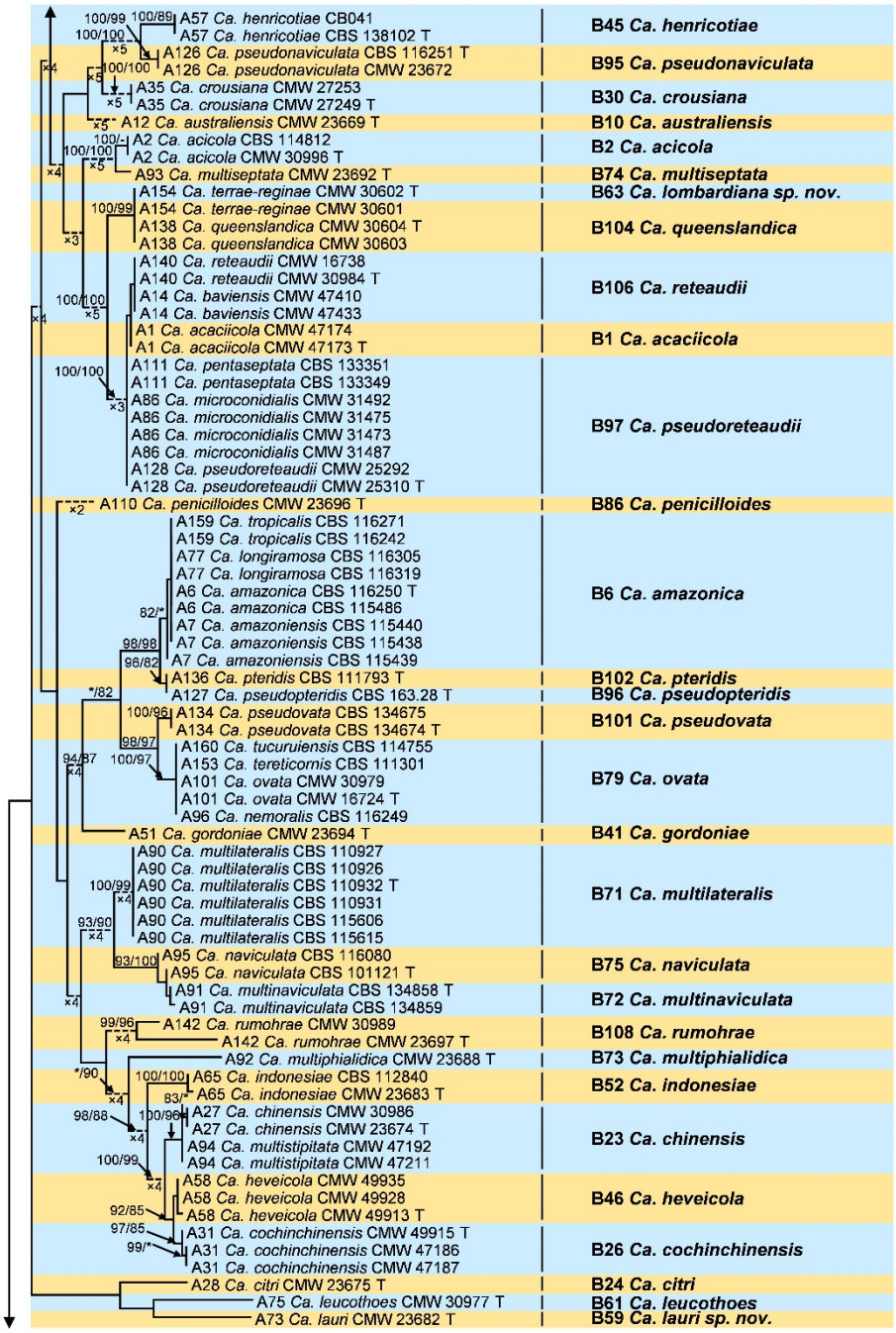
Supplementary Fig. S3 ***his3***



Supplementary Fig. S3. Phylogenetic tree of the genus *Calonectria* based on maximum likelihood (ML) analyses of *his3* gene region. Codes A1 to A169 showed the 169 *Calonectria* species before their taxonomic reconsideration in this study, codes B1 to B120 indicated the 120 accepted *Calonectria* species after the revision emerging from this study. Bootstrap values ≥ 80 % for ML and MP analyses are presented at the branches. Bootstrap values lower than 80 % are marked with "*", and absent analyses values are marked with "-". Ex-type isolates of *Calonectria* species after revision, are marked with "T". The tree is rooted to *Curvicladiella cignea* (CBS 109167, and CBS 109168).

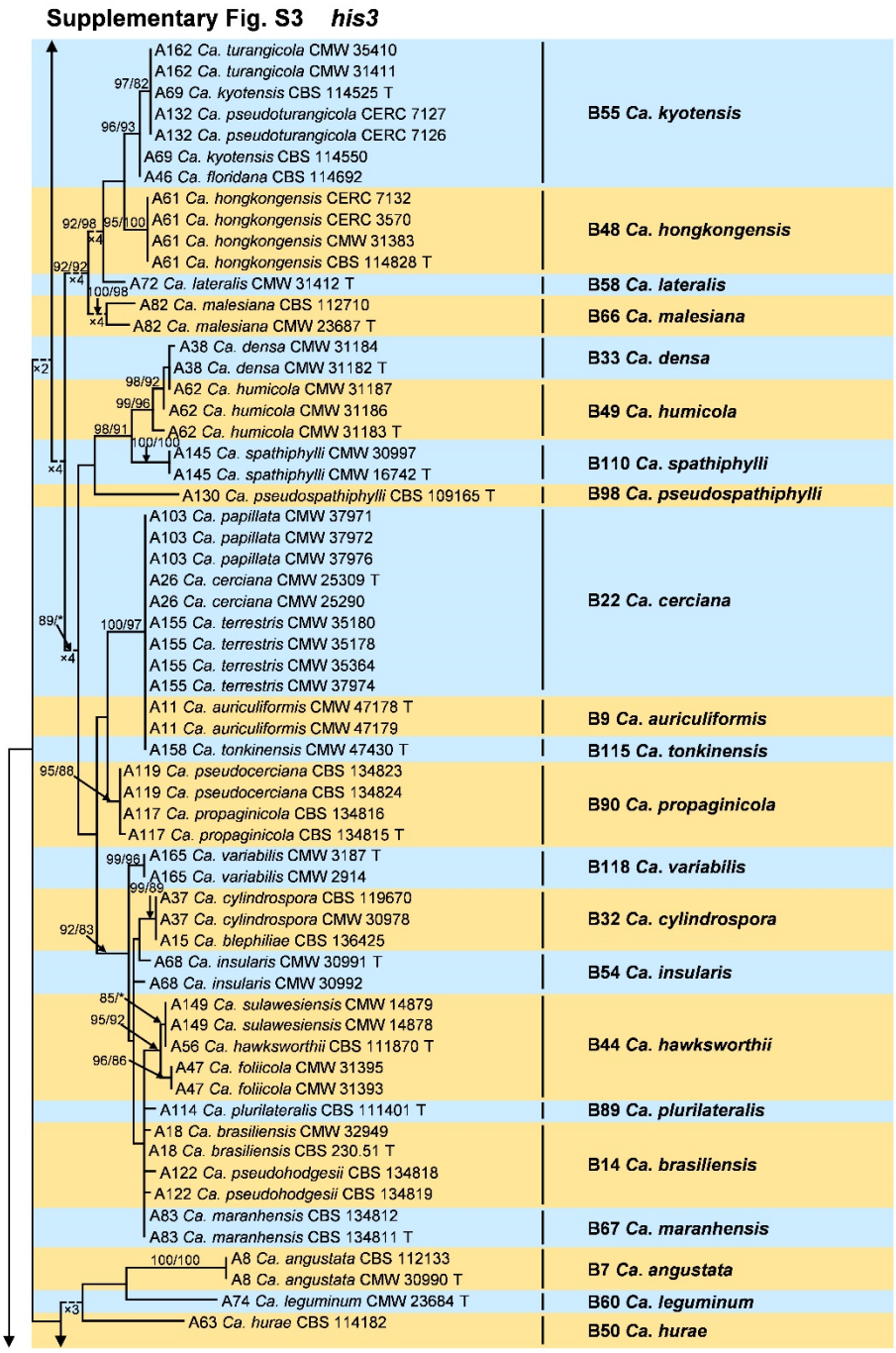
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Supplementary Fig. S3 ***his3***



Supplementary Fig. S3. (Continued).

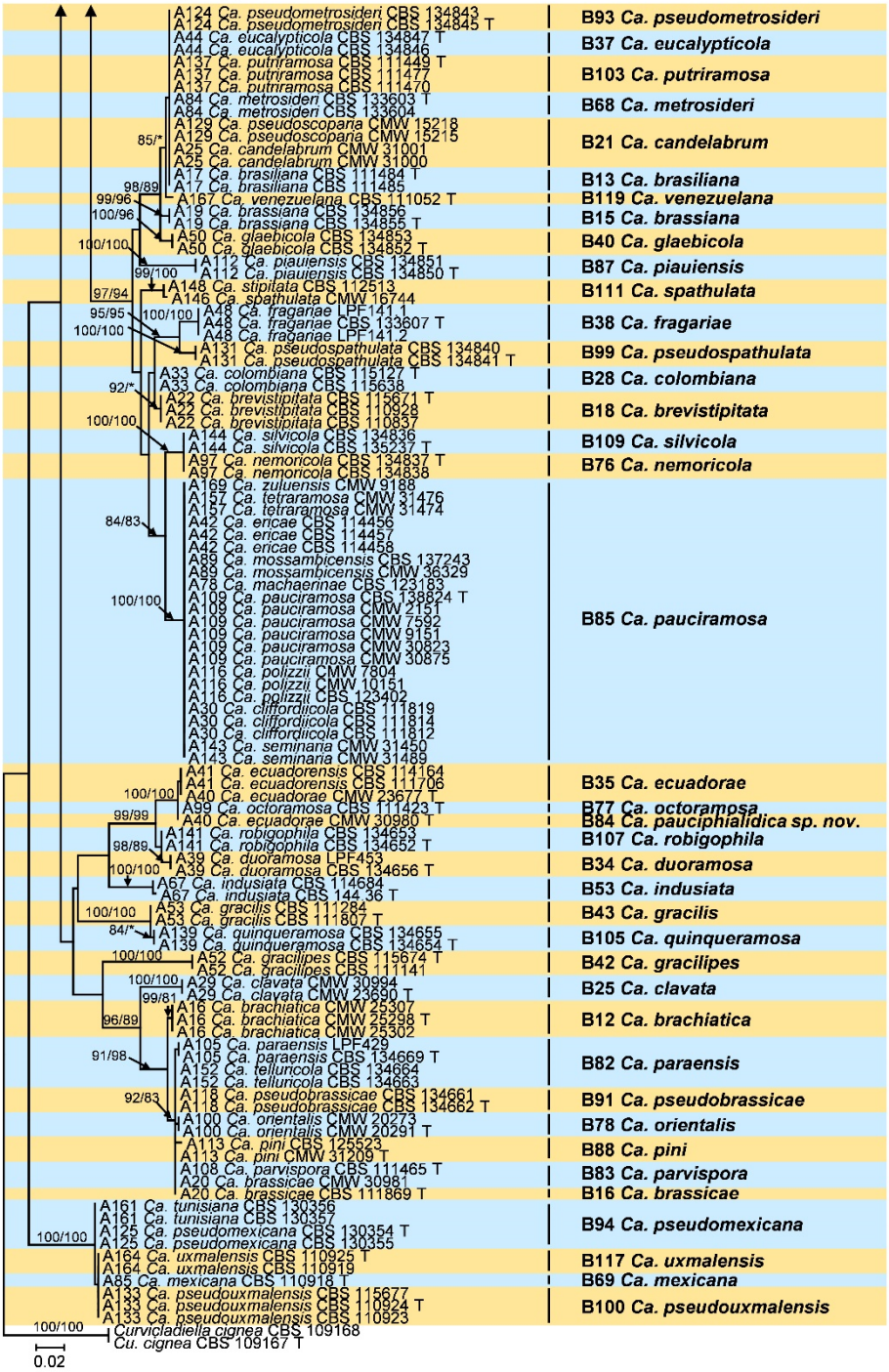
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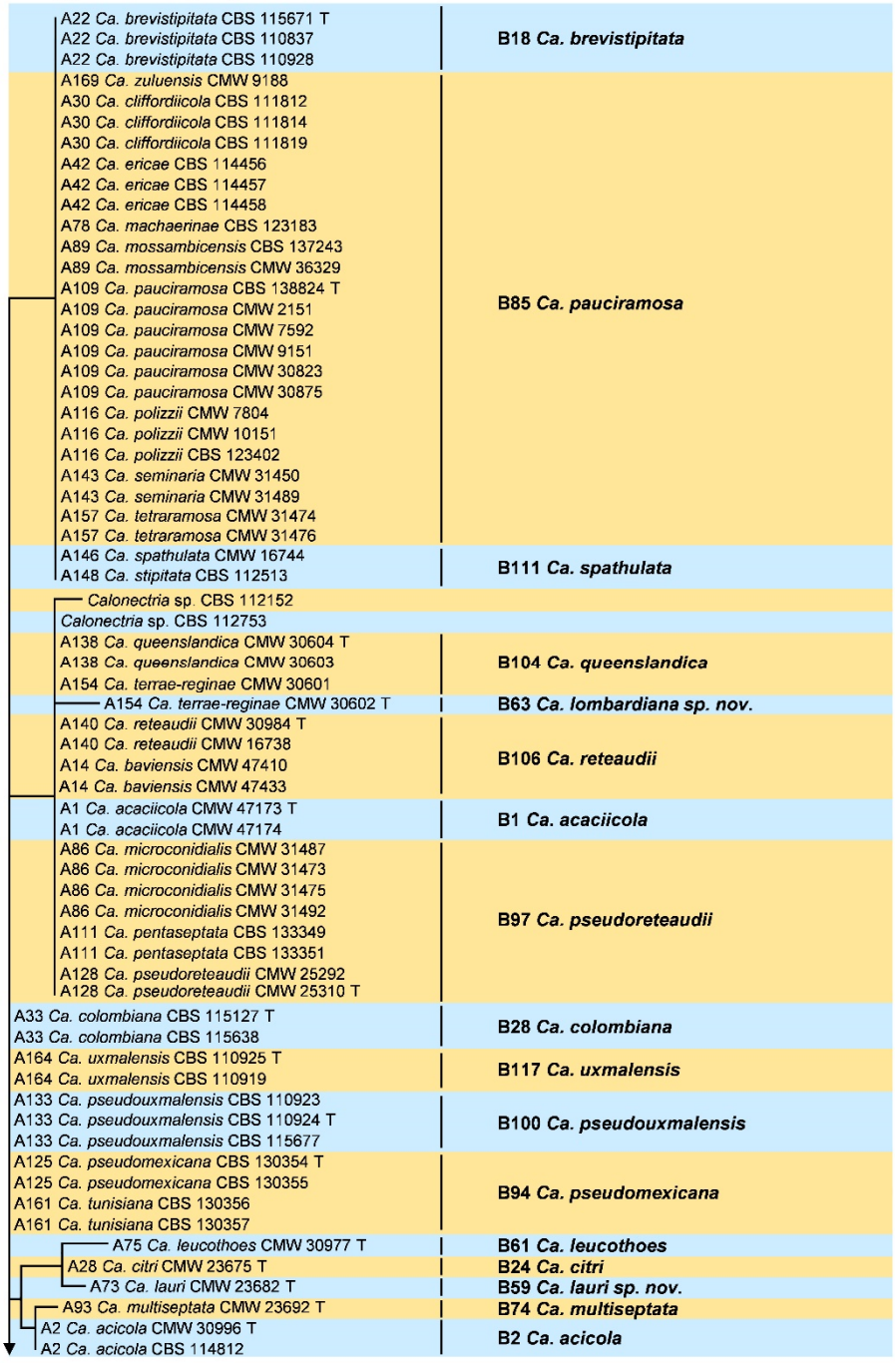
Supplementary Fig. S3 ***his3***



Supplementary Fig. S3. (Continued).

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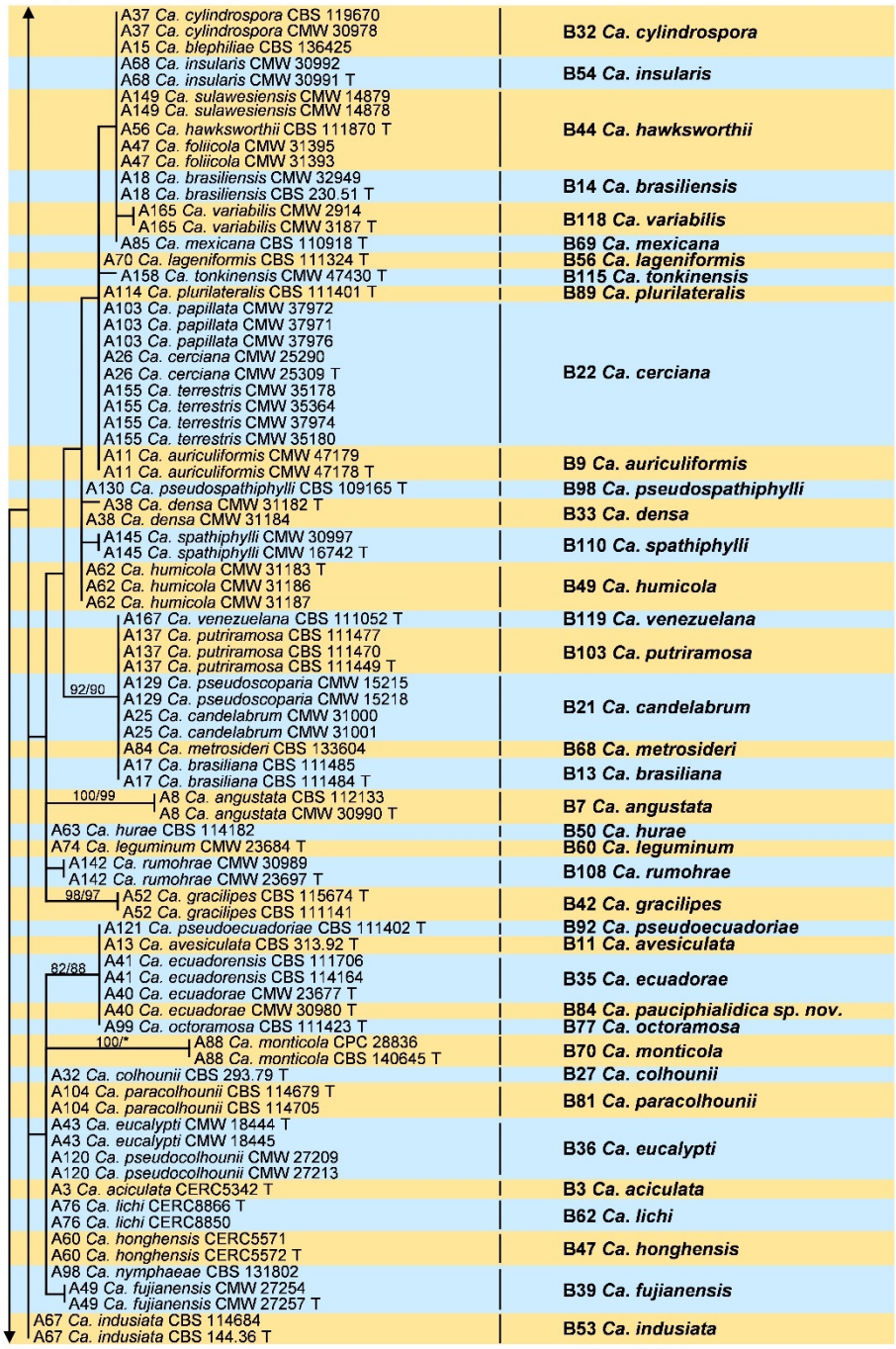
Supplementary Fig. S4 ITS



Supplementary Fig. S4. Phylogenetic tree of the genus *Calonectria* based on maximum likelihood (ML) analyses of ITS region. Codes A1 to A169 showed the 169 *Calonectria* species before their taxonomic reconsideration in this study, codes B1 to B120 indicated the 120 accepted *Calonectria* species after the revision emerging from this study. Bootstrap values ≥ 80 % for ML and MP analyses are presented at the branches. Bootstrap values lower than 80 % are marked with "*", and absent analyses values are marked with "-". Ex-type isolates of *Calonectria* species after revision, are marked with "T". The tree is rooted to *Curvicladiella cignea* (CBS 109167, and CBS 109168).

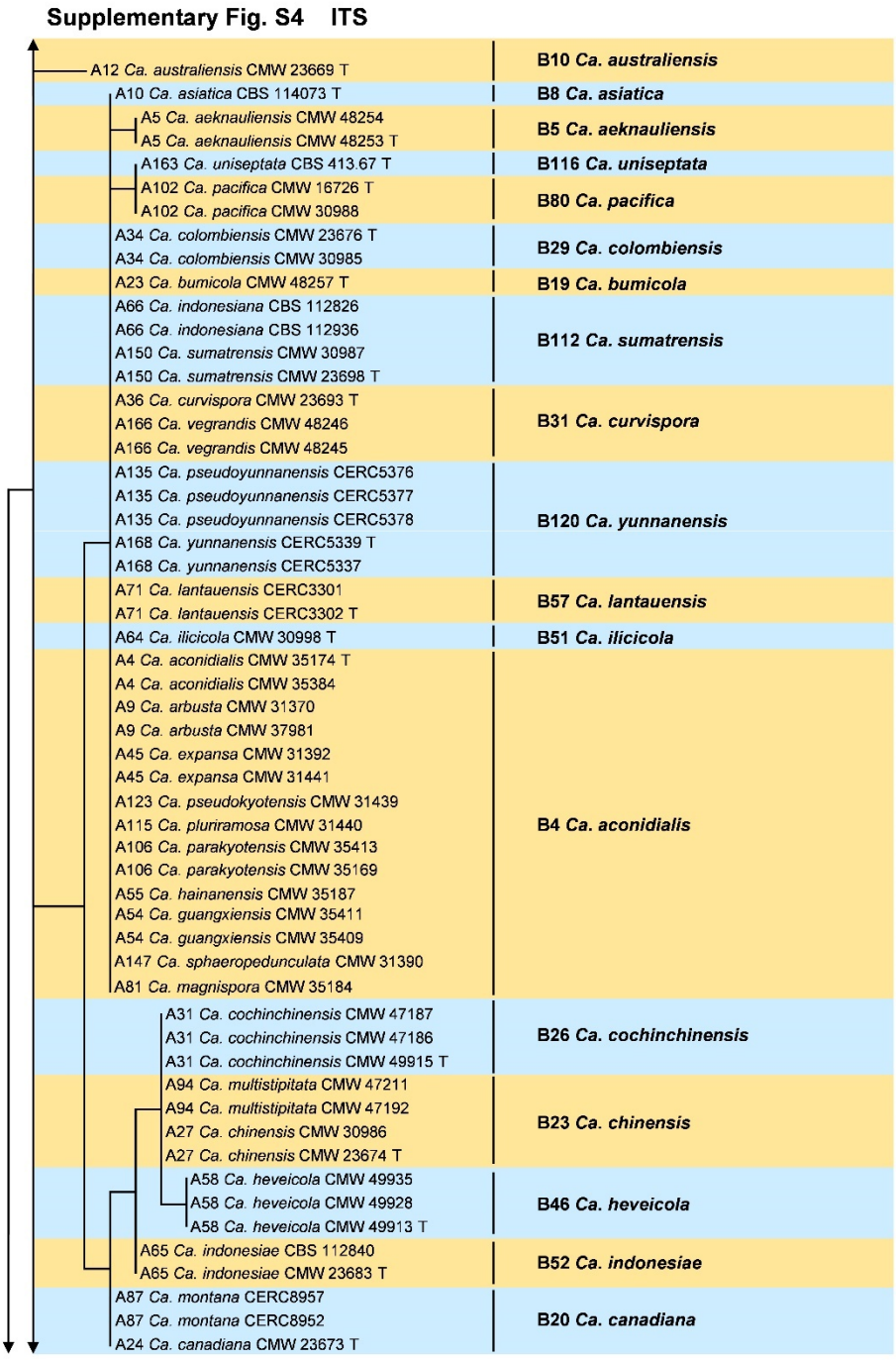
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Supplementary Fig. S4 ITS



Supplementary Fig. S4. (Continued).

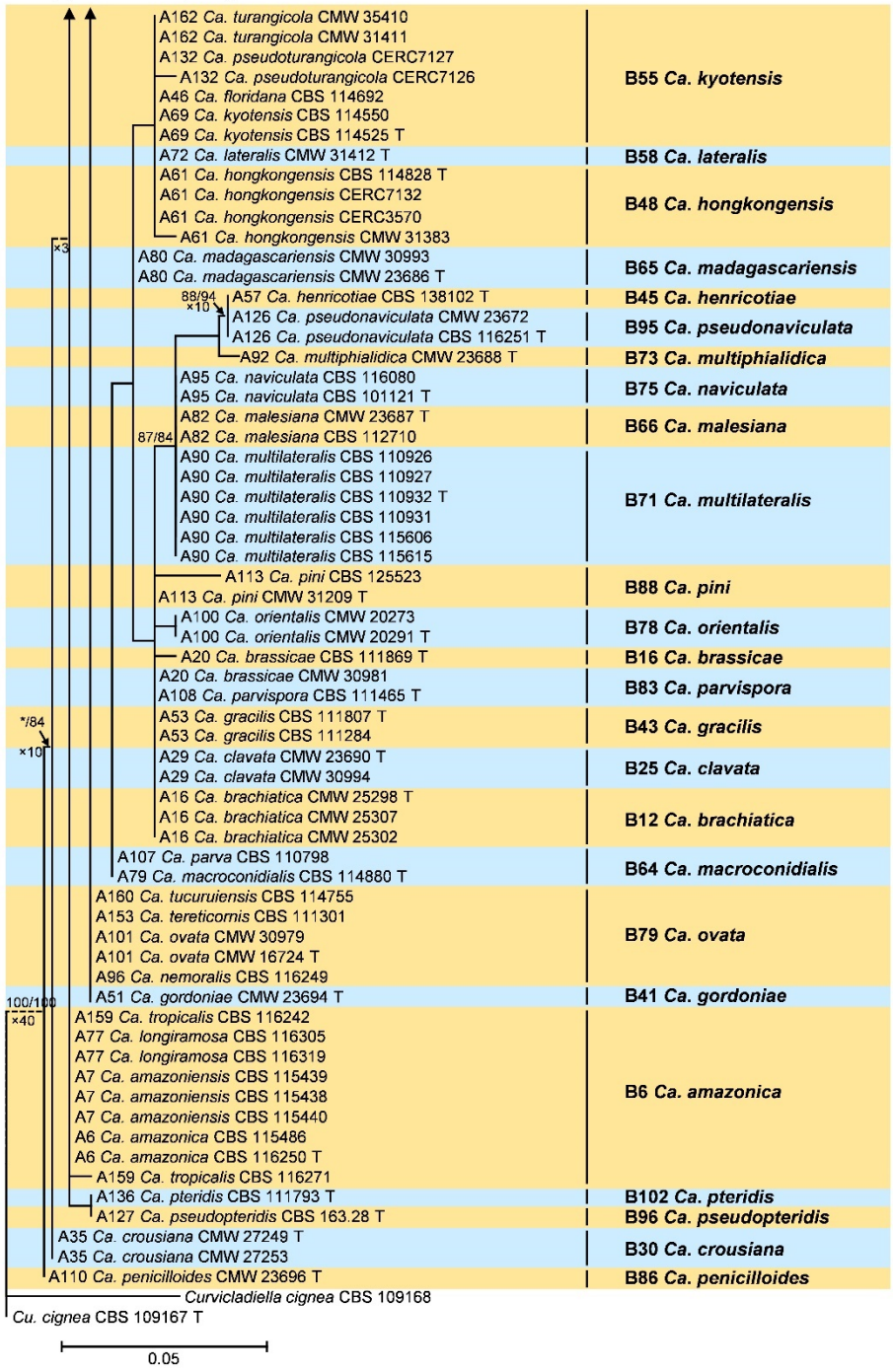
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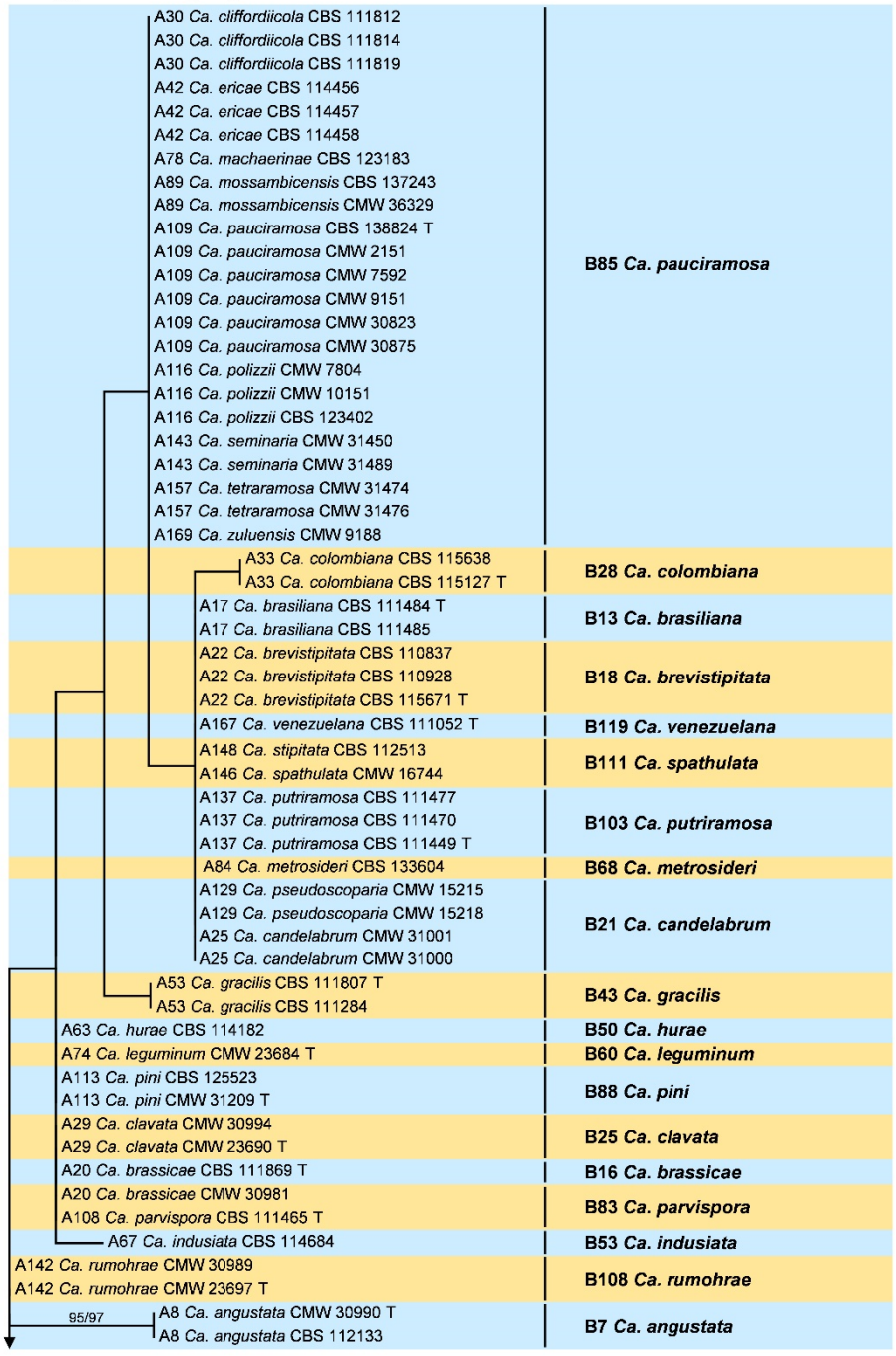
Supplementary Fig. S4 ITS



Supplementary Fig. S4. (Continued).

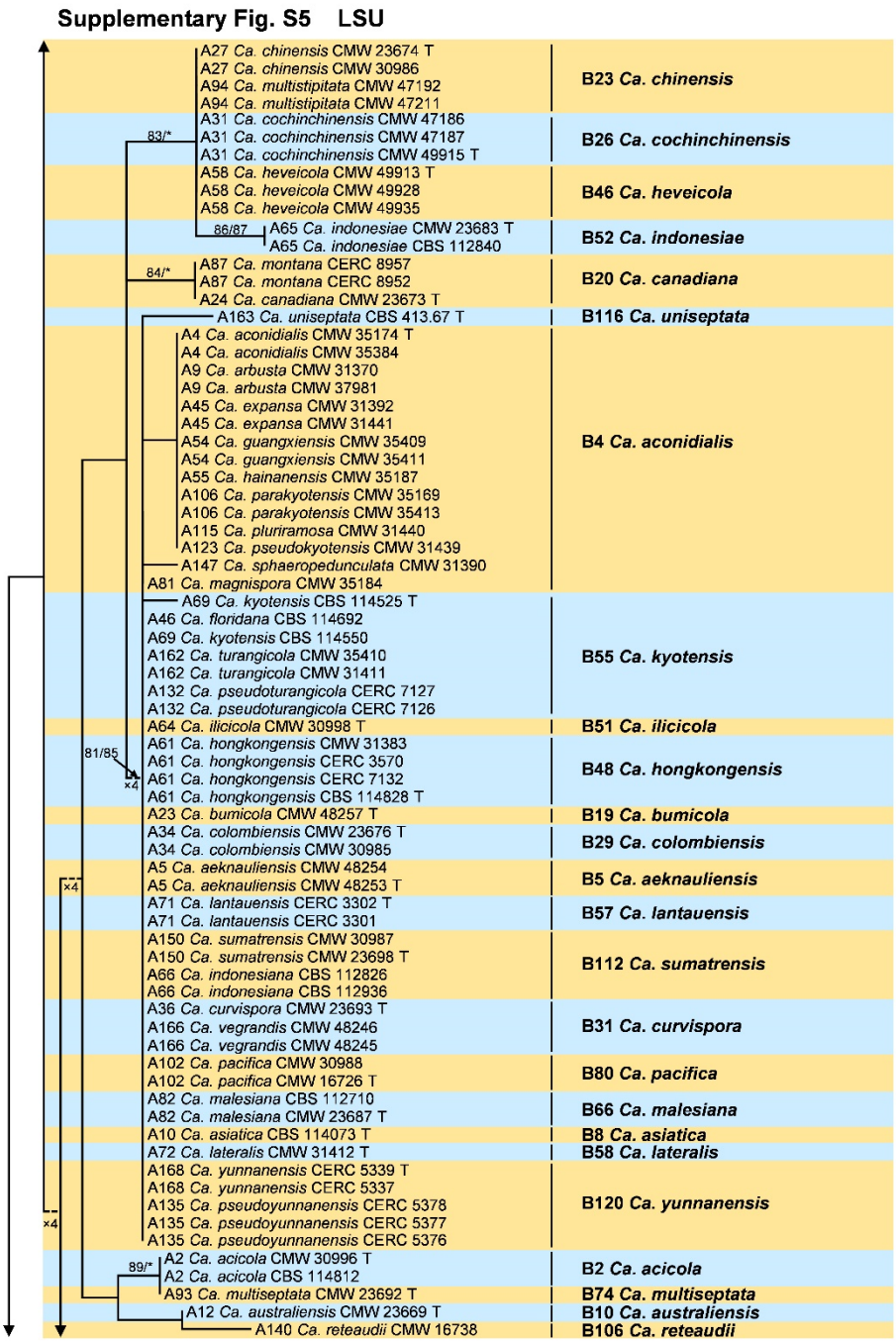
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Supplementary Fig. S5 LSU



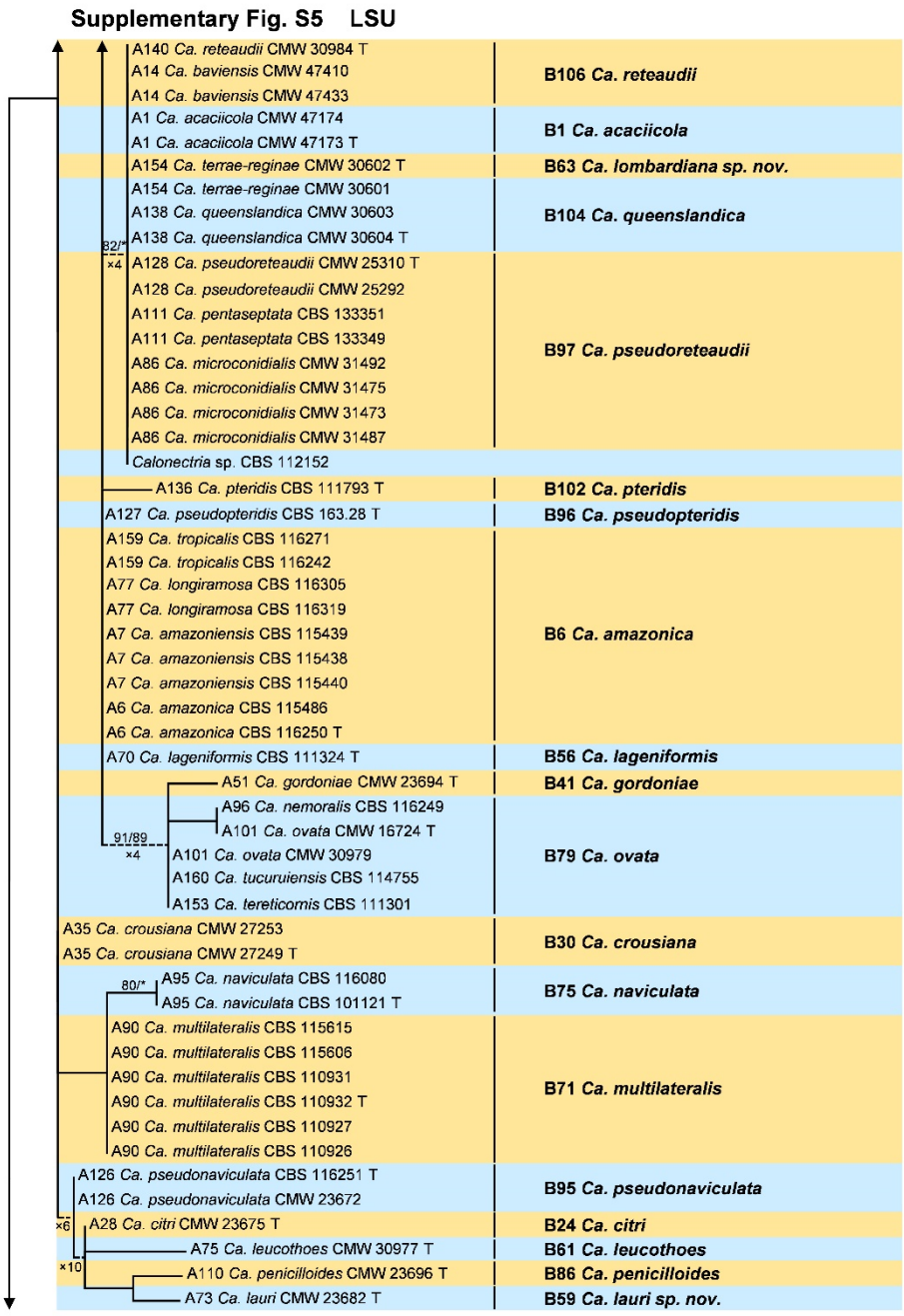
Supplementary Fig. S5. Phylogenetic tree of the genus *Calonectria* based on maximum likelihood (ML) analyses of LSU region. Codes A1 to A169 showed the 169 *Calonectria* species before their taxonomic reconsideration in this study, codes B1 to B120 indicated the 120 accepted *Calonectria* species after the revision emerging from this study. Bootstrap values ≥ 80 % for ML and MP analyses are presented at the branches. Bootstrap values lower than 80 % are marked with "*", and absent analyses values are marked with "-". Ex-type isolates of *Calonectria* species after revision, are marked with "T". The tree is rooted to *Curvicladiella cignea* (CBS 109167, and CBS 109168).

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Supplementary Fig. S5. (Continued).

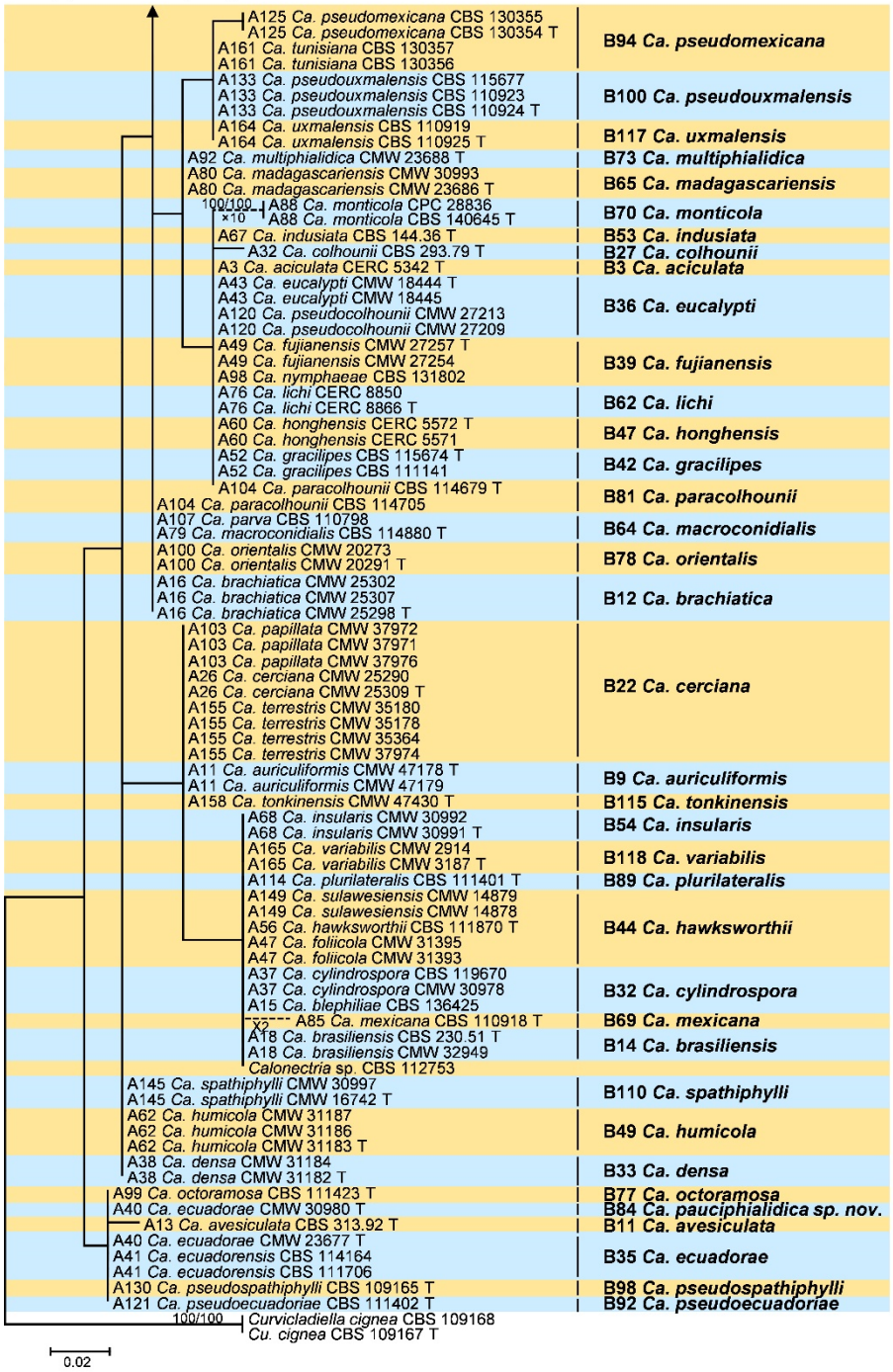
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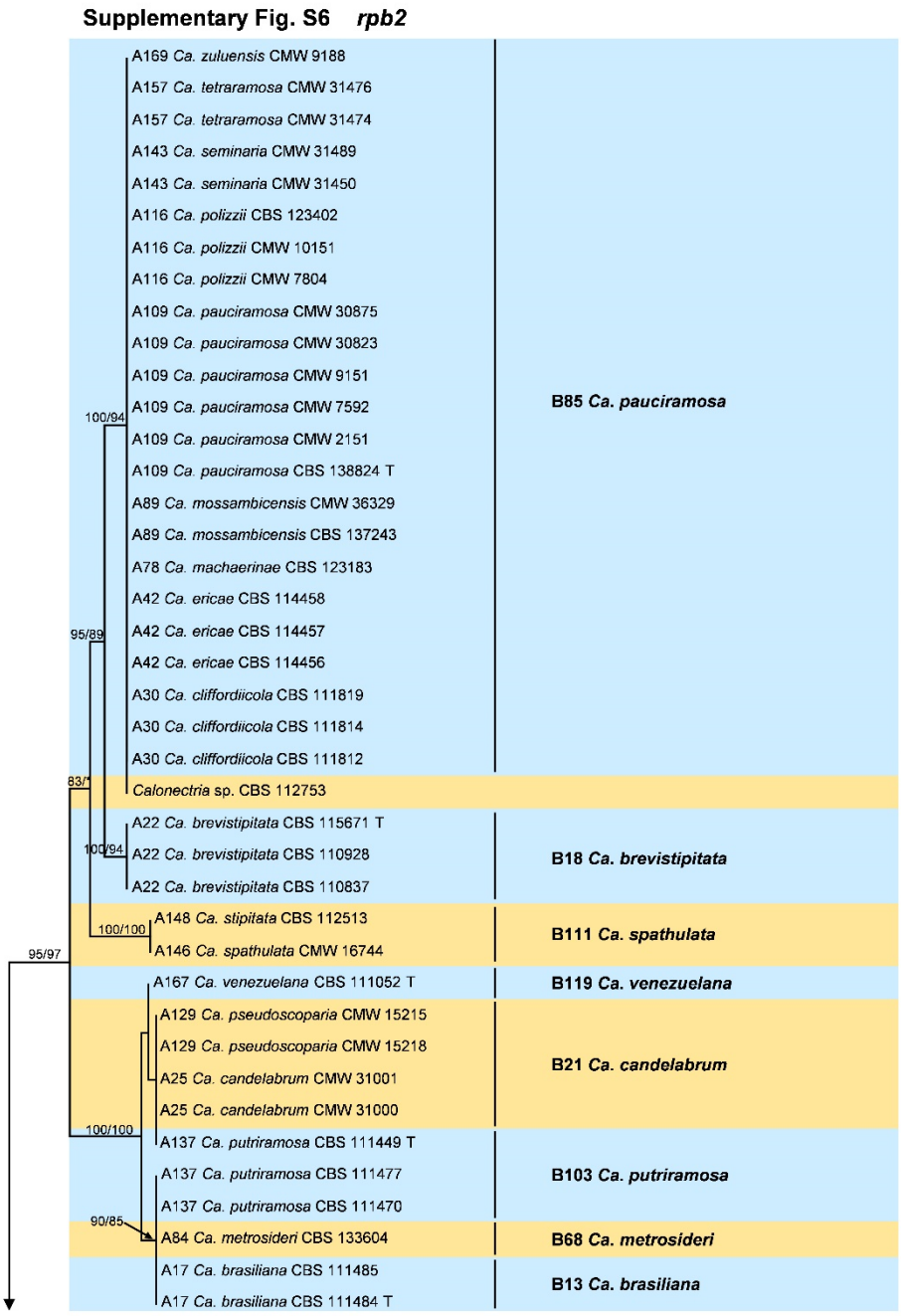
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Supplementary Fig. S5 LSU



Supplementary Fig. S5. (Continued).

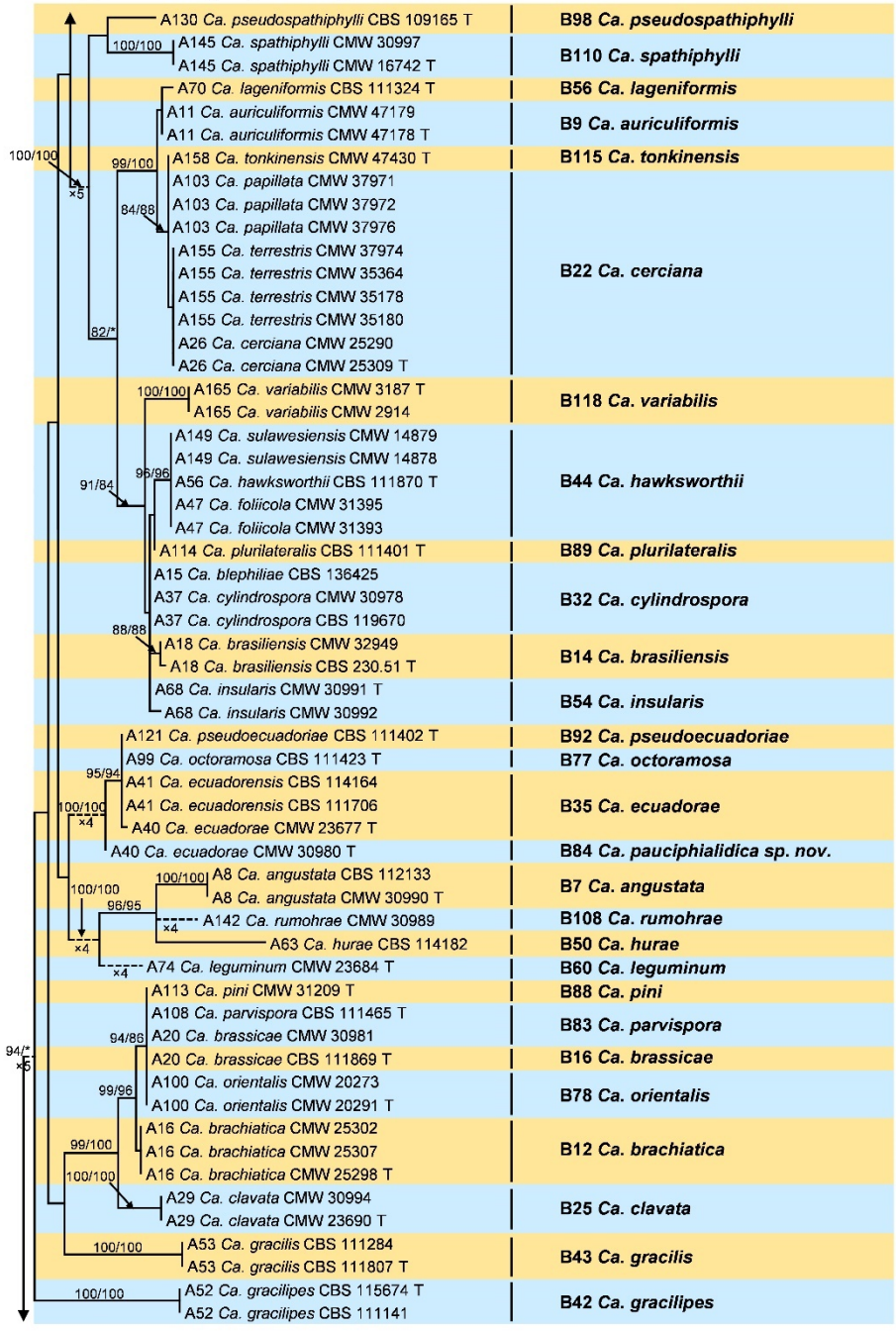
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Supplementary Fig. S6. Phylogenetic tree of the genus *Calonectria* based on maximum likelihood (ML) analyses of *rpb2* gene region. Codes A1 to A169 showed the 169 *Calonectria* species before their taxonomic reconsideration in this study, codes B1 to B120 indicated the 120 accepted *Calonectria* species after the revision emerging from this study. Bootstrap values ≥ 80 % for ML and MP analyses are presented at the branches. Bootstrap values lower than 80 % are marked with "*", and absent analyses values are marked with "-". Ex-type isolates of *Calonectria* species after revision, are marked with "T". The tree is rooted to *Curvicladiella cignea* (CBS 109167, and CBS 109168).

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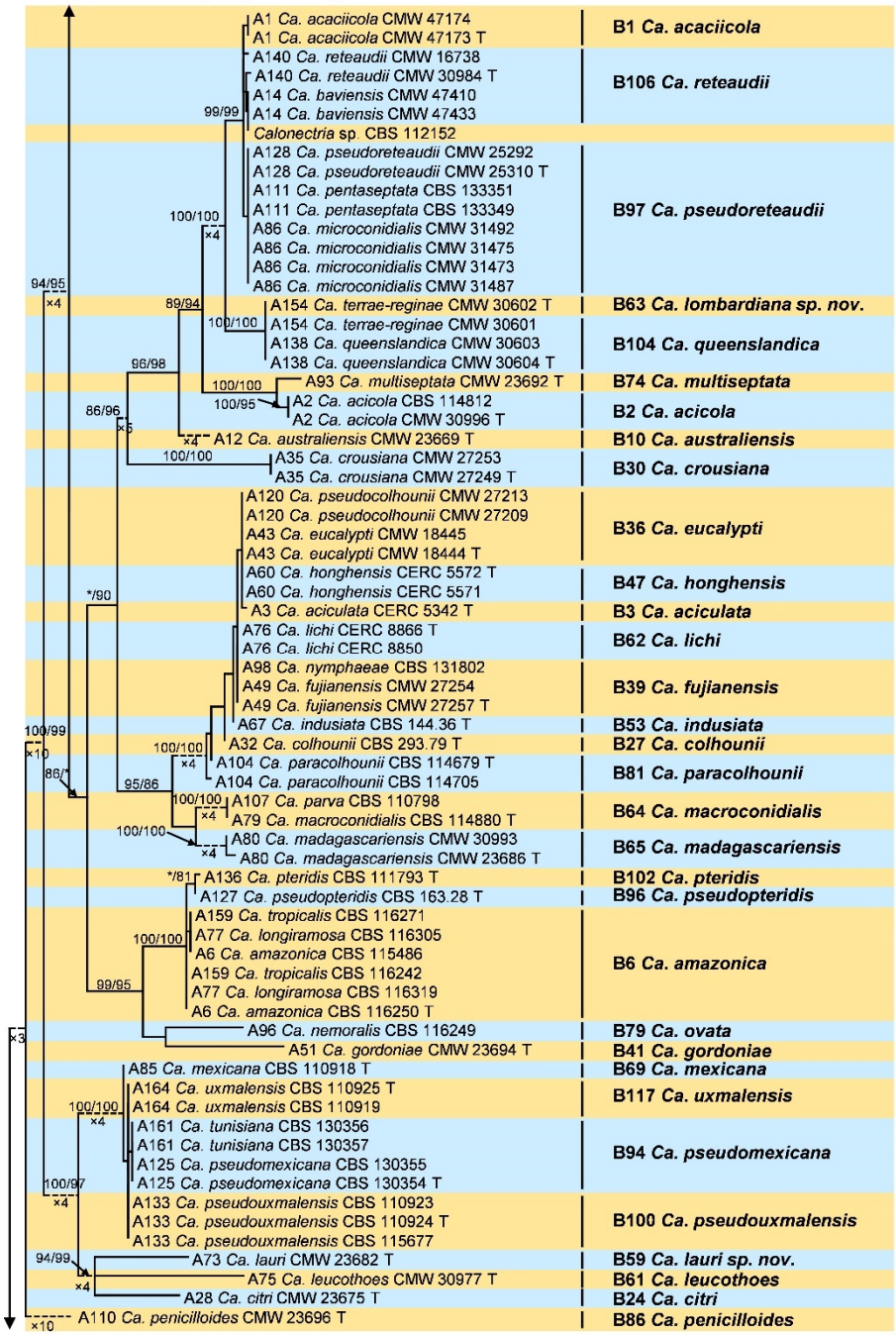
Supplementary Fig. S6 ***rpb2***



Supplementary Fig. S6. (Continued).

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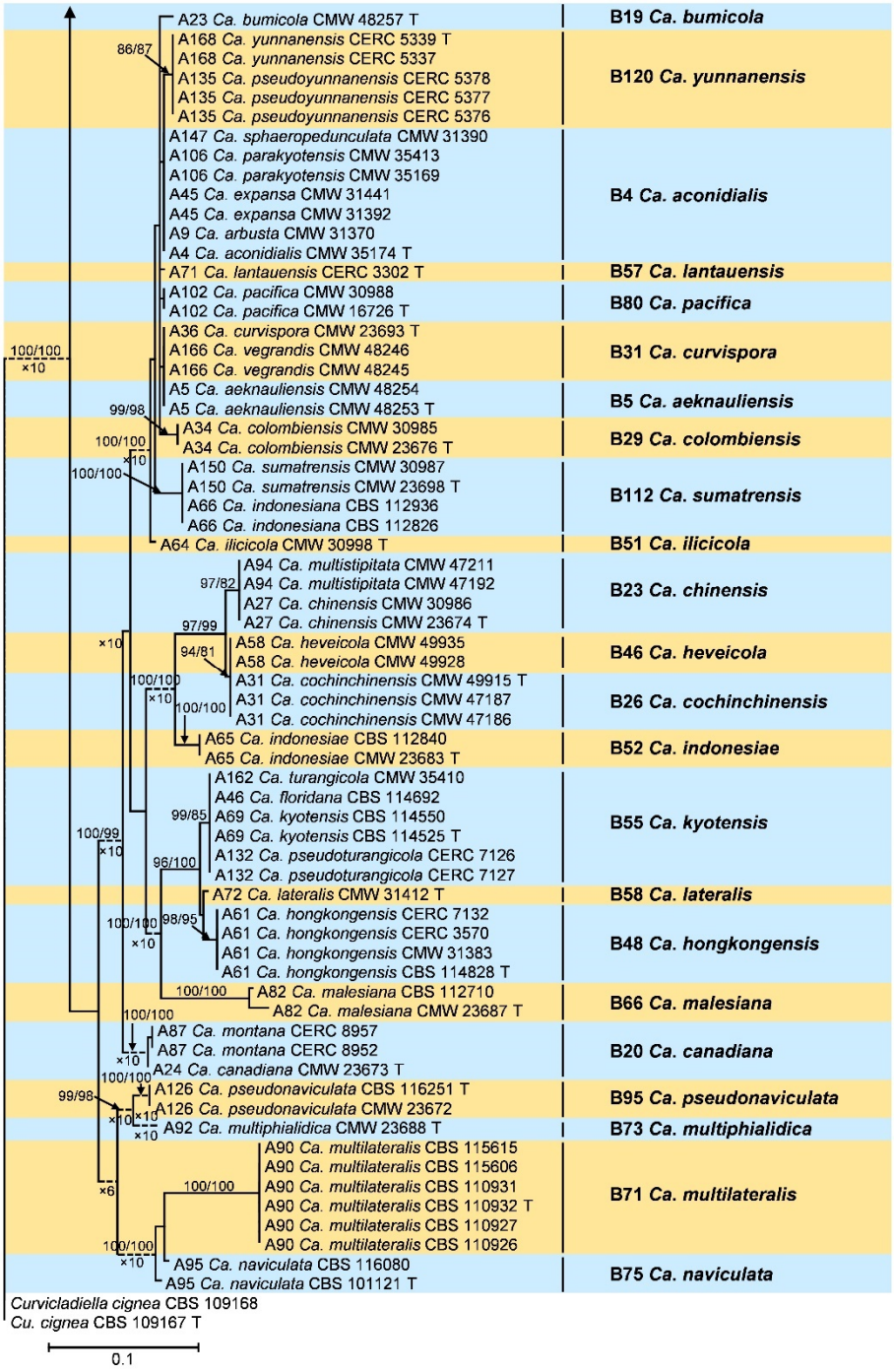
Supplementary Fig. S6 ***rpb2***



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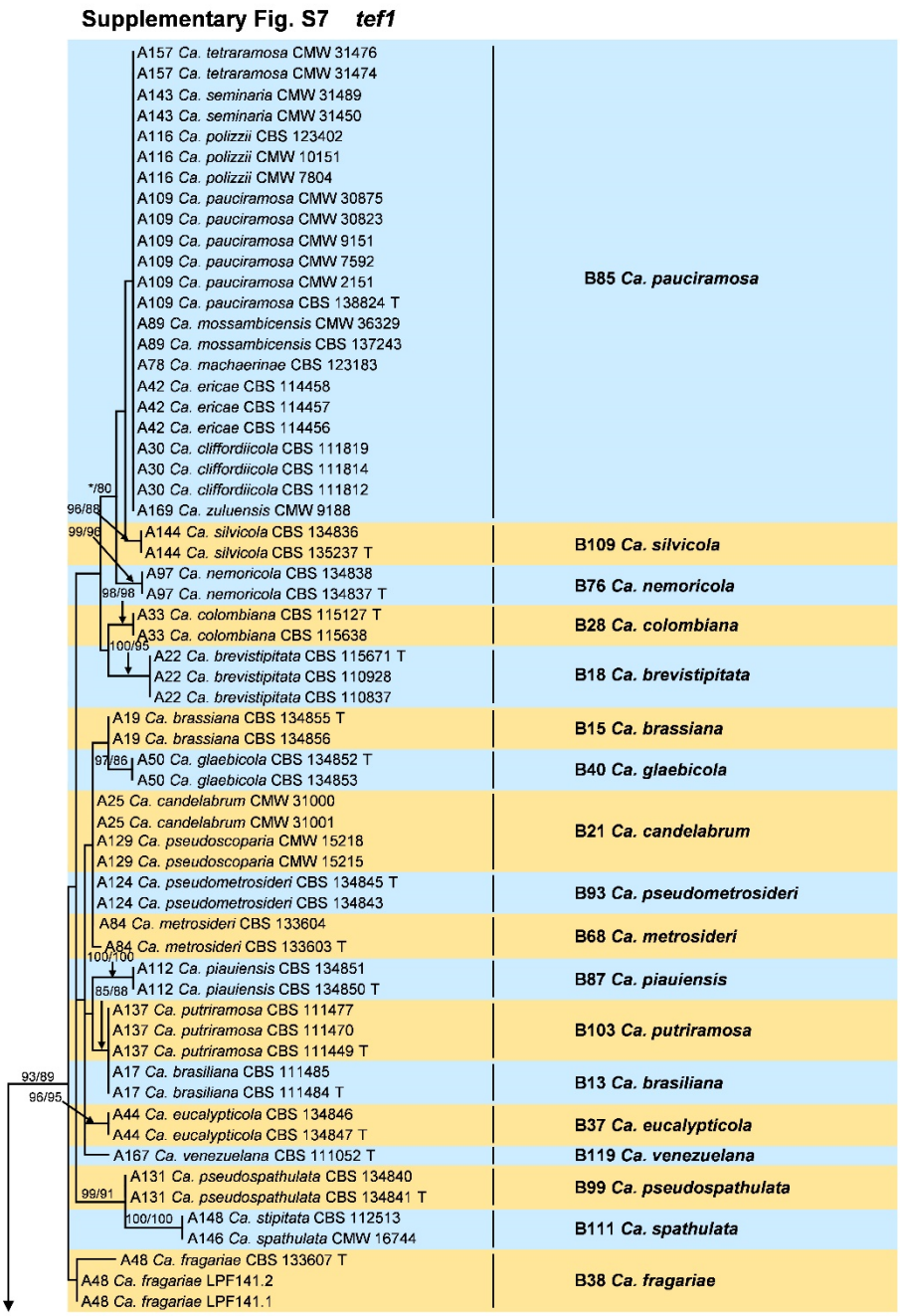
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Supplementary Fig. S6 ***rpb2***



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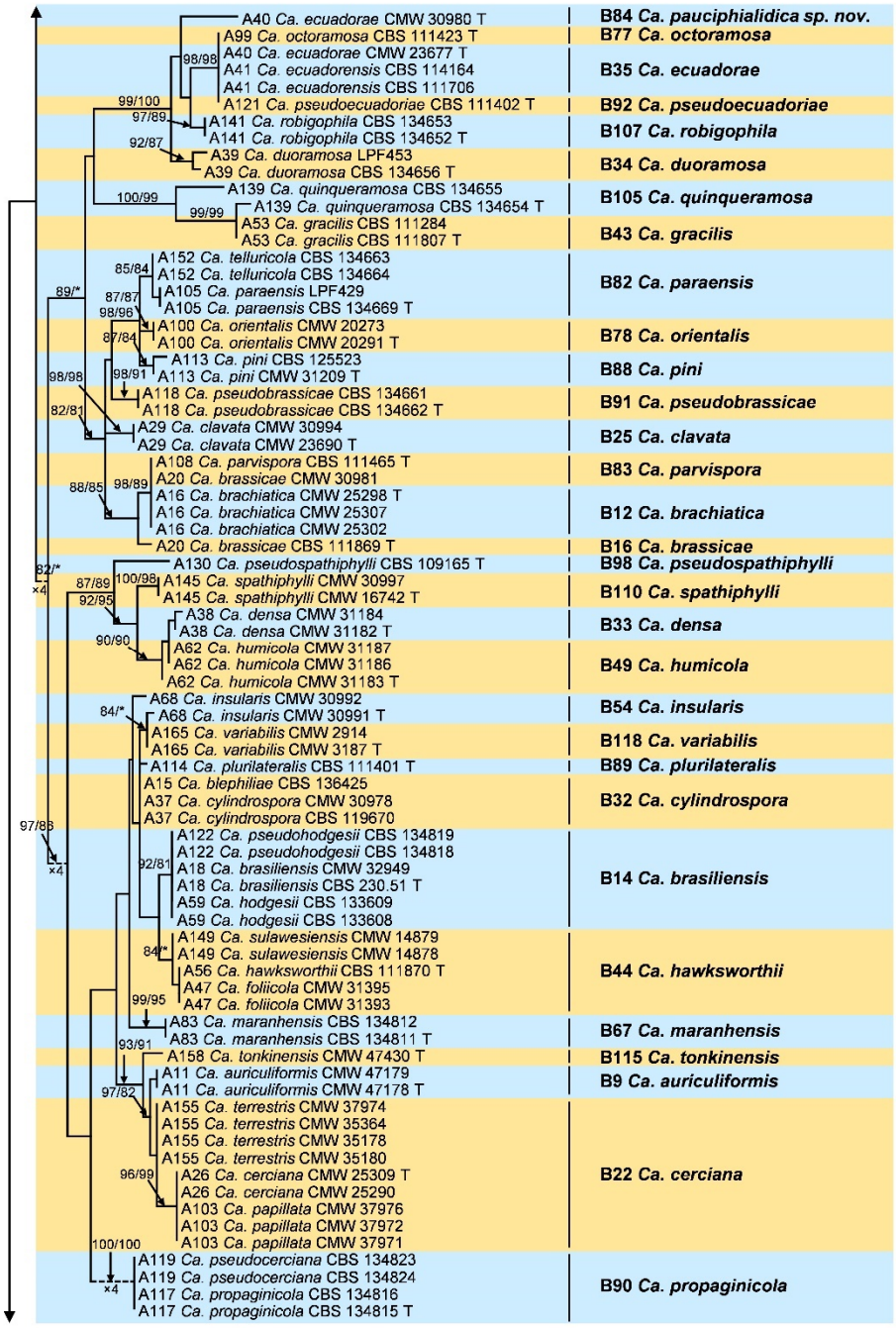
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Supplementary Fig. S7. Phylogenetic tree of the genus *Calonectria* based on maximum likelihood (ML) analyses of *tef1* gene region. Codes A1 to A169 showed the 169 *Calonectria* species before their taxonomic reconsideration in this study, codes B1 to B120 indicated the 120 accepted *Calonectria* species after the revision emerging from this study. Bootstrap values ≥ 80 % for ML and MP analyses are presented at the branches. Bootstrap values lower than 80 % are marked with "*", and absent analyses values are marked with "-". Ex-type isolates of *Calonectria* species after revision, are marked with "T". The tree is rooted to *Curvicladiella cignea* (CBS 109167, and CBS 109168).

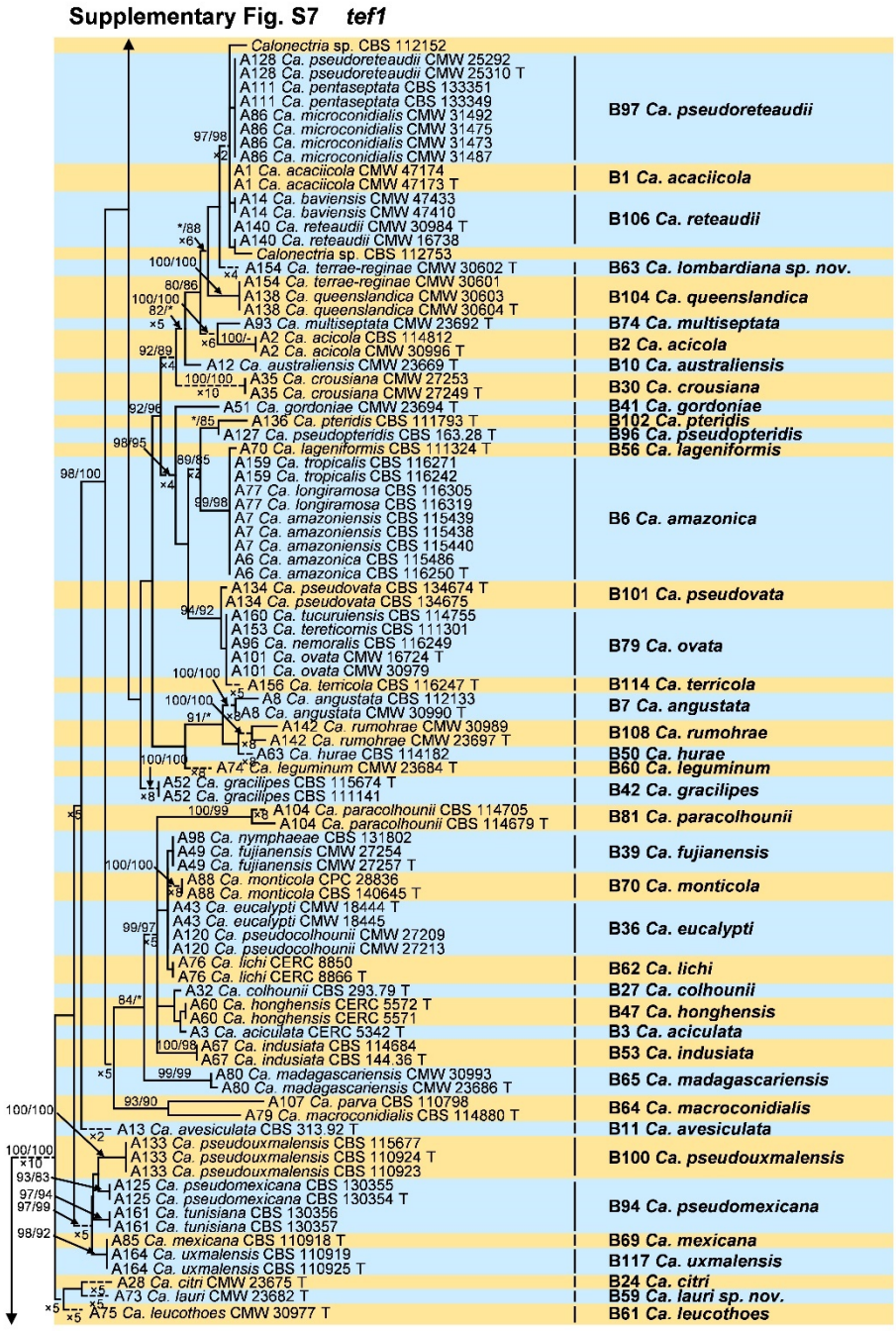
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Supplementary Fig. S7 ***tef1***



Supplementary Fig. S7. (Continued).

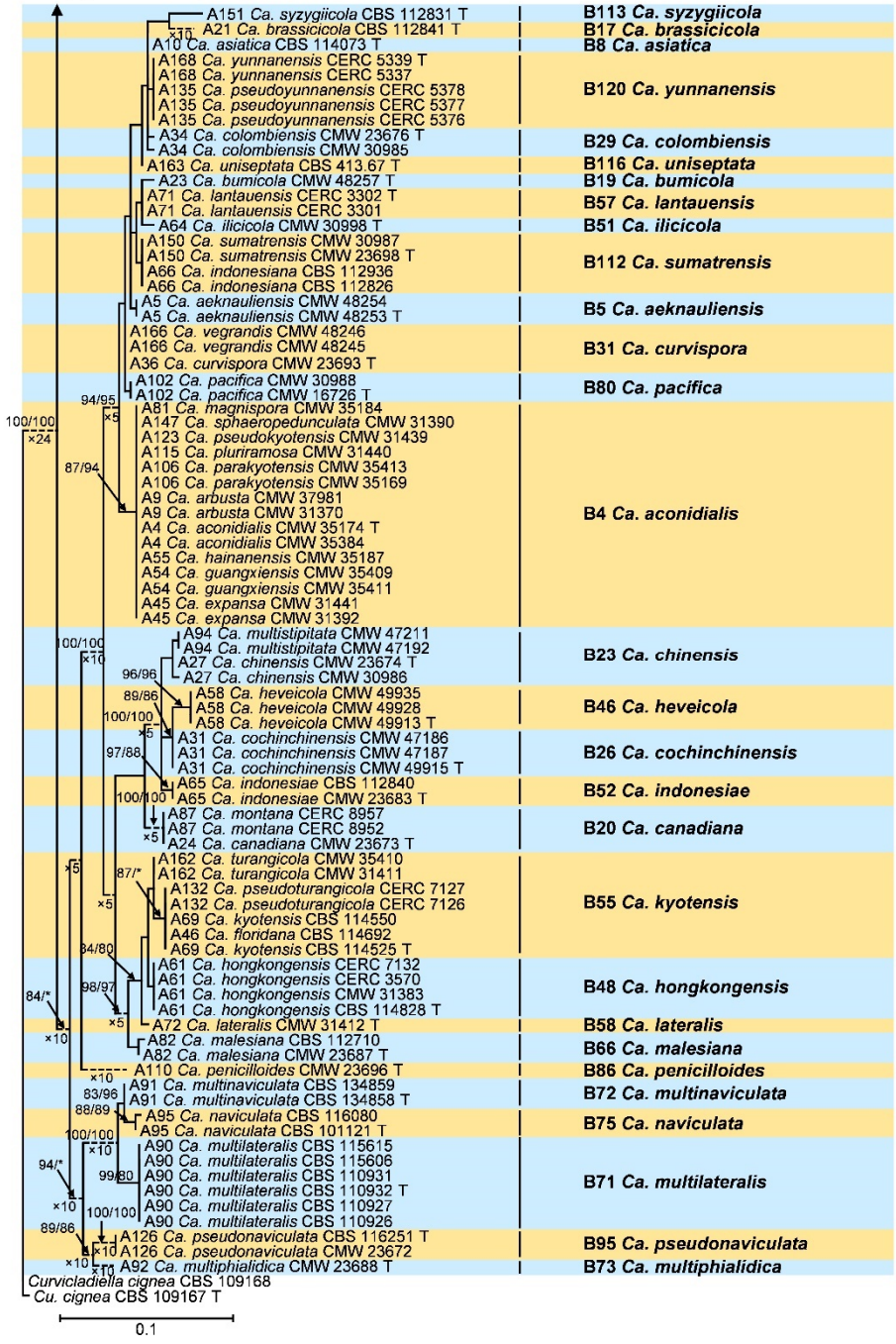
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Supplementary Fig. S7. (Continued).

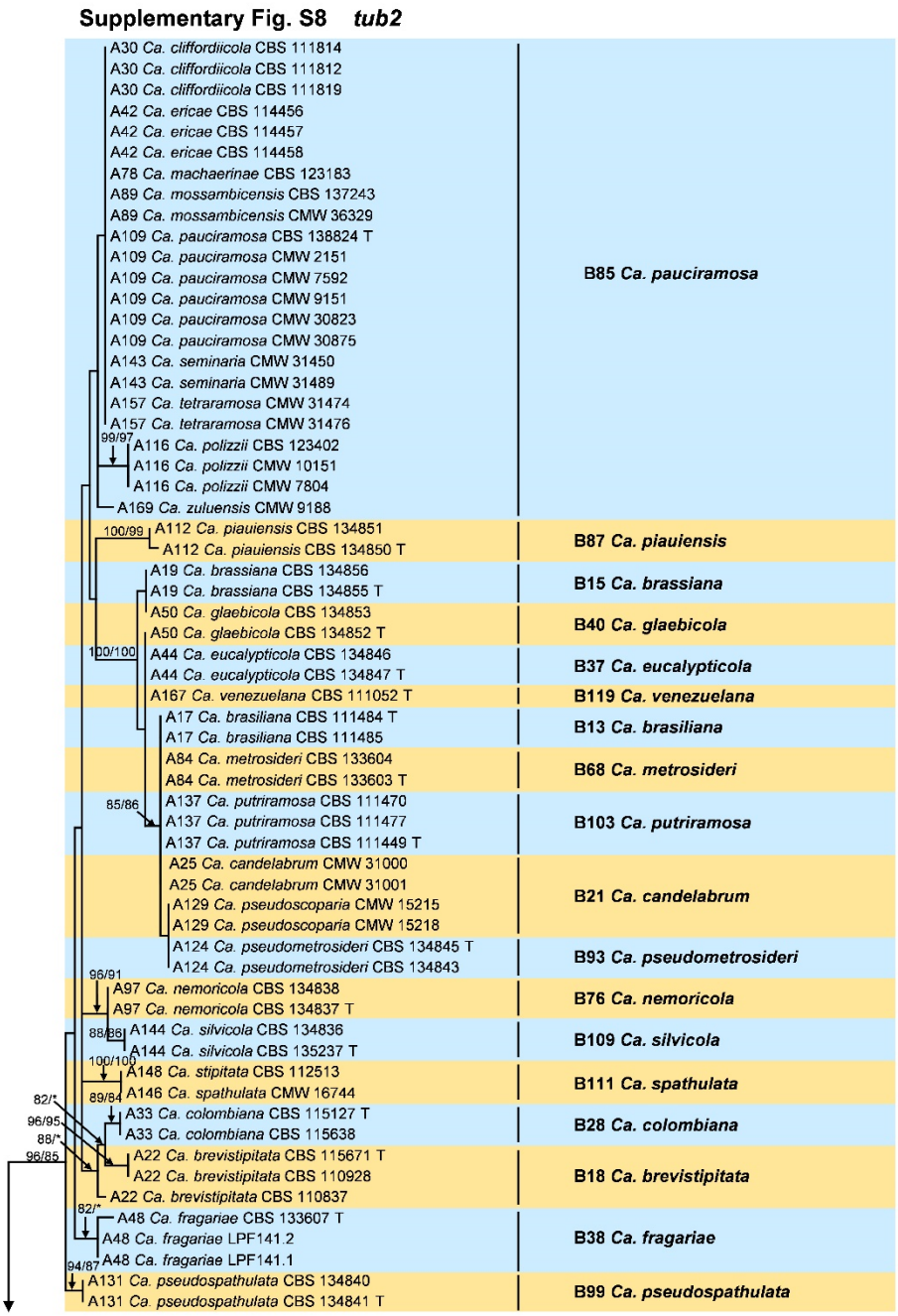
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Supplementary Fig. S7 ***tef1***



Supplementary Fig. S7. (Continued).

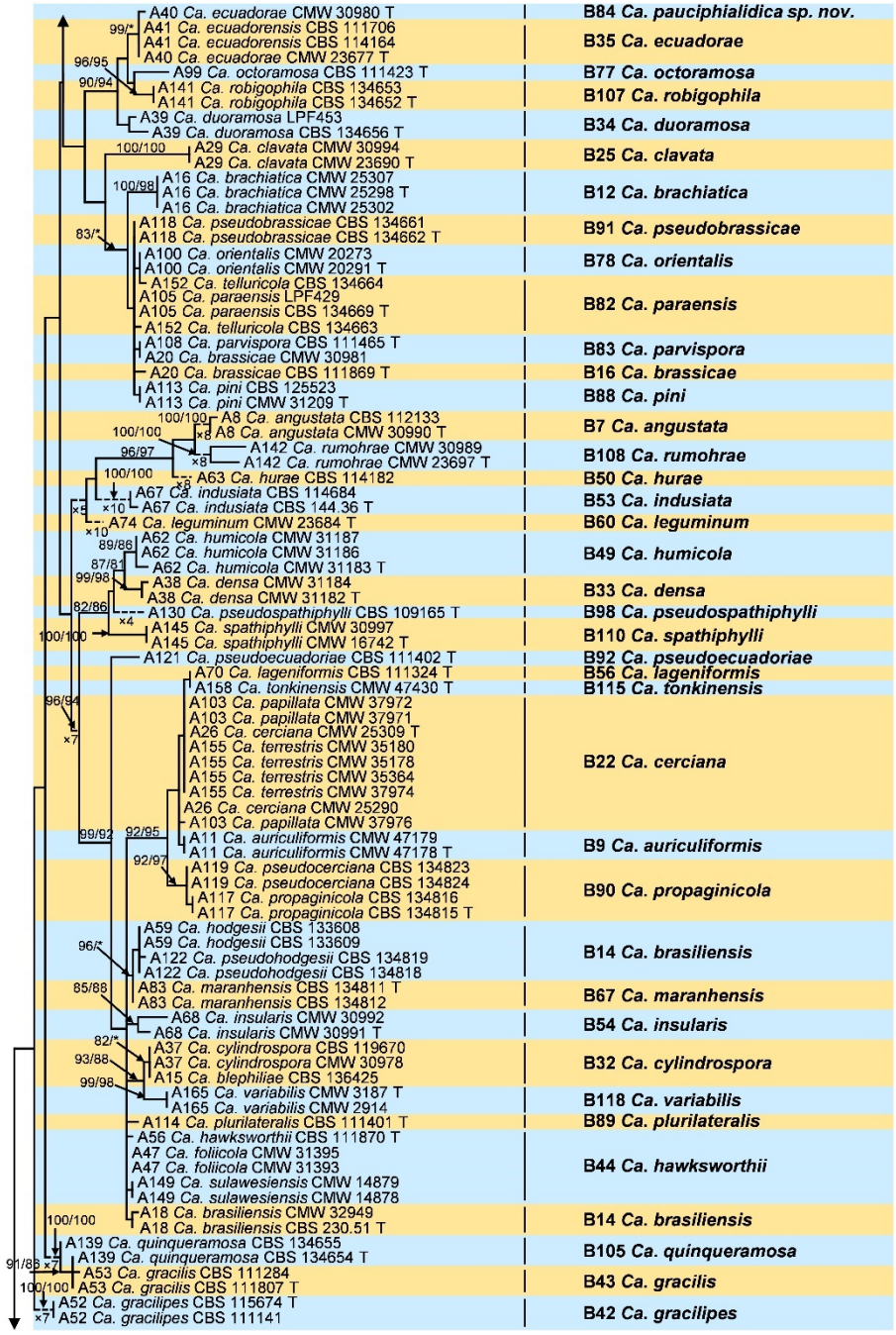
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Supplementary Fig. S8. Phylogenetic tree of the genus *Calonectria* based on maximum likelihood (ML) analyses of *tub2* gene region. Codes A1 to A169 showed the 169 *Calonectria* species before their taxonomic reconsideration in this study, codes B1 to B120 indicated the 120 accepted *Calonectria* species after the revision emerging from this study. Bootstrap values ≥ 80 % for ML and MP analyses are presented at the branches. Bootstrap values lower than 80 % are marked with "*", and absent analyses values are marked with "-". Ex-type isolates of *Calonectria* species after revision, are marked with "T". The tree is rooted to *Curvicladiella cignea* (CBS 109167, and CBS 109168).

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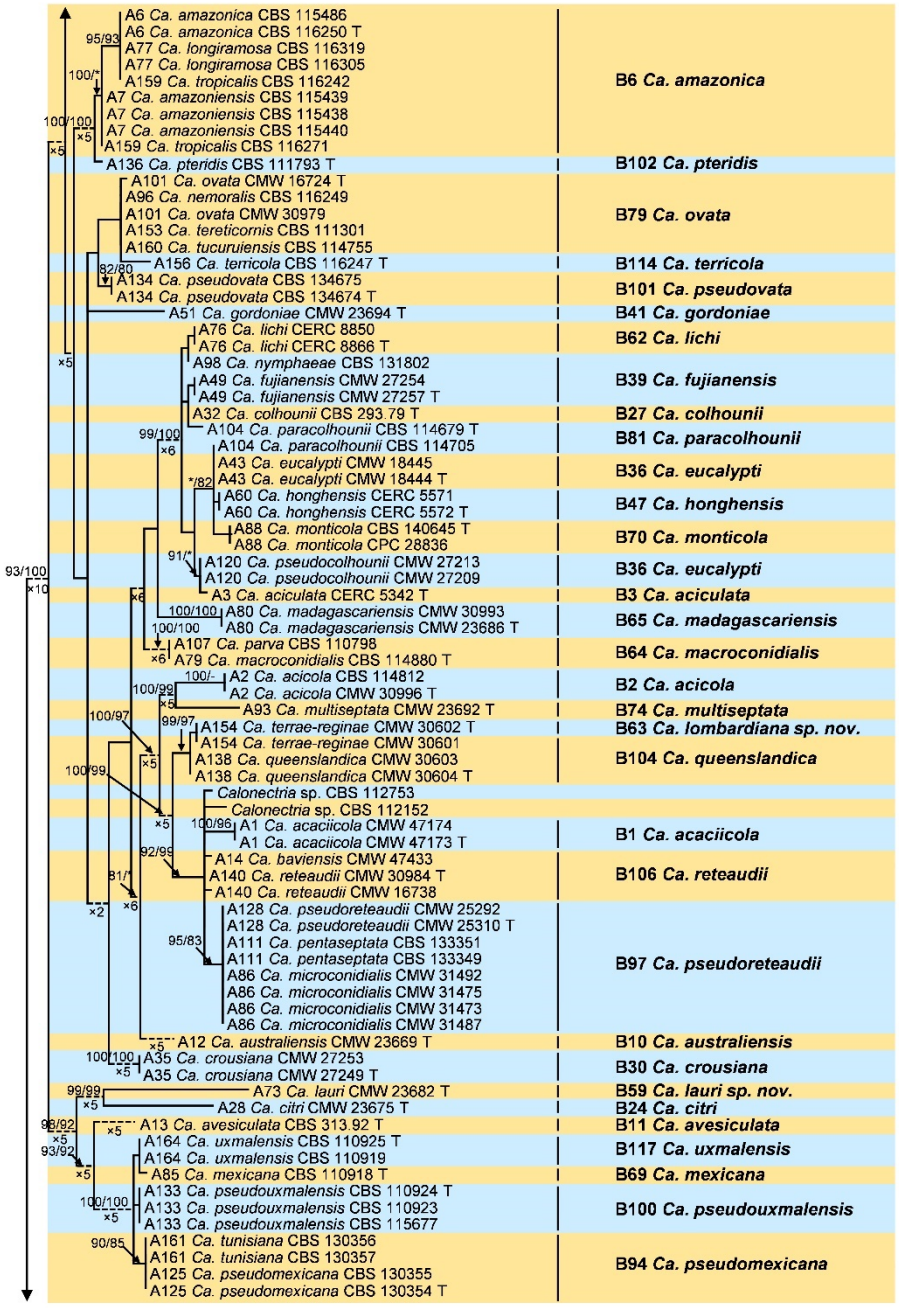
Supplementary Fig. S8 ***tub2***



Supplementary Fig. S8. (Continued).

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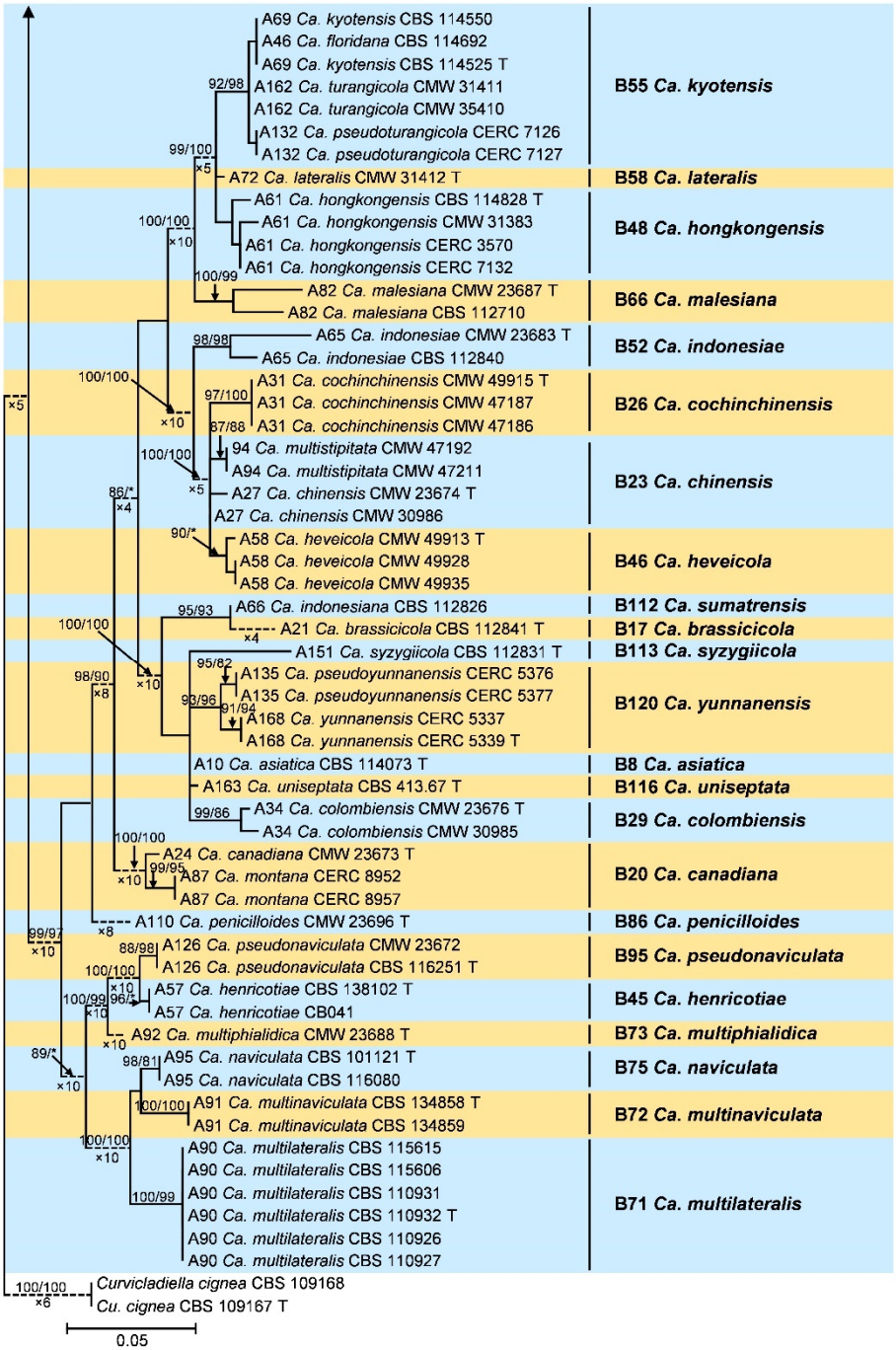
Supplementary Fig. S8 ***tub2***



Supplementary Fig. S8. (Continued).

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Supplementary Fig. S8 ***tub2***



Supplementary Fig. S8. (Continued).

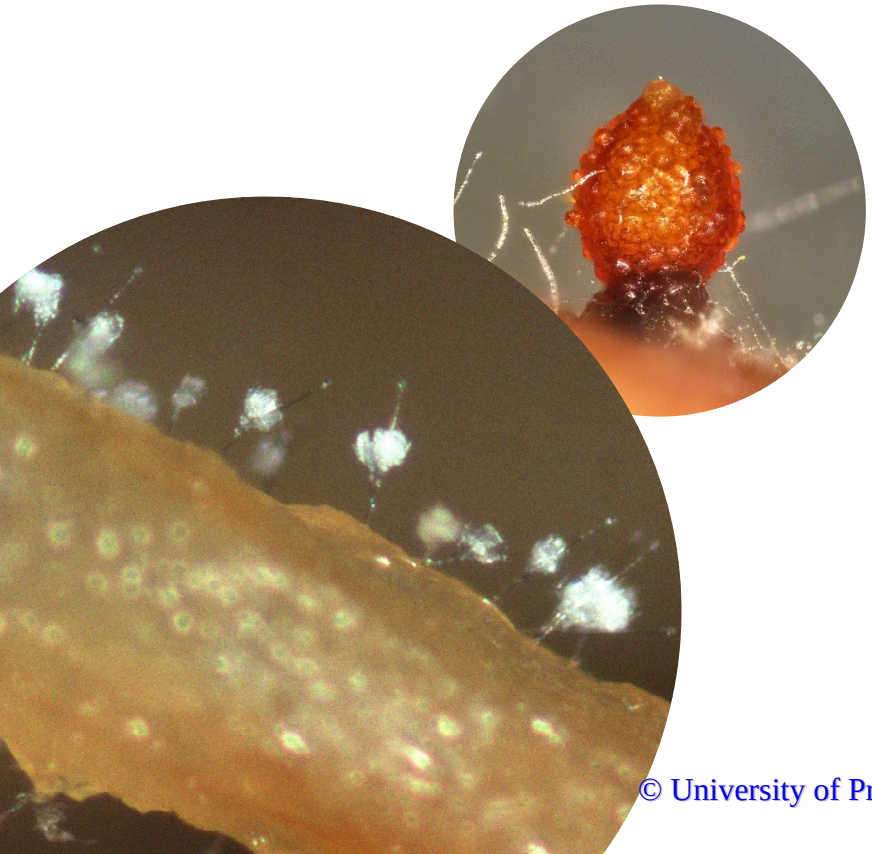
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CHAPTER 3

Diversity and Distribution of *Calonectria* Species from Plantation and Forest Soils in FuJian Province, China

Research Chapter:

Liu QL, Wingfield MJ, Duong TA, Wingfield BD, Chen SF. 2022. Diversity and Distribution of *Calonectria* Species from Plantation and Forest Soils in FuJian Province, China. **Journal of Fungi** 8: 811.



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Diversity and Distribution of *Calonectria* Species from Plantation and Forest Soils in FuJian Province, China

Abstract: To meet the growing demand for wood and pulp products, *Eucalyptus* plantations have expanded rapidly during the past two decades, becoming an integral part of the southern China landscape. Leaf blight caused by various *Calonectria* spp., is a serious threat to these plantations. To explore the diversity and distribution of *Calonectria* spp. in FuJian Province soils, samples were collected in *Eucalyptus* plantations and adjacent plantings of *Cunninghamia lanceolata*, *Phyllostachys heterocycle* and *Pinus massoniana* as well as in natural forests. Three hundred and fifty-three *Calonectria* isolates were recovered from soil samples and identified based on a comparison of multilocus DNA sequence data for the *act* (actin), *cmdA* (calmodulin), *his3* (histone H3), *rpb2* (the second largest subunit of RNA polymerase), *tef1* (translation elongation factor 1-alpha) and *tub2* (β-tubulin) gene regions, as well as morphological characteristics. Six known taxa including *Calonectria aconidialis*, *Ca. hongkongensis*, *Ca. ilicicola*, *Ca. kyotensis*, *Ca. pacifica*, *Ca. pseudoreteaudii* and one novel species described here as *Ca. minensis* sp. nov. were identified. Of these, *Ca. aconidialis* and *Ca. kyotensis* were the most prevalent species, and found in eight and seven sites, and four and five forest types, respectively. *Calonectria* spp. were most abundant in soils from *Eucalyptus* stands, followed by *P. heterocycle* and natural forests. Relatively few species were found in the soils associated with *Cunninghamia lanceolata* and *Pinus massoniana*. The abundance of known *Calonectria* spp. suggests that these fungi have been relatively well sampled in FuJian. The results are also consistent with the occurrence of Calonectria diseases are found on Angiosperm as opposed to Gymnosperm plants.

Keywords: Calonectria leaf blight; forest pathogens; fungal diversity; phylogeny; taxonomy.

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INTRODUCTION

Species of *Eucalyptus* are the most important trees used to establish plantations in the tropics and Southern Hemisphere, where they provide substantial resources for the global fibre market [1]. These trees were first introduced into China as ornamentals in 1890 and plantations of *Eucalyptus* spp. had reached 5.46 million hm^2 by 2018 [1]. Plantations of these trees are mainly distributed in 11 provinces of China, and over 75% can be found in the GuangXi, GuangDong, YunNan and FuJian Provinces of southern China [1]. The *Eucalyptus* plantations in China have been established with a relatively narrow genetic base and consequently many disease problems, caused by a variety of pathogens, have emerged as threats to their sustainability [2–6].

Among the diseases threatening *Eucalyptus* plantations, leaf blight caused by species of *Calonectria* De Not. has become a major constraint in southern China [4,7–10]. Symptoms of infection are characterised by water-soaked spots on leaves in the lower and middle parts of the tree crowns. These coalesce and gradually develop into extended necrotic areas, which result in blight and often severe defoliation [9]. In China, Calonectria Leaf Blight (CLB) has been observed in *Eucalyptus* plantations in FuJian, GuangDong, GuangXi, HaiNan and YunNan Provinces [4,7,9–11]. This is similar to the situation in Australia, Brazil, Indonesia, Thailand and Vietnam where *Eucalyptus* plantations have also suffered significant damage due to CLB [12–16].

The genus *Calonectria* includes many aggressive plant pathogens. These species are extensively distributed particularly in sub-tropical and tropical regions of the world and have a wide host range including more than 335 plant species [17]. *Calonectria* species are generally considered as soil-borne fungi and can survive in the soil for extended periods due to their thick-walled microsclerotia [17].

A recent taxonomic revision of *Calonectria* by Liu and co-authors [18] accepted 120 species. Of these, 65 have been reported from soils samples; the remaining species are known from infections on plant tissues [10,18–22]. To date, 27 species of *Calonectria* have been recorded in China, 18 of which have been isolated from soil samples [4,7,10,11,18,21,23–26].

Plantations of *Eucalyptus* spp. are commonly established alongside those of *Cunninghamia lanceolata*, *Phyllostachys heterocycle* and *Pinus massoniana* and can also be in mixed plantings in the FuJian Province (Figure 1). In recent years, leaf blight has become a serious

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threat to *Eucalyptus* plantations in this province [7,8]. *Calonectria* species including *Ca. crousiana*, *Ca. eucalypti*, *Ca. fujianensis*, *Ca. pauciromosa* and *Ca. pseudoreteaudii* [7,8,18] have been isolated from diseased *Eucalyptus* tissues and are regarded as the important causal agents of CLB in FuJian. *Calonectria* infections initially arise from inoculum in the soil but very little is known regarding the species diversity and distribution of these fungi in FuJian soils. The aim of this study was to determine the identity and distribution of *Calonectria* spp. from a wide variety of soils in FuJian, with a particular focus on *Eucalyptus* spp. but also including other trees that are found in the area.

MATERIALS AND METHODS

Sample Collection and Fungal Isolation

Soil samples were collected from *Eucalyptus* plantations and adjacent plantings, including those of *Cunninghamia lanceolata*, *Phyllostachys heterocycle* and *Pinus massoniana* as well as in natural forests (Figure 1). These plantations and forests were distributed in nine counties or districts in five regions of FuJian Province (one site in NanPing Region, two sites in FuZhou Region, two sites in SanMing Region, three sites in LongYan Region, one site in ZhangZhou Region) of southern China (Figure 2). These forests typically have thick layers of leaf litter, which was removed before collecting soil samples from the upper 0–20 cm of the humid soil profile. Between three and 37 soil samples (Table 1) were collected randomly at each site. The soil samples were placed in re-sealable plastic bags to maintain moisture and transported to the laboratory for further study.

Soil samples were placed in plastic cups and moistened using distilled water. *Medicago sativa* (alfalfa) seeds were surface-disinfested in 75% ethanol for 30 s and scattered onto the surface of the moistened soil to bait for *Calonectria* spp. as described by Crous [17]. After eight to ten days at 25°C, conidiophores typical of *Calonectria* spp. were observed with a Zeiss Stemi 2000C dissection microscope on the germinating alfalfa plants. Conidial masses were transferred to 2% MEA (Malt Extract Agar) using a sterile needle. After 12 h of incubation at 25°C, single hyphal tips were transferred to fresh MEA plates using a sterile needle and these cultures were incubated at 25°C for seven days. Cultures were sorted based on their morphological characteristics and one to five isolates were retained for each of the soil samples.

Cultures were deposited in the Culture Collection (CSF) at the Research Institute of Fast-growing Trees (RIFT) (previous institution: China Eucalypt Research Centre, CERC), Chinese

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Academy of Forestry (CAF), ZhanJiang, GuangDong Province, China. Representative isolates have also been maintained in the China General Microbiological Culture Collection Centre (CGMCC), Beijing, China. Dried specimens were deposited in the Mycological Fungarium of the Institute of Microbiology, Chinese Academy of Sciences (HMAS), Beijing, China.

DNA Extraction, PCR Amplifications and Sequencing

Mycelium was collected from axenic cultures grown on MEA for 5–7 days using a sterilised scalpel. Genomic DNA was extracted from the cultures using the CTAB method "5" described by Van Burik et al. [27]. Partial gene sequences were determined for the actin (*act*), calmodulin (*cmdA*), histone H3 (*his3*), the second largest subunit of RNA polymerase (*rpb2*), translation elongation factor 1-alpha (*tef1*) and β-tubulin (*tub2*) regions. Primer pairs ACT-512F/ACT-783R, CAL-228F/CAL-2Rd, CYLH3F/CYLH3R, fRpb2-5F/fRpb2-7cR, EF1-728F/EF2 and T1/CYLTUB1R [18] were used to amplify the six gene regions, respectively.

The PCR reaction mixtures contained 17.5 µL TopTaq^{TM} Master Mix, 1 µL of each primer (10 mM), 2 µL DNA sample and RNase-Free H_2O to a final volume of 35 µL. The amplifications were conducted under conditions described by Liu and co-authors [18]. All PCR products were sequenced in both directions using the same primers used for amplification. Raw sequences were inspected and manually corrected in Geneious v. 9.1.4 [28]. All sequences generated in this study were submitted to GenBank (http://www.ncbi.nlm.nih.gov; accessed on 24 July 2022) (Table 2, Appendix A Table A1).

Phylogenetic Analyses

To obtain the preliminary identification of the isolates, a standard nucleotide BLAST search was conducted using sequences of the six (*act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2*) gene regions. Furthermore, sequences obtained in this study (Table 2) and sequences of other phylogenetically closely related *Calonectria* species downloaded from NCBI (http://www.ncbi.nlm.nih.gov; accessed on 24 July 2022) (Table 3) were used in the analyses. Sequence alignments were conducted online with MAFFT v. 7 [29] and were manually adjusted in MEGA v. 6.0.5 software [30] when necessary. The final alignments used in phylogenetic analyses were submitted to TreeBASE (http://treebase.org; accessed on 3 October 2021).

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Genotypes of all the isolates were determined based on the sequences for the six gene regions. Representative isolates for all the genotypes were selected for the phylogenetic analyses. All the isolates of the novel species were used in the analyses. Maximum Parsimony (MP) and Maximum Likelihood (ML) approaches were used for phylogenetic analyses. The sequence datasets for the six individual gene regions and a concatenated dataset for those regions were used to determine the phylogenetic relatedness of all the isolates. PAUP v. 4.0 b10 [31] was used to perform the MP analyses, and PhyML v. 3.0 [32] was applied to conduct the ML analyses. A partition homogeneity test (PHT) [33] was performed to assess whether the datasets for the six gene regions could be combined.

For MP analyses, all characters were unordered and equally weighted. Gaps were regarded as fifth character and phylogenetic trees were obtained using a heuristic tree search criterion including 1000 random stepwise additions and tree-bisection-reconstruction (TBR) branch swapping. Branches of zero-length were collapsed. Supports for tree-branching points were determined using bootstrap analyses with 1000 replicates [34]. Tree length (TL), retention index (RI), consistency index (CI), rescaled consistency indexes (RC) and homoplasy index (HI) (Table 4) were calculated for parsimony trees. For ML analyses, the best substitution model for each dataset was determined using JModeltest 2.1.7 [35]. Sequence data for two isolates of *Curvicladiella cignea* (CBS 109167 and CBS 109168) were used as outgroup taxa (Table 3).

Sexual Compatibility

The mating system as either homothallic or heterothallic was determined for the novel species identified in this study. Representative isolates of this species were crossed with each other in all possible combinations. These crosses were made on minimum salt agar (MSA) [54] with autoclaved toothpicks randomly placed on the agar surface. Petri dishes were then incubated at 25 °C for 2–8 wk, and they were observed regularly for the appearance of perithecia. When perithecia extruding ascospores emerged, germination tests were conducted to determine if the spores were viable. Production of viable ascospores was accepted as an indication of successful mating.

Morphology

Representative isolates of the novel species identified in this study were selected for morphological characterisation. Synthetic nutrient-poor agar (SNA) [55] was used to induce

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the asexual morphs. Agar plugs from axenic cultures were transferred to SNA and incubated at 25 °C for seven days. Fungal structures were lifted from the plates using a sterile needle and transferred to a drop of 85% lactic acid on microscope slides. Microscopic structures were examined under a Zeiss Axio Imager A1 microscope (Carl Zeiss Ltd., Jena, Germany).

In the case of sexual structures, the perithecia were transferred to Jung tissue freezing medium (Leica Biosystems, Wetzlar, Germany), which was frozen at −20 °C for ten minutes. Vertical sections (10 µm thick) were cut through the perithecia on a HM550 cryostat microtome (Microme International GmbH, Termo Fisher Scientifc, Walldorf, Germany) at −20 °C and examined under an Axio Imager A1 microscope.

For cultures selected as the ex-type isolates, 50 replicate measurements were made for each taxonomically characteristic structure. For other isolates, 30 replicate measurements were made. Minimum, maximum and average (mean) measurements were recorded as (minimum–) (average–standard deviation)–(average + standard deviation) (–maximum).

Optimal growth temperatures for the novel species were determined on MEA. Agar plugs were removed from the actively growing edges of 7-day-old cultures with a 5 mm diam. cork borer and transferred to the centres of 90 mm Petri dishes containing MEA. Cultures were grown at seven different temperatures ranging from 5 °C to 35 °C, at 5 °C intervals with five replicates per isolate. Colony diameters were measured after seven days. Colony colours were described using the colour charts of Rayner [56] using seven-day-old cultures on MEA incubated at 25 °C. All descriptions were deposited in MycoBank (www.mycobank.org; accessed on 3 October 2021).

Results

Sample Collection and Fungal Isolation

A total of 209 soil samples were collected and 353 isolates having a morphology typical of *Calonectria* were isolated from 79 of these samples (Table 1, Appendix A Table A1). Of these, 121 soil samples were from seven *Eucalyptus* plantations, of which 57 samples yielded 253 *Calonectria* isolates. Forty-three soil samples were collected from four natural forests, of which 14 samples yielded 61 *Calonectria* isolates; 21 soil samples were collected from two *C. lanceolata* plantations, two of which yielded nine *Calonectria* isolates; and 14 soil samples collected from a single *P. heterocycle* plantation, of which five samples yielded 25 *Calonectria*

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isolates. In addition, ten soil samples were collected from the *Pi. massoniana* plantation, only one of which yielded five *Calonectria* isolates (Table 1).

Phylogenetic Analyses

The *tef1* fragment was amplified for all of the 353 isolates (Appendix A Table A1), and based on sequence differences for this region and the sampling sites, 144 isolates were selected to amplify the *cmdA*, *his3* and *tub2* gene regions. Subsequently, based on the 37 genotypes revealed by these four gene regions, 71 representative isolates were chosen to amplify the *act* and *rpb2* gene regions (Appendix A Table A1). All 71 isolates, representing the 40 genotypes determined from the sequence data for the six gene regions, were used for phylogenetic inference (Table 2). Amplicons generated for the *act*, *cmdA*, *his3*, *rpb2*, *tef1*, and *tub2* gene regions were approximately 300, 700, 500, 860, 550, and 600 bp, respectively.

Sequence data for 46 *Calonectria* species closely related to those collected in this study were downloaded from GenBank and a total of 78 sequences (for ex-type and other strains) from previous studies were included in the phylogenetic analyses (Table 3). Phylogenetic analyses based on the six individual gene regions and the concatenated dataset for those regions were conducted using both MP and ML methods. The results showed that the overall topologies generated from the MP analyses were essentially similar to those from the ML analyses, and consequently, only the ML trees are presented (Figure 3, Appendix B Figures A1–A6).

The partition homogeneity test carried out on the datasets, for the combined six gene regions, generated P values of 0.001. This showed that the accuracy of the combined data did not suffer relative to the individual partitions [57]. Sequence data for the six gene regions were thus combined for analyses. The sequence alignments based on the individual six gene regions and the combination of these were deposited in TreeBASE (No. S28845). Statistics and important parameters emerging from the phylogenetic analyses are presented in Table 4.

Based on the six-gene combined phylogenetic tree (Figure 3), for the 71 isolates used in the phylogenetic analyses, eight isolates resided in the *Ca. colhounii* species complex, two isolates in the *Ca. reteaudii* species complex and 61 isolates in the *Ca. kyotensis* species complex.

Species in the *Calonectria colhounii* Species Complex

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Six isolates (CSF9941, CSF9974, CSF9975, CSF9976, CSF9977 and CSF9978), representing one genotype, formed a distinct lineage in the *cmdA* and *tub2* analyses as well as in the six-gene combined phylogenetic tree (Figure 3, Appendix B Figures A2 and A6). The total number of SNP differences between the six isolates and other phylogenetically closely related species [*Ca. aciculata* (ex-type isolate CERC 5342), *Ca. colhounii* (ex-type isolate CBS 293.79), *Ca. eucalypti* (ex-type isolate CMW 18444) and *Ca. honghensis* (ex-type isolate CERC 5572)] for six gene regions combined, varied between 13 and 31. Thus, this fungus can be regarded as a novel species. Two isolates (CSF9933 and CSF9934) formed an independent clade and were phylogenetically most closely related to the six isolates in the six-gene phylogenetic tree (Figure 3). These two isolates were consequently considered as the same species as the six isolates CSF9941, CSF9974, CSF9975, CSF9976, CSF9977 and CSF9978 and were identified as the novel species.

Species in the *Calonectria reteaudii* Species Complex

Two isolates (CSF10059 and CSF10060) were phylogenetically closely related to *Ca. pseudoreteaudii* and various other species based on *act* and *cmdA* trees (Appendix B Figures A1 and A2), and clustered with *Ca. pseudoreteaudii* based on *his3*, *rpb2*, *tef1*, *tub2* and the six-gene combined trees (Figure 3, Appendix B Figures A3–A6). In comparisons of DNA sequences for these six gene regions, all the sequences for the two isolates (CSF10059 and CSF10060) were 100% identical to the ex-type isolate (CMW 25310) of *Ca. pseudoreteaudii*. Consequently, they were identified as *Ca. pseudoreteaudii* (Figure 3).

Species in the *Calonectria kyotensis* Species Complex

Thirty-four isolates representing 20 genotypes were phylogenetically closest to *Ca. kyotensis* in each of the *cmdA*, *his3*, *rpb2* (sequence data for the *rpb2* were not available for isolate CSF9834), *tef1*, *tub2* and the six-gene combined trees (Figure 3, Appendix B Figures A2–A6), and clustered with *Ca. kyotensis* based on the *act* tree (Appendix B Figure A1). Some isolates formed distinct clades based on the six-gene combined trees (Figure 3), while the total number of SNP differences between the 34 isolates and the ex-type isolate of *Ca. kyotensis* (CBS 114525) for six gene regions combined varied between 2 and 8. Based on the phylogenetic analyses, these 34 isolates were identified as *Ca. kyotensis*.

Four isolates (CSF7124, CSF9784, CSF9794 and CSF9799), representing two genotypes, were phylogenetically closest to *Ca. hongkongensis* in each of the *cmdA*, *tub2* and six-gene

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combined tree (Figure 3, Appendix B Figures A2 and A6), and clustered with *Ca. hongkongensis* based on *act*, *his3*, *rpb2* and *tef1* trees (Appendix B Figures A1, A3–A5). There were only three or four SNP differences between these four isolates and the ex-type isolate of *Ca. hongkongensis* (CBS 114828) when sequences for six gene regions were combined. Thus, these four isolates were identified as *Ca. hongkongensis*.

Two isolates (CSF9862 and CSF9863), representing one genotype clustered with *Ca. ilicicola* in the *his3* tree (Appendix B Figure A3), formed independent clades but closely related to *Ca. ilicicola* in the *act*, *cmdA*, *rpb2*, *tef1* and six-gene combined trees (Figure 3, Appendix B Figures A1, A2, A4–A6). There were only six SNP differences between the two isolates and the ex-type isolate of *Ca. ilicicola* (CMW 30998) for five gene regions (*tub2* sequence data were not available for *Ca. ilicicola*) combined. Consequently, these isolates were regarded as *Ca. ilicicola*.

Four isolates (CSF10024, CSF10070, CSF10077 and CSF10129), representing three genotypes, were phylogenetically related to *Ca. pacifica* and various other closely related species based on *act* and *tef1* trees (Appendix B Figures A1 and A5). They were, however, phylogenetically closest to *Ca. pacifica* based on *his3* and six-gene combined trees (Appendix B Figure A3), and clustered with *Ca. pacifica* based on *cmdA* and *rpb2* trees (Appendix B Figures A2 and A4). There were only one or three SNP difference(s) between the four isolates and the ex-type isolate of *Ca. pacifica* (CMW 16726) for five gene regions (*tub2* sequence data were not available for *Ca. pacifica*) combined. These four isolates were thus identified as *Ca. pacifica*.

Seventeen isolates representing 11 genotypes were phylogenetically closest to *Ca. aconidialis* based on *cmdA*, *his3*, *tef1* and six-gene combined trees (Figure 3, Appendix B Figures A2, A3, A5), and clustered with *Ca. aconidialis* based on *act* and *rpb2* (*rpb2* sequence data were not available for CSF9779 and CSF9875) trees (Appendix B Figures A1 and A4). Some isolates formed distinct clades based on the six-gene combined trees (Figure 3), while the total number of SNP differences between the 17 isolates and the ex-type isolate of *Ca. aconidialis* (CMW 35174) for five gene regions (sequence data for the *tub2* region were not available for *Ca. aconidialis*) combined varied between 0 and 4. Therefore, the 17 isolates were identified as *Ca. aconidialis*.

Seventy-one of the 353 isolates collected in this study were identified based on the DNA sequence of the six gene regions. According to the species identification results, we further

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identified the remaining 282 isolates based on the DNA sequences for two or four gene regions (Appendix A Table A1). Consequently, for the entire collection of 353 isolates, these were identified as *Ca. aconidialis* (178), *Ca. kyotensis* (103), *Ca. hongkongensis* (37), *Ca. pacifica* (17), *Ca. ilicicola* (five), *Ca. pseudoreteaudii* (five) and a novel species (eight), respectively.

Sexual Compatibility

Three isolates (CSF9933, CSF9941 and CSF9975) of the novel species were used in the mating tests (Table 2). All isolates examined formed protoperithecia readily within two weeks, and perithecia with viable ascospores were produced within four weeks. This was irrespective of whether they were crossed with each other or with themselves. The species was thus shown to be homothallic.

Morphology and Taxonomy

Based on multi-gene phylogenetic analyses (Figure 3, Appendix B Figures A1–A6) and morphological characteristics, seven *Calonectria* species were identified in this study, including six described species, i.e., *Ca. aconidialis*, *Ca. kyotensis*, *Ca. hongkongensis*, *Ca. pacifica*, *Ca. ilicicola*, *Ca. pseudoreteaudii* and one novel species. To facilitate future studies, complete morphological descriptions and illustrations have been made for the known species and these are presented in Appendix C (Figures A7–A12). The novel species can be distinguished from the phylogenetically most closely related species (*Ca. aciculata*, *Ca. colhounii*, *Ca. eucalypti* and *Ca. honghensis*) by the dimensions of its macroconidia and ascospores (Table 5). This species is described as follows:

Taxonomy

***Calonectria minensis* Q.L. Liu and S.F. Chen, sp. nov.**

MycoBank MB841412. (Figure 4).

Etymology: Name refers to the short name of FuJian Province in Chinese “Min”, where this fungus was isolated.

Diagnosis: *Calonectria minensis* can be distinguished from the phylogenetically closely related species *Ca. aciculata*, *Ca. colhounii*, *Ca. eucalypti* and *Ca. honghensis* by its distinct ascospore and macroconidia dimensions.

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Type: China: FuJian Province, LongYan Region, XinLuo District (25°07′08.597″ N, 116°44′42.257″ E), from soil collected in a *Eucalyptus* plantation, 6 November 2016, *S.F. Chen*, *Q.L. Liu* and *F.F. Liu* (HMAS249935—holotype, CSF9941 = CGMCC3.18877—ex-type culture).

Description*: Ascomata* perithecial, solitary or in groups of four, bright yellow, becoming orange with age; in section, apex and body yellow, base red-brown, sub-globose to ovoid, 258–395 µm high, 227–330 µm diam, body turning dark yellow, and base dark red-brown in 3% KOH+; ascomatal wall rough, consisting of two thick-walled layers; outer layer of *textura globulosa*, 22–66 µm thick, cells becoming more compressed towards the inner layer of *textura angularis*, 9–21 µm thick, cells becoming thin-walled and hyaline towards the centre; outermost cells 16–31 × 8–16 µm, cells of inner layer 8–33 × 2–8 µm; ascomatal base up to 196 µm wide, consisting of dark red, angular cells, merging with an erumpent stroma; cells of the outer wall layer continuous with the pseudoparenchymatous cells of the erumpent stroma. *Asci* 4-spored, clavate, 80–163 × 11–27 µm, tapering into a long thin stalk. *Ascospores* aggregated in the upper third of the ascus, hyaline, guttulate, fusoid with rounded ends, straight to slightly curved, (1–)3-septate, constricted at the septum, (38.5–)46.5–64.5(–80.5) × (6–)6.5–8(–8.5) µm (av. = 55.5 × 7 µm). *Macroconidiophores* consisting of a stipe, a suite of penicillately arranged fertile branches, a stipe extension, and a terminal vesicle; stipe septate, hyaline, smooth, 33–144 × 4–9 µm, stipe extension septate, straight to flexuous 63–240 µm long, 2–3 µm wide at the apical septum, terminating in a clavate vesicle, 3–5 µm diam; lateral stipe extensions (90° to main axis) absent. *Conidiogenous apparatus* 28–97 µm wide, and 35–83 µm long; primary branches aseptate, 13–40 × 3–7 µm; secondary branches aseptate, 9–31 × 3–6 µm; tertiary branches aseptate, 8–14 × 3–5 µm, quaternary branches aseptate, 7−12 × 3–5 µm, each terminal branch producing 2–4 phialides; phialides allantoid to elongate doliiform to reniform, hyaline, aseptate, 4–14 × 2–7 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at both ends, straight, (51–)55–66(–79) × (4.5–)5–6(–7.5) µm (av. = 60.5 × 5.5 µm), (1–)3-septate, lacking a visible abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies forming abundant woolly white to sienna (8) aerial mycelium at 25 °C on MEA, profuse sporulation; surface rust-coloured (39); reverse sienna (8) to rust-coloured (39) after 7 d. Chlamydospores extensive throughout the medium forming

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microsclerotia. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 18.1 mm, 27.0 mm, 58.2 mm, 69.5 mm and 42.4 mm, respectively.

Additional specimens examined: China: FuJian Province, LongYan Region, XinLuo District (25°07′08.597″ N, 116°44′42.257″ E), from soil collected in a *Eucalyptus* plantation, 6 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249936, culture CSF9933 = CGMCC3.18875); FuJian Province, LongYan Region, LianCheng County (25°26′14.348″ N, 116°38′42.400″ E), from soil under a natural forest, 6 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249937, culture CSF9975 = CGMCC3.18881).

Notes: *Calonectria minensis* is a new species in the *Ca. colhounii* species complex. It is closely related to *Ca. aciculata*, *Ca. colhounii*, *Ca. eucalypti*, and *Ca. honghensis*, and can be distinguished from those species by the dimensions of its ascospores and macroconidia. The ascospores of *Ca. minensis* (av. = 55.5 × 7 µm) are larger than those of *Ca. eucalypti* (av. = 33 × 6 µm) [37] and *Ca. honghensis* (av. = 49 × 6 µm) [4]. The macroconidia of *Ca. minensis* (av. = 60.5 × 5.5 µm) are shorter than those of *Ca. aciculata* (av. = 69 × 5.5 µm) [4], *Ca. colhounii* (av. = 65 × 5 µm) [17] and *Ca. eucalypti* (av. = 72 × 6 µm) [37], but longer than those of *Ca. honghensis* (av. = 54 × 5.5 µm) [4]. The total number of SNP differences between the ex-type isolate of *Ca. minensis* (CSF9941), and the ex-type isolates of *Ca. aciculata* (CERC5342), *Ca. colhounii* (CBS 293.79), *Ca. eucalypti* (CMW 18444) and *Ca. honghensis* (CERC 5572) for six gene regions combined, varied between 13 and 31.

Distribution of *Calonectria* Species in FuJian Province

Of the seven *Calonectria* species identified, *Ca. aconidialis* accounted for 50.4% of all the isolates. This was followed in order of occurrence by *Ca. kyotensis* (29.2%), *Ca. hongkongensis* (10.5%), *Ca. pacifica* (4.8%), *Ca. minensis* (2.3%), *Ca. ilicicola* (1.4%) and *Ca. pseudoreteaudii* (1.4%) (Figure 5). *Calonectria aconidialis* and *Ca. kyotensis* can be regarded as the most prevalent species (Figure 5).

Between two and four *Calonectria* species were isolated from soils sampled at each of the nine Counties or Districts (Figure 2). *Calonectria aconidialis* was found at all sites other than CangShan District, *Ca. kyotensis* was found at all sites other than YanPing District and ZhangPing County, and the remaining five species were found at between one and three sampling sites (Figure 2).

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All seven species were isolated from soils collected in *Eucalyptus* plantations. Five of the species were isolated from soils in natural forests, the exception being *Ca. ilicicola* and *Ca. pseudoreteaudii*. Only *Ca. aconidialis* and *Ca. kyotensis* were isolated from soils in *P. heterocycle* and *C. lanceolata* plantations, and only *Ca. kyotensis* was collected from soils in the *Pi. massoniana* plantation (Figure 5). Based on the percentage of soil samples that obtained *Calonectria* from each of the five forest types, the results showed that *Calonectria* was widely distributed in *Eucalyptus* plantation soils (47.1%, 57 of 121 sampled soils), followed by *P. heterocycle* (35.7%, 5 of 14 sampled soils) and natural forests (32.6%, 14 of 43 sampled soils), only 10% of soil samples obtained *Calonectria* from *C. lanceolata* (2 of 21 sampled soils) or *Pi. massoniana* (1 of 10 sampled soils).

Calonectria kyotensis was detected in soils in all of the soil types sampled, while *Ca. aconidialis* was isolated from soils in all forest types other than *Pi. massoniana*. *Calonectria hongkongensis*, *Ca. pacifica* and *Ca. minensis* were found both in *Eucalyptus* plantations and natural forests and the remaining two species were found only in *Eucalyptus* plantations (Figure 5).

DISCUSSION

A total of 353 *Calonectria* isolates were collected from soils in *Eucalyptus* plantations and adjacent plantations of other species or natural forests in FuJian Province. Multilocus phylogenetic inference and morphological characteristics revealed seven *Calonectria* species including *Ca. aconidialis*, *Ca. hongkongensis*, *Ca. ilicicola*, *Ca. kyotensis*, *Ca. pacifica* and *Ca. pseudoreteaudii*, and a novel species described here as *Ca. minensis*.

Results in this study showed that *Ca. aconidialis* and *Ca. kyotensis* were the most prevalent species in the soils sampled. *Calonectria aconidialis* accounted for 50.4% of all the isolates, which was found in eight of the nine sampled sites and soils of all forest types other than those of *Pi. massoniana*. The next most common species was *Ca. kyotensis*, accounting for 29.2% of the isolates, which was isolated from seven sites and soils of all five different forest types. The remaining five species were less common, and isolated only from one to three sites, either from *Eucalyptus* plantations or natural forests, or from both forest types.

Among the identified species, *Ca. aconidialis* is newly reported in FuJian Province and *Ca. pacifica* represents a first record for China. Eight *Calonectria* species were previously known in FuJian Province. These include *Ca. crousiana*, *Ca. eucalypti*, *Ca. fujianensis*, *Ca.*

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pauciramosa and *Ca. pseudoreteaudii* collected from diseased *Eucalyptus* leaves [7,8], *Ca. hongkongensis* and *Ca. kyotensis* isolated from soils in unknown forest types [4,18]and *Ca. ilicicola* collected from diseased peanuts (*Arachis hypogaea*) in LongYan Region [58].

The *Calonectria* species diversity in soils was clearly dependent on the forest types sampled. Of the seven species detected, all were obtained from *Eucalyptus* plantations, five were obtained from natural forests and only one or two species were from other forest types. While these observations are convincing in terms of broad patterns, they must be tempered by the fact that the greatest number of soil samples were from *Eucalyptus* plantations and natural forests, which could have influenced the results.

The newly described *Ca. minensis* isolated from soils both in *Eucalyptus* plantations and natural forest, adds a new species to the *Ca. colhounii* species complex. As a consequence, 13 species are now accommodated in this complex [4,7,17,18,21,25,37,39,46,49]. With the exception of *Ca. macroconidialis* [46], *Ca. madagascariensis* [17] and *Ca. paracolhounii* [39], all of the other 10 species have been recorded in south-eastern Asia [4,7,17,21,25]. Species in this complex include some important causal agents of CLB on *Eucalyptus* spp. including *Ca. aciculata*, *Ca. eucalypti* and *Ca. fujianensis*, which have all been reported from diseased *Eucalyptus* trees in China plantations [4,7].

Five species residing in the *Ca. kyotensis* species complex were identified in the present study. Of these, *Ca. aconidialis* accounted for more than half of all the isolates collected and has previously been shown to be widely distributed in soils of *Eucalyptus* plantation in many regions of southern China, including GuangDong [11,18], GuangXi [4,10,11] and HaiNan Provinces [11]. In the present study, *Ca. aconidialis* was collected from soils of four types of forests and in eight of the nine sampling sites in FuJian Province (Figure 2), providing new geographic records for this pathogen in China. This species has previously been shown to infect inoculated *Eucalyptus* seedlings [10] and could pose a threat to *Eucalyptus* plantation forestry. *Calonectria pacifica* was isolated from soils both in the *Eucalyptus* plantations (MinHou and YongAn Counties) and natural forests (YanPing District) in this study. This species was originally described on *Araucaria heterophylla* from Hawaii, USA [40], and this is the first report of the fungus in China.

This study elucidated the diversity and distribution characteristics of *Calonectria* species in soils collected from plantations and natural forests in FuJian Province. Broad patterns of

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occurrence were clear with *Eucalyptus* soils yielding the largest number of species. The conifer forests had the lowest number of species, which is consistent with the fact that most *Calonectria* spp. are known from Angiosperm hosts or from soils associated with these plants. The results of the present study bring the number of *Calonectria* species recorded in FuJian to 11. Most of these species have also been shown to be pathogenic to *Eucalyptus* in previous studies [7,9,10]. The surprisingly high species diversity in this region suggests that *Calonectria* species will pose long-term challenges for the development of *Eucalyptus* forestry in southern China.

Author Contributions: Conceptualization, Q.L. and S.C.; methodology, Q.L. and S.C.; software, Q.L.; validation, Q.L., M.J.W., T.A.D., B.D.W. and S.C.; formal analysis, Q.L.; investigation, Q.L. and S.C.; resources, Q.L. and S.C.; data curation, Q.L. and S.C; writing—original draft preparation, Q.L.; writing—review and editing, Q.L., M.J.W., T.A.D., B.D.W. and S.C.; visualization, Q.L.; supervision, M.J.W., T.A.D., B.D.W. and S.C.; project administration, S.C.; funding acquisition, S.C. All authors have read and agreed to the published version of the manuscript.

Funding: This study was initiated through the bilateral agreement between the Governments of South Africa and China and supported by The National Key R&D Program of China (China-South Africa Forestry Joint Research Centre Project; project No. 2018YFE0120900), the special fund for basic scientific research of State Key Laboratory of Tree Genetics and Breeding (SKLTGB) of China (project No. TGB2017001), the National Ten-thousand Talents Program (Project No. W03070115) and the GuangDong Top Young Talents Program in China (Project No. 20171172).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The sequences from the current study were submitted to the NCBI database (https://www.ncbi.nlm.nih.gov/, accessed on 24 July 2022) and the accession numbers were listed in Table 2.

Acknowledgments: We thank FeiFei Liu for her assistance in collecting soil samples.

Conflicts of Interest: The authors declare no conflict of interest.

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Table 1. Details of soils sampled, associated forest types and *Calonectria* spp. isolated.

Code	Sampling Site	Substrate	Number of Samples	Number of Samples Obtained *Calonectria*	Number of *Calonectria* Isolates Obtained	*Calonectria* spp. (Number of Isolates)
a	YanPing District	*Eucalyptus* plantation	5	3	12	*Ca. aconidialis* (7); *Ca. pseudoreteaudii* (5)
		natural forest	13	3	10	*Ca. aconidialis* (3); *Ca. pacifica* (7)
		Cunninghamia lanceolata	10	0	0	N/A [a]
b	MinHou County	*Eucalyptus* plantation	15	12	51	*Ca. aconidialis* (28); *Ca. kyotensis* (17); *Ca. hongkongensis* (4); *Ca. pacifica* (2)
c	CangShan District	natural forest	3	3	11	*Ca. kyotensis* (5); *Ca. hongkongensis* (6)
d	QingLiu County	natural forest	10	0	0	N/A
		Cunninghamia lanceolata	11	2	9	*Ca. aconidialis* (5); *Ca. kyotensis* (4)
		Pinus massoniana	10	1	5	*Ca. kyotensis* (5)
e	YongAn County	*Eucalyptus* plantation	27	7	28	*Ca. aconidialis* (12); *Ca. kyotensis* (8); *Ca. pacifica* (8)
f	LianCheng County	*Eucalyptus* plantation	20	4	20	*Ca. kyotensis* (20)
		natural forest	17	8	40	*Ca. aconidialis* (27); *Ca. kyotensis* (8); *Ca. minensis* (5)
g	ZhangPing County	*Eucalyptus* plantation	20	15	71	*Ca. aconidialis* (66); *Ca. ilicicola* (5)
h	XinLuo District	*Eucalyptus* plantation	19	4	16	*Ca. aconidialis* (6); *Ca. kyotensis* (7); *Ca. minensis* (3)
		Phyllostachys heterocycle	14	5	25	*Ca. aconidialis* (5); *Ca. kyotensis* (20)
i	HuaAn County	*Eucalyptus* plantation	15	12	55	*Ca. aconidialis* (19); *Ca. kyotensis* (9); *Ca. hongkongensis* (27)
		In total	209	79	353	

[a] N/A refers to samples that did not yield *Calonectria* isolates.

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Table 2. Isolates sequenced in this study and used for phylogenetic analyses and morphological studies.

Species [a]	Isolate No. [b,c]	Genotype [d]	Substrate	Sampling Site	GPS Coordinate	Collector	GenBank Accession No. [e]					
							act	*cmdA*	*his3*	*rpb2*	*tef1*	*tub2*
Calonectria aconidialis	CSF9779	AAA-AA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253064	OK253135	OK253279	N/A [f]	OK253491	OK253844
	CSF9857	AAAAAA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253065	OK253136	OK253280	OK253423	OK253492	OK253845
	CSF9937	AAAABA	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253066	OK253137	OK253281	OK253424	OK253493	OK253846
	CSF9938	AAAABA	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253067	OK253138	OK253282	OK253425	OK253494	OK253847
	CSF9939	AAAABA	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253068	OK253139	OK253283	OK253426	OK253495	OK253848
	CSF9809	ABAAAA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253069	OK253140	OK253284	OK253427	OK253496	OK253849
	CSF10105	ABAAAA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253070	OK253141	OK253285	OK253428	OK253497	OK253850

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CSF9789	ABAAAB	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253071	OK253142	OK253286	OK253429	OK253498	OK253851
CSF9839	ABAAAC	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253072	OK253143	OK253287	OK253430	OK253499	OK253852
CSF9844	ABAAAC	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253073	OK253144	OK253288	OK253431	OK253500	OK253853
CSF9882	ABAAAD	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253074	OK253145	OK253289	OK253432	OK253501	OK253854
CSF9987	ABAAAD	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253075	OK253146	OK253290	OK253433	OK253502	OK253855
CSF9813	ABAACA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253076	OK253147	OK253291	OK253434	OK253503	OK253856
CSF9841	ABAACA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253077	OK253148	OK253292	OK253435	OK253504	OK253857
CSF9870	ABBAAA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253078	OK253149	OK253293	OK253436	OK253505	OK253858

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	CSF9875	ABB-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253079	OK253150	OK253294	N/A	OK253506	OK253859
	CSF9957	ACBAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253080	OK253151	OK253295	OK253437	OK253507	OK253860
Ca. hongkongensis	CSF7124	AAAAAA	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253081	OK253192	OK253336	OK253438	OK253669	OK253900
	CSF9784	AAAAAA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253082	OK253193	OK253337	OK253439	OK253670	OK253901
	CSF9794	ABAAAA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253083	OK253194	OK253338	OK253440	OK253671	OK253902
	CSF9799	ABAAAA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253084	OK253195	OK253339	OK253441	OK253672	OK253903
Ca. ilicicola	CSF9862	AAAAAA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253085	OK253202	OK253346	OK253442	OK253706	OK253910
	CSF9863	AAAAAA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253086	OK253203	OK253347	OK253443	OK253707	OK253911

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Ca. kyotensis	CSF7130	AAAAAA	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253087	OK253207	OK253351	OK253444	OK253711	OK253915
	CSF10088	AAAAAA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253088	OK253208	OK253352	OK253445	OK253712	OK253916
	CSF9834	AAA-AB	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253089	OK253209	OK253353	N/A	OK253713	OK253917
	CSF9910	AAAAAB	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253090	OK253210	OK253354	OK253446	OK253714	OK253918
	CSF10014	AAAAAC	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253091	OK253211	OK253355	OK253447	OK253715	OK253919
	CSF10080	AAAAAD	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253092	OK253212	OK253356	OK253448	OK253716	OK253920
	CSF10086	AAAAAE	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253093	OK253213	OK253357	OK253449	OK253717	OK253921
	CSF10053	AAAABB	Soil (*Pinus massoniana*)	QingLiu, SanMing, FuJian, China	26°10′54.311″ N, 116°52′50.901″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253094	OK253214	OK253358	OK253450	OK253718	OK253922

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CSF10054	AAAABB	Soil (*Pinus massoniana*)	QingLiu, SanMing, FuJian, China	26°10′54.311″ N, 116°52′50.901″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253095	OK253215	OK253359	OK253451	OK253719	OK253923
CSF9922	AAAABF	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253096	OK253216	OK253360	OK253452	OK253720	OK253924
CSF9923	AAAABF	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253097	OK253217	OK253361	OK253453	OK253721	OK253925
CSF9949	AAAADB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253098	OK253218	OK253362	OK253454	OK253722	OK253926
CSF9951	AAAADB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253099	OK253219	OK253363	OK253455	OK253723	OK253927
CSF9932	AAAADG	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253100	OK253220	OK253364	OK253456	OK253724	OK253928
CSF9935	AAAADG	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253101	OK253221	OK253365	OK253457	OK253725	OK253929
CSF9936	AAAADG	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253102	OK253222	OK253366	OK253458	OK253726	OK253930

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CSF10020	AAAAEA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253103	OK253223	OK253367	OK253459	OK253727	OK253931
CSF10021	AAAAEA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253104	OK253224	OK253368	OK253460	OK253728	OK253932
CSF10009	AAABBH	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253105	OK253225	OK253369	OK253461	OK253729	OK253933
CSF10010	AAABBH	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253106	OK253226	OK253370	OK253462	OK253730	OK253934
CSF9997	AABAAB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253107	OK253227	OK253371	OK253463	OK253731	OK253935
CSF9969	AABACB	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253108	OK253228	OK253372	OK253464	OK253732	OK253936
CSF9972	AABACB	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253109	OK253229	OK253373	OK253465	OK253733	OK253937
CSF9973	AABACB	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253110	OK253230	OK253374	OK253466	OK253734	OK253938

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CSF10126	AACAAA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253111	OK253231	OK253375	OK253467	OK253735	OK253939
CSF9962	AACAAD	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253112	OK253232	OK253376	OK253468	OK253736	OK253940
CSF10019	AADABB	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253113	OK253233	OK253377	OK253469	OK253737	OK253941
CSF10022	AADABB	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253114	OK253234	OK253378	OK253470	OK253738	OK253942
CSF10023	AADABB	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253115	OK253235	OK253379	OK253471	OK253739	OK253943
CSF10045	ABAAAB	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253116	OK253236	OK253380	OK253472	OK253740	OK253944
CSF10047	ABAAAB	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253117	OK253237	OK253381	OK253473	OK253741	OK253945
CSF9824	ACBAAC	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253118	OK253238	OK253382	OK253474	OK253742	OK253946

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	CSF10004	ADAACB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253119	OK253239	OK253383	OK253475	OK253743	OK253947
	CSF10005	ADAACB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253120	OK253240	OK253384	OK253476	OK253744	OK253948
Ca. minensis sp. nov.	CSF9941 [g–i]; CGMCC3.18877	AAAAAA	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253121	OK253259	OK253403	OK253477	OK253814	OK253967
	CSF9974	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253122	OK253260	OK253404	OK253478	OK253815	OK253968
	CSF9975 [g,h]; CGMCC3.18881	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253123	OK253261	OK253405	OK253479	OK253816	OK253969
	CSF9976	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253124	OK253262	OK253406	OK253480	OK253817	OK253970
	CSF9977	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253125	OK253263	OK253407	OK253481	OK253818	OK253971
	CSF9978	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253126	OK253264	OK253408	OK253482	OK253819	OK253972

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	CSF9933 [g,h]; CGMCC3.18875	ABBABB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253127	OK253265	OK253409	OK253483	OK253820	OK253973
	CSF9934	ABBABB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253128	OK253266	OK253410	OK253484	OK253821	OK253974
Ca. pacifica	CSF10024	AAAAAA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253129	OK253267	OK253411	OK253485	OK253822	OK253975
	CSF10129	BAAAAA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253130	OK253268	OK253412	OK253486	OK253823	OK253976
	CSF10070	CABAAA	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253131	OK253269	OK253413	OK253487	OK253824	OK253977
	CSF10077	CABAAA	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253132	OK253270	OK253414	OK253488	OK253825	OK253978
Ca. pseudoreteaudii	CSF10059	AAAAAA	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253133	OK253274	OK253418	OK253489	OK253839	OK253982
	CSF10060 [g,h]	AAAAAA	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253134	OK253275	OK253419	OK253490	OK253840	OK253983

[a] New species described in this study are indicated in bold.

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[b] CSF = Culture Collection from Southern Forests (CSF), ZhanJiang, GuangDong Province, China; CGMCC = China General Microbiological Culture Collection Center, Beijing, China.

[c] Isolates used in phylogenetic analyses.

[d] Genotype within each identified species, determined by sequences of *act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2* regions; '-' means not available.

[e] *act* = actin; *cmdA* = calmodulin; *his3* = histone H3; *rpb2* = the second largest subunit of RNA polymerase; *tef1* = translation elongation factor 1-alpha; *tub2* = β-tubulin.

[f] N/A represents sequences that are not available.

[g] Isolates used in morphological and culture growth studies.

[h] Isolates used for mating studies.

i Isolates that represent ex-type cultures are indicated in bold.

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Table 3. Isolates from other studies and used in the phylogenetic analyses.

Code B [a]	Species	Isolates No. [b,c]	Other Collection Number [b]	Substrate	Area of Occurrence	Collector	GenBank accession No. [d] *act*; *cmdA*; *his3*; *rpb2*; *tef1*; *tub2*	References
B1	*Calonectria acaciicola*	CMW 47173^T	CBS 143557	Soil (*Acacia auriculiformis* plantation)	Do Luong, Nghe An, Vietnam	N.Q. Pham and T.Q. Pham	MT334933; MT335160; MT335399; MT412474; MT412690; MT412930	[16,18]
		CMW 47174	CBS 143558	Soil (*A. auriculiformis* plantation)	Do Luong, Nghe An, Vietnam	N.Q. Pham and T.Q. Pham	MT334934; MT335161; MT335400; MT412475; MT412691; MT412931	[16,18]
B2	*Ca. acicola*	CMW 30996^T	–	*Phoenix canariensis*	Northland, New Zealand	H. Pearson	MT334935; MT335162; MT335401; MT412476; MT412692; MT412932	[18,36,37]
		CBS 114812	CMW 51216	*P. canariensis*	Northland, New Zealand	H. Pearson	MT334936; MT335163; MT335402; MT412477; MT412693; MT412933	[18,36,37]
B3	*Ca. aciculata*	CERC 5342^T	CBS 142883; CMW 47645	*Eucalyptus urophylla* × *E. grandis*	YunNan, China	S.F. Chen and J.Q. Li	MT334937; MT335164; MT335403; MT412478; MT412694; MT412934	[4,18]
B4	*Ca. aconidialis*	CMW 35174^T	CBS 136086; CERC 1850	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou and S.F. Chen	MT334938; MT335165; MT335404; MT412479; MT412695; N/A [e]	[11,18]
		CMW 35384	CBS 136091; CERC 1886	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou and S.F. Chen	MT334939; MT335166; MT335405; N/A; MT412696; N/A	[11,18]
B5	*Ca. aeknauliensis*	CMW 48253^T	CBS 143559	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT334953; MT335180; MT335419; MT412486; MT412710; N/A	[16,18]
		CMW 48254	CBS 143560	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT334954; MT335181; MT335420; MT412487; MT412711; N/A	[16,18]

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B8	*Ca. asiatica*	CBS 114073^{T}	CMW 23782; CPC 3900	Debris (leaf litter)	Prathet Thai, Thailand	N.L. Hywel-Jones	GQ280428; AY725741; AY725658; N/A; AY725705; AY725616	[23,37]
B10	*Ca. australiensis*	CMW 23669^{T}	CBS 112954; CPC 4714	*Ficus pleurocarpa*	Queensland, Australia	C. Pearce and B. Paulus	MT334965; MT335192; MT335432; MT412496; MT412723; MT412946	[18,37,38]
B17	*Ca. brassicicola*	CBS 112841^{T}	CMW 51206; CPC 4552	Soil at *Brassica* sp.	Indonesia	M.J. Wingfield	N/A; KX784561; N/A; N/A; KX784689; KX784619	[39]
B19	*Ca. bumicola*	CMW 48257^{T}	CBS 143575	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT334975; MT335205; MT335445; MT412509; MT412736; N/A	[16,18]
B20	*Ca. canadiana*	CMW 23673^{T}	CBS 110817; STE-U 499	*Picea* sp.	Canada	S. Greifenhagen	MT334976; MT335206; MT335446; MT412510; MT412737; MT412958	[17,18,40,41]
		CERC 8952	–	Soil	HeNan, China	S.F. Chen	MT335058; MT335290; MT335530; MT412587; MT412821; MT413035	[18,25]
B23	*Ca. chinensis*	CMW 23674^{T}	CBS 114827; CPC 4101	Soil	Hong Kong, China	E.C.Y. Liew	MT334990; MT335220; MT335460; MT412524; MT412751; MT412972	[18,23,37]
		CMW 30986	CBS 112744; CPC 4104	Soil	Hong Kong, China	E.C.Y. Liew	MT334991; MT335221; MT335461; MT412525; MT412752; MT412973	[18,23,37]
B26	*Ca. cochinchinen-sis*	CMW 49915^{T}	CBS 143567	Soil (*Hevea brasiliensis* plantation)	Duong Minh Chau, Tay Ninh, Vietnam	N.Q. Pham, Q.N. Dang and T.Q. Pham	MT334995; MT335225; MT335465; MT412529; MT412756; MT412977	[16,18]
		CMW 47186	CBS 143568	Soil (*A. auriculiformis* plantation)	Song May, Dong Nai, Vietnam	N.Q. Pham and T.Q. Pham	MT334996; MT335226; MT335466; MT412530; MT412757; MT412978	[16,18]

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B27	*Ca. colhounii*	CBS 293.79 T	CMW 30999	*Camellia sinensis*	Mauritius	A. Peerally	GQ280443; GQ267373; DQ190639; KY653376; GQ267301; DQ190564	[17,37,38,42]
B29	*Ca. colombiensis*	CMW 23676^{T}	CBS 112220; CPC 723	Soil (*E. grandis* trees)	La Selva, Colombia	M.J. Wingfield	MT334998; MT335228; MT335468; MT412532; MT412759; MT412980	[18,23]
		CMW 30985	CBS 112221; CPC 724	Soil (*E. grandis* trees)	La Selva, Colombia	M.J. Wingfield	MT334999; MT335229; MT335469; MT412533; MT412760; MT412981	[18,23]
B30	*Ca. crousiana*	CMW 27249^{T}	CBS 127198	*E. grandis*	FuJian, China	M.J. Wingfield	MT335000; MT335230; MT335470; MT412534; MT412761; MT412982	[7,18]
		CMW 27253	CBS 127199	*E. grandis*	FuJian, China	M.J. Wingfield	MT335001; MT335231; MT335471; MT412535; MT412762; MT412983	[7,18]
B31	*Ca. curvispora*	CMW 23693^{T}	CBS 116159; CPC 765	Soil	Tamatave, Madagascar	P.W. Crous	MT335002; MT335232; MT335472; MT412536; MT412763; N/A	[11,17,18,37, 43]
		CMW 48245	CBS 143565	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT335003; MT335233; MT335473; MT412537; MT412764; N/A	[16,18]
B36	*Ca. eucalypti*	CMW 18444^{T}	CBS 125275	*E. grandis*	Aek Nauli, Sumatra Utara, Indonesia	M.J. Wingfield	MT335013; MT335243; MT335483; MT412545; MT412774; MT412992	[18,37]
		CMW 18445	CBS 125276	*E. grandis*	Aek Nauli, Sumatra Utara, Indonesia	M.J. Wingfield	MT335014; MT335244; MT335484; MT412546; MT412775; MT412993	[18,37]
B39	*Ca. fujianensis*	CMW 27257^{T}	CBS 127201	*E. grandis*	FuJian, China	M.J. Wingfield	MT335019; MT335249; MT335489; MT412551; MT412780; MT412998	[7,18]

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		CMW 27254	CBS 127200	*E. grandis*	FuJian, China	M.J. Wingfield	MT335020; MT335250; MT335490; MT412552; MT412781; MT412999	[7,18]
B46	*Ca. heveicola*	CMW 49913^{T}	CBS 143570	Soil (*H. brasiliensis* plantation)	Bau Bang, Binh Duong, Vietnam	N.Q. Pham, Q.N. Dang and T.Q. Pham	MT335025; MT335255; MT335495; N/A; MT412786; MT413004	[16,18]
		CMW 49928	CBS 143571	Soil	Bu Gia Map National Park, Binh Phuoc, Vietnam	N.Q. Pham, Q.N. Dang and T.Q. Pham	MT335048; MT335280; MT335520; MT412577; MT412811; MT413025	[16,18]
B47	*Ca. honghensis*	CERC 5572^{T}	CBS 142885; CMW 47669	Soil (*Eucalyptus* plantation)	HongHe, YunNan, China	S.F. Chen and J.Q. Li	MT335026; MT335256; MT335496; MT412557; MT412787; MT413005	[4,18]
		CERC 5571	CBS 142884; CMW 47668	Soil (*Eucalyptus* plantation)	HongHe, YunNan, China	S.F. Chen and J.Q. Li	MT335027; MT335257; MT335497; MT412558; MT412788; MT413006	[4,18]
B48	*Ca. hongkongensis*	CBS 114828^{T}	CMW 51217; CPC 4670	Soil	Hong Kong, China	M.J. Wingfield	MT335028; MT335258; MT335498; MT412559; MT412789; MT413007	[18,23]
		CERC 3570	CMW 47271	Soil (*Eucalyptus* plantation)	BeiHai, Guangxi, China	S.F. Chen, J.Q. Li and G.Q. Li	MT335030; MT335260; MT335500; MT412561; MT412791; MT413009	[4,18]
B51	*Ca. ilicicola*	CMW 30998^{T}	CBS 190.50; IMI 299389; STE-U 2482	*Solanum tuberosum*	Bogor, Java, Indonesia	K.B. Boedijn and J. Reitsma	MT335036; MT335266; MT335506; MT412564; MT412797; N/A	[17,18,37,44]
B52	*Ca. indonesiae*	CMW 23683^{T}	CBS 112823; CPC 4508	*Syzygium aromaticum*	Warambunga, Indonesia	M.J. Wingfield	MT335037; MT335267; MT335507; MT412565; MT412798; MT413015	[18,23]

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		CBS 112840	CMW 51205; CPC 4554	*S. aromaticum*	Warambunga, Indonesia	M.J. Wingfield	MT335038; MT335268; MT335508; MT412566; MT412799; MT413016	[18,23]
B53	*Ca. indusiata*	CBS 144.36 T	CMW 23699	*Camellia sinensis*	Sri lanka	N/A	GQ280536; GQ267453; GQ267262; KY653396; GQ267332; GQ267239	[17,37,39,45]
		CBS 114684	CMW 51213; CPC 2446; UFV16	*Rhododendron* sp.	Florida, USA	N.E. El-Gholl	GQ280537; GQ267454; DQ190653; N/A; GQ267333; AF232862	[17,38,46]
B55	*Ca. kyotensis*	CBS 114525 T	ATCC 18834; CMW 51824; CPC 2367	*Robinia pseudoacacia*	Japan	T. Terashita	MT335039; MT335271; MT335511; MT412569; MT412802; MT413019	[17,18,39,47]
		CBS 114550	CMW 51825; CPC 2351	Soil	China	M.J. Wingfield	MT335016; MT335246; MT335486; MT412548; MT412777; MT412995	[18,39]
B57	*Ca. lantauensis*	CERC 3302 T	CBS 142888; CMW 47252	Soil	LiDao, Hong Kong, China	M.J. Wingfield and S.F. Chen	MT335040; MT335272; MT335512; MT412570; MT412803; N/A	[4,18]
		CERC 3301	CBS 142887; CMW 47251	Soil	LiDao, Hong Kong, China	M.J. Wingfield and S.F. Chen	MT335041; MT335273; MT335513; N/A; MT412804; N/A	[4,18]
B58	*Ca. lateralis*	CMW 31412 T	CBS 136629	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao and F. Han	MT335042; MT335274; MT335514; MT412571; MT412805; MT413020	[11,18]
B62	*Ca. lichi*	CERC 8866 T	–	Soil	HeNan, China	S.F. Chen	MT335046; MT335278; MT335518; MT412575; MT412809; MT413023	[18,25]

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		CERC 8850	–	Soil	HeNan, China	S.F. Chen	MT335047; MT335279; MT335519; MT412576; MT412810; MT413024	[18,25]
B63	*Ca. lombardiana*	CMW 30602^{T}	CBS 112634; CPC 4233; Lynfield 417	*Xanthorrhoea australis*	Victoria, Australia	T. Baigent	MT335156; MT335395; MT335635; MT412686; MT412926; MT413133	[17,18,24,38]
B64	*Ca. macroconidialis*	CBS 114880^{T}	CMW 51219; CPC 307; PPRI 4000	*E. grandis*	Sabie, Mpumalanga, South Africa	P.W. Crous	MT335050; MT335282; MT335522; MT412579; MT412813; MT413027	[17,18,37,48]
B65	*Ca. madagascariensis*	CMW 23686^{T}	CBS 114572; CPC 2252	Soil	Rona, Madagascar	J.E. Taylor	MT335052; MT335284; MT335524; MT412581; MT412815; MT413029	[17,18,37,38]
		CMW 30993	CBS 114571; CPC 2253	Soil	Rona, Madagascar	J.E. Taylor	MT335053; MT335285; MT335525; MT412582; MT412816; MT413030	[17,18,37,38]
B66	*Ca. malesiana*	CMW 23687^{T}	CBS 112752; CPC 4223	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335054; MT335286; MT335526; MT412583; MT412817; MT413031	[18,23]
		CBS 112710	CMW 51199; CPC 3899	Leaf litter	Prathet, Thailand	N.L. Hywel-Jones	MT335055; MT335287; MT335527; MT412584; MT412818; MT413032	[18,23]
B70	*Ca. monticola*	CBS 140645^{T}	CPC 28835	Soil	Chiang Mai, Thailand	P.W. Crous	N/A; KT964771; N/A; N/A; KT964773; KT964769	[49]
		CPC 28836	–	Soil	Chiang Mai, Thailand	P.W. Crous	N/A; KT964772; N/A; N/A; KT964774; KT964770	[49]
B74	*Ca. multiseptata*	CMW 23692^{T}	CBS 112682; CPC 1589	*E. grandis*	North Sumatra, Indonesia	M.J. Wingfield	MT335067; MT335299; MT335539; MT412596; MT412830; MT413044	[17,18,38,50]

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B80	*Ca. pacifica*	CMW 16726^{T}	A1568; CBS 109063; IMI 354528; STE-U 2534	*Araucaria heterophylla*	Hawaii, USA	M. Aragaki	MT335079; MT335311; MT335551; MT412604; MT412842; N/A	[17,18,23,40]
		CMW 30988	CBS 114038	*Ipomoea aquatica*	Auckland, New Zealand	C.F. Hill	MT335080; MT335312; MT335552; MT412605; MT412843; N/A	[17,18,23,37]
B81	*Ca. paracolhounii*	CBS 114679^{T}	CMW 51212; CPC 2445	N/A	USA	A.Y. Rossman	N/A; KX784582; N/A; KY653423; KX784714; KX784644	[39,45]
		CBS 114705	CMW 51215; CPC 2423	Fruit of *Annona reticulata*	Australia	D. Hutton	N/A; N/A; N/A; KY653424; KX784715; KX784645	[39,45]
B86	*Ca. penicilloides*	CMW 23696^{T}	CBS 174.55; STE-U 2388	*Prunus* sp.	Hatizyo Island, Japan	M. Ookubu	MT335106; MT335338; MT335578; MT412631; MT412869; MT413081	[17,18,51]
B97	*Ca. pseudoreteaud-ii*	CMW 25310^{T}	CBS 123694	*E. urophylla* × *E. grandis*	GuangDong, China	M.J. Wingfield and X.D. Zhou	MT335119; MT335354; MT335594; MT412647; MT412885; MT413096	[18,24]
		CMW 25292	CBS 123696	*E. urophylla* × *E. grandis*	GuangDong, China	M.J. Wingfield and X.D. Zhou	MT335120; MT335355; MT335595; MT412648; MT412886; MT413097	[18,24]
B104	*Ca. queenslandica*	CMW 30604^{T}	CBS 112146; CPC 3213	*E. urophylla*	Lannercost, Queensland, Australia	B. Brown	MT335132; MT335367; MT335607; MT412660; MT412898; MT413108	[18,24]
		CMW 30603	CBS 112155; CPC 3210	*E. pellita*	Lannercost, Queensland, Australia	P.Q Thu and K.M. Old	MT335133; MT335368; MT335608; MT412661; MT412899; MT413109	[18,24]

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B106	*Ca. reteaudii*	CMW 30984^{T}	CBS 112144; CPC 3201	*E. camaldulensis*	Chon Thanh, Binh Phuoc, Vietnam	M.J. Dudzinski and P.Q. Thu	MT335135; MT335370; MT335610; MT412663; MT412901; MT413111	[17,18,38,52]
		CMW 16738	CBS 112143; CPC 3200	*Eucalyptus* leaves	Binh Phuoc, Vietnam	M.J. Dudzinski and P.Q. Thu	MT335136; MT335371; MT335611; MT412664; MT412902; MT413112	[17,18,38,52]
B112	*Ca. sumatrensis*	CMW 23698^{T}	CBS 112829; CPC 4518	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335145; MT335382; MT335622; MT412674; MT412913; N/A	[18,23]
		CMW 30987	CBS 112934; CPC 4516	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335146; MT335383; MT335623; MT412675; MT412914; N/A	[18,23]
B113	*Ca. syzygiicola*	CBS 112831^{T}	CMW 51204; CPC 4511	*S. aromaticum*	Sumatra, Indonesia	M.J. Wingfield	N/A; N/A; N/A; N/A; KX784736; KX784663	[39]
B116	*Ca. uniseptata*	CBS 413.67^{T}	CMW 23678; CPC 2391; IMI 299577	*Paphiopedilum callosum*	Celle, Germany	W. Gerlach	GQ280451; GQ267379; GQ267248; N/A; GQ267307; GQ267208	[39]
B123	*Ca. xianrensis*	CSF12909^{T}	CGMCC3.19584	Soil (near *Eucalyptus* plantation)	Dacheng Town, Gaozhou County, Maoming Region, GuangDong, China	S.F. Chen, Q.C. Wang and W. Wang	N/A; MK962845; MK962857; N/A; MK962869; MK962833	[21]
		CSF12908	CGMCC3.19518	Soil (near *Eucalyptus* plantation)	Dacheng Town, Gaozhou County, Maoming Region, GuangDong, China	S.F. Chen, Q.C. Wang and W. Wang	N/A; MK962844; MK962856; N/A; MK962868; MK962832	[21]

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B120	*Ca. yunnanensis*	CERC 5339[T]	CBS 142897; CMW 47644	Soil (*Eucalyptus* plantation)	YunNan, China	S.F. Chen and J.Q. Li	MT335157; MT335396; MT335636; MT412687; MT412927; MT413134	[4,18]
		CERC 5337	CBS 142895; CMW 47642	Soil (*Eucalyptus* plantation)	YunNan, China	S.F. Chen and J.Q. Li	MT335158; MT335397; MT335637; MT412688; MT412928; MT413135	[4,18]
	Curvicladiella cignea	CBS 109167[T]	CPC 1595; MUCL 40269	Decaying leaf	French Guiana	C. Decock	KM231122; KM231287; KM231461; KM232311; KM231867; KM232002	[11,38,53]
		CBS 109168	CPC 1594; MUCL 40268	Decaying seed	French Guiana	C. Decock	KM231121; KM231286; KM231460; KM232312; KM231868; KM232003	[11,38,53]

[a] Codes (B1 to B120) of the 120 accepted *Calonectria* species resulting from Liu and co-authors [18].

[b] *ATCC* = American Type Culture Collection, Virginia, USA; *CBS* = Westerdijk Fungal Biodiversity Institute, Utrecht, The Netherlands; *CERC* = China Eucalypt Research Centre, ZhanJiang, GuangDong Province, China; *CGMCC* = China General Microbiological Culture Collection Center, Beijing, China; *CMW* = Culture collection of the Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa; *CPC* = Pedro Crous working collection housed at Westerdijk Fungal Biodiversity Institute; *CSF* = Culture Collection from Southern Forests (CSF), ZhanJiang, GuangDong Province, China; *IMI* = International Mycological Institute, CABI Bioscience, Egham, Bakeham Lane, UK; *MUCL* = Mycotheque, Laboratoire de Mycologie Systematique st Appliqee, I'Universite, Louvian-la-Neuve, Belgium; *PPRI* = Plant Protection Research Institute, Pretoria, South Africa; *STE-U* = Department of Plant Pathology, University of Stellenbosch, South Africa; '–' represent no other collection number.

[c] *T* = ex-type isolates of the species.

[d] *act* = actin; *cmdA* = calmodulin; *his3* = histone H3; *rpb2* = the second largest subunit of RNA polymerase; *tef1* = translation elongation factor 1-alpha; *tub2* = β-tubulin.

[e] *N/A* = information not available.

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Table 4. Statistics resulting from phylogenetic analyses in this study.

Dataset	No. of Taxa	No. of bp [a]	Maximum Parsimony						
			PIC [b]	No. of Trees	Tree Length	CI [c]	RI [d]	RC [e]	HI [f]
act	147	278	111	4	258	0.636	0.968	0.615	0.364
cmdA	147	672	291	433	677	0.647	0.968	0.626	0.353
his3	143	464	183	1000	830	0.475	0.928	0.440	0.525
rpb2	134	863	269	1000	683	0.530	0.959	0.508	0.470
tef1	149	532	267	1000	758	0.637	0.963	0.613	0.363
tub2	135	597	286	1000	826	0.609	0.958	0.584	0.391
act/cmdA/his3/rpb2/tef1/tub2	149	3406	1407	3000	4408	0.532	0.949	0.504	0.468

Dataset	Maximum Likelihood							
	Subst. Mode [g]	NST [h]	Rate Matrix					Rates
act	TPM2+G	6	0.5990	4.0516	0.5990	1.0000	4.0516	Gamma
cmdA	TrN+G	6	1.0000	4.1556	1.0000	1.0000	7.1231	Gamma
his3	TPM2uf+I+G	6	1.2442	6.0957	1.2442	1.0000	6.0957	Gamma
rpb2	TrNef+I+G	6	1.0000	9.0443	1.0000	1.0000	13.4319	Gamma
tef1	GTR+G	6	0.9651	1.7160	1.1302	0.5271	3.1484	Gamma
tub2	TPM3uf+I+G	6	1.4044	4.4908	1.0000	1.4044	4.4908	Gamma
act/cmdA/his3/rpb2/tef1/tub2	GTR+I+G	6	1.4593	4.5939	1.1370	0.9972	6.3874	Gamma

[a] *bp* = Base pairs.

[b] *PIC* = Number of parsimony informative characters.

[c] *CI* = Consistency index. [d] *RI* = Retention index.

[e] *RC* = Rescaled consistency index.

[f] *HI* = Homoplasy index.

[g] *Subst. model* = best fit substitution model.

[h] *NST* = Number of substitution rate categories.

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Table 5. Morphological comparisons of *Calonectria* species obtained in this study and other phylogenetically closely related species.

Species	References or Source of Data	Ascospores (L × W) [abc]	Ascospores Average (L × W) [ab]	Ascospores Septation	Macroconidia (L × W) [abc]	Macroconidia Average (L × W) [ab]	Macroconidia Septation	Vesicle (Min.–Max.) [a]
Calonectria minensis	this study	(38.5–)46.5–64.5(–80.5) × (6–)6.5–8(–8.5)	55.5 × 7	3	(51–)55–66(–79) × (4.5–)5–6(–7.5)	60.5 × 5.5	(1–)3	3–5
Ca. aciculata	[4]	N/A [d]	N/A	N/A	(53–)62–76(–86) × (4.5–)5–6(–7)6	69 × 5.5	3	(2–)2.5–3.5(–5)
Ca. colhounii	[17]	(30–)50–65(–75) × (4–)5–6(–8)	55 × 6	(1–)3	(45–)60–70(–80) × (4–)5–(–6)	65 × 5	(1–)3	3–4
Ca. eucalypti	[37]	(25–)30–36(–56) × (3–)5–6(–8)	33 × 6	(1–)3	(66–)69–75(–80) × (5–)6	72 × 6	3	4–6
Ca. honghensis	[4]	(35–)43–55(–65) × (4.5–)5.5–6.5(–7.5)	49 × 6	3	(43–)49–59(–66) × (4.5–)5–5.5(–6)	54 × 5.5	3	(2.5–)3–4.5(–5.5)

[a] All measurements are in µm.

[b] L × W = length × width.

[c] Measurements are presented in the format [(minimum–) (average–standard deviation)–(average + standard deviation) (–maximum)].

[d] N/A represents data that is not available.

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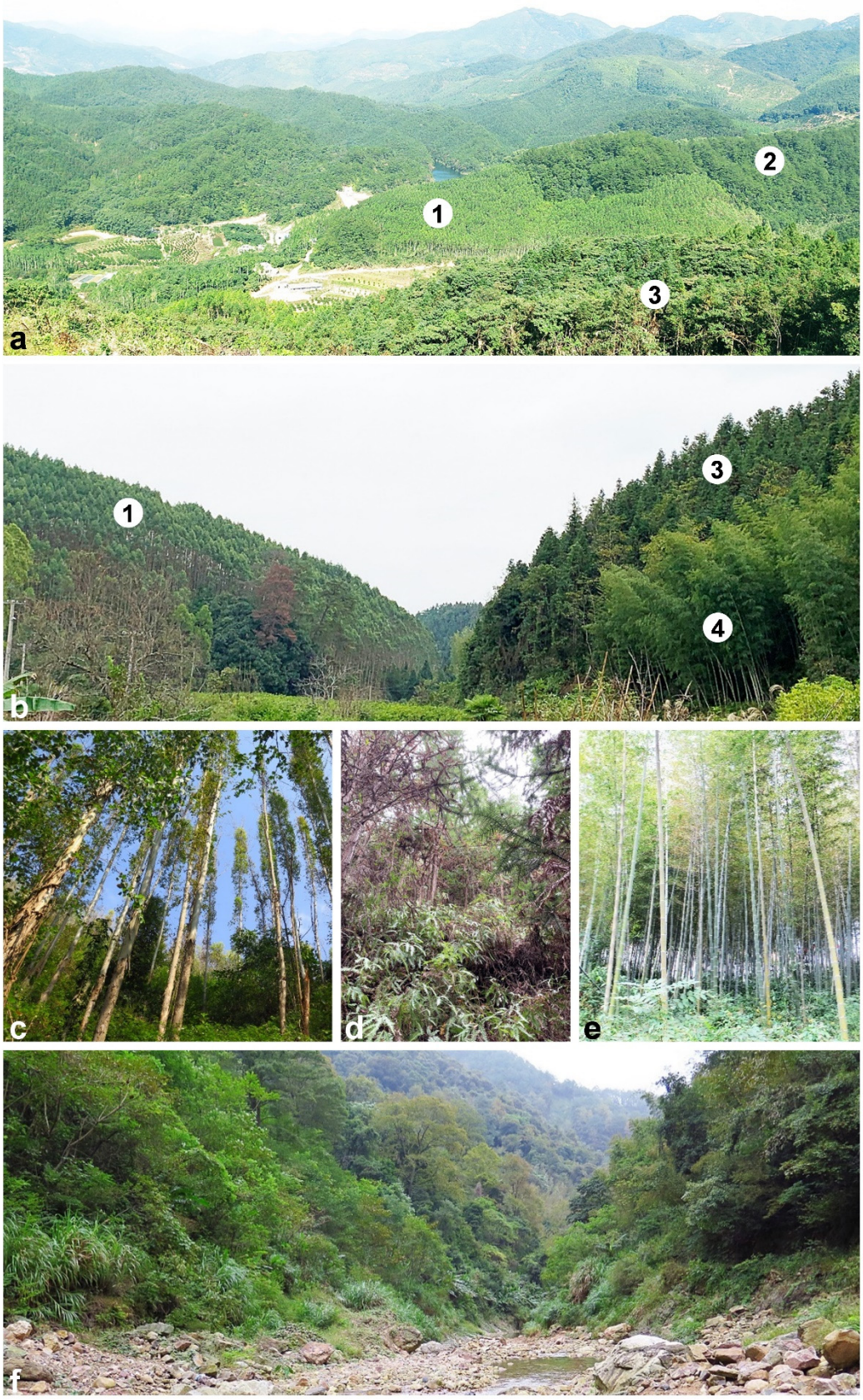


Figure 1. Different forest plantations and natural forests in southern China. (**a**). mixed species plantations in ZhangZhou Region, FuJian Province, 1: *Eucalyptus* sp., 2: *Pinus massoniana*, 3:

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Cunninghamia lanceolata; (**b**). mixed species plantations in JiangXi Province, 1: *Eucalyptus* sp., 3: *Cunninghamia lanceolata*; 4: *Phyllostachys heterocycle*; (**c**). *Eucalyptus* sp. in YongAn Region, FuJian Province; (**d**). *Cunninghamia lanceolata* in JiangXi Province; (**e**). *Phyllostachys heterocycle* in NanPing Region, FuJian Province; (**f**). natural forests in NanPing Region, FuJian Province. Soil samples in this study were collected from FuJian Province.

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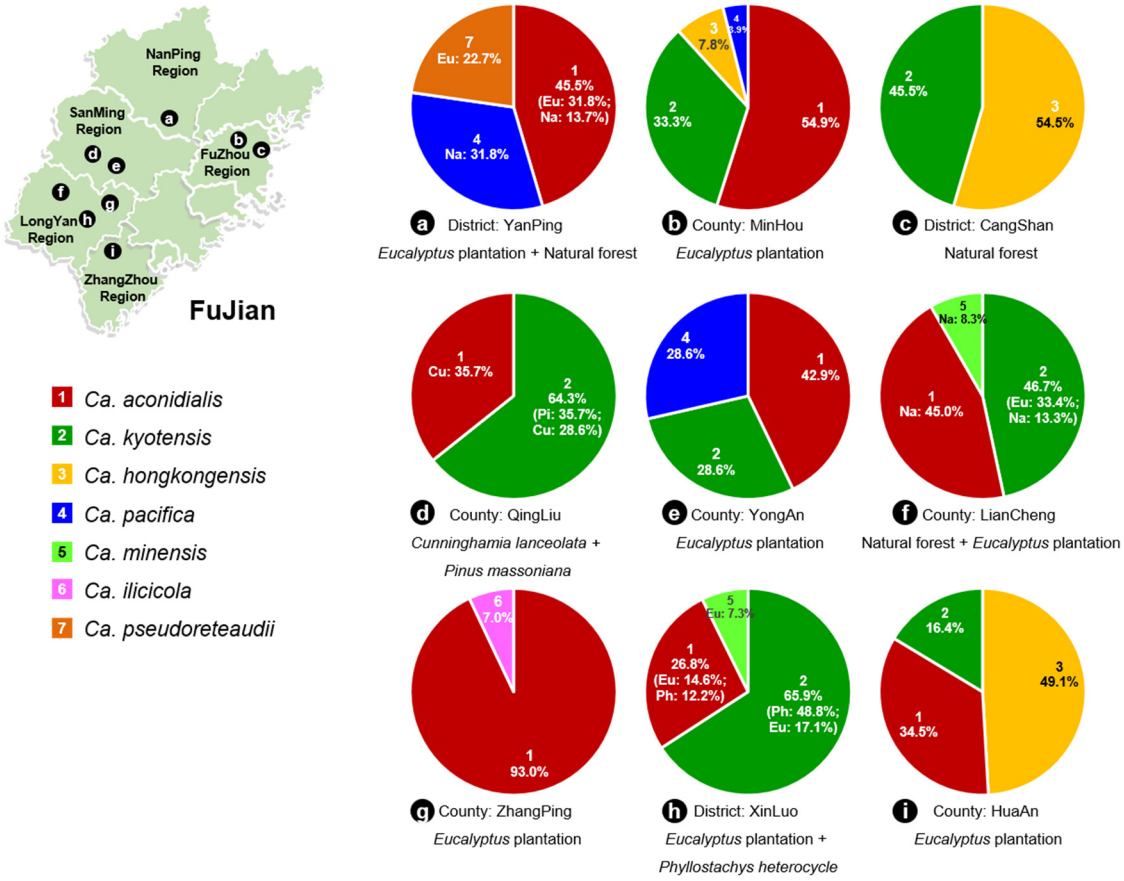


Figure 2. *Calonectria* species collected from nine counties (districts) in FuJian Province. (**a**–**i**). the percentage of each species in nine different counties (districts). Different species are indicated by numbers with different colours.

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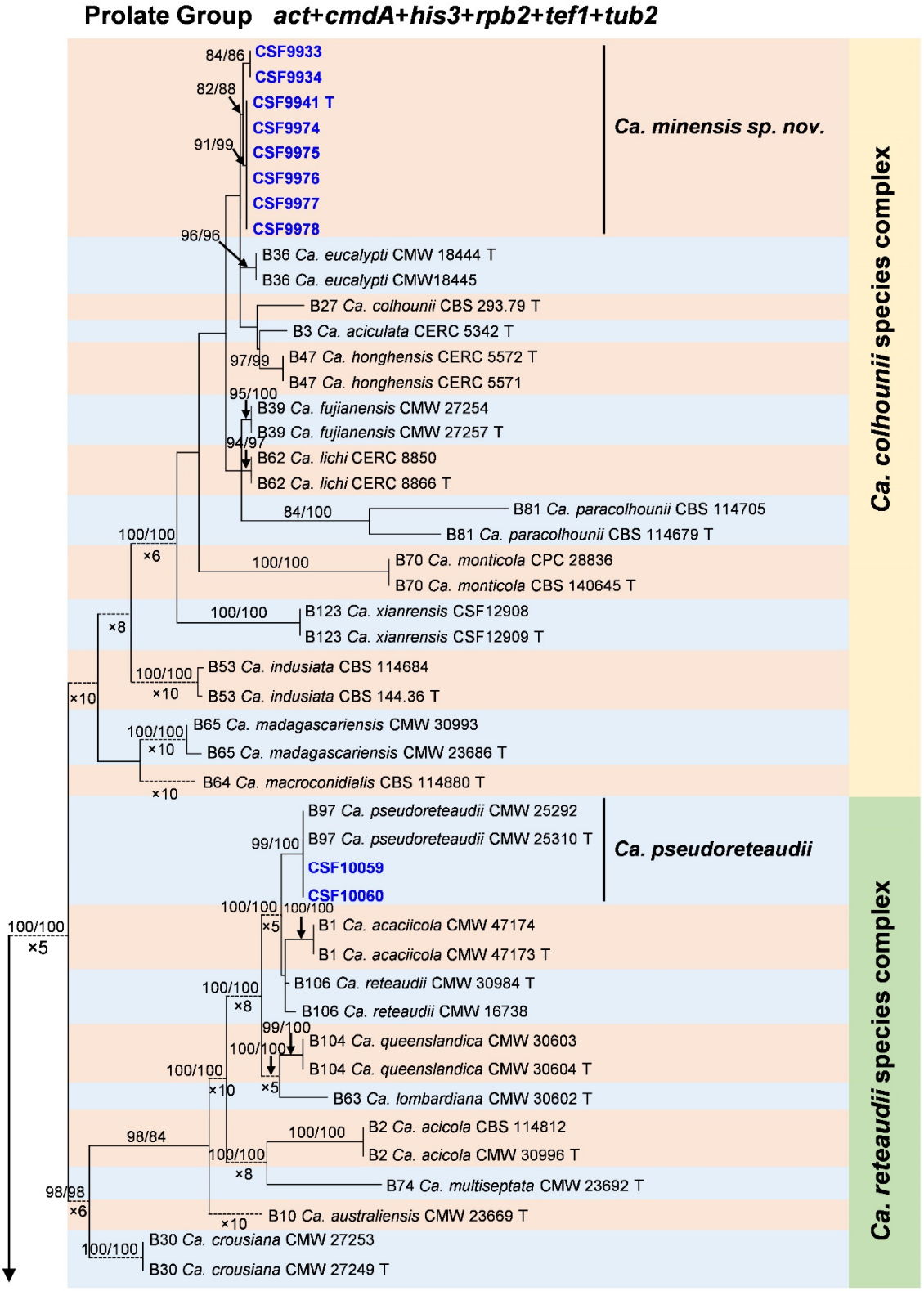


Figure 3. Phylogenetic tree of *Calonectria* species based on maximum likelihood (ML) analyses of combined DNA dataset of *act*, *cmdA*, *his3*, *rpb2*, *tef1*, and *tub2* gene sequences. Bootstrap value ≥ 70% for ML and MP analyses are presented above the branches. Bootstrap values lower than 70% are marked with "*", and absent analyses values are marked with "-".

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Ex-type isolates are marked with “T”. Isolates sequenced in this study are highlighted in blue and bold type. The “B” species codes are consistent with the recently published results in Liu and co-authors [18]. The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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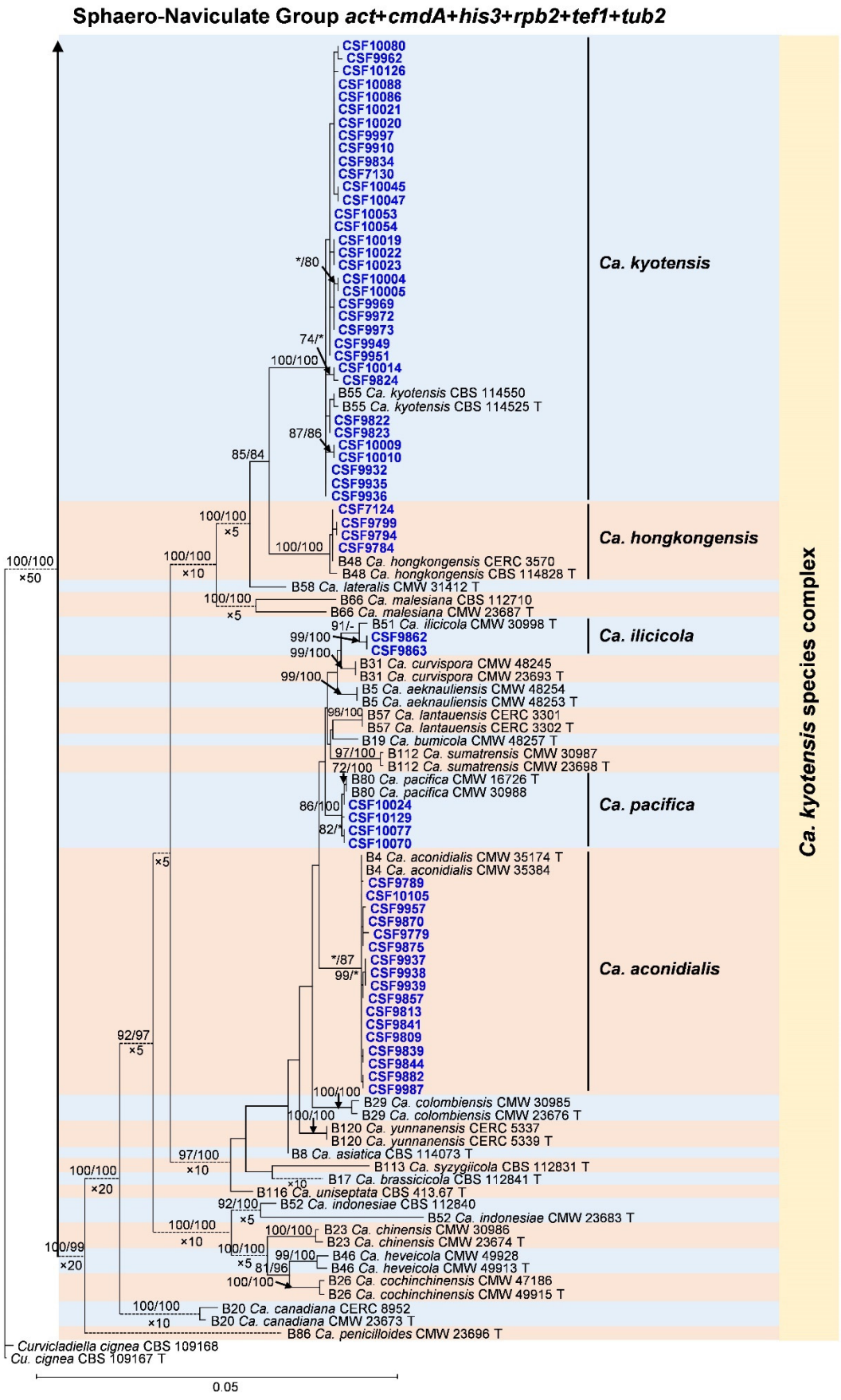


Figure 3. (Continued).

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Figure 4. *Calonectria minensis*. (**a**). Perithecium; (**b**). vertical section through a perithecium; (**c**). cells around ostiolar region of perithecium; (**d**). section through lateral perithecial wall; (**e**,**f**). asci; (**g**,**h**). ascospores; (**i**,**j**). macroconidiophore; (**k**–**m**). clavate vesicles; (**n**,**o**). conidiogenous apparatus with conidiophore branches and elongate doliiform to reniform

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phialides; (**p**,**q**). macroconidia. —Scale bars: a = 200 µm; b = 100 µm; c, d and f = 20 µm; e and i, j = 50 µm; g, h and n–q = 10 µm; k–m = 5 µm.

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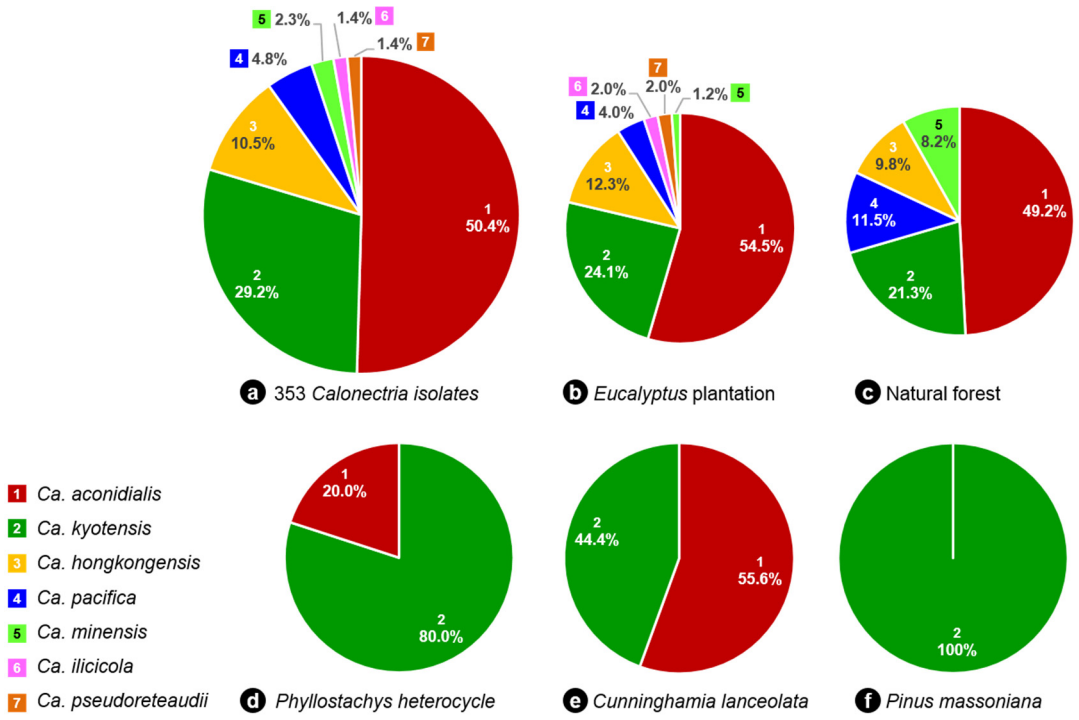


Figure 5. *Calonectria* species collected from soils of five different types of forests in FuJian Province. (**a**). the percentage of each *Calonectria* species accounted for all the species isolated in this study. Different species are indicated by numbers with different colours; (**b–f**). the percentage of each *Calonectria* species obtained from five different types of forests.

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Appendix Information

Appendix A. Species of *Calonectria* Collected in This Study

Table A1. Species of *Calonectria* collected in this study.

Species [a]	Isolate No. [b]	Genotype [c]	Substrate	Sampling Site	GPS Coordinate	Collector	GenBank Accession No. [d]					
							act	*cmdA*	*his3*	*rpb2*	*tef1*	*tub2*
Calonectria aconidialis	CSF9779 [e]	AAA-AA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253064	OK253135	OK253279	N/A [f]	OK253491	OK253844
	CSF9857 [e]	AAAAAA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253065	OK253136	OK253280	OK253423	OK253492	OK253845
	CSF9937 [e]	AAAABA	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253066	OK253137	OK253281	OK253424	OK253493	OK253846
	CSF9938 [e]	AAAABA	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253067	OK253138	OK253282	OK253425	OK253494	OK253847
	CSF9939 [e]	AAAABA	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253068	OK253139	OK253283	OK253426	OK253495	OK253848
	CSF9809 [e]	ABAAAA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253069	OK253140	OK253284	OK253427	OK253496	OK253849

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CSF10105 [e]	ABAAAA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253070	OK253141	OK253285	OK253428	OK253497	OK253850
CSF9789 [e]	ABAAAB	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253071	OK253142	OK253286	OK253429	OK253498	OK253851
CSF9839 [e]	ABAAAC	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253072	OK253143	OK253287	OK253430	OK253499	OK253852
CSF9844 [e]	ABAAAC	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253073	OK253144	OK253288	OK253431	OK253500	OK253853
CSF9882 [e]	ABAAAD	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253074	OK253145	OK253289	OK253432	OK253501	OK253854
CSF9987 [e]	ABAAAD	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253075	OK253146	OK253290	OK253433	OK253502	OK253855
CSF9813 [e]	ABAACA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253076	OK253147	OK253291	OK253434	OK253503	OK253856
CSF9841 [e]	ABAACA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253077	OK253148	OK253292	OK253435	OK253504	OK253857

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CSF9870 [e]	ABBAAA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253078	OK253149	OK253293	OK253436	OK253505	OK253858
CSF9875 [e]	ABB-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253079	OK253150	OK253294	N/A	OK253506	OK253859
CSF9957 [e]	ACBAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253080	OK253151	OK253295	OK253437	OK253507	OK253860
CSF9851	-AA-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–[g]	OK253152	OK253296	–	OK253508	OK253861
CSF9943	-AA-AA	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253153	OK253297	–	OK253509	OK253862
CSF9812	-BA-AA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253154	OK253298	–	OK253510	OK253863
CSF9831	-BA-AA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253155	OK253299	–	OK253511	OK253864
CSF9846	-BA-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253156	OK253300	–	OK253512	OK253865

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CSF9880	-BA-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253157	OK253301	–	OK253513	OK253866
CSF9895	-BA-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253158	OK253302	–	OK253514	OK253867
CSF9905	-BA-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253159	OK253303	–	OK253515	OK253868
CSF9930	-BA-AA	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253160	OK253304	–	OK253516	OK253869
CSF9964	-BA-AA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253161	OK253305	–	OK253517	OK253870
CSF9970	-BA-AA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253162	OK253306	–	OK253518	OK253871
CSF9982	-BA-AA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253163	OK253307	–	OK253519	OK253872
CSF9989	-BA-AA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253164	OK253308	–	OK253520	OK253873

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CSF10032	-BA-AA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253165	OK253309	–	OK253521	OK253874
CSF10034	-BA-AA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253166	OK253310	–	OK253522	OK253875
CSF10041	-BA-AA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253167	OK253311	–	OK253523	OK253876
CSF10050	-BA-AA	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253168	OK253312	–	OK253524	OK253877
CSF10064	-BA-AA	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253169	OK253313	–	OK253525	OK253878
CSF10068	-BA-AA	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253170	OK253314	–	OK253526	OK253879
CSF10073	-BA-AA	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253171	OK253315	–	OK253527	OK253880
CSF10075	-BA-AA	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253172	OK253316	–	OK253528	OK253881

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CSF10081	-BA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253173	OK253317	–	OK253529	OK253882
CSF10082	-BA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253174	OK253318	–	OK253530	OK253883
CSF10097	-BA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253175	OK253319	–	OK253531	OK253884
CSF10098	-BA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253176	OK253320	–	OK253532	OK253885
CSF10110	-BA-A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253177	OK253321	–	OK253533	N/A
CSF10112	-BA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253178	OK253322	–	OK253534	OK253886
CSF10119	-BA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253179	OK253323	–	OK253535	OK253887
CSF10125	-BA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253180	OK253324	–	OK253536	OK253888

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CSF9856	-BA-AC	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253181	OK253325	–	OK253537	OK253889
CSF9897	-BA-AC	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253182	OK253326	–	OK253538	OK253890
CSF9814	-BA-CA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253183	OK253327	–	OK253539	OK253891
CSF9815	-BA-CA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253184	OK253328	–	OK253540	OK253892
CSF9842	-BA-CA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253185	OK253329	–	OK253541	OK253893
CSF9843	-BA-CA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253186	OK253330	–	OK253542	OK253894
CSF9887	-BA-CA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253187	OK253331	–	OK253543	OK253895
CSF9888	-BA-CA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253188	OK253332	–	OK253544	OK253896

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CSF9889	-BA-CA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253189	OK253333	–	OK253545	OK253897
CSF9890	-BA-CA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253190	OK253334	–	OK253546	OK253898
CSF9891	-BA-CA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253191	OK253335	–	OK253547	OK253899
CSF9776	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253548	–
CSF9777	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253549	–
CSF9778	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253550	–
CSF9780	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253551	–
CSF9787	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253552	–

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CSF9788	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253553	–
CSF9790	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253554	–
CSF9806	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253555	–
CSF9807	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253556	–
CSF9808	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253557	–
CSF9810	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253558	–
CSF9836	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253559	–
CSF9837	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253560	–

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CSF9838	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253561	–
CSF9840	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253562	–
CSF9845	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253563	–
CSF9847	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253564	–
CSF9848	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253565	–
CSF9849	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253566	–
CSF9850	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253567	–
CSF9852	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253568	–

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CSF9853	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253569	–
CSF9854	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253570	–
CSF9855	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253571	–
CSF9858	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253572	–
CSF9859	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253573	–
CSF9860	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253574	–
CSF9861	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253575	–
CSF9867	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253576	–

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CSF9868	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253577	–
CSF9869	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253578	–
CSF9871	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253579	–
CSF9872	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253580	–
CSF9873	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253581	–
CSF9874	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253582	–
CSF9876	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253583	–
CSF9877	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253584	–

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CSF9878	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253585	–
CSF9879	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253586	–
CSF9881	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253587	–
CSF9883	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253588	–
CSF9884	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253589	–
CSF9885	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253590	–
CSF9886	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253591	–
CSF9892	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253592	–

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CSF9893	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253593	–
CSF9894	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253594	–
CSF9896	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253595	–
CSF9898	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253596	–
CSF9899	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253597	–
CSF9900	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253598	–
CSF9901	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253599	–
CSF9902	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253600	–

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CSF9903	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253601	–
CSF9904	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253602	–
CSF9906	----A-	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253603	–
CSF9927	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253604	–
CSF9928	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253605	–
CSF9929	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253606	–
CSF9931	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253607	–
CSF9940	----A-	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253608	–

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CSF9944	----A-	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253609	–
CSF9954	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253610	–
CSF9955	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253611	–
CSF9956	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253612	–
CSF9958	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253613	–
CSF9965	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253614	–
CSF9966	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253615	–
CSF9967	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253616	–

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CSF9968	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253617	–
CSF9971	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253618	–
CSF9979	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253619	–
CSF9980	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253620	–
CSF9981	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253621	–
CSF9983	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253622	–
CSF9984	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253623	–
CSF9985	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253624	–

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CSF9986	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253625	–
CSF9988	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253626	–
CSF9990	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253627	–
CSF9991	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253628	–
CSF9992	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253629	–
CSF9993	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253630	–
CSF10029	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253631	–
CSF10030	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253632	–

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CSF10031	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253633	–
CSF10033	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253634	–
CSF10035	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253635	–
CSF10036	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253636	–
CSF10037	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253637	–
CSF10042	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253638	–
CSF10043	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253639	–
CSF10048	----A-	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253640	–

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CSF10049	----A-	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253641	–
CSF10051	----A-	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253642	–
CSF10052	----A-	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253643	–
CSF10063	----A-	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253644	–
CSF10065	----A-	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253645	–
CSF10066	----A-	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253646	–
CSF10067	----A-	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253647	–
CSF10069	----A-	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253648	–

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CSF10074	----A-	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253649	–
CSF10083	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253650	–
CSF10099	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253651	–
CSF10100	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253652	–
CSF10101	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253653	–
CSF10102	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253654	–
CSF10103	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253655	–
CSF10104	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253656	–

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CSF10106	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253657	–
CSF10107	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253658	–
CSF10108	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253659	–
CSF10109	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253660	–
CSF10111	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253661	–
CSF10113	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253662	–
CSF10114	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253663	–
CSF10115	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253664	–

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	CSF10116	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253665	–
	CSF10117	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253666	–
	CSF10118	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253667	–
	CSF10120	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253668	–
Ca. hongkongensis	CSF7124 [e]	AAAAAA	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253081	OK253192	OK253336	OK253438	OK253669	OK253900
	CSF9784 [e]	AAAAAA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253082	OK253193	OK253337	OK253439	OK253670	OK253901
	CSF9794 [e]	ABAAAA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253083	OK253194	OK253338	OK253440	OK253671	OK253902
	CSF9799 [e]	ABAAAA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253084	OK253195	OK253339	OK253441	OK253672	OK253903

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CSF7139	-AA-AA	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253196	OK253340	–	OK253673	OK253904
CSF9804	-AA-AA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253197	OK253341	–	OK253674	OK253905
CSF9819	-AA-AA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253198	OK253342	–	OK253675	OK253906
CSF10093	-AA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253199	OK253343	–	OK253676	OK253907
CSF10096	-AA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253200	OK253344	–	OK253677	OK253908
CSF9829	-BA-AA	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253201	OK253345	–	OK253678	OK253909
CSF7134	----A-	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253679	–
CSF7135	----A-	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253680	–

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CSF7136	----A-	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253681	–
CSF7138	----A-	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253682	–
CSF9781	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253683	–
CSF9782	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253684	–
CSF9783	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253685	–
CSF9785	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253686	–
CSF9791	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253687	–
CSF9792	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253688	–

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CSF9793	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253689	–
CSF9795	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253690	–
CSF9796	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253691	–
CSF9800	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253692	–
CSF9801	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253693	–
CSF9802	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253694	–
CSF9803	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253695	–
CSF9816	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253696	–

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CSF9817	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253697	–
CSF9818	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253698	–
CSF9820	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253699	–
CSF9826	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253700	–
CSF9827	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253701	–
CSF9828	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253702	–
CSF9830	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253703	–
CSF10094	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253704	–

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	CSF10095	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253705	–
Ca. ilicicola	CSF9862 [e]	AAAAAA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253085	OK253202	OK253346	OK253442	OK253706	OK253910
	CSF9863 [e]	AAAAAA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253086	OK253203	OK253347	OK253443	OK253707	OK253911
	CSF9864	-AA-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253204	OK253348	–	OK253708	OK253912
	CSF9865	-AA-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253205	OK253349	–	OK253709	OK253913
	CSF9866	-AA-AA	Soil (*Eucalyptus* plantation)	ZhangPing, LongYan, FuJian, China	25°17′10.882″ N, 117°27′33.635″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253206	OK253350	–	OK253710	OK253914
Ca. kyotensis	CSF7130 [e]	AAAAAA	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253087	OK253207	OK253351	OK253444	OK253711	OK253915
	CSF10088 [e]	AAAAAA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253088	OK253208	OK253352	OK253445	OK253712	OK253916

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CSF9834 [e]	AAA-AB	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253089	OK253209	OK253353	N/A	OK253713	OK253917
CSF9910 [e]	AAAAAB	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253090	OK253210	OK253354	OK253446	OK253714	OK253918
CSF10014 [e]	AAAAAC	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253091	OK253211	OK253355	OK253447	OK253715	OK253919
CSF10080 [e]	AAAAAD	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253092	OK253212	OK253356	OK253448	OK253716	OK253920
CSF10086 [e]	AAAAAE	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253093	OK253213	OK253357	OK253449	OK253717	OK253921
CSF10053 [e]	AAAABB	Soil (*Pinus massoniana*)	QingLiu, SanMing, FuJian, China	26°10′54.311″ N, 116°52′50.901″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253094	OK253214	OK253358	OK253450	OK253718	OK253922
CSF10054 [e]	AAAABB	Soil (*Pinus massoniana*)	QingLiu, SanMing, FuJian, China	26°10′54.311″ N, 116°52′50.901″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253095	OK253215	OK253359	OK253451	OK253719	OK253923
CSF9922 [e]	AAAABF	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253096	OK253216	OK253360	OK253452	OK253720	OK253924

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CSF9923 [e]	AAAABF	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253097	OK253217	OK253361	OK253453	OK253721	OK253925
CSF9949 [e]	AAAADB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253098	OK253218	OK253362	OK253454	OK253722	OK253926
CSF9951 [e]	AAAADB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253099	OK253219	OK253363	OK253455	OK253723	OK253927
CSF9932 [e]	AAAADG	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253100	OK253220	OK253364	OK253456	OK253724	OK253928
CSF9935 [e]	AAAADG	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253101	OK253221	OK253365	OK253457	OK253725	OK253929
CSF9936 [e]	AAAADG	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253102	OK253222	OK253366	OK253458	OK253726	OK253930
CSF10020 [e]	AAAAEA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253103	OK253223	OK253367	OK253459	OK253727	OK253931
CSF10021 [e]	AAAAEA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253104	OK253224	OK253368	OK253460	OK253728	OK253932

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CSF10009 [e]	AAABBH	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253105	OK253225	OK253369	OK253461	OK253729	OK253933
CSF10010 [e]	AAABBH	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253106	OK253226	OK253370	OK253462	OK253730	OK253934
CSF9997 [e]	AABAAB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253107	OK253227	OK253371	OK253463	OK253731	OK253935
CSF9969 [e]	AABACB	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253108	OK253228	OK253372	OK253464	OK253732	OK253936
CSF9972 [e]	AABACB	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253109	OK253229	OK253373	OK253465	OK253733	OK253937
CSF9973 [e]	AABACB	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253110	OK253230	OK253374	OK253466	OK253734	OK253938
CSF10126 [e]	AACAAA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253111	OK253231	OK253375	OK253467	OK253735	OK253939
CSF9962 [e]	AACAAD	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253112	OK253232	OK253376	OK253468	OK253736	OK253940

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CSF10019 [e]	AADABB	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253113	OK253233	OK253377	OK253469	OK253737	OK253941
CSF10022 [e]	AADABB	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253114	OK253234	OK253378	OK253470	OK253738	OK253942
CSF10023 [e]	AADABB	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253115	OK253235	OK253379	OK253471	OK253739	OK253943
CSF10045 [e]	ABAAAB	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253116	OK253236	OK253380	OK253472	OK253740	OK253944
CSF10047 [e]	ABAAAB	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253117	OK253237	OK253381	OK253473	OK253741	OK253945
CSF9824 [e]	ACBAAC	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253118	OK253238	OK253382	OK253474	OK253742	OK253946
CSF10004 [e]	ADAACB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253119	OK253239	OK253383	OK253475	OK253743	OK253947
CSF10005 [e]	ADAACB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253120	OK253240	OK253384	OK253476	OK253744	OK253948

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CSF7123	-AA-AB	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253241	OK253385	–	OK253745	OK253949
CSF9915	-AA-AB	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253242	OK253386	–	OK253746	OK253950
CSF9999	-AA-AB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253243	OK253387	–	OK253747	OK253951
CSF10124	-AA-AB	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253244	OK253388	–	OK253748	OK253952
CSF10055	-AA-BB	Soil (*Pinus massoniana*)	QingLiu, SanMing, FuJian, China	26°10′54.311″ N, 116°52′50.901″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253245	OK253389	–	OK253749	OK253953
CSF10056	-AA-BB	Soil (*Pinus massoniana*)	QingLiu, SanMing, FuJian, China	26°10′54.311″ N, 116°52′50.901″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253246	OK253390	–	OK253750	OK253954
CSF10057	-AA-BB	Soil (*Pinus massoniana*)	QingLiu, SanMing, FuJian, China	26°10′54.311″ N, 116°52′50.901″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253247	OK253391	–	OK253751	OK253955
CSF9952	-AA-DB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253248	OK253392	–	OK253752	OK253956

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CSF9953	-AA-DB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253249	OK253393	–	OK253753	OK253957
CSF9924	-AA-BF	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253250	OK253394	–	OK253754	OK253958
CSF9925	-AA-BF	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253251	OK253395	–	OK253755	OK253959
CSF9926	-AA-BF	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253252	OK253396	–	OK253756	OK253960
CSF10011	-AA-BH	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253253	OK253397	–	OK253757	OK253961
CSF10012	-AA-BH	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253254	OK253398	–	OK253758	OK253962
CSF10013	-AA-BH	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253255	OK253399	–	OK253759	OK253963
CSF10006	-DA-CB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253256	OK253400	–	OK253760	OK253964

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CSF10007	-DA-CB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253257	OK253401	–	OK253761	OK253965
CSF10008	-DA-CB	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253258	OK253402	–	OK253762	OK253966
CSF9821	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253763	–
CSF9822	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253764	–
CSF9823	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253765	–
CSF9825	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°53′49.369″ N, 117°32′45.070″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253766	–
CSF9832	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253767	–
CSF9833	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253768	–

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CSF9835	----A-	Soil (*Eucalyptus* plantation)	HuaAn, ZhangZhou, FuJian, China	24°58′22.263″ N, 117°31′09.708″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253769	–
CSF9907	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253770	–
CSF9908	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253771	–
CSF9909	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253772	–
CSF9911	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253773	–
CSF9912	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253774	–
CSF9913	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253775	–
CSF9914	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253776	–

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CSF9916	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253777	–
CSF9917	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253778	–
CSF9918	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253779	–
CSF9919	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253780	–
CSF9920	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253781	–
CSF9921	----A-	Soil (*Phyllostachys heterocycla*)	XinLuo, LongYan, FuJian, China	25°07′31.133″ N, 116°51′37.485″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253782	–
CSF9959	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253783	–
CSF9960	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253784	–

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CSF9961	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253785	–
CSF9963	----A-	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253786	–
CSF9994	----A-	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253787	–
CSF9995	----A-	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253788	–
CSF9996	----A-	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253789	–
CSF9998	----A-	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253790	–
CSF10000	----A-	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253791	–
CSF10001	----A-	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253792	–

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CSF10002	----A-	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253793	–
CSF10003	----A-	Soil (*Eucalyptus* plantation)	LianCheng, LongYan, FuJian, China	25°33′06.994″ N, 116°41′42.328″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253794	–
CSF10015	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253795	–
CSF10016	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253796	–
CSF10044	----A-	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253797	–
CSF10046	----A-	Soil (*Cunninghamia lanceolata*)	QingLiu, SanMing, FuJian, China	26°07′23.497″ N, 116°53′00.762″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253798	–
CSF10084	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253799	–
CSF10085	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253800	–

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CSF10087	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253801	–
CSF10089	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253802	–
CSF10090	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253803	–
CSF10091	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253804	–
CSF10092	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253805	–
CSF10121	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253806	–
CSF10122	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253807	–
CSF10123	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253808	–

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	CSF10127	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253809	–
	CSF10128	----A-	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253810	–
	CSF7122	----A-	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253811	–
	CSF7128	----A-	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253812	–
	CSF7129	----A-	Soil (natural forest area)	CangShan, FuZhou, FuJian, China	26°5′16.2″ N, 119°14′19.8″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253813	–
Ca. minensis sp. nov.	CSF9941 [e,h–j]; CGMCC3.18877	AAAAAA	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253121	OK253259	OK253403	OK253477	OK253814	OK253967
	CSF9974 [e]	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253122	OK253260	OK253404	OK253478	OK253815	OK253968
	CSF9975 [e,h,i]; CGMCC3.18881	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253123	OK253261	OK253405	OK253479	OK253816	OK253969

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	CSF9976 [e]	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253124	OK253262	OK253406	OK253480	OK253817	OK253970
	CSF9977 [e]	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253125	OK253263	OK253407	OK253481	OK253818	OK253971
	CSF9978 [e]	AAAAAA	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	25°26′14.348″ N, 116°38′42.400″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253126	OK253264	OK253408	OK253482	OK253819	OK253972
	CSF9933 [e,h,i]; CGMCC3.18875	ABBABB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253127	OK253265	OK253409	OK253483	OK253820	OK253973
	CSF9934 [e]	ABBABB	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	25°07′08.597″ N, 116°44′42.257″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253128	OK253266	OK253410	OK253484	OK253821	OK253974
Ca. pacifica	CSF10024 [e]	AAAAAA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253129	OK253267	OK253411	OK253485	OK253822	OK253975
	CSF10129 [e]	BAAAAA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253130	OK253268	OK253412	OK253486	OK253823	OK253976
	CSF10070 [e]	CABAAA	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253131	OK253269	OK253413	OK253487	OK253824	OK253977

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CSF10077[e]	CABAAA	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253132	OK253270	OK253414	OK253488	OK253825	OK253978
CSF10027	-AA-AA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253271	OK253415	–	OK253826	OK253979
CSF10039	-AA-AA	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253272	OK253416	–	OK253827	OK253980
CSF10130	-AA-AA	Soil (*Eucalyptus* plantation)	MinHou, FuZhou, FuJian, China	26°15′04.285″ N, 119°02′38.917″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253273	OK253417	–	OK253828	OK253981
CSF10025	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253829	–
CSF10026	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253830	–
CSF10028	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253831	–
CSF10038	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253832	–

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	CSF10040	----A-	Soil (*Eucalyptus* plantation)	YongAn, SanMing, FuJian, China	25°55′10.860″ N, 117°16′39.591″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253833	–
	CSF10071	----A-	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253834	–
	CSF10072	----A-	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253835	–
	CSF10076	----A-	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253836	–
	CSF10078	----A-	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253837	–
	CSF10079	----A-	Soil (natural forest area)	YanPing, NanPing, FuJian, China	26°42′26.672″ N, 118°07′58.317″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	–	–	–	OK253838	–
Ca. pseudoreteaudii	CSF10059[e]	AAAAAA	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253133	OK253274	OK253418	OK253489	OK253839	OK253982
	CSF10060[e]	AAAAAA	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	OK253134	OK253275	OK253419	OK253490	OK253840	OK253983

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CSF10058	-AA-AA	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253276	OK253420	–	OK253841	OK253984
CSF10061	-AA-AA	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253277	OK253421	–	OK253842	OK253985
CSF10062	-AA-AA	Soil (*Eucalyptus* plantation)	YanPing, NanPing, FuJian, China	26°46′19.651″ N, 117°57′37.233″ E	S.F. Chen, Q.L. Liu and F.F. Liu	–	OK253278	OK253422	–	OK253843	OK253986

[a] New species described in this study are indicated in bold.

[b] *CSF* = Culture Collection at the Research Institute of Fast-growing Trees (RIFT)/China Eucalypt Research Centre (CERC), Chinese Academy of Forestry (CAF), ZhanJiang, GuangDong Province, China; *CGMCC* = China General Microbiological Culture Collection Center, Beijing, China.

[c] Genotype within each identified species, determined by sequences of *act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2* regions; '-' means not available.

[d] *act* = actin; *cmdA* = calmodulin; *his3* = histone H3; *rpb2* = the second largest subunit of RNA polymerase; *tef1* = translation elongation factor 1-alpha; *tub2* = β-tubulin.

[e] Isolates used in phylogenetic analyses.

[f] *N/A* represents the relative locus was not successfully amplified in the current study.

[g] '–' represents the relative locus was not amplified in the current study.

[h] Isolates used in morphological and culture growth studies.

[i] Isolates used for mating studies.

[j] Isolates that represent ex-type cultures are indicated in bold.

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Appendix B. Phylogenetic Tree of *Calonectria* Species Based on Maximum Likelihood (ML) Analyses of *act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2* Gene Sequences

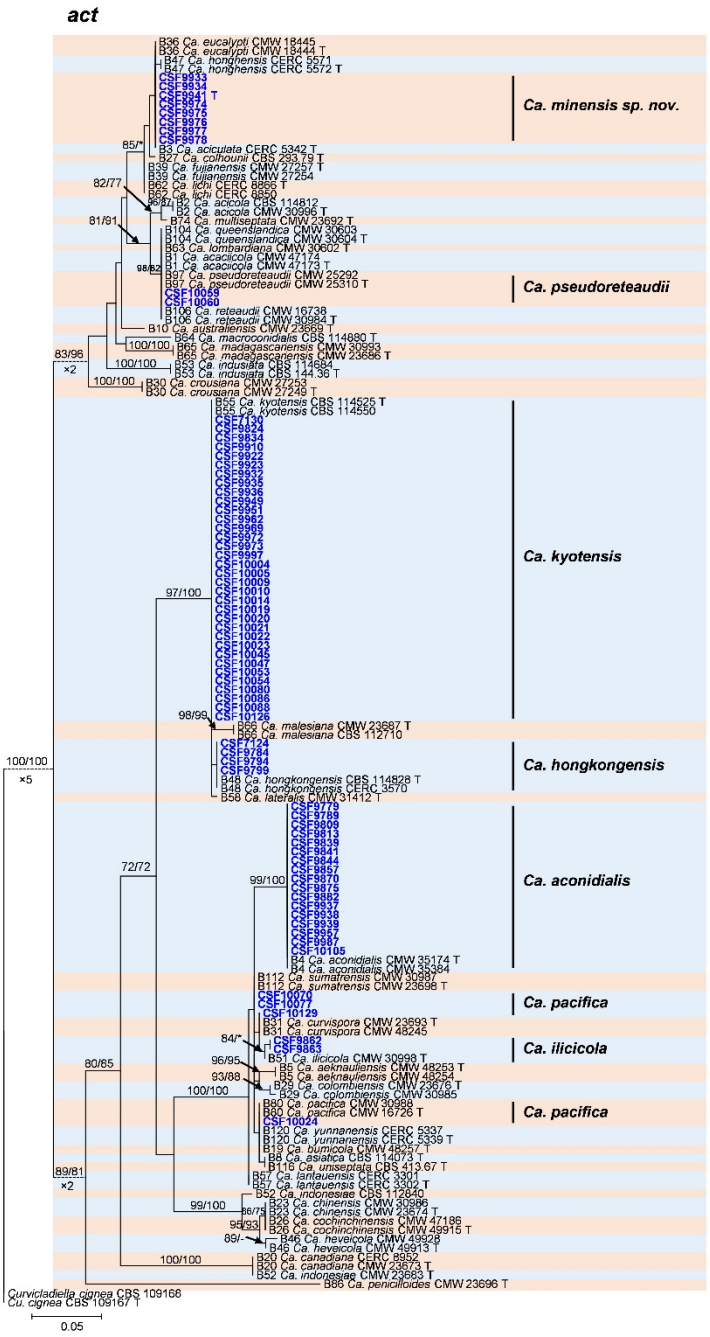


Figure A1. Phylogenetic tree of *Calonectria* species based on maximum likelihood (ML) analyses of *act* gene sequences. Bootstrap value ≥ 70% for ML and MP analyses are presented at the branches. Bootstrap values lower than 70% are marked with "*", and absent analyses values are marked with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and bold type. The "B" species codes are consistent with the recently published results in Liu and co-authors [18]. The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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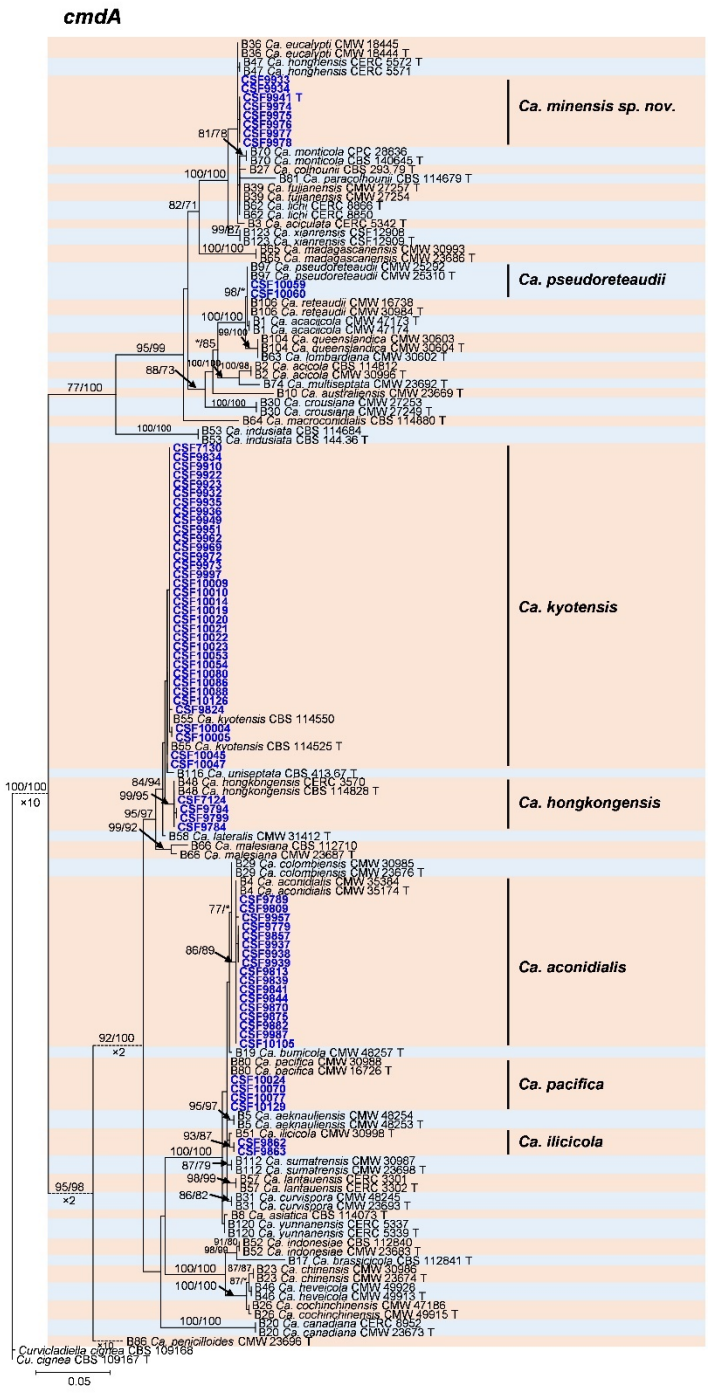


Figure A2. Phylogenetic tree of *Calonectria* species based on maximum likelihood (ML) analyses of *cmdA* gene sequences. Bootstrap value ≥ 70% for ML and MP analyses are presented at the branches. Bootstrap values lower than 70% are marked with "*", and absent analyses values are marked with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and bold type. The "B" species codes are consistent with the recently published results in Liu and co-authors [18]. The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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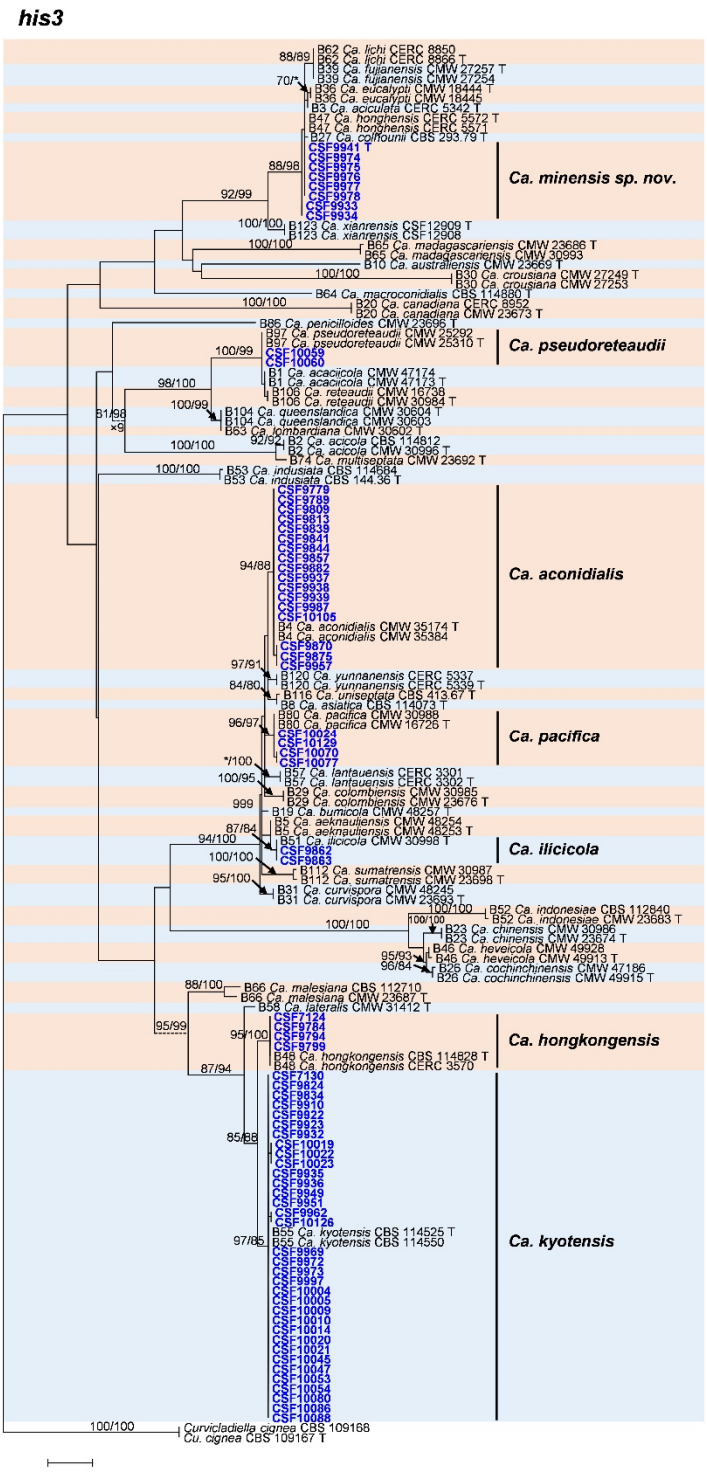


Figure A3. Phylogenetic tree of *Calonectria* species based on maximum likelihood (ML) analyses of *his3* gene sequences. Bootstrap value ≥ 70% for ML and MP analyses are presented at the branches. Bootstrap values lower than 70% are marked with "*", and absent analyses values are marked with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and bold type. The "B" species codes are consistent with the recently published results in Liu and co-authors [18]. The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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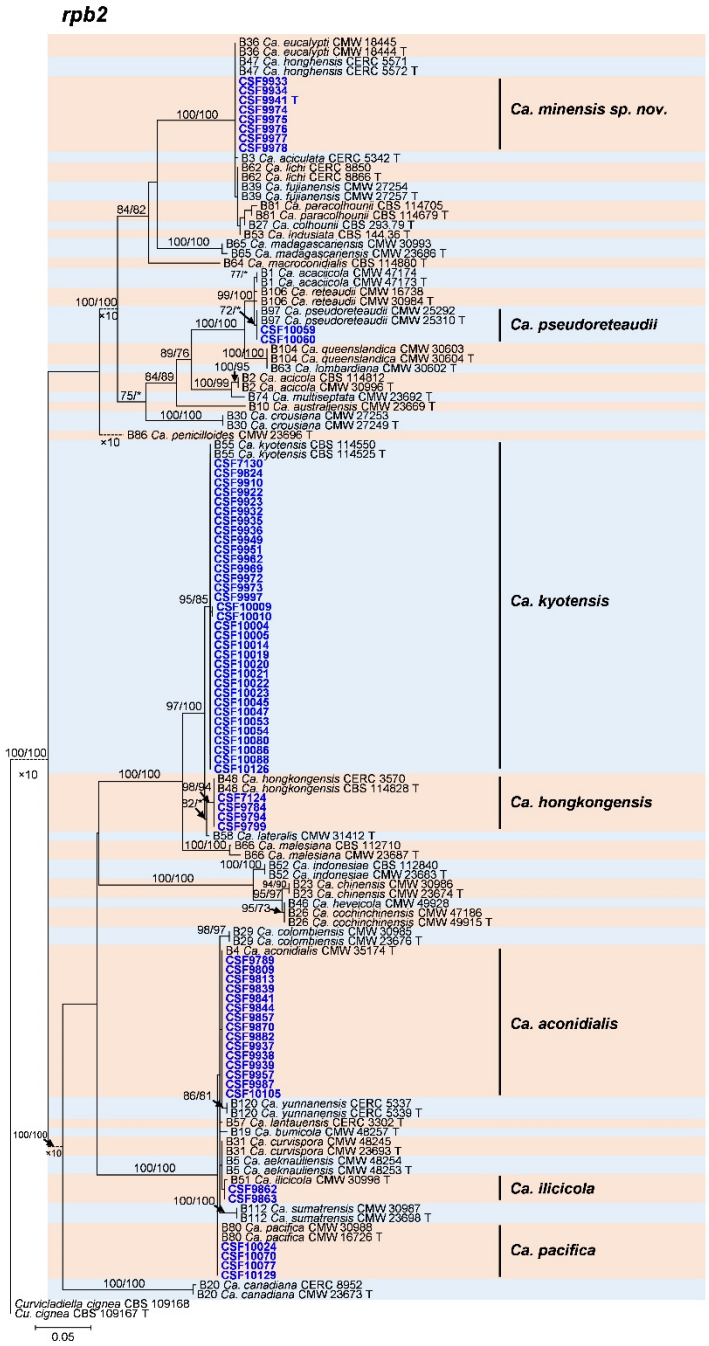


Figure A4. Phylogenetic tree of *Calonectria* species based on maximum likelihood (ML) analyses of *rpb2* gene sequences. Bootstrap value ≥ 70% for ML and MP analyses are presented at the branches. Bootstrap values lower than 70% are marked with "*", and absent analyses values are marked with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and bold type. The "B" species codes are consistent with the recently published results in Liu and co-authors [18]. The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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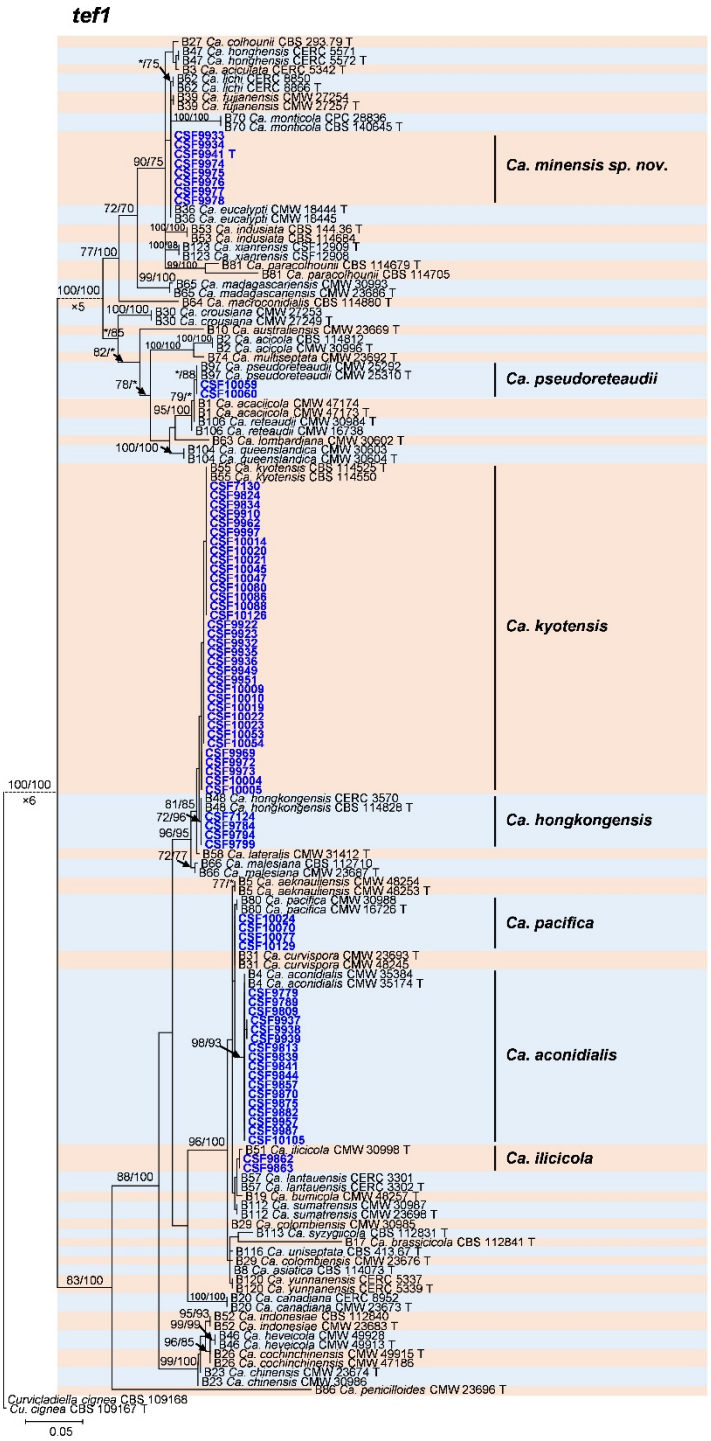


Figure A5. Phylogenetic tree of *Calonectria* species based on maximum likelihood (ML) analyses of *tef1* gene sequences. Bootstrap value ≥ 70% for ML and MP analyses are presented at the branches. Bootstrap values lower than 70% are marked with "*", and absent analyses values are marked with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and bold type. The "B" species codes are consistent with the recently published results in Liu and co-authors [18]. The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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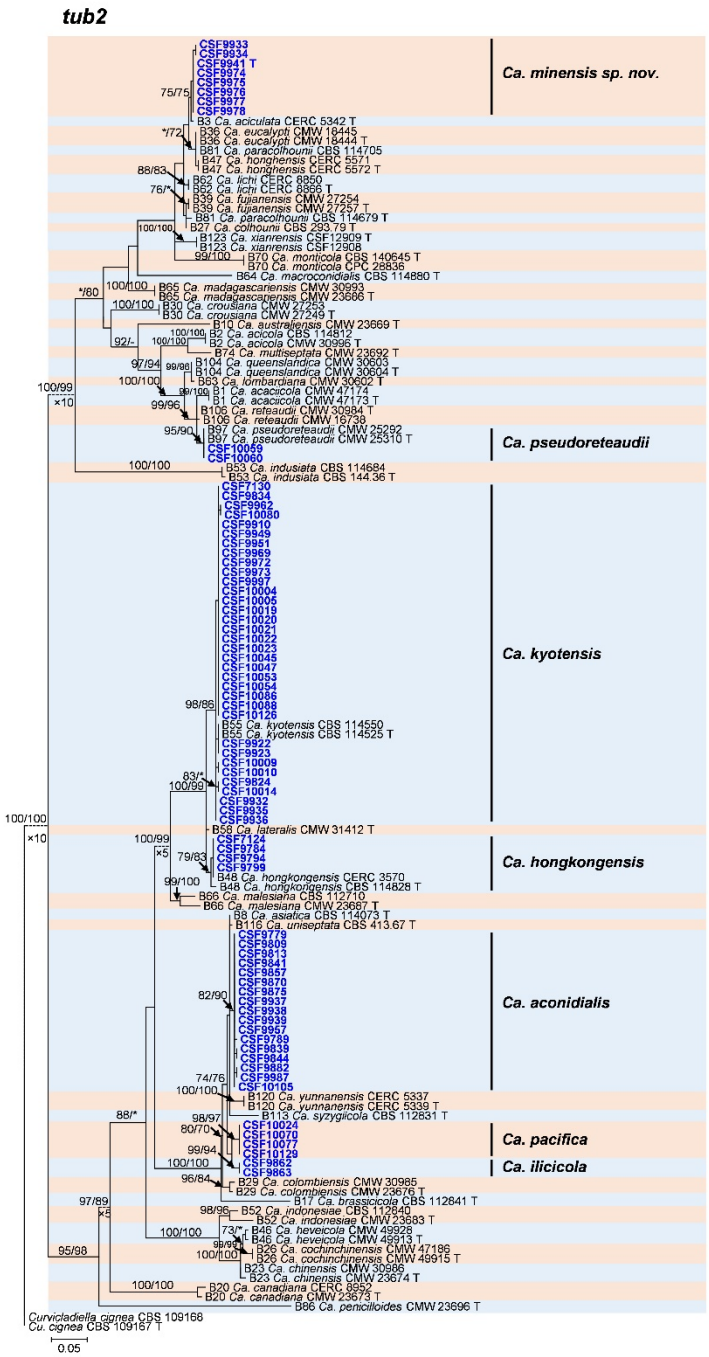


Figure A6. Phylogenetic tree of *Calonectria* species based on maximum likelihood (ML) analyses of *tub2* gene sequences. Bootstrap value ≥ 70% for ML and MP analyses are presented at the branches. Bootstrap values lower than 70% are marked with "*", and absent analyses values are marked with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and bold type. The "B" species codes are consistent with the recently published results in Liu and co-authors [18]. The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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Appendix C. Morphology of Six Previously Described *Calonectria* Species Collected in This Study

Calonectria aconidialis

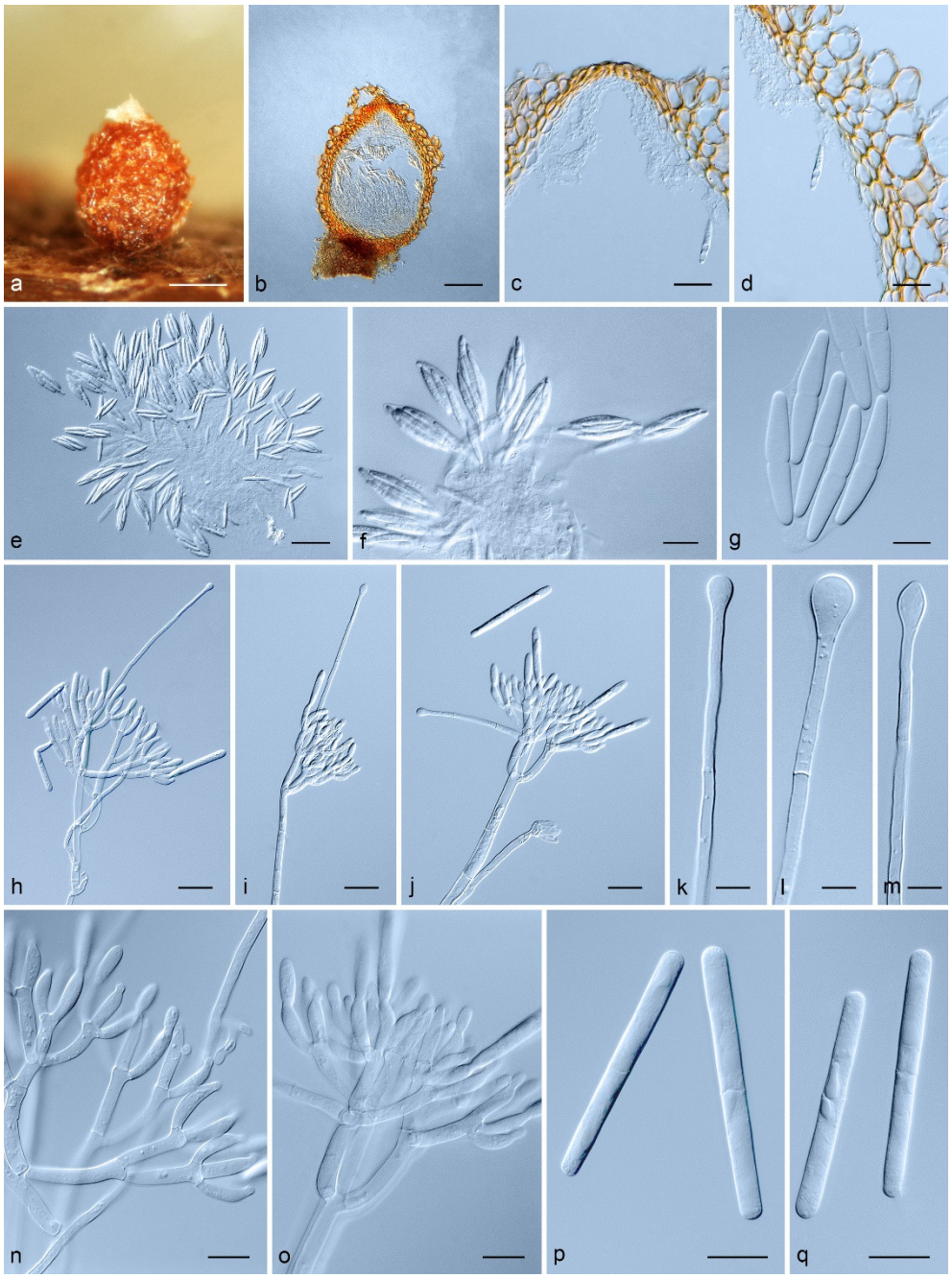


Figure A7. *Calonectria aconidialis*. (**a**). Perithecium; (**b**). vertical section through a perithecium; (**c**). cells around ostiolar region of perithecium; (**d**). section through lateral perithecial wall; (**e**,**f**). asci; (**g**). ascospores; (**h–j**). macroconidiophore; (**k–m**). obpyriform to sphaeropedunculate vesicles; (**n**,**o**). conidiogenous apparatus with conidiophore branches and elongate doliiform to reniform phialides; (**p**,**q**). macroconidia. —Scale bars: a = 200 µm; b = 100 µm; c, d, f and h–j = 20 µm; e = 50 µm; g and n–q = 10 µm; k–m = 5 µm.

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Description: *Ascomata* perithecial, solitary or in groups of two, orange, becoming orange-brown with age; in section, apex and body orange, base red-brown, subglobose to ovoid, 368–491 µm high, 335–455 µm diam, body turning dark orange to red, and base dark red-brown in 3% KOH+; ascomatal wall rough, consisting of two thick-walled layers; outer layer of *textura globulosa*, 23–82 µm thick, cells becoming more compressed towards the inner layer of *textura angularis*, 8–21 µm thick, cells becoming thin-walled and hyaline towards the centre; outermost cells 21–35 × 7–21 µm, cells of inner layer 9–34 × 2–9 µm; ascomatal base up to 201 µm wide, consisting of dark red, angular cells, merging with an erumpent stroma; cells of the outer wall layer continuous with the pseudoparenchymatous cells of the erumpent stroma. *Asci* 8-spored, clavate, 68–143 × 10–22 µm, tapering into a long thin stalk. *Ascospores* aggregated in the upper third of the ascus, hyaline, guttulate, fusoid with rounded ends, straight to slightly curved, 1-septate, constricted at the septum, (24.5–)30.5–37.5(–42.5) × (4–)4.5–5.5(–7) µm (av. = 34 × 5 µm). *Macroconidiophores* consisting of a stipe, a suite of penicillate arranged fertile branches, a stipe extension, and a terminal vesicle; stipe septate, hyaline, smooth, 27–134 × 4–6 µm, stipe extension septate, straight to flexuous 64–129 µm long, 2–4 µm wide at the apical septum, terminating in a obpyriform to sphaeropedunculate vesicle, 3–7 µm diam; lateral stipe extensions (90° to main axis) moderate, 31–88 µm long, 1.5–3 µm wide at the apical septum, terminating in obpyriform vesicles, 2−5 µm. *Conidiogenous apparatus* 37–134 µm wide, and 41–128 µm long; primary branches aseptate, 15–27 × 3–5 µm; secondary branches aseptate, 12–20 × 3–4.5 µm; tertiary branches aseptate, 11–15 × 3–4 µm; quaternary branches aseptate, 8−16 × 3–5 µm, each terminal branch producing 2–6 phialides; phialides elongate doliiform to reniform, hyaline, aseptate, 9–18 × 2–5 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at both ends, straight, (40–)46–54.5(–63.5) × (3.5–)4.5–5(–6) µm (av. = 50 × 5 µm), 1-septate, lacking a visible abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies producing abundant white to cinnamon (62) aerial mycelium at 25 °C on MEA, moderate sporulation on the medium surface; reverse sienna (8) to umber (9) after 7 d; chlamydospores extensive throughout the medium forming microsclerotia. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 21.5 mm, 31.2 mm, 57.1 mm, 81.3 mm and 55.2 mm, respectively.

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Specimens examined: China: FuJian Province, LongYan Region, XinLuo District (25°07′08.597″ N, 116°44′42.257″ E), from soil collected in a *Eucalyptus* plantation, 6 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249929, culture CSF9937); FuJian Province, LongYan Region, LianCheng County (25°26′14.348″ N, 116°38′42.400″ E), from soil under a natural forest, 6 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249930, culture CSF9957).

Notes: Isolates CSF9937, CSF9938 and CSF9957 were crossed with each other in all possible combinations on MSA to which autoclaved toothpicks had been placed, randomly distributed on the agar surface. Isolates CSF9937 and CSF9938 readily formed protoperithecia within two weeks, and perithecia with viable ascospores were produced within four weeks, when they crossed with themselves. After eight weeks of incubation, isolate CSF9957 failed to form sexual structures in any combination. *Calonectria aconidialis* is a species in the *Ca. kyotensis* species complex. The ascospores of *Ca. aconidialis* obtained in this study (av. = 34 × 5 µm) were smaller than those of the originally described *Ca. aconidialis* (av. = 36 × 6 µm) [11].

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Calonectria hongkongensis

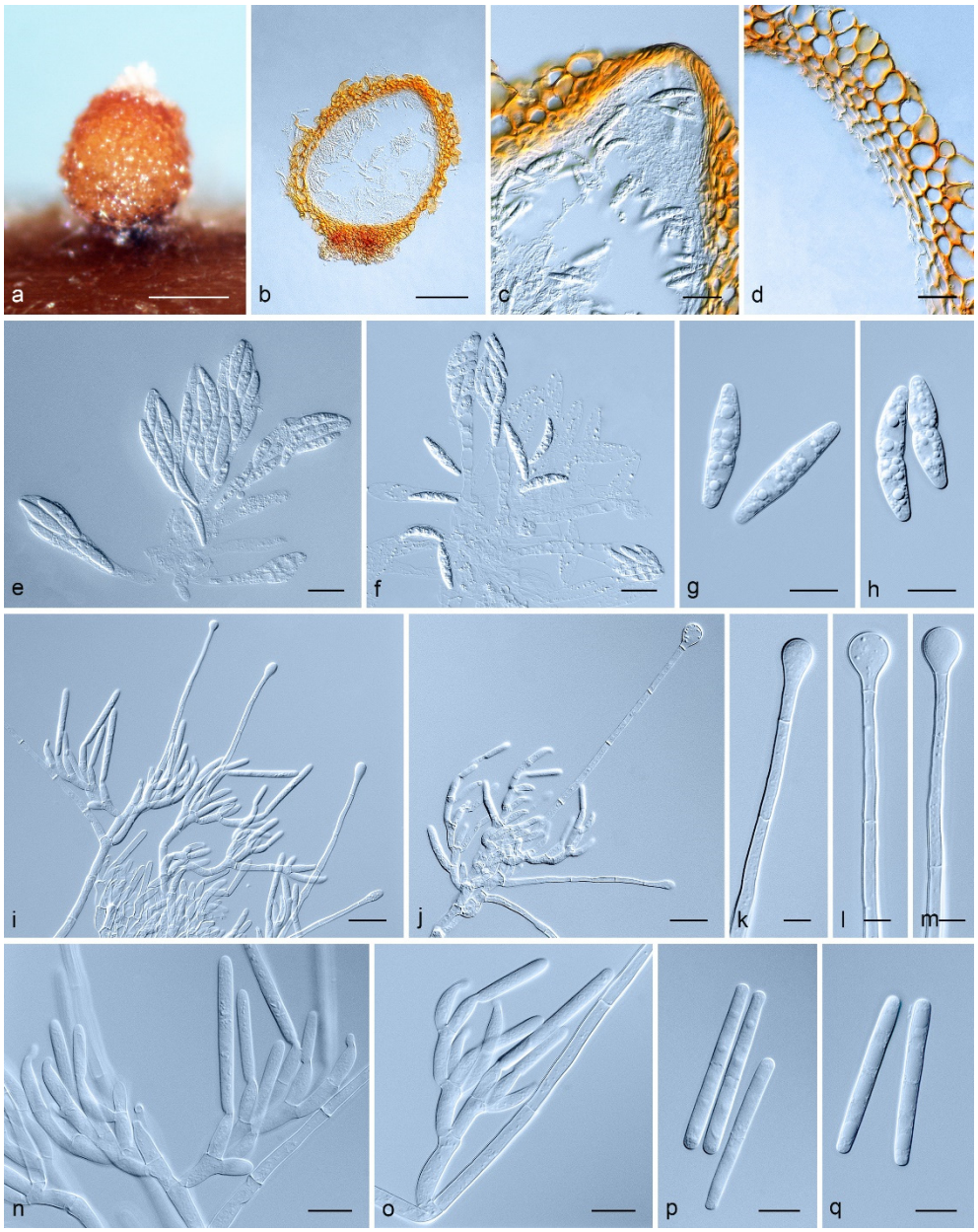


Figure A8. *Calonectria hongkongensis*. (**a**). Perithecium; (**b**). vertical section through a perithecium; (**c**). cells around ostiolar region of perithecium; (**d**). section through lateral perithecial wall; (**e**,**f**). asci; (**g**,**h**). ascospores; (**i**,**j**). macroconidiophore; (**k–m**). sphaeropedunculate vesicles; (**n**,**o**). conidiogenous apparatus with conidiophore branches and elongate doliiform to reniform phialides; (**p**,**q**). macroconidia. —Scale bars: a = 200 µm; b = 100 µm; c–f and i,j = 20 µm; g,h and n–q = 10 µm; k–m = 5 µm.

Description: *Ascomata* perithecial, solitary or in groups of up to three, orange, becoming red-brown with age; in section, apex and body orange, base dark red-brown, subglobose to ovoid,

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243–376 µm high, 219–355 µm diam, body turning red, and base dark red-brown in 3% KOH+; ascomatal wall rough, consisting of two thick-walled layers; outer layer of *textura globulosa*, 31–54 µm thick, cells becoming more compressed towards the inner layer of *textura angularis*, 10–28 µm thick, cells becoming thin-walled and hyaline towards the centre; outermost cells 10–25 × 9–23 µm, cells of inner layer 6–24 × 2–6 µm; ascomatal base up to 168 µm wide, consisting of dark red, angular cells, merging with an erumpent stroma; cells of the outer wall layer continuous with the pseudoparenchymatous cells of the erumpent stroma. *Asci* 8-spored, clavate, 82–148 × 12–32 µm, tapering into a long thin stalk. *Ascospores* aggregated in the upper third of the ascus, hyaline, guttulate, fusoid with rounded ends, straight to slightly curved, 1-septate, constricted at the septum, (23–)25–30(–34) × (4–)5–7(–8) µm (av. = 28 × 6 µm). *Macroconidiophores* consisting of a stipe, a suite of penicillate arranged fertile branches, a stipe extension, and a terminal vesicle; stipe septate, hyaline, smooth, 47–117 × 4–8 µm, stipe extension septate, straight to flexuous 68–198 µm long, 1–4 µm wide at the apical septum, terminating in a sphaeropedunculate vesicle, 4–10 µm diam; lateral stipe extensions (90° to main axis) abundant, 42–111 µm long, 1–3 µm wide at the apical septum, terminating in obpyriform vesicles, 2−6 µm. *Conidiogenous apparatus* 37–146 µm wide, and 41–111 µm long; primary branches aseptate, 12–28 × 3–5.5 µm; secondary branches aseptate, 9.5–19 × 3–6 µm; tertiary branches aseptate, 9–13 × 3–5 µm, additional branches –5, aseptate, 8–15 × 2–4.5 µm, each terminal branch producing 2–4 phialides; phialides elongate doliiform to reniform, hyaline, aseptate, 8–14 × 2–5 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at both ends, straight, (34–)37–41(–44) × (3–)3.5–4(–5) µm (av. = 39 × 4 µm), 1-septate, lacking a visible abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies forming abundant white to sienna (8) aerial mycelium at 25 °C on MEA, with irregular margins, abundant sporulation; surface rust-coloured (39); reverse sienna (8) to umber (9) after 7 d. Chlamydospores extensive throughout the medium forming microsclerotia. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 21.2 mm, 26.1 mm, 46.3 mm, 69.1 mm and 64.1 mm, respectively.

Specimens examined: China: FuJian Province, ZhangZhou Region, HuaAn county (24°53′49.369″ N, 117°32′45.070″ E), from soil collected in a *Eucalyptus* plantation, 5 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249931, culture CSF9784).

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Notes: Isolates CSF7124, CSF9784 and CSF9794 were crossed with each other in all possible combinations on MSA. Isolates CSF7124 and CSF9784 readily formed protoperithecia within two weeks, and perithecia with viable ascospores were produced within four weeks, when they crossed with themselves. After eight weeks of incubation, isolate CSF9794 failed to form sexual structures in any combination. *Calonectria hongkongensis* is a species in the *Ca. kyotensis* species complex. The ascospores and macroconidia of *Ca. hongkongensis* obtained in this study (ascospores: av. = 28 × 6 µm; macroconidia: av. = 39 × 4 µm) were shorter than those of the originally described *Ca. hongkongensis* (ascospores: av. = 31 × 6 µm; macroconidia: av. = 46.5 × 4 µm) [23]. The vesicle of *Ca. hongkongensis* obtained in this study (4–10 µm) was narrower than those of the originally described *Ca. hongkongensis* (8–14 µm) [23].

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Calonectria ilicicola



Figure A9. *Calonectria ilicicola*. (**a**). Perithecium; (**b**). vertical section through a perithecium; (**c**). cells around ostiolar region of perithecium; (**d**). section through lateral perithecial wall; (**e**,**f**). asci; (**g**). ascospores; (**h**,**i**). macroconidiophore; (**j**,**k**). ovoid to sphaeropedunculate vesicles; (**l**,**m**). conidiogenous apparatus with conidiophore branches and elongate doliiform to reniform phialides; (**n**,**o**). macroconidia. —Scale bars: a = 200 µm; b = 100 µm; c, d, f and i = 20 µm; e and h = 50 µm; g and l–o = 10 µm; j, k = 5 µm.

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Description: *Ascomata* perithecial, solitary or in groups of two, orange to red, becoming red-brown with age; in section, apex and body red-brown, base dark red-brown, subglobose to ovoid, 375–509 µm high, 363–474 µm diam, body turning dark red, and base dark red-brown in 3% KOH+; ascomatal wall rough, consisting of two thick-walled layers; outer layer of *textura globulosa*, 47–75 µm thick, cells becoming more compressed towards the inner layer of *textura angularis*, 14–30 µm thick, cells becoming thin-walled and hyaline towards the centre; outermost cells 9–40 × 8–36 µm, cells of inner layer 10–23 × 2–7 µm; ascomatal base up to 208 µm wide, consisting of dark red, angular cells, merging with an erumpent stroma; cells of the outer wall layer continuous with the pseudoparenchymatous cells of the erumpent stroma. *Asci* 8-spored, clavate, 70–137 × 12–34 µm, tapering into a long thin stalk. *Ascospores* aggregated in the upper third of the ascus, hyaline, guttulate, fusoid with rounded ends, straight to slightly curved, 1-septate, not or slightly constricted at the septum, (30–)37–46.5(–58) × (4–)5–6(–8) µm (av. = 42 × 5 µm). *Macroconidiophores* consisting of a stipe, a suite of penicillate arranged fertile branches, a stipe extension, and a terminal vesicle; stipe septate, hyaline, smooth, 12–98 × 4–7 µm, stipe extension septate, straight to flexuous 111–216 µm long, 2–4.5 µm wide at the apical septum, terminating in an ovoid to sphaeropedunculate vesicle, 6–13 µm diam; lateral stipe extensions (90° to main axis) absent. *Conidiogenous apparatus* 32–94 µm wide, and 49–106 µm long; primary branches aseptate, 12–34 × 4–6 µm; secondary branches aseptate, 4–21 × 3.5–6 µm; tertiary branches aseptate, 9–17 × 4–6 µm, each terminal branch producing 2–4 phialides; phialides elongate doliiform to reniform, hyaline, aseptate, 8–15 × 3–5 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at both ends, straight, (58–)63–70(–76) × 6–7(–8) µm (av. = 67 × 7 µm), (1–)3-septate, lacking a visible abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies forming abundant white to cinnamon (62) aerial mycelium at 25 °C on MEA, with irregular margins, profuse sporulation; reverse with cinnamon (62) outer margin, and rust (39) inner region after 7 d. Chlamydospores extensive throughout the medium forming microsclerotia. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 16.1 mm, 24.9 mm, 54.8 mm, 74.3 mm and 66.4 mm, respectively.

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Specimens examined: China: FuJian Province, LongYan Region, ZhangPing County (25°17′10.882″ N, 117°27′33.635″ E), from soil collected in a *Eucalyptus* plantation, 6 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249932, culture CSF9862).

Notes: Isolates CSF9862 and CSF9863 were crossed with each other on MSA and they were readily formed protoperithecia within two weeks, and perithecia with viable ascospores were produced within four weeks, when they crossed with themselves. *Calonectria ilicicola* is a species in the *Ca. kyotensis* species. The ascospores of *Ca. ilicicola* (av. = 42 × 5.5 µm) obtained in this study were smaller than those of the originally described *Ca. ilicicola* (av. = 45 × 6 µm) [17], and the macroconidia of *Ca. ilicicola* (av. = 67 × 7 µm) were larger than those of the originally described *Ca. ilicicola* (av. = 62 × 6 µm) [17], and they share similar vesicle dimensions.

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Calonectria kyotensis

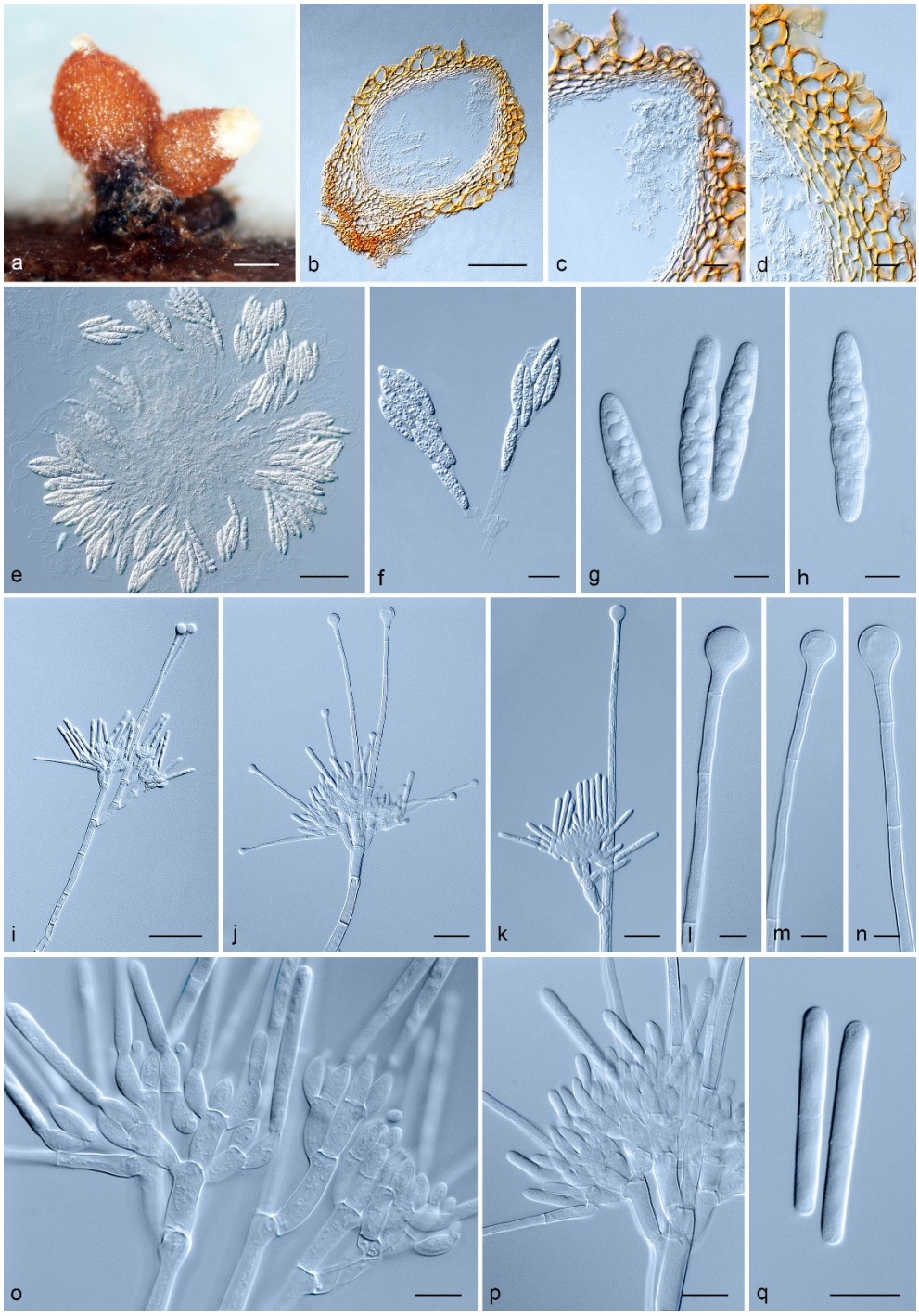


Figure A10. *Calonectria kyotensis*. (**a**). Perithecium; (**b**). vertical section through a perithecium; (**c**). cells around ostiolar region of perithecium; (**d**). section through lateral perithecial wall; (**e**,**f**). asci; (**g**,**h**). ascospores; (**i**–**k**). macroconidiophore; (**l**–**n**). sphaeropedunculate vesicles; (**o**,**p**). conidiogenous apparatus with conidiophore branches and elongate doliiform to reniform phialides; (**q**). macroconidia. —Scale bars: a = 200 µm; b = 100 µm; c, d, f and j–k = 20 µm; e and i = 50 µm; g, h and o–q = 10 µm; l–n = 5 µm.

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Description: *Ascomata* perithecial, solitary or in groups of up to four, orange, becoming red-brown with age; in section, apex and body orange, base dark red-brown, subglobose to ovoid, 322–482 µm high, 296–432 µm diam, body turning red, and base dark red-brown in 3% KOH+; ascomatal wall rough, consisting of two thick-walled layers; outer layer of *textura globulosa*, 8–24 µm thick, cells becoming more compressed towards the inner layer of *textura angularis*, 25–59 µm thick, cells becoming thin-walled and hyaline towards the centre; outermost cells 14–25 × 8–13 µm, cells of inner layer 10–30 × 2–6 µm; ascomatal base up to 234 µm wide, consisting of dark red, angular cells, merging with an erumpent stroma; cells of the outer wall layer continuous with the pseudoparenchymatous cells of the erumpent stroma. *Asci* 8-spored, clavate, 73–125 × 15–29 µm, tapering into a long thin stalk. *Ascospores* aggregated in the upper third of the ascus, hyaline, guttulate, fusoid with rounded ends, straight to slightly curved, 1(–3)-septate, constricted at the septum, (26–)31–38.5(–43.5) × (5–)5.5–7.5(–9.5) µm (av. = 34.5 × 6.5 µm). *Macroconidiophores* consisting of a stipe, a suite of penicillate arranged fertile branches, a stipe extension, and a terminal vesicle; stipe septate, hyaline, smooth, 36–135 × 4–9 µm, stipe extension septate, straight to flexuous 69.5–222 µm long, 2–4 µm wide at the apical septum, terminating in a sphaeropedunculate vesicle, 4–10 µm diam; lateral stipe extensions (90° to main axis) abundant, 41–108 µm long, 1–3 µm wide at the apical septum, terminating in sphaeropedunculate vesicles, 3−7 µm. *Conidiogenous apparatus* 40–110 µm wide, and 36–108 µm long; primary branches aseptate, 14–31 × 4–6 µm; secondary branches aseptate, 9–22 × 3–5 µm; tertiary branches aseptate, 7–16 × 3–5 µm, quaternary branches aseptate, 8−11 × 3–5 µm, each terminal branch producing 2–4 phialides; phialides doliiform to reniform, hyaline, aseptate, 6–10 × 2–4 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at both ends, straight, (28–)32–35.5(–39.5) × (2.5–)3–4(–4.5) µm (av. = 33.5 × 3.5 µm), 1-septate, lacking a visible abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies forming abundant white to sienna (8) aerial mycelium at 25 °C on MEA, with feather, irregular margins, profuse sporulation; reverse sienna (8) to umber (9) after 7 d. Chlamydospores extensive throughout the medium forming microsclerotia. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 16.2 mm, 23.2 mm, 52.1 mm, 66.3 mm and 61.5 mm, respectively.

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Specimens examined: China**:** FuJian Province, ZhangZhou Region, HuaAn county (24°53′49.369″ N, 117°32′45.070″ E), from soil collected in a *Eucalyptus* plantation, 5 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249933, culture CSF9824); FuJian Province, LongYan Region, LianCheng county (25°33′06.994″ N, 116°41′42.328″ E), from soil collected in a *Eucalyptus* plantation, 6 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249934, culture CSF10004).

Notes: Isolates CSF7130, CSF9824 and CSF10004 were crossed with each other in all possible combinations on MSA. Isolates CSF9824 readily formed protoperithecia within two weeks. After eight weeks of incubation, isolates CSF7130 and CSF10004 failed to form sexual structures in any combination. *Calonectria kyotensis* is a species in the *Ca. kyotensis* species. The ascospores of *Ca. kyotensis* (av. = 34.5 × 6.5 µm) obtained in this study were longer than those of the originally described *Ca. kyotensis* (av. = 29 × 6 µm) [47], while the macroconidia of *Ca. kyotensis* (av. = 33.5 × 3.5 µm) in this study were shorter than those of the originally described *Ca. kyotensis* (av. = 41 × 4 µm) [47], and the vesicle in this study (4–10 µm) was narrower than those of originally described *Ca. kyotensis* (8.8–19 µm) [47].

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Calonectria pacifica

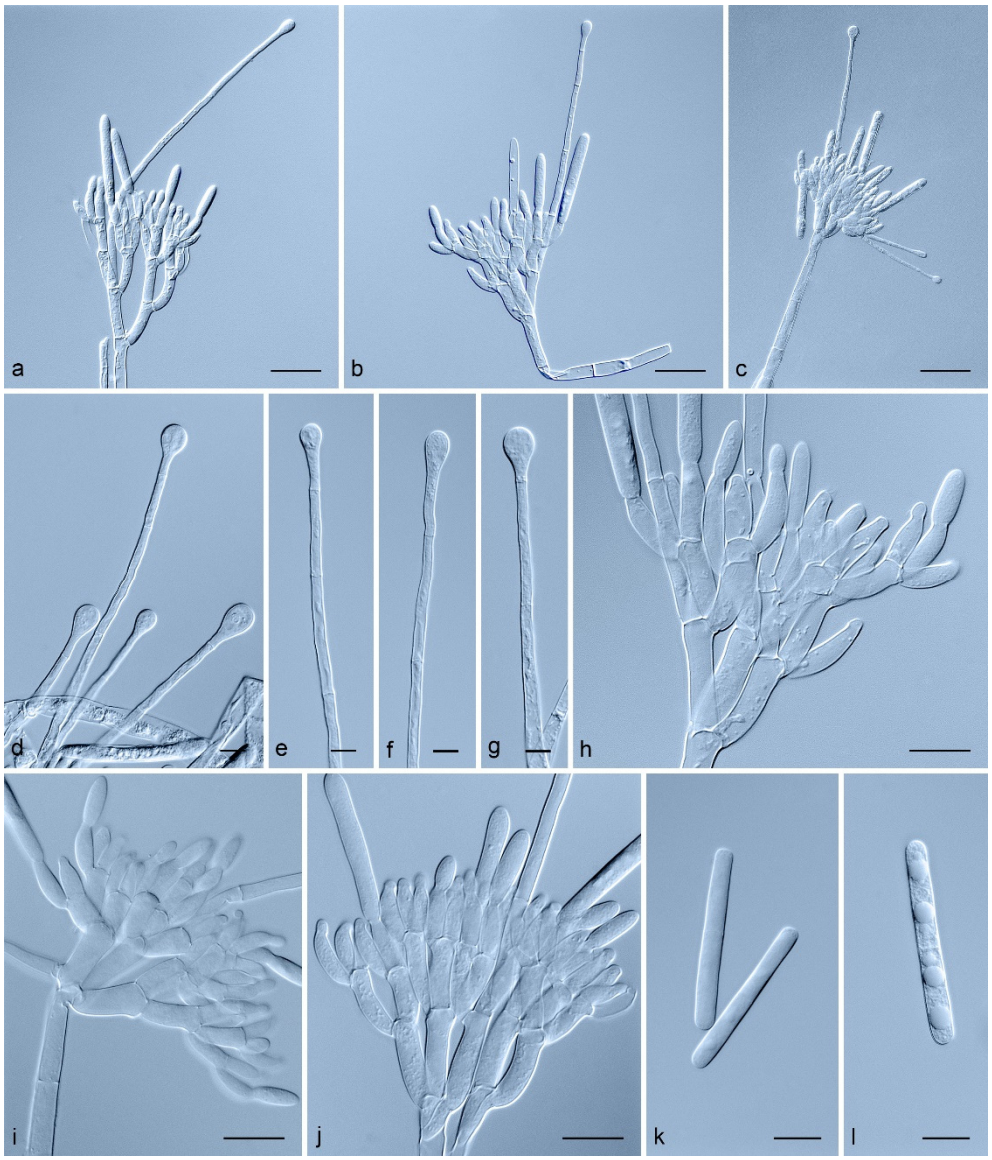


Figure A11. *Calonectria pacifica*. (**a**–**c**). Macroconidiophore; (**d**–**g**). ovoid to sphaeropedunculate vesicles; (**h**–**j**). conidiogenous apparatus with conidiophore branches and doliiform to reniform phialides; (**k**–**l**). macroconidia. —Scale bars: a–c = 20 µm; d–g = 5 µm; h–l = 10 µm.

Description: *Sexual morph* unknown. *Macroconidiophores* consisting of a stipe, a suite of penicillate arranged fertile branches, a stipe extension, and a terminal vesicle; stipe septate, hyaline, smooth, 44–115 × 4–7 µm; stipe extensions septate, straight to flexuous 73.5–171 µm long, 2–3.5 µm wide, at the apical septum, terminating in an ovoid to sphaeropedunculate vesicle, 4–10 µm diam; lateral stipe extensions (90° to main axis) abundant, 36–98 µm long, 1.5–2.5 µm wide at the apical septum, terminating in an ovoid vesicles, 3–5 µm diam. *Conidiogenous apparatus* 45–105 µm wide, and 35–81 µm long; primary branches aseptate,

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12.5–23 × 4–6 µm; secondary branches aseptate, 10–20 × 3–6 µm; tertiary branches aseptate, 10–15 × 3–5 µm, each terminal branch producing 2–4 phialides; phialides doliiform to reniform, hyaline, aseptate, 6−15 × 3–5 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at both ends, straight, (36–)40–46(–48) × (3.5–)4–5(–6) µm, (av. = 43 × 5 µm), 1-septate, lacking a visible abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies forming sparse white to sienna (8) aerial mycelium at 25 °C on MEA, with feathery, irregular margins at the edges, abundant sporulation; reverse sienna (8) to umber (9) after 7 d. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 15.1 mm, 21.4 mm, 45.1 mm, 58.2 mm and 42.1 mm, respectively.

Specimens examined: China: FuJian Province, NanPing Region, YanPing District (26°42′26.672″ N, 118°07′58.317″ E), from soil under a natural forest, 08 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249938, culture CSF10070); FuJian Province: NanPing Region, YanPing District (26°42′26.672″ N, 118°07′58.317″ E), from soil under a natural forest, 08 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249939, culture CSF10077).

Notes: Isolates CSF10024, CSF10070 and CSF10077 were crossed with each other in all possible combinations on MSA and failed to form sexual structures in any combination. *Calonectria pacifica* is a species in the *Ca. kyotensis* species complex. The macroconidia of *Ca. pacifica* (av. = 43 × 5 µm) obtained in this study were shorter than those of the originally described *Ca. pacifica* (av. = 55 × 4.5 µm) [17], and the vesicles were narrower than those of originally described strains of *Ca. pacifica* (7–15 µm) [17].

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Calonectria pseudoreteaudii

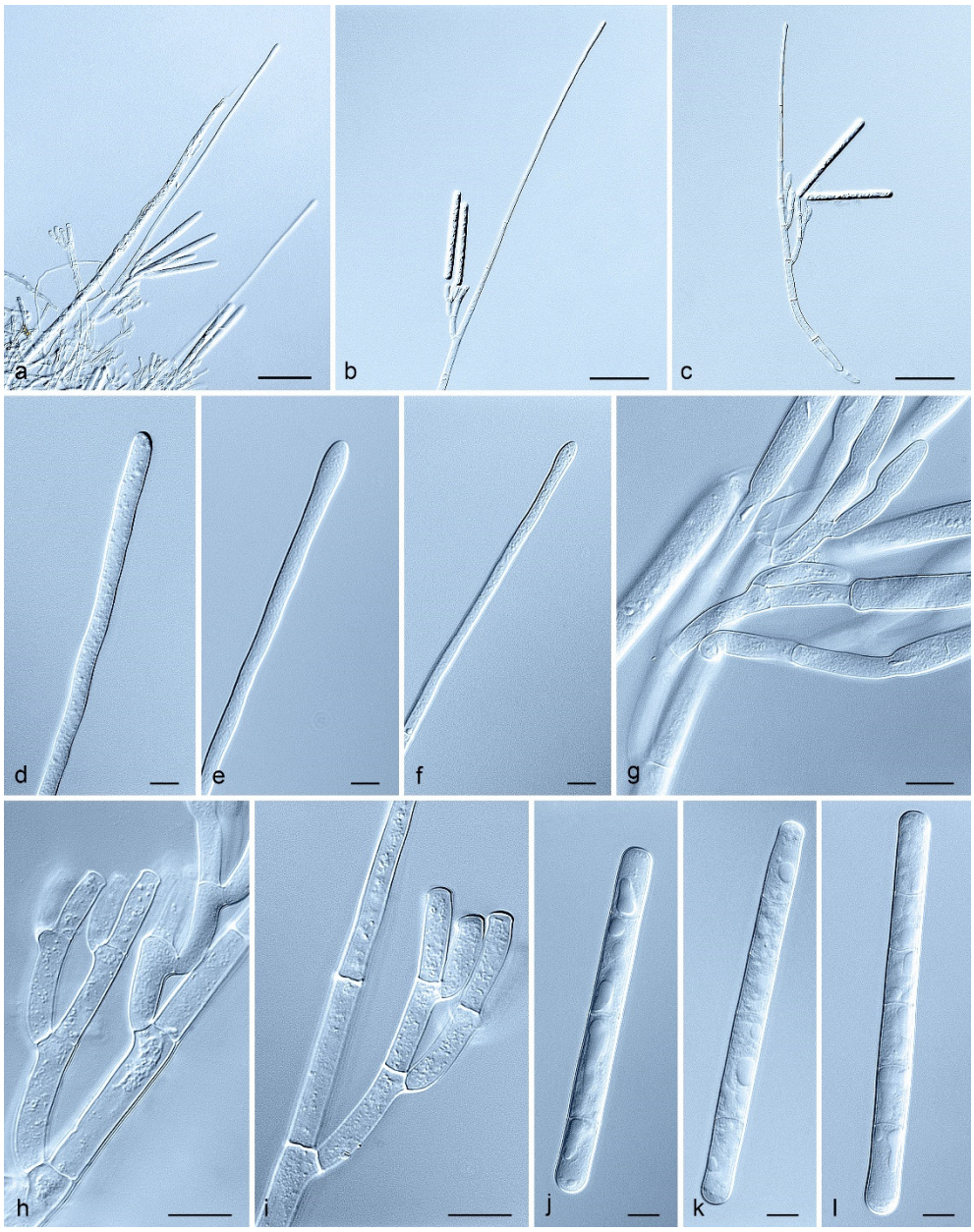


Figure A12. *Calonectria pseudoreteaudii*. (**a**–**c**). Macroconidiophore; (**d**–**f**). clavate to narrowly clavate vesicle; (**g**–**i**.) conidiogenous apparatus with conidiophore branches and cylindrical to allantoid phialides; (**j**–**l**). macroconidia. —Scale bars: a–c = 20 µm; d–f = 5 µm; g–l = 10 µm.

Description: *Sexual morph* unknown. *Macroconidiophores* consisting of a stipe, a suite of penicillate arranged fertile branches, a stipe extension, and a terminal vesicle; stipe septate, hyaline, smooth, 81–145 × 3–8 µm; stipe extensions septate, straight to flexuous 150–268 µm long, 5–7 µm wide, at the apical septum, terminating in a narrowly clavate vesicle, 3–5 µm diam. *Conidiogenous apparatus* 68–140 µm long, and 30–92 µm wide; primary branches

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aseptate or 1-septate, 19–34 × 4–6 µm; secondary branches aseptate, 16–25 × 4–5 µm; tertiary branches aseptate, 13–22 × 3–5 µm, each terminal branch producing 1–3 phialides; phialides cylindrical to allantoid, hyaline, aseptate, 10−18 × 3–5 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at the apex, flattened at the base, straight, (54.5–)73–88.5(–96) × (6–)6.5–8(–9) µm, (av. = 81 × 7.5 µm), 5-septate, lacking a visible abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies forming white to sienna (8) aerial mycelium at 25 °C on MEA, with feathery, regular margins at the edges, abundant sporulation; reverse sienna (8) to chestnut (40) after 7 d; chlamydospores extensive throughout the medium, forming microsclerotia. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 19.3 mm, 25.1 mm, 49.2 mm, 59.1 mm and 47.1 mm, respectively.

Specimens examined: China: FuJian Province, NanPing Region, YanPing District (26°46′19.651″ N, 117°57′37.233″ E), from soil collected in a *Eucalyptus* plantation, 08 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249940, culture CSF10059); FuJian Province: NanPing Region, YanPing District (26°46′19.651″ N, 117°57′37.233″ E), from soil collected in a *Eucalyptus* plantation, 08 November 2016, S.F. Chen, Q.L. Liu and F.F. Liu (HMAS249941, culture CSF10060).

Notes: Isolates CSF10059 and CSF10060 were crossed with each other on MSA and failed to form sexual structures in any combination. *Calonectria pseudoreteaudii* is a species in the *Ca. reteaudii* species complex. The macroconidia of isolates obtained in this study (av. = 81 × 7.5 µm) were much shorter than those of the originally described strains of *Ca. pseudoreteaudii* (av. = 104 × 8 µm) [24].

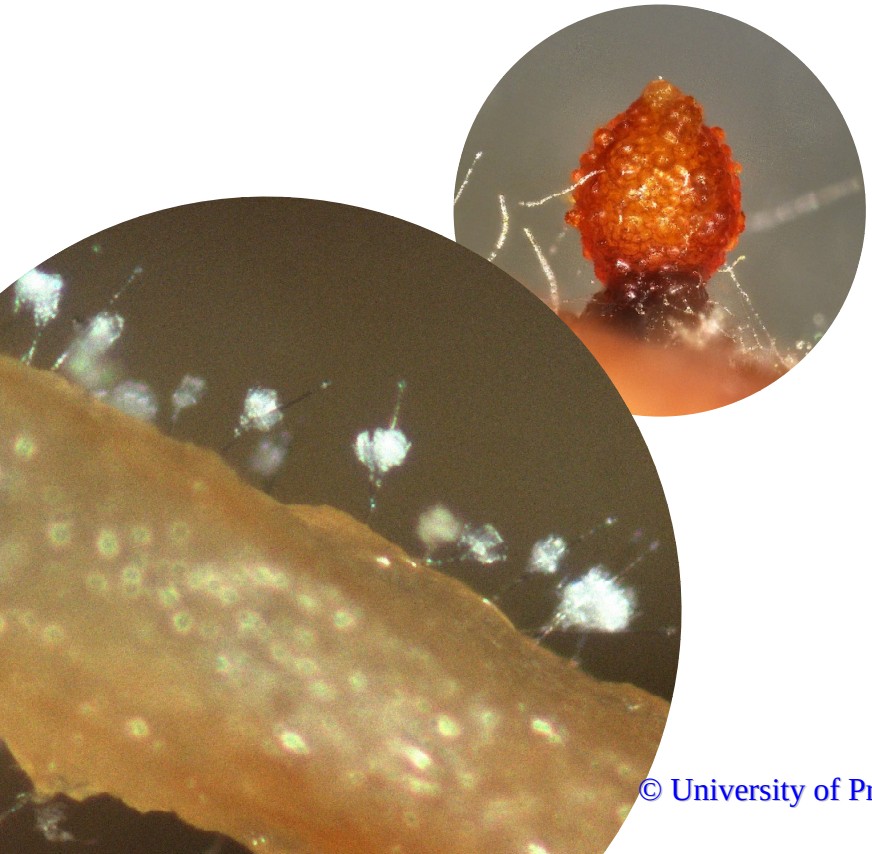
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CHAPTER 4

Leaf blight in a *Eucalyptus* plantation caused by *Calonectria* spp. originating from leaves and soils

Research Chapter:

Liu QL, Wingfield MJ, Duong TA, Wingfield BD, Chen SF. 2022. Leaf blight in a *Eucalyptus* plantation caused by *Calonectria* spp. originating from both leaves and soils



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Leaf blight in a *Eucalyptus* plantation caused by *Calonectria* spp. originating from leaves and soils

Abstract Calonectria leaf blight (CLB) is one of the best-known diseases of *Eucalyptus* spp., particularly in Asia and South America. Recently, typical symptoms of leaf and shoot blight caused by *Calonectria* spp. were observed in a *Eucalyptus* plantation in the YunNan Province of southwestern China. Isolations were made from diseased leaves and soil samples collected from below the infected trees to determine the causal agent of the disease and to consider the distribution characteristics of the *Calonectria* species. This resulted in 417 isolates, of which 228 were from leaves and 189 were from soils. Based on comparisons of DNA sequences for the *act* (actin), *cmdA* (calmodulin), *his3* (histone H3), *rpb2* (the second largest subunit of RNA polymerase), *tef1* (translation elongation factor 1-alpha) and *tub2* (β-tubulin) gene regions, as well as morphological characteristics, 11 *Calonectria* species were identified. These included *Calonectria aciculata* (0.7%), *Ca. colhounii* (1.2%), *Ca. eucalypti* (10.6%) and *Ca. honghensis* (43.2%) in the *Ca. colhounii* species complex, and *Ca. aconidialis* (15.3%), *Ca. asiatica* (9.8%), *Ca. hongkongensis* (1.0%), *Ca. ilicicola* (6.0%), *Ca. kyotensis* (0.5%), and *Ca. yunnanensis* (11.3%) in the *Ca. kyotensis* species complex. In addition, a novel species, accounting for 0.5% of the isolates, was discovered and described here as *Ca. dianii* sp. nov. in the *Ca colhounii* species complex. Most (99.1%) of the isolates collected from the leaves resided in the *Ca. colhounii* species complex and a majority (95.8%) of those from the soils were in *Ca. kyotensis* species complex. These results suggest that *Calonectria* spp. in the *Ca. colhounii* species complex infecting leaves are specifically adapted to that niche and likewise those in the *Ca. kyotensis* species complex are better adapted to a soil habitat.

Keywords: Calonectria leaf blight, Forest pathogens, Fungal diversity, Taxonomy, Soil-borne fungi

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INTRODUCTION

As areas of China planted to *Eucalyptus* have expanded during the past four decades, growing numbers of diseases have emerged as threats to these trees (Zhou and Wingfield 2011; Liu and Xie 2020). Prominent disease problems include stem canker caused by the *Botryosphaeriaceae* (Li et al. 2018, 2020) and the *Cryphonectriaceae* (Wang et al. 2018, 2020), Coniothyrium canker caused by *Teratosphaeria zuluensis* (Chen et al. 2011a), wilt associated with infections of the bacterium *Ralstonia solanacearum* (Old et al. 2003; Carstensen et al. 2017; Jiang et al. 2017), leaf spot caused by species of *Mycosphaerella* (Burgess et al. 2007) and *Teratosphaeria* (Burgess et al. 2006; Havenga et al. 2020). Amongst the most common and often serious disease problems is leaf blight caused by *Calonectria* spp. (Li et al. 2017; Wang and Chen 2020; Wu and Chen 2021), particularly in southern China plantations.

Species of *Calonectria* are widely distributed in tropical and subtropical regions of the world, resulting in a wide variety of symptoms on a large number of agronomic, horticultural and forestry crops (Crous 2002; Lombard et al. 2010a; Alfenas et al. 2013, 2015). There are currently 133 accepted names in *Calonectria* (Crous et al. 2018, 2019, 2021a, b; Wang et al. 2019; Liu et al. 2020, 2022; Mohali and Stewart 2021; Pham et al. 2022; Sanchez-Gonzalez et al. 2022) distributed across 11 species complexes residing in either one of two morphological assemblages known as the Prolate or Sphaero-Naviculate Groups (Lombard et al. 2010a; Liu et al. 2020). The Prolate Group includes species with clavate to pyriform to ellipsoidal vesicles and those in the Sphaero-Naviculate Group have sphaeropedunculate and naviculate vesicles (Liu et al. 2020).

Calonectria species are well-known to infect the leaves of *Eucalyptus* spp. but also to occur in the soils associated with these trees in China (Li et al. 2017; Wu and Chen 2021; Liu et al. 2021). There are currently 28 species of *Calonectria* known from China, and of these seven (*Ca. aciculata*, *Ca. crousiana*, *Ca. eucalypti*, *Ca. fujianensis*, *Ca. hawksworthii*, *Ca. pauciramosa* and *Ca. queenslandica*) have been isolated from diseased *Eucalyptus* tissues (Chen et al. 2011b; Lombard et al. 2010b, 2015; Li et al. 2017, 2022; Wang and Chen 2020). Eleven other species (*Ca. asiatica*, *Ca. auriculiformis*, *Ca. chinensis*, *Ca. honghensis*, *Ca. hongkongensis*, *Ca. ilicicola*, *Ca. kyotensis*, *Ca. lateralis*, *Ca. yunnanensis*, *Ca. minensis* and *Ca. orientalis*) have been isolated from soils in *Eucalyptus* plantations (Crous et al. 2004; Lombard et al. 2015; Li et al. 2017; Liu et al. 2020, 2022; Wu and Chen 2021; Liu and Chen 2022) and four (*Ca. aconidialis*, *Ca. cerciana*, *Ca. pseudoreteaudii* and *Ca. reteaudii*) are

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known to occur both in soils and on infected *Eucalyptus* tissues (Lombard et al. 2010b, 2015; Wu and Chen 2021; Li et al. 2022).

Broadly, *Calonectria* spp. are known as soil-associated fungi with the ability to infect young plant tissues under favourable environmental conditions. Anecdotal observations, based on extensive field collections suggest that some species occurring in the soil are more likely to infect plants than others. However, very little is known regarding the species diversity and distribution characteristics of these fungi isolated from the diseased *Eucalyptus* tissues and soils. To the best of our knowledge, only one study has considered *Calonectria* species from diseased leaves of *Eucalyptus* and the soils associated with those trees (Wu and Chen 2021). That study showed that *Ca. pseudoreteaudii* occurred both on diseased leaves and in the associated soils in one *Eucalyptus* plantation, but the other four species (*Ca. aconidialis*, *Ca. auriculiformis*, *Ca. hongkongensis* and *Ca. reteaudii*) occurred only in the soil samples. The study of Wu and Chen (2021) was of a preliminary nature and included relatively few isolates. The present study was undertaken when a single *Eucalyptus* planation in the YunNan Province was seriously damaged by Calonectria Leaf Blight (CLB), providing an opportunity to intensively sample both infected leaves and the soils associated with the affected trees. The aim of this study was thus to determine the species diversity and the distribution characteristics of *Calonectria* spp. in diseased *Eucalyptus* leaves and soil samples associated with those trees.

MATERIALS AND METHODS

Sample collection and fungal isolation

Extensive disease surveys of *Eucalyptus* plantations were conducted in JingGu County, PuEr Region, YunNan Province, southwestern China (23º23'58"N, 100º50'37"E) in December 2016. Typical symptoms of CLB were detected in an approximately 10 ha plantation of one-year-old *Eucalyptus urophylla* × *E. grandis*. Two hundred and fifty-one diseased trees in the plantation were randomly selected for leaf sampling and one symptomatic leaf was taken from each tree. The same number of soil samples were collected randomly in the plantation and the leaf litter was removed before collecting soil samples from the upper 20 cm of the soil profile. The leaf and soil samples were then transported to a laboratory for further study.

Diseased *Eucalyptus* leaves were incubated in moist Petri dishes for one to two days at 25 °C and checked regularly throughout the incubation period for fungal sporulation. Soil samples were baited with germinating *Medicago sativa* seeds (alfalfa, surface-disinfested in 75%

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ethanol) as described by Crous (2002) and after seven to ten days incubation at 25 °C, conidiophores emerged on the tissues of the germinating plants. Conidial masses were transferred from the *Eucalyptus* leaves and the infected alfalfa tissues onto 2% (v/v) Malt Extract Agar (MEA) using a sterile needle under a dissection microscope (Stemi 2000C, Carl Zeiss, Germany). After two days incubation at 25 °C, a single hyphae tip from each culture was transferred to fresh 2% MEA plates and these were incubated at 25 °C for seven days to obtain axenic cultures.

All cultures were deposited in the Culture Collection (CSF) at the Research Institute of Fast-growing Trees (RIFT) (previous institution: China Eucalypt Research Centre, CERC), Chinese Academy of Forestry (CAF), ZhanJiang, GuangDong Province, China. Representative isolates were stored in the China General Microbiological Culture Collection Centre (CGMCC), Beijing, China. The dried specimens were deposited in the mycological fungarium of the Institute of Microbiology, Chinese Academy of Sciences (HMAS), Beijing, China.

DNA extraction, PCR amplifications and sequencing

Genomic DNA was extracted from cultures grown on MEA for seven days, following the CTAB method as described by Van Burik et al. (1998). Six gene regions including the *act* (actin), *cmdA* (calmodulin), *his3* (histone H3), *rpb2* (the second largest subunit of RNA polymerase), *tef1* (translation elongation factor 1-alpha) and *tub2* (β-tubulin) were amplified using the primer pairs and protocols described by Liu et al. (2020). All the PCR products were sequenced in both directions using the same primers used for amplification. All sequences obtained in this study were deposited in GenBank (http://www.ncbi.nlm.nih.gov) (Table 1, Additional file 1: Table S1).

Phylogenetic analyses

The *tef1* and *tub2* gene regions were amplified and sequenced for all isolates in this study. These sequences were then used in a standard nucleotide BLAST search in the NCBI data base (https://blast.ncbi.nlm.nih.gov/Blast.cgi) to allow for a preliminary identification of these species and to determine the complexes in which they reside. Based on a preliminary identification, representative isolates were selected for PCR amplification and sequencing of four additional gene regions (*act*, *cmdA*, *his3* and *rpb2*). Sequences of the representative isolates and all the published species in the relevant complexes were used for phylogenetic analyses. Sequence datasets were aligned in MAFFT v. 7 (Katoh and Standley 2013) via the

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online version using an FFT-NS-i strategy and were curated in MEGA v. 6.0.5 software (Tamura et al. 2013).

Both maximum parsimony (MP) and maximum likelihood (ML) analyses were conducted using the method described by Liu et al. (2020). Sequence datasets for each of the six gene regions and a concatenated dataset for those regions were used for phylogenetic inference. A partition homogeneity test (PHT, Farris et al. 1994) was conducted to determine whether there was conflict between datasets. Sequence data from two isolates of *Curvicladiella cignea* (CBS 109167 and CBS 109168) were used as outgroups (Table 2).

Morphology and taxonomy

Based on DNA sequence comparisons, representative isolates were selected for morphological identification. To induce asexual structures, mycelium plugs from pure cultures were transferred onto synthetic nutrient-poor agar (SNA, Nirenburg 1981) and incubated at 25 °C for four to seven days. The asexual structures were mounted in 85% lactic acid and examined with a Zeiss Axio Imager A1 microscope (Carl Zeiss Ltd., Germany).

An attempt to induce sexual structures was made by crossing isolates of the novel species in all possible combinations on Minimum Salt Agar (MSA, Guerber and Correll 2001) amended with sterile bamboo toothpicks and incubated at 25 °C for 2–8 wk.

For the novel species, 50 measurements were made for each taxonomically informative structure in the isolate selected to represent the holotype specimen, and 30 measurements were made for the paratypes. Minimum, maximum and average (mean) values are presented as (minimum–) (average – standard deviation) – (average + standard deviation) (–maximum).

The optimal growth temperature for the novel species was determined by transferring mycelial plugs taken from the actively growing margins of cultures to fresh MEA and incubating these at temperatures ranging from 5 °C to 35 °C at 5 °C intervals, with five replicate plates per temperature per isolate. Colony diameters were measured after seven days. Colony colour and morphology was described based on the colour charts of Rayner (1970) using 7-d-old cultures on MEA incubated at 25 °C. All descriptions were deposited in MycoBank (www.mycobank.org).

RESULTS

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Sample collection and fungal isolation

A total of 251 symptomatic *Eucalyptus* leaves and associated soil samples were collected from an equal number of diseased *E. urophylla* × *E. grandis* trees and sampling points. Based on the morphological characteristics of the cultures, between one and three isolates were retained for each of the leaf samples and between one and four isolates were retained for each of the soil samples. In total, 228 *Calonectria* isolates were obtained from 198 diseased trees, and 189 isolates were obtained from 88 soil samples. This amounted to a collection of 417 isolates with typical morphological characteristics of *Calonectria* species (Additional file 1: Table S1).

DNA extraction, PCR amplifications and sequencing

DNA was extracted and the *tef1* and *tub2* gene regions were sequenced for all isolates obtained (Additional file 1: Table S1). Based on the combined genotype of *tef1* and *tub2* as well as the sampling source, 151 isolates were selected for further analyses by sequencing the *cmdA* and *his3* gene regions (Additional file 1: Table S1). Based on the combined genotype of *tef1, tub2*, *cmdA* and *his3*, 102 representative isolates were further chosen to amplify *act* and *rpb2* gene regions. Analysis of the sequence data from all six gene regions for these 102 isolates resulted in a total of 72 genotypes (Table 1). The approximate size of the amplicons generated for the six loci were *act*: 300bp, *cmdA*: 700bp, *his3*: 500 bp, *rpb2*: 860 bp, *tef1*: 500 bp, and *tub2*: 600 bp. Overall, 102 isolates were identified based on sequence comparisons for six gene regions and the remaining 315 *Calonectria* isolates were identified based on two to four gene regions.

Phylogenetic analyses

A total of 65 sequences (including all ex-type isolates of the respective complexes) were downloaded from NCBI and used in phylogenetic analyses (Table 2). Both MP and ML methods based on the six individual gene regions and the combined sequence datasets were used to infer phylogenetic relationships. Only ML trees were utilised and bootstrap values for the MP and ML analyses were annotated on the tree branches (Fig. 1, Additional files 3–8: Figs S1–S6). Statistical values for MP and ML analyses and parameters are provided in Additional file 2: Table S2. The PHT test (P = 0.001) showed that the different datasets were congruent and could be combined for analysis.

Based on the six gene combined phylogeny (Fig. 1), the 102 isolates clustered in eleven groups (Groups 1 to 11). Of these, 70 isolates belonged to the *Ca. colhounii* species complex in the

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Prolate group of *Calonectria* and were identified as five species (Groups 1 to 5, Fig. 1). Three isolates (CSF6495, CSF6515 and CSF6528) grouped with *Ca. aciculata* (Group 1), five isolates were most closely related to *Ca. colhounii* (Group 2), two isolates (CSF6439 and CSF6520) formed an independent clade that was distinct from all known species (Group 3), 23 isolates clustered with *Ca. eucalypti* (Group 4) and 37 isolates in Group 5 were identified as *Ca. honghensis*.

Thirty-two isolates resided in the *Ca. kyotensis* species complex of the Sphaero-Naviculate group were identified as six species (Groups 6 to 11). Of these, eight isolates grouped with *Ca. aconidialis* (Group 6), ten isolates with *Ca. asiatica* (Group 7), four isolates with *Ca. hongkongensis* (Group 8), two isolates (CSF13767 and CSF13819) with *Ca. ilicicola* (Group 9), two isolates (CSF13723 and CSF13724) with *Ca. kyotensis* (Group 10) and six isolates with *Ca. yunnanensis* (Group 11).

Based on multi-gene phylogenetic inference (Fig. 1, Additional files 3–8: Figs. S1–S6) and morphological comparisons, eleven *Calonectria* species were identified, including ten described species and one novel species. Five of these (*Ca. aciculata*, *Ca. colhounii*, *Ca. eucalypti*, *Ca. honghensis* and the novel species) resided in the *Ca. colhounii* species complex, and six (*Ca. aconidialis*, *Ca. asiatica*, *Ca. hongkongensis*, *Ca. ilicicola*, *Ca. kyotensis* and *Ca. yunnanensis*) were in the *Ca. kyotensis* species complex.

All *Calonectria* isolates obtained in this study were identified based on the two to six gene regions sequenced. Consequently, the 417 isolates obtained were identified as *Ca. aciculata* (three isolates), *Ca. colhounii* (five isolates), *Ca. eucalypti* (44 isolates), *Ca. honghensis* (180 isolates), *Ca. aconidialis* (64 isolates), *Ca. asiatica* (41 isolates), *Ca. hongkongensis* (four isolates), *Ca. ilicicola* (25 isolates), *Ca. kyotensis* (two isolates), *Ca. yunnanensis* (47 isolates) and two isolates of a novel species.

Morphology and taxonomy

The mating tests with the two isolates (CSF6439 and CSF6520) representing a novel species did not result in sexual structures. Asexual structures were however common in these isolates on the SNA medium. The novel species is described as follows:

Calonectria dianii Q.L. Liu & S.F. Chen, **sp. nov.**

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MycoBank MB845488. (Fig. 2).

Etymology: Name refers to the Chinese short name Dian of YunNan Province, where this fungus was isolated.

Diagnosis: *Calonectria dianii* can be distinguished phylogenetically from the most closely related species *Ca. aciculata*, *Ca. eucalypti*, *Ca. honghensis* and *Ca. minensis* and morphologically by its macroconidial dimensions (see notes below).

Type: **China**: YunNan Province, PuEr Region, JingGu County (23º23'58"N, 100º50'37"E), from leaves collected in a *E. urophylla* × *E. grandis* plantation, 27 December 2014, *G.Q. Li & C.F. Liu* (HMAS350282 – holotype, CSF6520 = CGMCC3.20446 – ex-type culture).

Description: Sexual morph unknown. *Macroconidiophores* consisting of a stipe, a suite of penicillate arranged fertile branches, a stipe extension, and a terminal vesicle; stipe septate, hyaline, smooth, 52–206 × 5–9 µm, stipe extension septate, straight to flexuous 129–248 µm long, 2–4 µm wide at the apical septum, terminating in a broadly clavate to clavate vesicle, 3–5 µm diam; lateral stipe extensions (90° to main axis) absent. *Conidiogenous apparatus* 23–99 µm wide, and 34–96 µm long; primary branches aseptate, 14–30 × 3–6 µm; secondary branches aseptate, 9–23 × 3–6 µm; tertiary branches aseptate, 8–14 × 2–5 µm, each terminal branch producing 2–4 phialides; phialides elongate doliiform to reniform, hyaline, aseptate, 6–13 × 3–5 µm, apex with minute periclinal thickening and inconspicuous collarette. *Macroconidia* cylindrical, rounded at both ends, straight, (43.5–)45.5–54(–62.5) × (4.5–)5–5.5(–6) µm (av. = 49.5 × 5.5 µm), 3-septate, lacking a visible abscission scar, held in parallel cylindrical clusters by colourless slime. Mega- and microconidia not observed.

Culture characteristics: Colonies forming abundant woolly white aerial mycelium at 25 °C on MEA, moderate sporulation; surface white to buff (45); reverse ochreous (44) to sienna (8) after 7 d. Chlamydospores not observed. Optimal growth temperature 25 °C, no growth at 5 °C and 35 °C, after 7 d, colonies at 10 °C, 15 °C, 20 °C, 25 °C and 30 °C reached 14.5 mm, 34.2 mm, 50.5 mm, 61.3 mm and 31.8 mm, respectively.

Host: *E. urophylla* × *E. grandis*

Distribution: Currently only known from PuEr Region inYunNan Province, China.

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Notes: Calonectria dianii resides in the *Ca. colhounii* species complex, and is most closely related to *Ca. aciculata*, *Ca. eucalypti*, *Ca. honghensis* and *Ca. minensis*. It can easily be distinguished from those species by the dimensions of its macroconidia (Table 3) as follows: The macroconidia of *Ca. dianii* (av. = 49.5 × 5.5 µm) are shorter than those of *Ca. aciculata* (av. = 69 × 5.5 µm; Li et al. 2017), *Ca. eucalypti* (av. = 72 × 6 µm; Lombard et al. 2010a), *Ca. honghensis* (av. = 54 × 5.5 µm; Li et al. 2017) and *Ca. minensis* (av. = 60.5 × 5.5 µm; Liu et al. 2022). The total number of SNP differences between the ex-type isolate of *Ca. dianii* (CSF6520), and the ex-type isolates of *Ca. aciculata* (CERC 5342), *Ca. eucalypti* (CMW 18444), *Ca. honghensis* (CERC 5572) and *Ca. minensis* (CSF9941) for six gene regions combined, varied between 20–25.

Additional specimens examined: **China**: YunNan Province, PuEr Region, JingGu County (23º23'58"N, 100º50'37"E), from leaves collected in a *E. urophylla* × *E. grandis* plantation, 27 December 2014, *G.Q. Li & C.F. Liu* (HMAS350281, culture CSF6439 = CGMCC3.20445).

Calonectria species diversity in leaves and soil

The 417 isolates collected in this study represented 11 *Calonectria* species residing in the *Ca. colhounii* and *Ca. kyotensis* species complexes. Of these, 234 (56.1%) isolates were in the *Ca. colhounii* species complex and 183 (43.9%) resided in the *Ca. kyotensis* species complex (Fig. 3a, 3b). There were 228 (54.7%) and 189 (45.3%) isolates from diseased leaves and soil samples, respectively (Fig. 3c, 3d). Of these, most isolates from leaves (99.1%) resided in the *Ca. colhounii* species complex, and 95.8% from soils were in the *Ca. kyotensis* species complex (Fig. 3c, 3d). *Calonectria eucalypti*, *Ca. honghensis*, *Ca. asiatica* and *Ca. yunnanensis* were found in both leaves and soils, *Ca. aciculata*, *Ca. colhounii* and *Ca. dianii* were isolated only from diseased leaves, and *Ca. aconidialis*, *Ca. hongkongensis*, *Ca. ilicicola* and *Ca. kyotensis* were isolated only from soils (Fig. 3c, 3d).

The 234 isolates in the *Ca. colhounii* complex included *Ca. aciculata*, *Ca. colhounii*, *Ca. dianii*, *Ca. eucalypti* and *Ca. honghensis* (Fig. 4). *Calonectria honghensis* and *Ca. eucalypti* were the dominant species in this complex accounting for 76.9% and 18.8% of isolates, respectively. The remaining isolates included *Ca. colhounii* (2.1%), *Ca. aciculata* (1.3%) and *Ca. dianii* (0.8%) (Fig. 4). Of the total collection of 234 isolates, 226 (96.6%) were obtained from diseased *Eucalyptus* leaves, and the remaining eight isolates (3.4%) were collected from soil samples

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(Fig. 4). The majority of the *Ca. honghensis* (96.7%) and *Ca. eucalypti* (95.5%), were isolated from leaves. The remaining three species were only collected from leaves (Fig. 4).

The 183 isolates in the *Ca. kyotensis* species complex were identified as *Ca. aconidialis*, *Ca. asiatica*, *Ca. hongkongensis*, *Ca. ilicicola*, *Ca. kyotensis* and *Ca. yunnanensis* (Fig. 4). They accounted for 35% (64), 22.4% (41), 2.2% (4), 13.7% (25), 1.1% (2) and 25.7% (47) of the isolates respectively. Most (98.9%) were collected from soil samples, and the remaining 1.1 % were from leaves (Fig. 4).

Four species were collected from both *Eucalyptus* leaves and soils. In the case of *Ca. honghensis*, the three genotypes from the soils were also found in isolates from diseased leaves (26 genotypes) (Table 4). *Ca. asiatica* and *Ca. yunnanensis* isolates from leaves each represented a single genotype and these were also found in isolates from soil samples (nine and three genotypes, respectively) (Table 4).

DISCUSSION

A total of 417 *Calonectria* isolates were collected from diseased *Eucalyptus* leaves or soil samples collected beneath these trees in YunNan Province. Based on multi-gene phylogenetic analyses and morphological characteristics, 11 species were identified, including *Ca. aciculata*, *Ca. colhounii*, *Ca. dianii sp. nov*, *Ca. eucalypti* and *Ca. honghensis* in the *Ca. colhounii* species complex, and *Ca. aconidialis*, *Ca. asiatica*, *Ca. hongkongensis*, *Ca. ilicicola*, *Ca. kyotensis* and *Ca. yunnanensis* in the *Ca. kyotensis* species complex. *Calonectria eucalypti*, *Ca. honghensis* and all five species in the *Ca. colhounii* species complex were isolated from diseased leaves; *Ca. asiatica*, *Ca. yunnanensis* and all six species in the *Ca. kyotensis* species complex were isolated from soils. *Calonectria eucalypti*, *Ca. honghensis*, *Ca. asiatica* and *Ca. yunnanensis* were found on both the diseased leaves and in soils; all remaining species were found exclusively in either on leaves or in soils. *Calonectria honghensis* and *Ca. eucalypti* were the predominant species in the diseased *Eucalyptus* leaves while *Ca. aconidialis*, *Ca. yunnanensis*, *Ca. asiatica* and *Ca. ilicicola* were prevalent in the soil samples.

The majority of the isolates obtained from diseased leaves resided in the *Ca. colhounii* species complex. *Calonectria aciculata* and *Ca. honghensis* were originally found and described by Li et al. (2017) in YunNan Province and have never been identified outside that area. *Calonectria colhounii*, originally described from *Camellia sinensis* in Mauritius (Peerally, 1973) was reported from *Vaccinium* spp. (blueberry) in the LiaoNing Province of North-eastern China

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(Feng et al. 2007) and is now also known to occur on *Eucalyptus* in China. *Calonectria eucalypti*, commonly found in this study was originally described from diseased *Eucalyptus* in Indonesia (Lombard et al. 2010a), and has previously also been found on these trees in FuJian (Chen et al. 2011b; Liu et al. 2020) and YunNan Provinces (Li et al. 2017).

Calonectria dianii described as new in this study represents a new member to the *Ca. colhounii* species complex. This species is closely related to *Ca. aciculata*, *Ca. eucalypti*, *Ca. honghensis* and *Ca. minensis*, but all those species can be distinguished using DNA sequences in the *act*, *cmdA* and *tub2* gene regions, and macroconidial dimensions (Lombard et al. 2010a; Li et al. 2017; Liu et al. 2022). The *Ca. colhounii* species complex now includes 14 species (Liu et al. 2020, 2022), of which 11 have been found in Asia. Of these, nine have been reported from China (Chen et al. 2011b; Li et al. 2017; Liu and Chen 2017; Wang et al. 2019; Liu et al. 2022), *Ca. indusiata* was reported in Sri Lanka (Crous 2002) and *Ca. monticola* was described in Thailand (Crous et al. 2015). This species complex includes some *Calonectria* species associated with the CLB on *Eucalyptus* spp., such as *Ca. aciculata*, *Ca. colhounii*, *Ca. eucalypti*, *Ca. fujianensis* and *Ca. macroconidialis* (Crous et al. 1993, 2006; Chen et al. 2011b; Li et al. 2017).

Calonectria honghensis and *Ca. eucalypti* were dominant species from diseased leaves in the *Ca. colhounii* species complex, which is different to that observed in other provinces (Li et al. 2017; Wang and Chen 2020; Wu and Chen 2021). Previous studies have shown that *Ca. pseudoreteaudii*, in the *Ca. reteaudii* species complex, was most frequently collected in diseased *Eucalyptus* plantations or nurseries in four provinces (Lombard et al. 2015; Li et al. 2017; Ye et al. 2018; Liu et al. 2020; Wang and Chen 2020; Wu and Chen 2021) and was regarded as the most important species causing CLB in southern China. It is intriguing that *Ca. pseudoreteaudii* was not observed in the present study. In contrast, *Ca. eucalypti* has been found in various of regions of China and seems to be emerging as a threat to *Eucalyptus* plantations.

The majority of the isolates obtained from soils resided in the *Ca. kyotensis* species complex. Previous studies have found that *Ca. aconidialis*, *Ca. hongkongensis* and *Ca. kyotensis* were the most widely distributed species in the soils of southern China, and they have been frequently been collected from soils in the FuJian, GuangDong, GuangXi and HaiNan Provinces (Lombard et al. 2015; Li et al. 2017). Our results provide added support for the fact

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that these species are predominantly soil-inhabiting fungi and they add a new geographical distribution record for them.

Calonectria ilicicola was first described from *Solanum tuberosum* (Boedijn and Reitsma 1950) and is a well-known soil-borne pathogen, causing severe black rot on peanut and red crown rot on soybean (Gai et al. 2017; Akamatsu et al. 2020). This species has been reported in many countries of the world including Australia (Johnson 1985), China (Gai et al. 2017), Japan (Akamatsu et al. 2020), United States (Kleczewski et al. 2019) and South Korea (Sung 1980) where it occurs on soybean, and Brazil, India and Kenya (Alfenas et al. 1979; Sharma and Mohanan 1982; Crous et al. 1989) associated with Eucalyptus leaf disease. It has previously been reported in Chinese *Eucalyptus* plantations (Liu et al. 2022; Liu and Chen 2022) and was not surprising that it emerged in the present study.

The majority of the *Ca. colhounii* species complex isolates were from diseased leaves in contrast to most species in the *Ca. kyotensis* species complex being from soil samples. This suggests that *Ca. colhounii* complex species are mainly leaf-infecting fungi and isolates recovered from the soil samples likely originated from diseased leaves. Species in the *Ca. kyotensis* species complex appear to be more specifically soil inhabiting fungi but having the ability to cause leaf disease under suitable conditions, as has recently been shown in inoculation studies (Wu and Chen 2021).

CONCLUSIONS

Results of this study revealed a remarkably rich *Calonectria* diversity in the sampled *Eucalyptus* plantations. There were also clear differences in species diversity and distribution relating to either the leaf or soil environments where they were found. These results provide a foundation on which to pursue an understanding of their pathogenicity to *Eucalyptus*. Furthermore, it is becoming increasingly apparent that some species are predominantly soil inhabitants and different to those that cause plant diseases. The reason for these differences deserves further study.

ACKNOWLEDGEMENTS

The authors thank Mr. GuoQing Li and Mr. ChengFeng Liu for their assistance in collecting soil samples in YunNan Province.

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Author's contributions

Q.L. Liu performed isolations, sequencing, data analysis and wrote the first drat manuscript, M.J. Wingfield, T.A. Duong, B.D. Wingfield and S.F. Chen advised the project and critically reviewed the draft manuscript, S.F. Chen conceived, supervised and administered the study and acquired funding. All authors read and approved the final manuscript.

Funding

This study was initiated through the bilateral agreement between the Governments of South Africa and China and supported by The National Key R&D Program of China (China-South Africa Forestry Joint Research Centre Project; project No. 2018YFE0120900), the National Ten-thousand Talents Program (Project No. W03070115) and the GuangDong Top Young Talents Program in China (Project No. 20171172).

Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

Declarations

Ethics approval and consent to participate

Not applicable.

Adherence to national and international regulations

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Table 1 Isolates sequenced and used for phylogenetic analyses and morphological studies in this study

Species[a]	Isolate No.[b]	Genotype[c]	Substrate	Sampling site	Collector	GenBank accession No.[d]					
						act	*cmdA*	*his3*	*rpb2*	*tef1*	*tub2*
Calonectria colhounii species complex											
Ca. aciculata	CSF6495	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321585	OP321689	OP321839	OP321990	OP322094	OP322511
	CSF6515	AAAABA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321586	OP321690	OP321840	OP321991	OP322095	OP322512
	CSF6528	ABBBCB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321587	OP321691	OP321841	OP321992	OP322096	OP322513
Ca. colhounii	CSF6433	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321588	OP321692	OP321842	OP321993	OP322097	OP322514
	CSF6471	AAAABB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321589	OP321693	OP321843	OP321994	OP322098	OP322515
	CSF6589	ABABCA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321590	OP321694	OP321844	OP321995	OP322099	OP322516
	CSF6592	ACBADA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321591	OP321695	OP321845	OP321996	OP322100	OP322517
	CSF6642	ADABCA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321592	OP321696	OP321846	OP321997	OP322101	OP322518
***Ca. dianii* sp. nov.**	**CSF6520[e-g]; CGMCC3.20446**	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321593	OP321697	OP321847	OP321998	OP322102	OP322519
	CSF6439[e,f] **CGMCC3.20445**	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321594	OP321698	OP321848	OP321999	OP322103	OP322520
Ca. eucalypti	CSF5407	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321595	OP321699	OP321849	OP322000	OP322104	OP322521
	CSF6466	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321596	OP321700	OP321850	OP322001	OP322105	OP322522
	CSF6483	AAAAAB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321597	OP321701	OP321851	OP322002	OP322106	OP322523

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CSF6645	AAAAAB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321598	OP321702	OP321852	OP322003	OP322107	OP322524
CSF6536	AAAAAC	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321599	OP321703	OP321853	OP322004	OP322108	OP322525
CSF6610	AAAAAD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321600	OP321704	OP321854	OP322005	OP322109	OP322526
CSF6650	AAAAAE	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321601	OP321705	OP321855	OP322006	OP322110	OP322527
CSF6587	AAAABA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321602	OP321706	OP321856	OP322007	OP322111	OP322528
CSF6564	AAAABD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321603	OP321707	OP321857	OP322008	OP322112	OP322529
CSF6504	AAAACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321604	OP321708	OP321858	OP322009	OP322113	OP322530
CSF6646	AAAACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321605	OP321709	OP321859	OP322010	OP322114	OP322531
CSF6571	AAAACF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321606	OP321710	OP321860	OP322011	OP322115	OP322532
CSF6572	AAAACF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321607	OP321711	OP321861	OP322012	OP322116	OP322533
CSF6461	AAAADA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321608	OP321712	OP321862	OP322013	OP322117	OP322534
CSF6473	AAAAEA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321609	OP321713	OP321863	OP322014	OP322118	OP322535
CSF6667	AAAAEA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321610	OP321714	OP321864	OP322015	OP322119	OP322536
CSF6533	AAAAGF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321611	OP321715	OP321865	OP322016	OP322120	OP322537
CSF6607	AAAAHA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321612	OP321716	OP321866	OP322017	OP322121	OP322538
CSF6608	AAAAHA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321613	OP321717	OP321867	OP322018	OP322122	OP322539

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	CSF13848	ABAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321614	OP321718	OP321868	OP322019	OP322123	OP322540
	CSF13849	ABAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321615	OP321719	OP321869	OP322020	OP322124	OP322541
	CSF6531	ABAAFA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321616	OP321720	OP321870	OP322021	OP322125	OP322542
	CSF6453	ACAACF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321617	OP321721	OP321871	OP322022	OP322126	OP322543
Ca. honghensis	CSF5381	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321618	OP321725	OP321876	OP322023	OP322148	OP322565
	CSF6459	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321619	OP321726	OP321877	OP322024	OP322149	OP322566
	CSF6474	AAAAAB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321620	OP321727	OP321878	OP322025	OP322150	OP322567
	CSF6517	AAAAAG	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321621	OP321728	OP321879	OP322026	OP322151	OP322568
	CSF5399	AAAABA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321622	OP321729	OP321880	OP322027	OP322152	OP322569
	CSF6462	AAAABA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321623	OP321730	OP321881	OP322028	OP322153	OP322570
	CSF13721	AAAABA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321624	OP321731	OP321882	OP322029	OP322154	OP322571
	CSF13722	AAAABA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321625	OP321732	OP321883	OP322030	OP322155	OP322572
	CSF5415	AAAABB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321626	OP321733	OP321884	OP322031	OP322156	OP322573
	CSF6477	AAAABB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321627	OP321734	OP321885	OP322032	OP322157	OP322574
	CSF6436	AAAABC	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321628	OP321735	OP321886	OP322033	OP322158	OP322575
	CSF6525	AAAABD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321629	OP321736	OP321887	OP322034	OP322159	OP322576

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CSF6498	AAAABF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321630	OP321737	OP321888	OP322035	OP322160	OP322577
CSF6500	AAAABG	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321631	OP321738	OP321889	OP322036	OP322161	OP322578
CSF6573	AAAABG	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321632	OP321739	OP321890	OP322037	OP322162	OP322579
CSF6561	AAAABI	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321633	OP321740	OP321891	OP322038	OP322163	OP322580
CSF6634	AAAABJ	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321634	OP321741	OP321892	OP322039	OP322164	OP322581
CSF5417	AAAACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321635	OP321742	OP321893	OP322040	OP322165	OP322582
CSF6669	AAAACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321636	OP321743	OP321894	OP322041	OP322166	OP322583
CSF6532	AAAACG	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321637	OP321744	OP321895	OP322042	OP322167	OP322584
CSF6428	AAAADA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321638	OP321745	OP321896	OP322043	OP322168	OP322585
CSF13771	AAAADA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321639	OP321746	OP321897	OP322044	OP322169	OP322586
CSF13772	AAAADA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321640	OP321747	OP321898	OP322045	OP322170	OP322587
CSF6508	AAAADH	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321641	OP321748	OP321899	OP322046	OP322171	OP322588
CSF6625	AAAADH	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321642	OP321749	OP321900	OP322047	OP322172	OP322589
CSF6440	AAAAED	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321643	OP321750	OP321901	OP322048	OP322173	OP322590
CSF6605	AAAAFA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321644	OP321751	OP321902	OP322049	OP322174	OP322591
CSF6613	AAAAFB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321645	OP321752	OP321903	OP322050	OP322175	OP322592

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	CSF6512	AAAAFD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321646	OP321753	OP321904	OP322051	OP322176	OP322593
	CSF6442	AAAAFE	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321647	OP321754	OP321905	OP322052	OP322177	OP322594
	CSF6456	AAAAGA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321648	OP321755	OP321906	OP322053	OP322178	OP322595
	CSF6619	AAAAGA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321649	OP321756	OP321907	OP322054	OP322179	OP322596
	CSF6481	AAAAHA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321650	OP321757	OP321908	OP322055	OP322180	OP322597
	CSF6568	AAAAIA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321651	OP321758	OP321909	OP322056	OP322181	OP322598
	CSF6437	AABACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321652	OP321759	OP321910	OP322057	OP322182	OP322599
	CSF6522	AACABD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321653	OP321760	OP321911	OP322058	OP322183	OP322600
	CSF6612	BBBAHA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321654	OP321761	OP321912	OP322059	OP322184	OP322601
Calonectria kyotensis species complex											
Ca. aconidialis	CSF13739	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321655	OP321785	OP321936	OP322060	OP322328	OP322745
	CSF13743	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321656	OP321786	OP321937	OP322061	OP322329	OP322746
	CSF13753	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321657	OP321787	OP321938	OP322062	OP322330	OP322747
	CSF13774	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321658	OP321788	OP321939	OP322063	OP322331	OP322748
	CSF13780	AAAAAC	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321659	OP321789	OP321940	OP322064	OP322332	OP322749
	CSF13850	AAAAAD	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321660	OP321790	OP321941	OP322065	OP322333	OP322750

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	CSF13851	AAAAAD	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321661	OP321791	OP321942	OP322066	OP322334	OP322751
	CSF13862	ABAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321662	OP321792	OP321943	OP322067	OP322335	OP322752
Ca. asiatica	CSF6468	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321663	OP321799	OP321950	OP322068	OP322392	OP322809
	CSF13795	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321664	OP321800	OP321951	OP322069	OP322393	OP322810
	CSF13741	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321665	OP321801	OP321952	OP322070	OP322394	OP322811
	CSF13734	AACAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321666	OP321802	OP321953	OP322071	OP322395	OP322812
	CSF13751	AACBAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321667	OP321803	OP321954	OP322072	OP322396	OP322813
	CSF13713	ABAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321668	OP321804	OP321955	OP322073	OP322397	OP322814
	CSF13760	ABABAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321669	OP321805	OP321956	OP322074	OP322398	OP322815
	CSF13704	ABCAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321670	OP321806	OP321957	OP322075	OP322399	OP322816
	CSF13701	BAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321671	OP321807	OP321958	OP322076	OP322400	OP322817
	CSF13731	BABAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321672	OP321808	OP321959	OP322077	OP322401	OP322818
Ca. hongkongensis	CSF13786	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321673	OP321810	OP321961	OP322078	OP322433	OP322850
	CSF13790	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321674	OP321811	OP321962	OP322079	OP322434	OP322851
	CSF13812	ABAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321675	OP321812	OP321963	OP322080	OP322435	OP322852
	CSF13813	ABAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321676	OP321813	OP321964	OP322081	OP322436	OP322853

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Ca. ilicicola	CSF13767	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321677	OP321814	OP321965	OP322082	OP322437	OP322854
	CSF13819	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321678	OP321815	OP321966	OP322083	OP322438	OP322855
Ca. kyotensis	CSF13723	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321679	OP321824	OP321975	OP322084	OP322462	OP322879
	CSF13724	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321680	OP321825	OP321976	OP322085	OP322463	OP322880
Ca. yunnanensis	CSF6506	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321681	OP321826	OP321977	OP322086	OP322464	OP322881
	CSF13694	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321682	OP321827	OP321978	OP322087	OP322465	OP322882
	CSF13783	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321683	OP321828	OP321979	OP322088	OP322466	OP322883
	CSF13832	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321684	OP321829	OP321980	OP322089	OP322467	OP322884
	CSF13852	AAABAC	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321685	OP321830	OP321981	OP322090	OP322468	OP322885
	CSF13853	AAABAC	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321686	OP321831	OP321982	OP322091	OP322469	OP322886

[a] New species described in this study are indicated in bold.

[b] CSF: Culture Collection at the Research Institute of Fast-growing Trees (RIFT)/China Eucalypt Research Centre (CERC), ZhanJiang, GuangDong Province, China; CGMCC: China General Microbiological Culture Collection Center, Beijing, China.

[c] Genotype within each identified species, determined by sequences of *act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2* regions.

[d] *act*, actin; *cmdA*, calmodulin; *his3*, histone H3; *rpb2*, the second largest subunit of RNA polymerase; *tef1*, translation elongation factor 1-alpha; *tub2*, β-tubulin.

[e] Isolates used in morphological and culture growth studies.

[f] Isolates used for mating studies.

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[g] Isolates that represent ex-type cultures are indicated in bold.

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Table 2 Isolates from other studies and used in the phylogenetic analyses for this study

Code B[a]	Species	Isolates No.[b,c]	Other collection number[b]	Substrate	Area of occurrence	Collector	GenBank accession No.[d]	References
							act*; *cmdA*; *his3*; *rpb2*; *tef1*; *tub2	
Species in *Calonectria colhounii* species complex								
B3	*Ca. aciculata*	CERC 5342[T]	CBS 142883; CMW 47645	*Eucalyptus urophylla* × *E. grandis*	YunNan, China	S.F. Chen & J.Q. Li	MT334937; MT335164; MT335403; MT412478; MT412694; MT412934	Li et al. 2017; Liu et al. 2020
B27	*Ca. colhounii*	CBS 293.79[T]	CMW 30999	*Camellia sinensis*	Mauritius	A. Peerally	GQ280443; GQ267373; DQ190639; KY653376; GQ267301; DQ190564	Peerally 1973; Crous 2002; Crous et al. 2006; Lombard et al. 2010a
B36	*Ca. eucalypti*	CMW 18444[T]	CBS 125275	*E. grandis*	Aek Nauli, Sumatra Utara, Indonesia	M.J. Wingfield	MT335013; MT335243; MT335483; MT412545; MT412774; MT412992	Lombard et al. 2010a; Liu et al. 2020
		CMW 18445	CBS 125276	*E. grandis*	Aek Nauli, Sumatra Utara, Indonesia	M.J. Wingfield	MT335014; MT335244; MT335484; MT412546; MT412775; MT412993	Lombard et al. 2010a; Liu et al. 2020
B39	*Ca. fujianensis*	CMW 27257[T]	CBS 127201	*E. grandis*	FuJian, China	M.J. Wingfield	MT335019; MT335249; MT335489; MT412551; MT412780; MT412998	Chen et al. 2011b; Liu et al. 2020
		CMW 27254	CBS 127200	*E. grandis*	FuJian, China	M.J. Wingfield	MT335020; MT335250; MT335490; MT412552; MT412781; MT412999	Chen et al. 2011b; Liu et al. 2020
B47	*Ca. honghensis*	CERC 5572[T]	CBS 142885; CMW 47669	Soil (*Eucalyptus* plantation)	HongHe, YunNan, China	S.F. Chen & J.Q. Li	MT335026; MT335256; MT335496; MT412557; MT412787; MT413005	Li et al. 2017; Liu et al. 2020
		CERC 5571	CBS 142884; CMW 47668	Soil (*Eucalyptus* plantation)	HongHe, YunNan, China	S.F. Chen & J.Q. Li	MT335027; MT335257; MT335497; MT412558; MT412788; MT413006	Li et al. 2017; Liu et al. 2020
B53	*Ca. indusiata*	CBS 144.36[T]	CMW 23699	*Camellia sinensis*	Sri lanka	N/A	GQ280536; GQ267453; GQ267262; KY653396; GQ267332; GQ267239	Crous 2002; Lombard et al. 2010a, 2016; Marin-Felix et al. 2017
		CBS 114684	CMW 51213; CPC 2446; UFV16	*Rhododendron* sp.	Florida, USA	N.E. El-Gholl	GQ280537; GQ267454; DQ190653; N/A; GQ267333; AF232862	Crous et al. 1999, 2006; Crous 2002
B62	*Ca. lichi*	CERC 8866[T]	–	Soil	HeNan, China	S.F. Chen	MT335046; MT335278; MT335518; MT412575; MT412809; MT413023	Liu and Chen 2017; Liu et al. 2020
		CERC 8850	–	Soil	HeNan, China	S.F. Chen	MT335047; MT335279; MT335519; MT412576; MT412810; MT413024	Liu and Chen 2017; Liu et al. 2020

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B64	*Ca. macroconidialis*	CBS 114880[T]	CMW 51219; CPC 307; PPRI 4000	*E. grandis*	Sabie, Mpumalanga, South Africa	P.W. Crous	MT335050; MT335282; MT335522; MT412579; MT412813; MT413027	Crous et al. 1993; Crous 2002; Lombard et al. 2010a; Liu et al. 2020
B65	*Ca. madagascariensis*	CMW 23686[T]	CBS 114572; CPC 2252	Soil	Rona, Madagascar	J.E. Taylor	MT335052; MT335284; MT335524; MT412581; MT412815; MT413029	Crous 2002; Crous et al. 2006; Lombard et al. 2010a; Liu et al. 2020
		CMW 30993	CBS 114571; CPC 2253	Soil	Rona, Madagascar	J.E. Taylor	MT335053; MT335285; MT335525; MT412582; MT412816; MT413030	Crous 2002; Crous et al. 2006; Lombard et al. 2010a; Liu et al. 2020
	Ca. minensis	CSF9941[T]	CGMCC3.18877	Soil (*Eucalyptus* plantation)	XinLuo, LongYan, FuJian, China	S.F. Chen, Q.L. Liu & F.F. Liu	OK253121; OK253259; OK253403; OK253477; OK253814; OK253967	Liu et al. 2022
		CSF9975	CGMCC3.18881	Soil (natural forest area)	LianCheng, LongYan, FuJian, China	S.F. Chen, Q.L. Liu & F.F. Liu	OK253123; OK253261; OK253405; OK253479; OK253816; OK253969	Liu et al. 2022
B70	*Ca. monticola*	CBS 140645[T]	CPC 28835	Soil	Chiang Mai, Thailand	P.W. Crous	N/A; KT964771; N/A; N/A; KT964773; KT964769	Crous et al. 2015
		CPC 28836	–	Soil	Chiang Mai, Thailand	P.W. Crous	N/A; KT964772; N/A; N/A; KT964774; KT964770	Crous et al. 2015
B81	*Ca. paracolhounii*	CBS 114679[T]	CMW 51212; CPC 2445	N/A	USA	A.Y. Rossman	N/A; KX784582; N/A; KY653423; KX784714; KX784644	Lombard et al. 2016; Marin-Felix et al. 2017
		CBS 114705	CMW 51215; CPC 2423	Fruit of *Annona reticulata*	Australia	D. Hutton	N/A; N/A; N/A; KY653424; KX784715; KX784645	Lombard et al. 2016; Marin-Felix et al. 2017
B123	*Ca. xianrensis*	CSF12909[T]	CGMCC3.19584	Soil (near *Eucalyptus* plantation)	Dacheng Town, Gaozhou County, Maoming Region, GuangDong, China	S.F. Chen, Q.C. Wang & W. Wang	**OP321687**; MK962845; MK962857; **OP322092**; MK962869; MK962833	Wang et al. 2019; This study
		CSF12908	CGMCC3.19518	Soil (near *Eucalyptus* plantation)	Dacheng Town, Gaozhou County, Maoming Region, GuangDong, China	S.F. Chen, Q.C. Wang & W. Wang	**OP321688**; MK962844; MK962856; **OP322093**; MK962868; MK962832	Wang et al. 2019; This study
Species in *Calonectria kyotensis* species complex								
B4	*Ca. aconidialis*	CMW 35174[T]	CBS 136086; CERC 1850	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou & S.F. Chen	MT334938; MT335165; MT335404; MT412479; MT412695; N/A[e]	Lombard et al. 2015; Liu et al. 2020
		CMW 35384	CBS 136091; CERC 1886	Soil (*Eucalyptus* plantation)	HaiNan, China	X. Mou & S.F. Chen	MT334939; MT335166; MT335405; N/A; MT412696; N/A	Lombard et al. 2015; Liu et al. 2020

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B5	*Ca. aeknauliensis*	CMW 48253^{T}	CBS 143559	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT334953; MT335180; MT335419; MT412486; MT412710; N/A	Pham et al. 2019; Liu et al. 2020
		CMW 48254	CBS 143560	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT334954; MT335181; MT335420; MT412487; MT412711; N/A	Pham et al. 2019; Liu et al. 2020
B8	*Ca. asiatica*	CBS 114073^{T}	CMW 23782; CPC 3900	Debris (leaf litter)	Prathet Thai, Thailand	N.L. Hywel-Jones	GQ280428; AY725741; AY725658; N/A; AY725705; AY725616	Crous et al. 2004; Lombard et al. 2010a
B17	*Ca. brassicicola*	CBS 112841^{T}	CMW 51206; CPC 4552	Soil at *Brassica* sp.	Indonesia	M.J. Wingfield	N/A; KX784561; N/A; N/A; KX784689; KX784619	Lombard et al. 2016
B19	*Ca. bumicola*	CMW 48257^{T}	CBS 143575	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT334975; MT335205; MT335445; MT412509; MT412736; N/A	Pham et al. 2019; Liu et al. 2020
B20	*Ca. canadiana*	CMW 23673^{T}	CBS 110817; STE-U 499	*Picea* sp.	Canada	S. Greifenhagen	MT334976; MT335206; MT335446; MT412510; MT412737; MT412958	Kang et al. 2001; Crous 2002; Lechat et al. 2010; Liu et al. 2020
		CERC 8952	–	Soil	HeNan, China	S.F. Chen	MT335058; MT335290; MT335530; MT412587; MT412821; MT413035	Liu and Chen 2017; Liu et al. 2020
B23	*Ca. chinensis*	CMW 23674^{T}	CBS 114827; CPC 4101	Soil	Hong Kong, China	E.C.Y. Liew	MT334990; MT335220; MT335460; MT412524; MT412751; MT412972	Crous et al. 2004; Lombard et al. 2010a; Liu et al. 2020
		CMW 30986	CBS 112744; CPC 4104	Soil	Hong Kong, China	E.C.Y. Liew	MT334991; MT335221; MT335461; MT412525; MT412752; MT412973	Crous et al. 2004; Lombard et al. 2010a; Liu et al. 2020
B26	*Ca. cochinchinensis*	CMW 49915^{T}	CBS 143567	Soil (*Hevea brasiliensis* plantation)	Duong Minh Chau, Tay Ninh, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	MT334995; MT335225; MT335465; MT412529; MT412756; MT412977	Pham et al. 2019; Liu et al. 2020
		CMW 47186	CBS 143568	Soil (*A. auriculiformis* plantation)	Song May, Dong Nai, Vietnam	N.Q. Pham & T.Q. Pham	MT334996; MT335226; MT335466; MT412530; MT412757; MT412978	Pham et al. 2019; Liu et al. 2020
B29	*Ca. colombiensis*	CMW 23676^{T}	CBS 112220; CPC 723	Soil (*E. grandis* trees)	La Selva, Colombia	M.J. Wingfield	MT334998; MT335228; MT335468; MT412532; MT412759; MT412980	Crous et al. 2004; Liu et al. 2020
		CMW 30985	CBS 112221; CPC 724	Soil (*E. grandis* trees)	La Selva, Colombia	M.J. Wingfield	MT334999; MT335229; MT335469; MT412533; MT412760; MT412981	Crous et al. 2004; Liu et al. 2020
B31	*Ca. curvispora*	CMW 23693^{T}	CBS 116159; CPC 765	Soil	Tamatave, Madagascar	P.W. Crous	MT335002; MT335232; MT335472; MT412536; MT412763; N/A	Victor et al. 1997; Crous 2002; Lombard et al. 2010a, 2015; Liu et al. 2020
		CMW 48245	CBS 143565	Soil (*Eucalyptus* plantation)	Aek Nauli, North Sumatra, Indonesia	M.J. Wingfield	MT335003; MT335233; MT335473; MT412537; MT412764; N/A	Pham et al. 2019; Liu et al. 2020

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B46	*Ca. heveicola*	CMW 49913^{T}	CBS 143570	Soil (*H. brasiliensis* plantation)	Bau Bang, Binh Duong, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	MT335025; MT335255; MT335495; N/A; MT412786; MT413004	Pham et al. 2019; Liu et al. 2020
		CMW 49928	CBS 143571	Soil	Bu Gia Map National Park, Binh Phuoc, Vietnam	N.Q. Pham, Q.N. Dang & T.Q. Pham	MT335048; MT335280; MT335520; MT412577; MT412811; MT413025	Pham et al. 2019; Liu et al. 2020
B48	*Ca. hongkongensis*	CBS 114828^{T}	CMW 51217; CPC 4670	Soil	Hong Kong, China	M.J. Wingfield	MT335028; MT335258; MT335498; MT412559; MT412789; MT413007	Crous et al. 2004; Liu et al. 2020
		CERC 3570	CMW 47271	Soil (*Eucalyptus* plantation)	BeiHai, Guangxi, China	S.F. Chen, J.Q. Li & G.Q. Li	MT335030; MT335260; MT335500; MT412561; MT412791; MT413009	Li et al. 2017; Liu et al. 2020
B51	*Ca. ilicicola*	CMW 30998^{T}	CBS 190.50; IMI 299389; STE-U 2482	*Solanum tuberosum*	Bogor, Java, Indonesia	K.B. Boedijn & J. Reitsma	MT335036; MT335266; MT335506; MT412564; MT412797; N/A	Boedijn and Reitsma 1950; Crous 2002; Lombard et al. 2010a; Liu et al. 2020
B52	*Ca. indonesiae*	CMW 23683^{T}	CBS 112823; CPC 4508	*Syzygium aromaticum*	Warambunga, Indonesia	M.J. Wingfield	MT335037; MT335267; MT335507; MT412565; MT412798; MT413015	Crous et al. 2004; Liu et al. 2020
		CBS 112840	CMW 51205; CPC 4554	*S. aromaticum*	Warambunga, Indonesia	M.J. Wingfield	MT335038; MT335268; MT335508; MT412566; MT412799; MT413016	Crous et al. 2004; Liu et al. 2020
B55	*Ca. kyotensis*	CBS 114525^{T}	ATCC 18834; CMW 51824; CPC 2367	*Robinia pseudoacacia*	Japan	T. Terashita	MT335039; MT335271; MT335511; MT412569; MT412802; MT413019	Terashita 1968; Crous 2002; Lombard et al. 2016; Liu et al. 2020
		CBS 114550	CMW 51825; CPC 2351	Soil	China	M.J. Wingfield	MT335016; MT335246; MT335486; MT412548; MT412777; MT412995	Lombard et al. 2016; Liu et al. 2020
B57	*Ca. lantauensis*	CERC 3302^{T}	CBS 142888; CMW 47252	Soil	LiDao, Hong Kong, China	M.J. Wingfield & S.F. Chen	MT335040; MT335272; MT335512; MT412570; MT412803; N/A	Li et al. 2017; Liu et al. 2020
		CERC 3301	CBS 142887; CMW 47251	Soil	LiDao, Hong Kong, China	M.J. Wingfield & S.F. Chen	MT335041; MT335273; MT335513; N/A; MT412804; N/A	Li et al. 2017; Liu et al. 2020
B58	*Ca. lateralis*	CMW 31412^{T}	CBS 136629	Soil (*Eucalyptus* plantation)	GuangXi, China	X. Zhou, G. Zhao & F. Han	MT335042; MT335274; MT335514; MT412571; MT412805; MT413020	Lombard et al. 2015; Liu et al. 2020
B66	*Ca. malesiana*	CMW 23687^{T}	CBS 112752; CPC 4223	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335054; MT335286; MT335526; MT412583; MT412817; MT413031	Crous et al. 2004; Liu et al. 2020
		CBS 112710	CMW 51199; CPC 3899	Leaf litter	Prathet, Thailand	N.L. Hywel-Jones	MT335055; MT335287; MT335527; MT412584; MT412818; MT413032	Crous et al. 2004; Liu et al. 2020
B80	*Ca. pacifica*	CMW 16726^{T}	A1568; CBS 109063;	*Araucaria heterophylla*	Hawaii, USA	M. Aragaki	MT335079; MT335311; MT335551; MT412604; MT412842; N/A	Kang et al. 2001; Crous 2002;

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			IMI 354528; STE-U 2534					Crous et al. 2004; Liu et al. 2020
		CMW 30988	CBS 114038	*Ipomoea aquatica*	Auckland, New Zealand	C.F. Hill	MT335080; MT335312; MT335552; MT412605; MT412843; N/A	Crous 2002; Crous et al. 2004; Lombard et al. 2010a; Liu et al. 2020
B86	*Ca. penicilloides*	CMW 23696^{T}	CBS 174.55; STE-U 2388	*Prunus* sp.	Hatizyo Island, Japan	M. Ookubu	MT335106; MT335338; MT335578; MT412631; MT412869; MT413081	Tubaki 1958; Crous 2002; Liu et al. 2020
	Ca. singaporensis	CBS 146715^{T}	MUCL 048320	leaf litter (submerged in a small stream)	South East Asian rainforest, Mac Ritchie Reservoir, Singapore	C. Decock	MW890022; MW890042; MW890055; MW883409; MW883804; N/A; MW890086; MW890124	Crous et al. 2021a
		CBS 146713	MUCL 048171	leaf litter (submerged in a small stream)	South East Asian rainforest, Mac Ritchie Reservoir, Singapore	C. Decock	MW890020; MW890040; MW890053; MW883407; MW883802; N/A; MW890084; MW890123	Crous et al. 2021a
B112	*Ca. sumatrensis*	CMW 23698^{T}	CBS 112829; CPC 4518	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335145; MT335382; MT335622; MT412674; MT412913; N/A	Crous et al. 2004; Liu et al. 2020
		CMW 30987	CBS 112934; CPC 4516	Soil	Northern Sumatra, Indonesia	M.J. Wingfield	MT335146; MT335383; MT335623; MT412675; MT412914; N/A	Crous et al. 2004; Liu et al. 2020
B113	*Ca. syzygiicola*	CBS 112831^{T}	CMW 51204; CPC 4511	*S. aromaticum*	Sumatra, Indonesia	M.J. Wingfield	N/A; N/A; N/A; N/A; KX784736; KX784663	Lombard et al. 2016
B116	*Ca. uniseptata*	CBS 413.67^{T}	CMW 23678; CPC 2391; IMI 299577	*Paphiopedilum callosum*	Celle, Germany	W. Gerlach	GQ280451; GQ267379; GQ267248; N/A; GQ267307; GQ267208	Lombard et al. 2016
B120	*Ca. yunnanensis*	CERC 5339^{T}	CBS 142897; CMW 47644	Soil (*Eucalyptus* plantation)	YunNan, China	S.F. Chen & J.Q. Li	MT335157; MT335396; MT335636; MT412687; MT412927; MT413134	Li et al. 2017; Liu et al. 2020
		CERC 5337	CBS 142895; CMW 47642	Soil (*Eucalyptus* plantation)	YunNan, China	S.F. Chen & J.Q. Li	MT335158; MT335397; MT335637; MT412688; MT412928; MT413135	Li et al. 2017; Liu et al. 2020
Outgroups								
	Curvicladiella cignea	CBS 109167^{T}	CPC 1595; MUCL 40269	Decaying leaf	French Guiana	C. Decock	KM231122; KM231287; KM231461; KM232311; KM231867; KM232002	Decock and Crous 1998; Crous et al. 2006; Lombard et al. 2015
		CBS 109168	CPC 1594; MUCL 40268	Decaying seed	French Guiana	C. Decock	KM231121; KM231286; KM231460; KM232312; KM231868; KM232003	Decock and Crous 1998; Crous et al. 2006; Lombard et al. 2015

[a] Codes (B1 to B120) of the 120 accepted *Calonectria* species resulting from Liu et al. (2020).

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[b] ATCC: American Type Culture Collection, Virginia, USA; CBS: Westerdijk Fungal Biodiversity Institute, Utrecht, The Netherlands; CERC: China Eucalypt Research Centre, ZhanJiang, GuangDong Province, China; CGMCC: China General Microbiological Culture Collection Center, Beijing, China; CMW: Culture collection of the Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa; CPC: Pedro Crous working collection housed at Westerdijk Fungal Biodiversity Institute; CSF: Culture Collection at the Research Institute of Fast-growing Trees (RIFT)/China Eucalypt Research Centre (CERC), ZhanJiang, GuangDong Province, China; IMI: International Mycological Institute, CABI Bioscience, Egham, Bakeham Lane, UK; MUCL: Mycotheque, Laboratoire de Mycologie Systematique st Appliqee, I'Universite, Louvian-la-Neuve, Belgium; PPRI: Plant Protection Research Institute, Pretoria, South Africa; STE-U: Department of Plant Pathology, University of Stellenbosch, South Africa; "–" represent no other collection number.

[c] "T" represents ex-type isolates of the species.

[d] *act*, actin; *cmdA*, calmodulin; *his3*, histone H3; *rpb2*, the second largest subunit of RNA polymerase; *tef1*, translation elongation factor 1-alpha; *tub2*, β-tubulin. GenBank accession number obtained in this study are indicated in bold.

[e] "N/A" represents information not available.

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Table 3 Morphological comparisons of *Calonectria dianii* and its phylogenetically closely related species

Species[a]	**Macroconidia (L × W)**[abc]	**Macroconidia average (L × W)**[ab]	**Macroconidia septation**	**Vesicle (Min.–Max.)**[a]	**References or source of data**
Calonectria dianii	(43.5–)45.5–54(–62.5) × (4.5–)5–5.5(–6)	49.5 × 5.5	3	3–5	this study
Ca. aciculata	(53–)62–76(–86) × (4.5–)5–6(–7)6	69 × 5.5	3	(2–)2.5–3.5(–5)	Li et al. 2017
Ca. eucalypti	(66–)69–75(–80) × (5–)6	72 × 6	3	4–6	Lombard et al. 2010a
Ca. honghensis	(43–)49–59(–66) × (4.5–)5–5.5(–6)	54 × 5.5	3	(2.5–)3–4.5(–5.5)	Li et al. 2017
Ca. minensis	(51–)55–66(–79) × (4.5–)5–6(–7.5)	60.5 × 5.5	(1–)3	3–5	Liu et al. 2022

[a] All measurements are in µm.

[b] L × W = length × width.

[c] Measurements are presented in the format [(minimum–) (average – standard deviation) – (average + standard deviation) (–maximum)].

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Table 4 Species and genotypic diversity of *Calonectria* obtained from diseased *Eucalyptus* leaves and soils in this study

Species ID and species names	Isolate number from leaf	Isolate number from soil	Isolate number of each genotype[a] of each species obtained from leaf	Isolate number of each genotype[a] of each species obtained from soil
Calonectria colhounii species complex				
1. *Ca. aciculata*	3	0	GT1 (1), GT2 (1), GT3 (1)	No[b]
2. *Ca. colhounii*	5	0	GT1 (1), GT2 (1), GT3 (1), GT4 (1), GT5 (1)	No
3. *Ca. dianii*	2	0	GT1 (2)	No
4. *Ca. eucalypti*	42	2	GT1 (2), GT2 (2), GT3 (1), GT4 (1), GT5 (1), GT6 (1), GT7 (1), GT8 (2), GT9 (2), GT10 (1), GT11 (2), GT12 (1), GT13 (2), GT14 (1), GT15 (1)	GT16[c] (2)
5. *Ca. honghensis*	174	6	**GT1**[d] (1), GT2 (1), GT3 (1), **GT4** (1), GT5 (2), GT6 (1), GT7 (1), GT8 (1), GT9 (2), GT10 (1), GT11 (1), GT12 (2), GT13 (1), **GT14** (1), GT15 (2), GT16 (1), GT17 (1), GT18 (1), GT19 (1), GT20 (1), GT21 (2), GT22 (1), GT23 (1), GT24 (1), GT25 (1), GT26 (1)	**GT1** (1), **GT4** (3), **GT14** (2)
Calonectria kyotensis species complex				
6. *Ca. aconidialis*	0	64	No	GT1 (2), GT2 (2), GT3 (1), GT4 (2), GT5 (1)
7. *Ca. asiatica*	1	40	**GT1** (1)	**GT1** (1), GT2 (1), GT3 (1), GT4 (1), GT5 (1) GT6 (1), GT7 (1), GT8 (1), GT9 (1)
8. *Ca. hongkongensis*	0	4	No	GT1 (2), GT2 (2)
9. *Ca. ilicicola*	0	25	No	GT1 (2)
10. *Ca. kyotensis*	0	2	No	GT1 (2)
11. *Ca. yunnanensis*	1	46	**GT1** (1)	**GT1** (1), GT2 (2), GT3 (2)

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[a] "GT1–GT26" represent Genotype1 to Genotype26, determined by *act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2* gene regions, the isolate number of each genotype was in bracket.

[b] "No" means no *Calonectria* isolate obtained.

[c] representing the unique genotype only observed from soil.

[d] the bolded and underlined genotype was observed from both leaf and soil.

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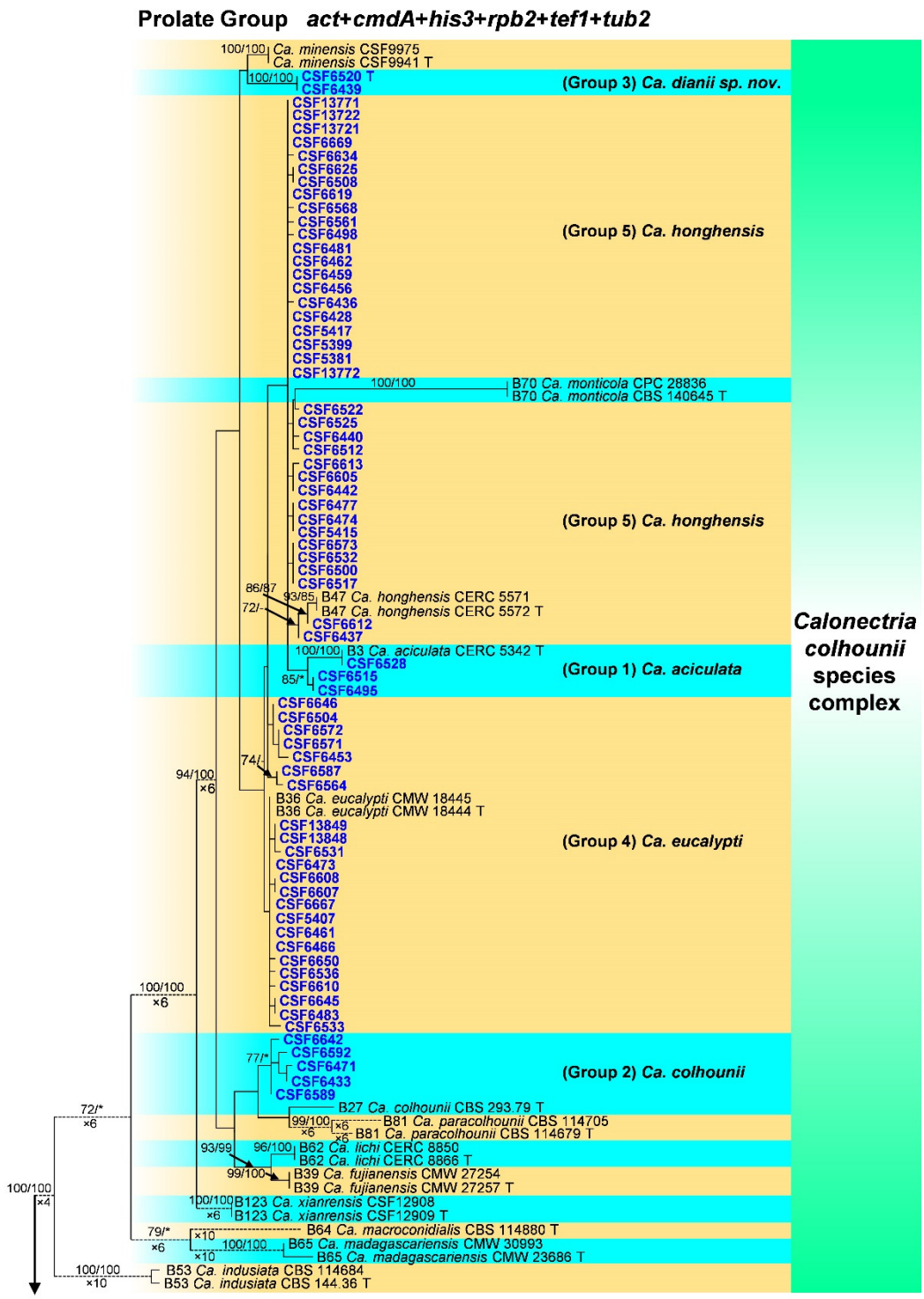


Fig. 1 Maximum Likelihood (ML) tree inferred from the combined dataset of *act*, *cmdA*, *his3*, *rpb2*, *tef1*, and *tub2* sequences. Bootstrap value ≥ 70 % for ML and MP analyses are presented above the branches as ML/MP. Bootstrap values lower than 70 % are marked with "*", whereas absent of clade from a given analysis is indicated with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and **bold**. The "B" species codes are consistent with the recently published results in Liu et al. (2020). The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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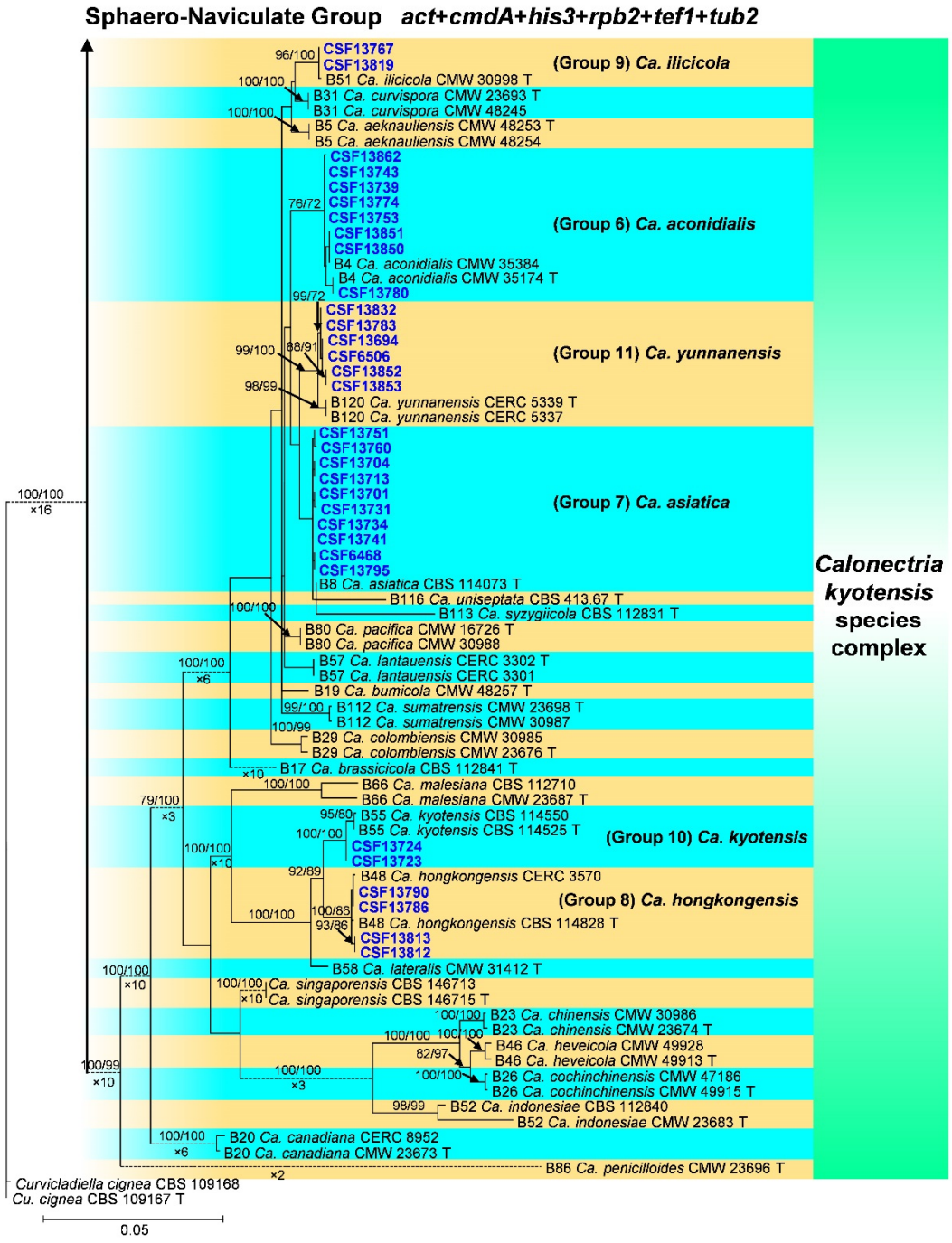


Fig. 1 (Continued).

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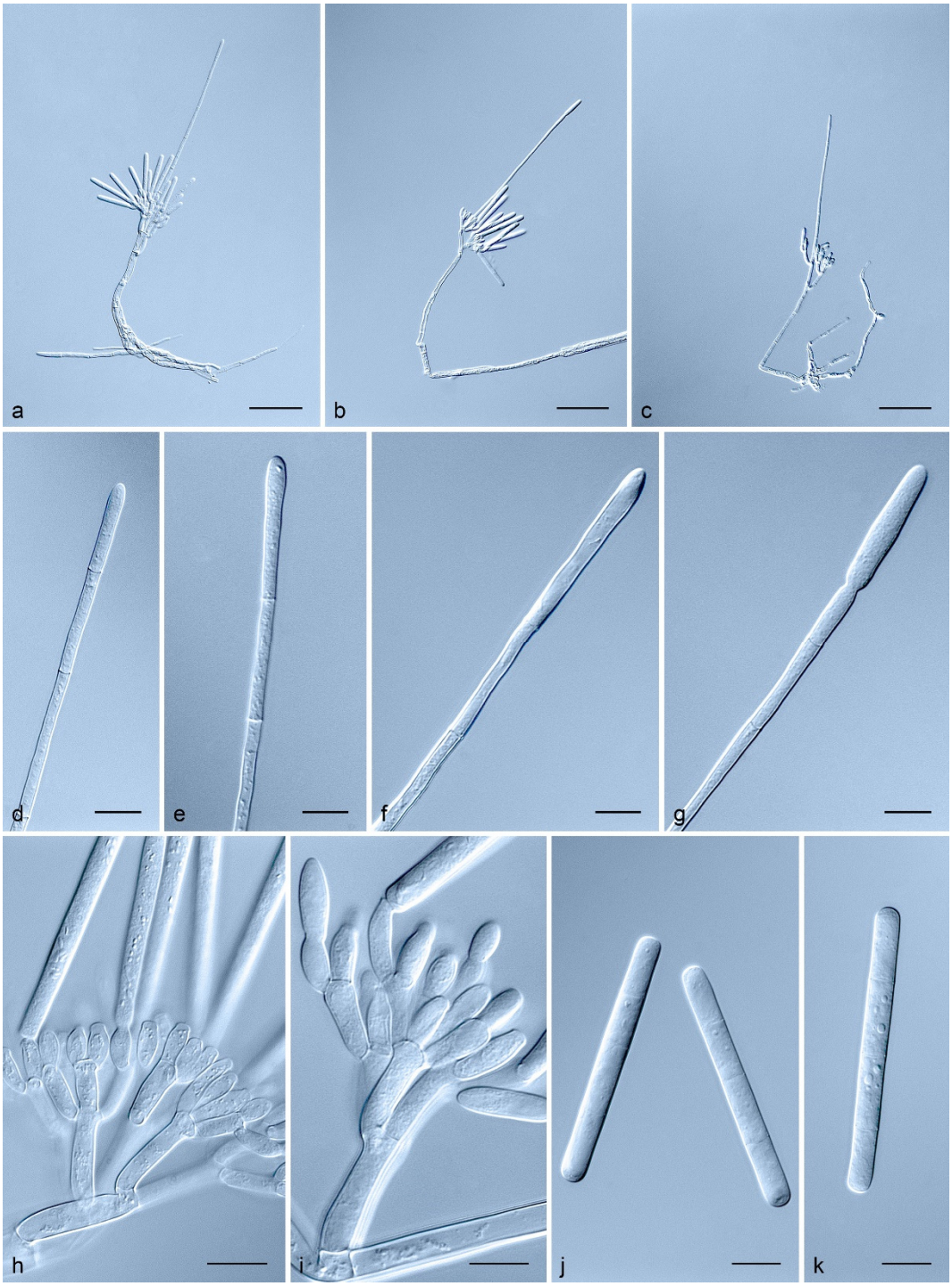


Fig. 2 *Calonectria dianii*. **a–c.** macroconidiophore; **d–g**. broadly clavate to clavate vesicle; **h, i**. conidiogenous apparatus with conidiophore branches and elongate doliiform to reniform phialides; **j, k**. macroconidia. — Scale bars: a–c = 50 µm; h–k = 10 µm; d–g = 5 µm.

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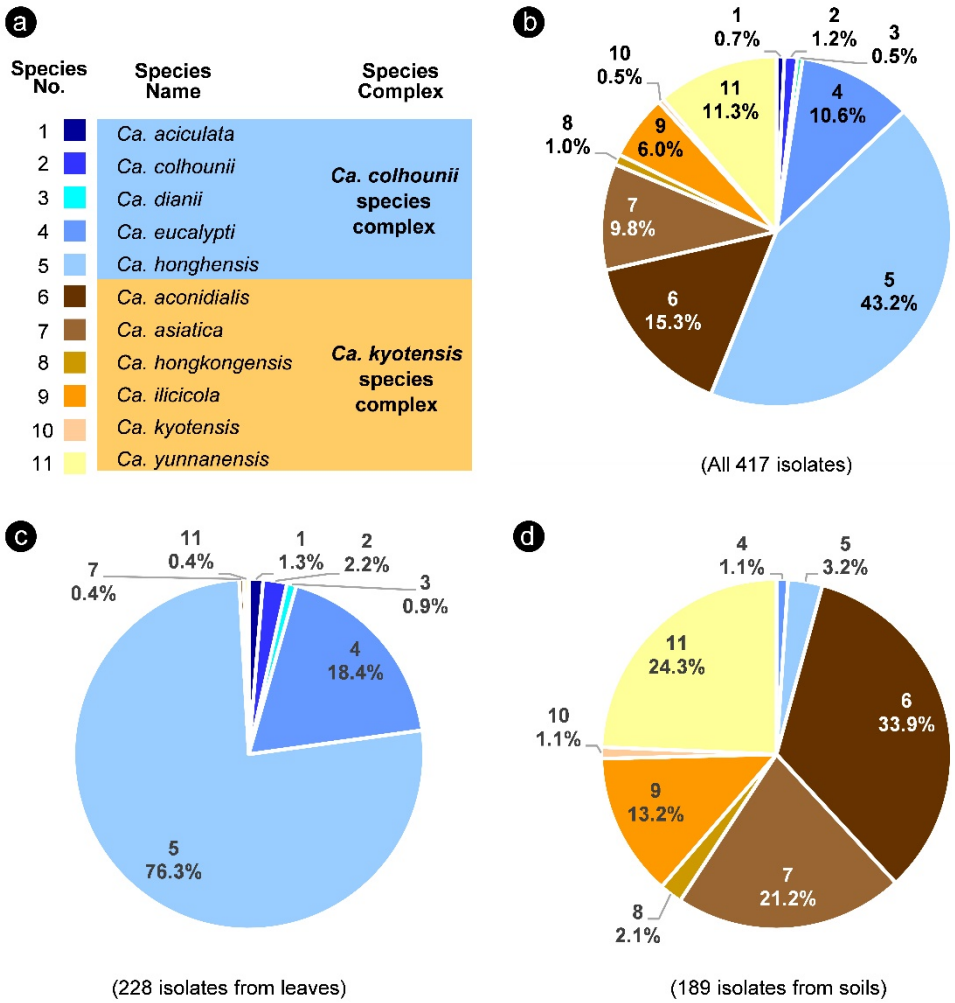


Fig. 3 *Calonectria* species were observed from one *Eucalyptus* plantation in YunNan Province, southwestern China. **a.** Eleven *Calonectria* species were identified in this study and belong to two species complexes. Different species are indicated by numbers with different colours; **b.** The percentage of each *Calonectria* species accounted for all of the species obtained in this study; **c.** The percentage of each *Calonectria* species accounted for the species isolated from diseased leaves; **d.** The percentage of each *Calonectria* species accounted for the species isolated from soils.

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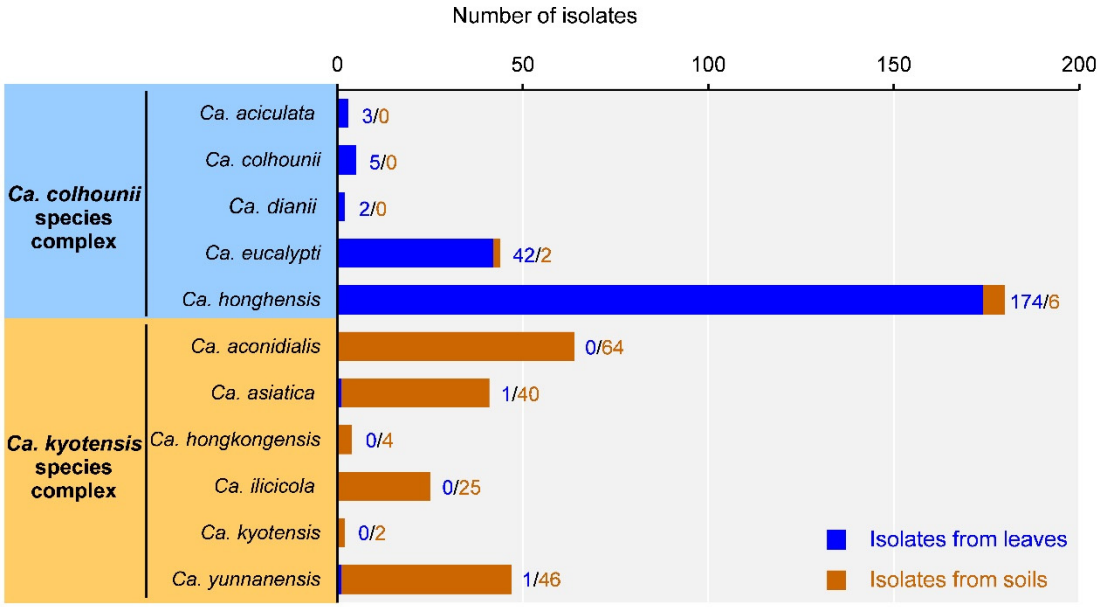


Fig. 4 Isolation sources of 11 *Calonectria* species reside in the *Ca. colhounii* species complex and *Ca. kyotensis* species complex.

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Supplementary Information

Additional file 1. Table S1. Species of *Calonectria* collected in this study

Species[a]	Isolate No.[b]	Genotype[c]	Substrate	Sampling site	Collector	GenBank accession No.[d]					
						act	*cmdA*	*his3*	*rpb2*	*tef1*	*tub2*
Calonectria colhounii species complex											
Calonectria aciculata	CSF6495[e]	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321585	OP321689	OP321839	OP321990	OP322094	OP322511
	CSF6515[e]	AAAABA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321586	OP321690	OP321840	OP321991	OP322095	OP322512
	CSF6528[e]	ABBBCB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321587	OP321691	OP321841	OP321992	OP322096	OP322513
Ca. colhounii	CSF6433[e]	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321588	OP321692	OP321842	OP321993	OP322097	OP322514
	CSF6471[e]	AAAABB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321589	OP321693	OP321843	OP321994	OP322098	OP322515
	CSF6589[e]	ABABCA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321590	OP321694	OP321844	OP321995	OP322099	OP322516
	CSF6592[e]	ACBADA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321591	OP321695	OP321845	OP321996	OP322100	OP322517
	CSF6642[e]	ADABCA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321592	OP321696	OP321846	OP321997	OP322101	OP322518
***Ca. dianii* sp. nov.**	**CSF6520[e,g-i]; CGMCC3.20446**	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321593	OP321697	OP321847	OP321998	OP322102	OP322519
	CSF6439[e,g,h]; **CGMCC3.20445**	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321594	OP321698	OP321848	OP321999	OP322103	OP322520
Ca. eucalypti	CSF5407[e]	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321595	OP321699	OP321849	OP322000	OP322104	OP322521
	CSF6466[e]	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321596	OP321700	OP321850	OP322001	OP322105	OP322522

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CSF6483[e]	AAAAAB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321597	OP321701	OP321851	OP322002	OP322106	OP322523
CSF6645[e]	AAAAAB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321598	OP321702	OP321852	OP322003	OP322107	OP322524
CSF6536[e]	AAAAAC	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321599	OP321703	OP321853	OP322004	OP322108	OP322525
CSF6610[e]	AAAAAD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321600	OP321704	OP321854	OP322005	OP322109	OP322526
CSF6650[e]	AAAAAE	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321601	OP321705	OP321855	OP322006	OP322110	OP322527
CSF6587[e]	AAAABA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321602	OP321706	OP321856	OP322007	OP322111	OP322528
CSF6564[e]	AAAABD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321603	OP321707	OP321857	OP322008	OP322112	OP322529
CSF6504[e]	AAAACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321604	OP321708	OP321858	OP322009	OP322113	OP322530
CSF6646[e]	AAAACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321605	OP321709	OP321859	OP322010	OP322114	OP322531
CSF6571[e]	AAAACF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321606	OP321710	OP321860	OP322011	OP322115	OP322532
CSF6572[e]	AAAACF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321607	OP321711	OP321861	OP322012	OP322116	OP322533
CSF6461[e]	AAAADA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321608	OP321712	OP321862	OP322013	OP322117	OP322534
CSF6473[e]	AAAAEA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321609	OP321713	OP321863	OP322014	OP322118	OP322535
CSF6667[e]	AAAAEA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321610	OP321714	OP321864	OP322015	OP322119	OP322536
CSF6533[e]	AAAAGF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321611	OP321715	OP321865	OP322016	OP322120	OP322537
CSF6607[e]	AAAAHA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321612	OP321716	OP321866	OP322017	OP322121	OP322538

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CSF6608[e]	AAAAHA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321613	OP321717	OP321867	OP322018	OP322122	OP322539
CSF13848[e]	ABAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321614	OP321718	OP321868	OP322019	OP322123	OP322540
CSF13849[e]	ABAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321615	OP321719	OP321869	OP322020	OP322124	OP322541
CSF6531[e]	ABAAFA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321616	OP321720	OP321870	OP322021	OP322125	OP322542
CSF6453[e]	ACAACF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321617	OP321721	OP321871	OP322022	OP322126	OP322543
CSF6507	-AA-AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321722	OP321872	–	OP322127	OP322544
CSF6594	-AA-AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321723	OP321873	–	OP322128	OP322545
CSF6622	-AA-AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321724	OP321874	–	OP322129	OP322546
CSF6575	--A-CA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	N/A[j]	OP321875	–	OP322130	OP322547
CSF5424	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322131	OP322548
CSF6430	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322132	OP322549
CSF6467	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322133	OP322550
CSF6488	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322134	OP322551
CSF6499	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322135	OP322552
CSF6534	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322136	OP322553
CSF6544	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322137	OP322554

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	CSF6550	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322138	OP322555
	CSF6557	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322139	OP322556
	CSF6600	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322140	OP322557
	CSF6627	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322141	OP322558
	CSF6638	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322142	OP322559
	CSF6670	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322143	OP322560
	CSF6443	----AB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322144	OP322561
	CSF6637	----AB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322145	OP322562
	CSF6651	----AB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322146	OP322563
	CSF6652	----AB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322147	OP322564
Ca. honghensis	CSF5381[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321618	OP321725	OP321876	OP322023	OP322148	OP322565
	CSF6459[e]	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321619	OP321726	OP321877	OP322024	OP322149	OP322566
	CSF6474[e]	AAAAAB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321620	OP321727	OP321878	OP322025	OP322150	OP322567
	CSF6517[e]	AAAAAG	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321621	OP321728	OP321879	OP322026	OP322151	OP322568
	CSF5399[e]	AAAABA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321622	OP321729	OP321880	OP322027	OP322152	OP322569
	CSF6462[e]	AAAABA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321623	OP321730	OP321881	OP322028	OP322153	OP322570

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CSF13721[e]	AAAABA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321624	OP321731	OP321882	OP322029	OP322154	OP322571
CSF13722[e]	AAAABA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321625	OP321732	OP321883	OP322030	OP322155	OP322572
CSF5415[e]	AAAABB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321626	OP321733	OP321884	OP322031	OP322156	OP322573
CSF6477[e]	AAAABB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321627	OP321734	OP321885	OP322032	OP322157	OP322574
CSF6436[e]	AAAABC	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321628	OP321735	OP321886	OP322033	OP322158	OP322575
CSF6525[e]	AAAABD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321629	OP321736	OP321887	OP322034	OP322159	OP322576
CSF6498[e]	AAAABF	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321630	OP321737	OP321888	OP322035	OP322160	OP322577
CSF6500[e]	AAAABG	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321631	OP321738	OP321889	OP322036	OP322161	OP322578
CSF6573[e]	AAAABG	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321632	OP321739	OP321890	OP322037	OP322162	OP322579
CSF6561[e]	AAAABI	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321633	OP321740	OP321891	OP322038	OP322163	OP322580
CSF6634[e]	AAAABJ	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321634	OP321741	OP321892	OP322039	OP322164	OP322581
CSF5417[e]	AAAACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321635	OP321742	OP321893	OP322040	OP322165	OP322582
CSF6669[e]	AAAACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321636	OP321743	OP321894	OP322041	OP322166	OP322583
CSF6532[e]	AAAACG	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321637	OP321744	OP321895	OP322042	OP322167	OP322584
CSF6428[e]	AAAADA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321638	OP321745	OP321896	OP322043	OP322168	OP322585
CSF13771[e]	AAAADA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321639	OP321746	OP321897	OP322044	OP322169	OP322586

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CSF13772[e]	AAAADA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321640	OP321747	OP321898	OP322045	OP322170	OP322587
CSF6508[e]	AAAADH	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321641	OP321748	OP321899	OP322046	OP322171	OP322588
CSF6625[e]	AAAADH	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321642	OP321749	OP321900	OP322047	OP322172	OP322589
CSF6440[e]	AAAAED	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321643	OP321750	OP321901	OP322048	OP322173	OP322590
CSF6605[e]	AAAAFA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321644	OP321751	OP321902	OP322049	OP322174	OP322591
CSF6613[e]	AAAAFB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321645	OP321752	OP321903	OP322050	OP322175	OP322592
CSF6512[e]	AAAAFD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321646	OP321753	OP321904	OP322051	OP322176	OP322593
CSF6442[e]	AAAAFE	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321647	OP321754	OP321905	OP322052	OP322177	OP322594
CSF6456[e]	AAAAGA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321648	OP321755	OP321906	OP322053	OP322178	OP322595
CSF6619[e]	AAAAGA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321649	OP321756	OP321907	OP322054	OP322179	OP322596
CSF6481[e]	AAAAHA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321650	OP321757	OP321908	OP322055	OP322180	OP322597
CSF6568[e]	AAAAIA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321651	OP321758	OP321909	OP322056	OP322181	OP322598
CSF6437[e]	AABACA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321652	OP321759	OP321910	OP322057	OP322182	OP322599
CSF6522[e]	AACABD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321653	OP321760	OP321911	OP322058	OP322183	OP322600
CSF6612[e]	BBBAHA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321654	OP321761	OP321912	OP322059	OP322184	OP322601
CSF5404	-AA-AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321762	OP321913	–	OP322185	OP322602

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CSF6464	-AA-AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321763	OP321914	–	OP322186	OP322603
CSF6538	-AA-AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321764	OP321915	–	OP322187	OP322604
CSF6609	-AA-AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321765	OP321916	–	OP322188	OP322605
CSF6672	-AA-AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321766	OP321917	–	OP322189	OP322606
CSF5408	-AA-BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321767	OP321918	–	OP322190	OP322607
CSF6523	-AA-BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321768	OP321919	–	OP322191	OP322608
CSF6549	-AA-BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321769	OP321920	–	OP322192	OP322609
CSF6581	-AA-BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321770	OP321921	–	OP322193	OP322610
CSF6603	-AA-BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321771	OP321922	–	OP322194	OP322611
CSF6633	-AA-BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321772	OP321923	–	OP322195	OP322612
CSF6666	-AA-BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321773	OP321924	–	OP322196	OP322613
CSF5416	-AA-CA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321774	OP321925	–	OP322197	OP322614
CSF6431	-AA-CA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321775	OP321926	–	OP322198	OP322615
CSF6432	-AA-CA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321776	OP321927	–	OP322199	OP322616
CSF6435	-AA-CA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321777	OP321928	–	OP322200	OP322617
CSF6465	-AA-CA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321778	OP321929	–	OP322201	OP322618

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CSF6492	-AA-CA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321779	OP321930	–	OP322202	OP322619
CSF6659	-AA-CA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321780	OP321931	–	OP322203	OP322620
CSF6514	-AA-DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321781	OP321932	–	OP322204	OP322621
CSF6624	-AA-DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321782	OP321933	–	OP322205	OP322622
CSF6632	-AA-DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321783	OP321934	–	OP322206	OP322623
CSF6647	-AA-DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321784	OP321935	–	OP322207	OP322624
CSF5411	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322208	OP322625
CSF5412	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322209	OP322626
CSF6447	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322210	OP322627
CSF6455	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322211	OP322628
CSF6478	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322212	OP322629
CSF6529	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322213	OP322630
CSF6539	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322214	OP322631
CSF6541	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322215	OP322632
CSF6553	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322216	OP322633
CSF6554	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322217	OP322634

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CSF6558	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322218	OP322635
CSF6567	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322219	OP322636
CSF6615	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322220	OP322637
CSF6641	----AA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322221	OP322638
CSF5409	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322222	OP322639
CSF5410	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322223	OP322640
CSF5413	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322224	OP322641
CSF5414	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322225	OP322642
CSF6434	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322226	OP322643
CSF6438	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322227	OP322644
CSF6444	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322228	OP322645
CSF6445	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322229	OP322646
CSF6448	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322230	OP322647
CSF6450	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322231	OP322648
CSF6451	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322232	OP322649
CSF6457	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322233	OP322650

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CSF6460	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322234	OP322651
CSF6463	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322235	OP322652
CSF6470	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322236	OP322653
CSF6472	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322237	OP322654
CSF6482	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322238	OP322655
CSF6484	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322239	OP322656
CSF6489	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322240	OP322657
CSF6490	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322241	OP322658
CSF6496	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322242	OP322659
CSF6497	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322243	OP322660
CSF6501	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322244	OP322661
CSF6502	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322245	OP322662
CSF6503	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322246	OP322663
CSF6505	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322247	OP322664
CSF6510	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322248	OP322665
CSF6511	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322249	OP322666

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CSF6513	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322250	OP322667
CSF6521	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322251	OP322668
CSF6524	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322252	OP322669
CSF6526	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322253	OP322670
CSF6527	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322254	OP322671
CSF6543	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322255	OP322672
CSF6546	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322256	OP322673
CSF6547	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322257	OP322674
CSF6548	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322258	OP322675
CSF6555	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322259	OP322676
CSF6556	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322260	OP322677
CSF6559	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322261	OP322678
CSF6560	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322262	OP322679
CSF6562	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322263	OP322680
CSF6565	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322264	OP322681
CSF6569	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322265	OP322682

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CSF6570	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322266	OP322683
CSF6580	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322267	OP322684
CSF6582	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322268	OP322685
CSF6583	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322269	OP322686
CSF6585	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322270	OP322687
CSF6586	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322271	OP322688
CSF6590	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322272	OP322689
CSF6597	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322273	OP322690
CSF6598	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322274	OP322691
CSF6599	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322275	OP322692
CSF6601	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322276	OP322693
CSF6602	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322277	OP322694
CSF6606	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322278	OP322695
CSF6611	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322279	OP322696
CSF6616	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322280	OP322697
CSF6620	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322281	OP322698

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CSF6626	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322282	OP322699
CSF6630	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322283	OP322700
CSF6631	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322284	OP322701
CSF6635	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322285	OP322702
CSF6644	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322286	OP322703
CSF6648	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322287	OP322704
CSF6662	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322288	OP322705
CSF6665	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322289	OP322706
CSF6668	----BA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322290	OP322707
CSF6491	----BB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322291	OP322708
CSF6563	----BB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322292	OP322709
CSF6588	----BB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322293	OP322710
CSF6671	----BB	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322294	OP322711
CSF6542	----BD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322295	OP322712
CSF6574	----BD	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322296	OP322713
CSF6446	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322297	OP322714

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CSF6449	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322298	OP322715
CSF6485	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322299	OP322716
CSF6493	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322300	OP322717
CSF6494	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322301	OP322718
CSF6535	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322302	OP322719
CSF6537	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322303	OP322720
CSF6552	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322304	OP322721
CSF6577	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322305	OP322722
CSF6623	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322306	OP322723
CSF6628	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322307	OP322724
CSF6629	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322308	OP322725
CSF6636	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322309	OP322726
CSF6639	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322310	OP322727
CSF6640	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322311	OP322728
CSF6643	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322312	OP322729
CSF6649	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322313	OP322730

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	CSF6654	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322314	OP322731
	CSF6657	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322315	OP322732
	CSF6660	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322316	OP322733
	CSF6664	----DA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322317	OP322734
	CSF6509	----DH	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322318	OP322735
	CSF6452	----GA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322319	OP322736
	CSF6519	----GA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322320	OP322737
	CSF6584	----GA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322321	OP322738
	CSF6593	----GA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322322	OP322739
	CSF6595	----GA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322323	OP322740
	CSF6604	----GA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322324	OP322741
	CSF6621	----GA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322325	OP322742
	CSF6655	----GA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322326	OP322743
	CSF6480	----HA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322327	OP322744
Calonectria kyotensis species complex											
Ca. aconidialis	CSF13739[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321655	OP321785	OP321936	OP322060	OP322328	OP322745
	CSF13743[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321656	OP321786	OP321937	OP322061	OP322329	OP322746

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CSF13753[e]	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321657	OP321787	OP321938	OP322062	OP322330	OP322747
CSF13774[e]	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321658	OP321788	OP321939	OP322063	OP322331	OP322748
CSF13780[e]	AAAAAC	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321659	OP321789	OP321940	OP322064	OP322332	OP322749
CSF13850[e]	AAAAAD	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321660	OP321790	OP321941	OP322065	OP322333	OP322750
CSF13851[e]	AAAAAD	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321661	OP321791	OP321942	OP322066	OP322334	OP322751
CSF13862[e]	ABAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321662	OP321792	OP321943	OP322067	OP322335	OP322752
CSF5386	-AA-AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–[f]	OP321793	OP321944	–	OP322336	OP322753
CSF13788	-AA-AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321794	OP321945	–	OP322337	OP322754
CSF13797	-AA-AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321795	OP321946	–	OP322338	OP322755
CSF13837	-AA-AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321796	OP321947	–	OP322339	OP322756
CSF13846	-AA-AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321797	OP321948	–	OP322340	OP322757
CSF13858	-AA-AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321798	OP321949	–	OP322341	OP322758
CSF13740	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322342	OP322759
CSF13744	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322343	OP322760
CSF5393	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322344	OP322761
CSF13709	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322345	OP322762

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CSF13710	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322346	OP322763
CSF13715	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322347	OP322764
CSF13716	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322348	OP322765
CSF13725	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322349	OP322766
CSF13726	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322350	OP322767
CSF13749	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322351	OP322768
CSF13750	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322352	OP322769
CSF13754	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322353	OP322770
CSF13757	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322354	OP322771
CSF13758	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322355	OP322772
CSF13761	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322356	OP322773
CSF13762	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322357	OP322774
CSF13763	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322358	OP322775
CSF13764	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322359	OP322776
CSF13768	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322360	OP322777
CSF13773	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322361	OP322778

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CSF13775	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322362	OP322779
CSF13776	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322363	OP322780
CSF13785	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322364	OP322781
CSF13787	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322365	OP322782
CSF13789	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322366	OP322783
CSF13791	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322367	OP322784
CSF13796	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322368	OP322785
CSF13798	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322369	OP322786
CSF13799	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322370	OP322787
CSF13800	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322371	OP322788
CSF13801	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322372	OP322789
CSF13806	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322373	OP322790
CSF13807	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322374	OP322791
CSF13816	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322375	OP322792
CSF13817	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322376	OP322793
CSF13824	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322377	OP322794

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	CSF13828	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322378	OP322795
	CSF13829	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322379	OP322796
	CSF13835	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322380	OP322797
	CSF13840	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322381	OP322798
	CSF13841	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322382	OP322799
	CSF13847	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322383	OP322800
	CSF13854	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322384	OP322801
	CSF13855	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322385	OP322802
	CSF13856	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322386	OP322803
	CSF13857	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322387	OP322804
	CSF13859	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322388	OP322805
	CSF13863	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322389	OP322806
	CSF13866	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322390	OP322807
	CSF13867	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322391	OP322808
Ca. asiatica	CSF6468[e]	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321663	OP321799	OP321950	OP322068	OP322392	OP322809
	CSF13795[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321664	OP321800	OP321951	OP322069	OP322393	OP322810

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CSF13741[e]	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321665	OP321801	OP321952	OP322070	OP322394	OP322811
CSF13734[e]	AACAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321666	OP321802	OP321953	OP322071	OP322395	OP322812
CSF13751[e]	AACBAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321667	OP321803	OP321954	OP322072	OP322396	OP322813
CSF13713[e]	ABAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321668	OP321804	OP321955	OP322073	OP322397	OP322814
CSF13760[e]	ABABAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321669	OP321805	OP321956	OP322074	OP322398	OP322815
CSF13704[e]	ABCAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321670	OP321806	OP321957	OP322075	OP322399	OP322816
CSF13701[e]	BAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321671	OP321807	OP321958	OP322076	OP322400	OP322817
CSF13731[e]	BABAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321672	OP321808	OP321959	OP322077	OP322401	OP322818
CSF13830	-BA-AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321809	OP321960	–	OP322402	OP322819
CSF13702	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322403	OP322820
CSF13703	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322404	OP322821
CSF13705	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322405	OP322822
CSF13706	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322406	OP322823
CSF13707	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322407	OP322824
CSF13708	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322408	OP322825
CSF13711	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322409	OP322826

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CSF13712	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322410	OP322827
CSF13714	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322411	OP322828
CSF13717	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322412	OP322829
CSF13718	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322413	OP322830
CSF13732	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322414	OP322831
CSF13733	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322415	OP322832
CSF13735	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322416	OP322833
CSF13736	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322417	OP322834
CSF13742	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322418	OP322835
CSF13752	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322419	OP322836
CSF13759	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322420	OP322837
CSF13769	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322421	OP322838
CSF13770	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322422	OP322839
CSF13779	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322423	OP322840
CSF13781	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322424	OP322841
CSF13782	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322425	OP322842

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	CSF13794	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322426	OP322843
	CSF13804	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322427	OP322844
	CSF13805	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322428	OP322845
	CSF13825	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322429	OP322846
	CSF13826	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322430	OP322847
	CSF13827	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322431	OP322848
	CSF13831	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322432	OP322849
Ca. hongkongensis	CSF13786[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321673	OP321810	OP321961	OP322078	OP322433	OP322850
	CSF13790[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321674	OP321811	OP321962	OP322079	OP322434	OP322851
	CSF13812[e]	ABAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321675	OP321812	OP321963	OP322080	OP322435	OP322852
	CSF13813[e]	ABAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321676	OP321813	OP321964	OP322081	OP322436	OP322853
Ca. ilicicola	CSF13767[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321677	OP321814	OP321965	OP322082	OP322437	OP322854
	CSF13819[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321678	OP321815	OP321966	OP322083	OP322438	OP322855
	CSF13695	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321816	OP321967	–	OP322439	OP322856
	CSF13808	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321817	OP321968	–	OP322440	OP322857
	CSF13811	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321818	OP321969	–	OP322441	OP322858

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CSF13834	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321819	OP321970	–	OP322442	OP322859
CSF13838	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321820	OP321971	–	OP322443	OP322860
CSF13845	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321821	OP321972	–	OP322444	OP322861
CSF13865	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321822	OP321973	–	OP322445	OP322862
CSF13875	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321823	OP321974	–	OP322446	OP322863
CSF13696	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322447	OP322864
CSF13697	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322448	OP322865
CSF13698	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322449	OP322866
CSF13747	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322450	OP322867
CSF13748	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322451	OP322868
CSF13765	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322452	OP322869
CSF13766	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322453	OP322870
CSF13809	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322454	OP322871
CSF13810	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322455	OP322872
CSF13818	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322456	OP322873
CSF13836	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322457	OP322874

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	CSF13839	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322458	OP322875
	CSF13844	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322459	OP322876
	CSF13864	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322460	OP322877
	CSF13874	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322461	OP322878
Ca. kyotensis	CSF13723[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321679	OP321824	OP321975	OP322084	OP322462	OP322879
	CSF13724[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321680	OP321825	OP321976	OP322085	OP322463	OP322880
Ca. yunnanensis	CSF6506[e]	AAAAAA	*E. urophylla* × *E. grandis* leaf	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321681	OP321826	OP321977	OP322086	OP322464	OP322881
	CSF13694[e]	AAAAAA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321682	OP321827	OP321978	OP322087	OP322465	OP322882
	CSF13783[e]	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321683	OP321828	OP321979	OP322088	OP322466	OP322883
	CSF13832[e]	AAAAAB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321684	OP321829	OP321980	OP322089	OP322467	OP322884
	CSF13852[e]	AAABAC	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321685	OP321830	OP321981	OP322090	OP322468	OP322885
	CSF13853[e]	AAABAC	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	OP321686	OP321831	OP321982	OP322091	OP322469	OP322886
	CSF5380	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321832	OP321983	–	OP322470	OP322887
	CSF13727	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321833	OP321984	–	OP322471	OP322888
	CSF13738	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321834	OP321985	–	OP322472	OP322889
	CSF13746	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321835	OP321986	–	OP322473	OP322890

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CSF13814	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321836	OP321987	–	OP322474	OP322891
CSF13842	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321837	OP321988	–	OP322475	OP322892
CSF13861	-AA-AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	OP321838	OP321989	–	OP322476	OP322893
CSF5379	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322477	OP322894
CSF5387	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322478	OP322895
CSF10231	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322479	OP322896
CSF10235	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322480	OP322897
CSF13693	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322481	OP322898
CSF13719	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322482	OP322899
CSF13720	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322483	OP322900
CSF13728	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322484	OP322901
CSF13729	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322485	OP322902
CSF13730	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322486	OP322903
CSF13737	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322487	OP322904
CSF13745	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322488	OP322905
CSF13755	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322489	OP322906

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CSF13756	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322490	OP322907
CSF13777	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322491	OP322908
CSF13778	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322492	OP322909
CSF13784	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322493	OP322910
CSF13792	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322494	OP322911
CSF13793	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322495	OP322912
CSF13802	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322496	OP322913
CSF13803	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322497	OP322914
CSF13815	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322498	OP322915
CSF13820	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322499	OP322916
CSF13821	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322500	OP322917
CSF13822	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322501	OP322918
CSF13823	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322502	OP322919
CSF13833	----AB	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322503	OP322920
CSF13843	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322504	OP322921
CSF13860	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322505	OP322922

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CSF13869	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322506	OP322923
CSF13870	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322507	OP322924
CSF13871	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322508	OP322925
CSF13872	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322509	OP322926
CSF13873	----AA	Soil (*Eucalyptus* plantation)	JingGu, PuEr, YunNan, China	G.Q. Li & C.F. Liu	–	–	–	–	OP322510	OP322927

[a] New species described in this study are indicated in bold.

[b] CSF: Culture Collection at the Research Institute of Fast-growing Trees (RIFT)/China Eucalypt Research Centre (CERC), ZhanJiang, GuangDong Province, China; CGMCC: China General Microbiological Culture Collection Center, Beijing, China.

[c] Genotype within each identified species, determined by sequences of *act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2* regions, "-" means not available.

[d] *act*, actin; *cmdA*, calmodulin; *his3*, histone H3; *rpb2*, the second largest subunit of RNA polymerase; *tef1*, translation elongation factor 1-alpha; *tub2*, β-tubulin.

[e] Isolates used in phylogenetic analyses.

[f] "–" represents the relative locus was not amplified in the current study.

[g] Isolates used in morphological and culture growth studies.

[h] Isolates used for mating studies.

[i] Isolates that represent ex-type cultures are indicated in bold.

[j] "N/A" represents the relative locus was not successfully amplified in the current study.

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Additional file 2. Table S2. Statistics resulting from phylogenetic analyses in this study

Dataset	No. of taxa	No. of bp[a]	Maximum parsimony						
			PIC[b]	No. of trees	Tree length	CI[c]	RI[d]	RC[e]	HI[f]
act	163	280	111	32	243	0.679	0.978	0.664	0.321
cmdA	167	690	283	590	608	0.684	0.981	0.671	0.316
his3	163	463	165	248	626	0.526	0.946	0.497	0.474
rpb2	157	863	247	3	546	0.604	0.974	0.589	0.396
tef1	169	520	247	1000	631	0.678	0.980	0.664	0.322
tub2	155	591	273	1000	726	0.643	0.965	0.621	0.357
act/cmdA/his3/rpb2/tef1/tub2	169	3407	1207	1000	3106	0.582	0.967	0.563	0.418

Dataset	Maximum likelihood							
	Subst. mode[g]	NST[h]	Rate matrix					Rates
act	TPM2+I+G	6	0.5513	3.8036	0.5513	1.0000	3.8036	Gamma
cmdA	TrN+G	6	1.0000	4.0386	1.0000	1.0000	7.0477	Gamma
his3	TIM2+I+G	6	1.5968	4.9686	1.5968	1.0000	8.7562	Gamma
rpb2	TIM2ef+I+G	6	1.5060	9.3370	1.5060	1.0000	19.6665	Gamma
tef1	GTR+G	6	1.2250	1.8779	1.0719	0.4995	3.4869	Gamma
tub2	TPM3uf+I+G	6	1.4444	4.7166	1.0000	1.4444	4.7166	Gamma
act/cmdA/his3/rpb2/tef1/tub2	TIM2+I+G	6	1.3655	4.4279	1.3655	1.0000	7.0732	Gamma

[a] bp = Base pairs.

[b] PIC = Number of parsimony informative characters.

[c] CI = Consistency index.

[d] RI = Retention index.

[e] RC = Rescaled consistency index.

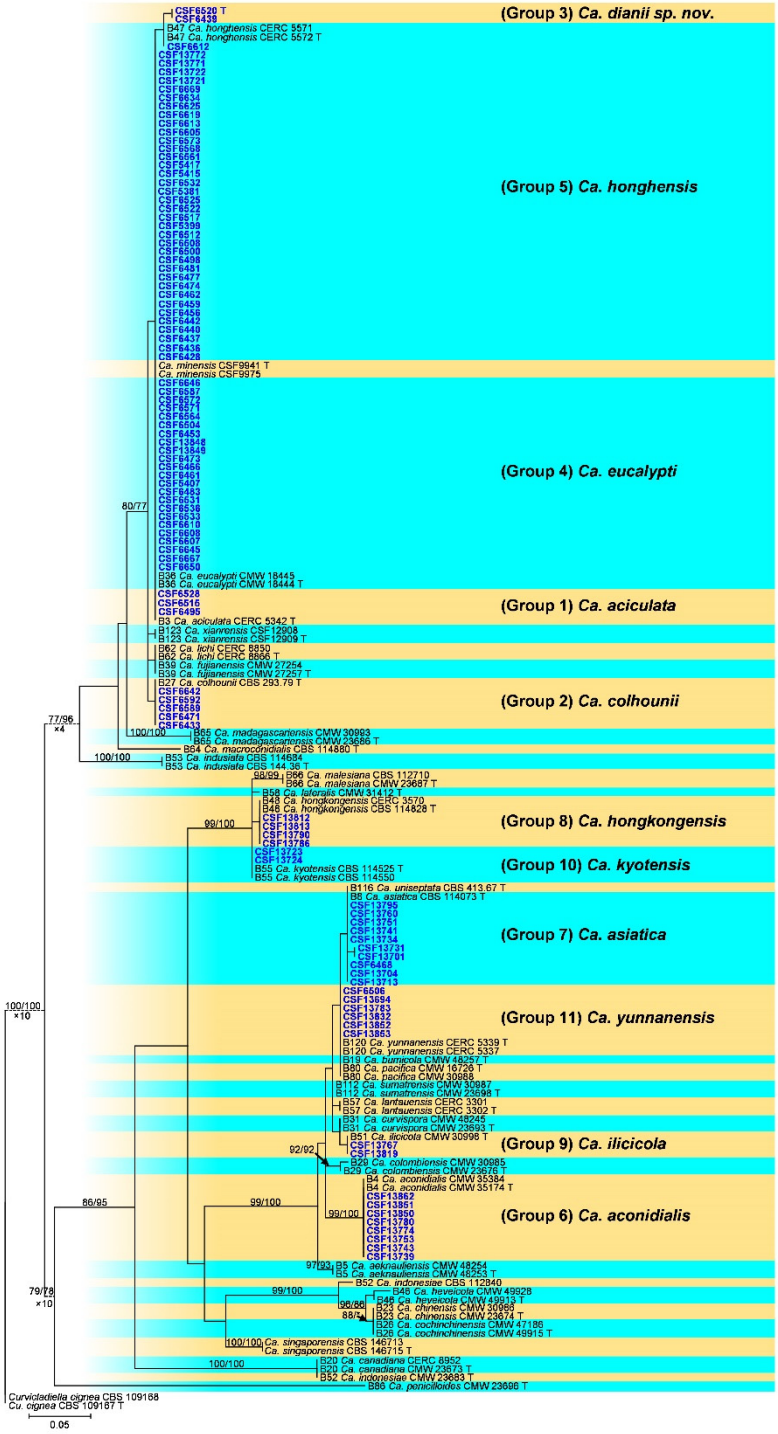
[f] HI = Homoplasy index.

[g] Subst. model = best fit substitution model.

[h] NST = Number of substitution rate categories.

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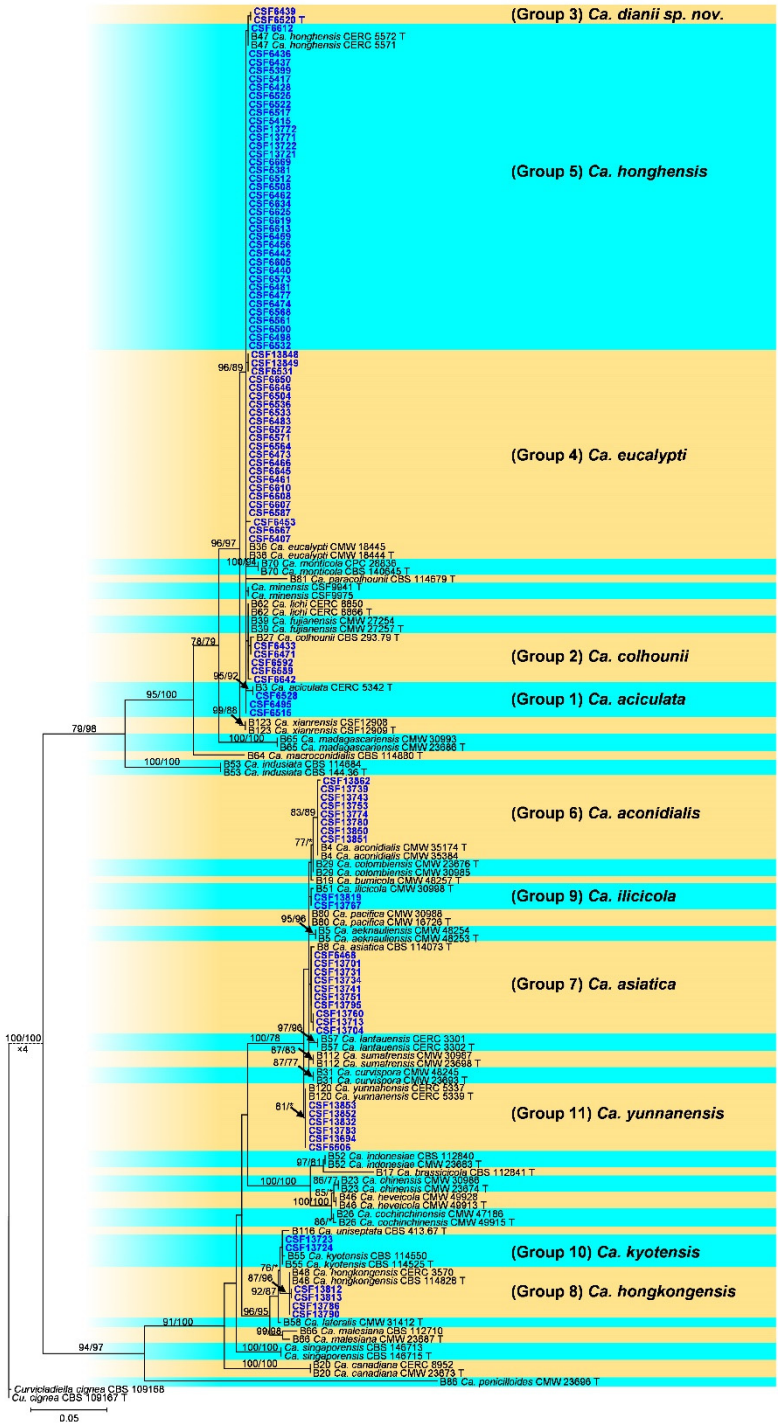
act



Additional file 3: Figure S1. The Maximum Likelihood (ML) tree inferred from the *act* gene sequence. Bootstrap value ≥ 70 % for ML and MP analyses are presented above the branches as ML/MP. Bootstrap values lower than 70 % are marked with "*", whereas absent of clade from a given analysis is indicated with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and **bold**. The "B" species codes are consistent with the recently published results in Liu et al. (2020). The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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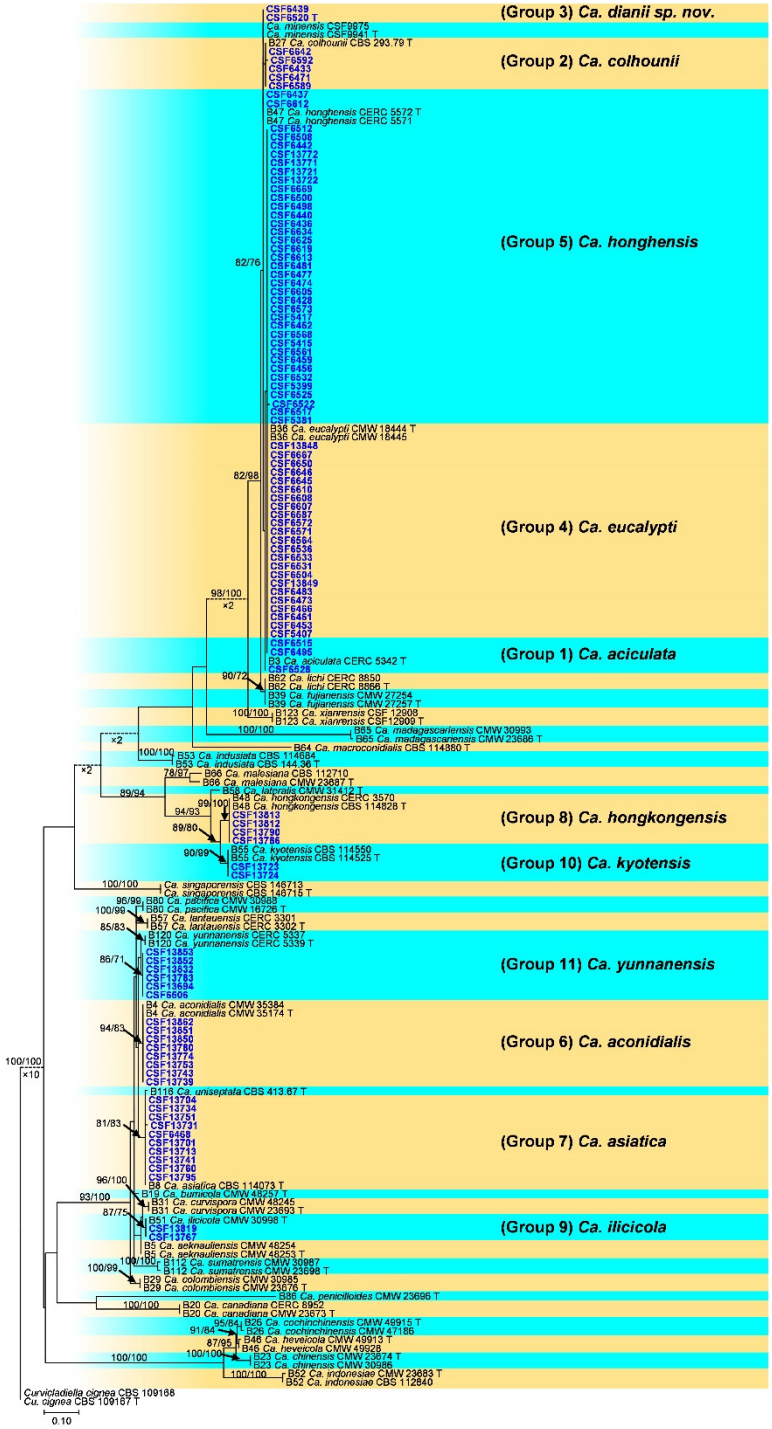
cmdA



Additional file 4: Figure S2. The Maximum Likelihood (ML) tree inferred from the *cmdA* gene sequence. Bootstrap value ≥ 70 % for ML and MP analyses are presented above the branches as ML/MP. Bootstrap values lower than 70 % are marked with "*", whereas absent of clade from a given analysis is indicated with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and **bold**. The "B" species codes are consistent with the recently published results in Liu et al. (2020). The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

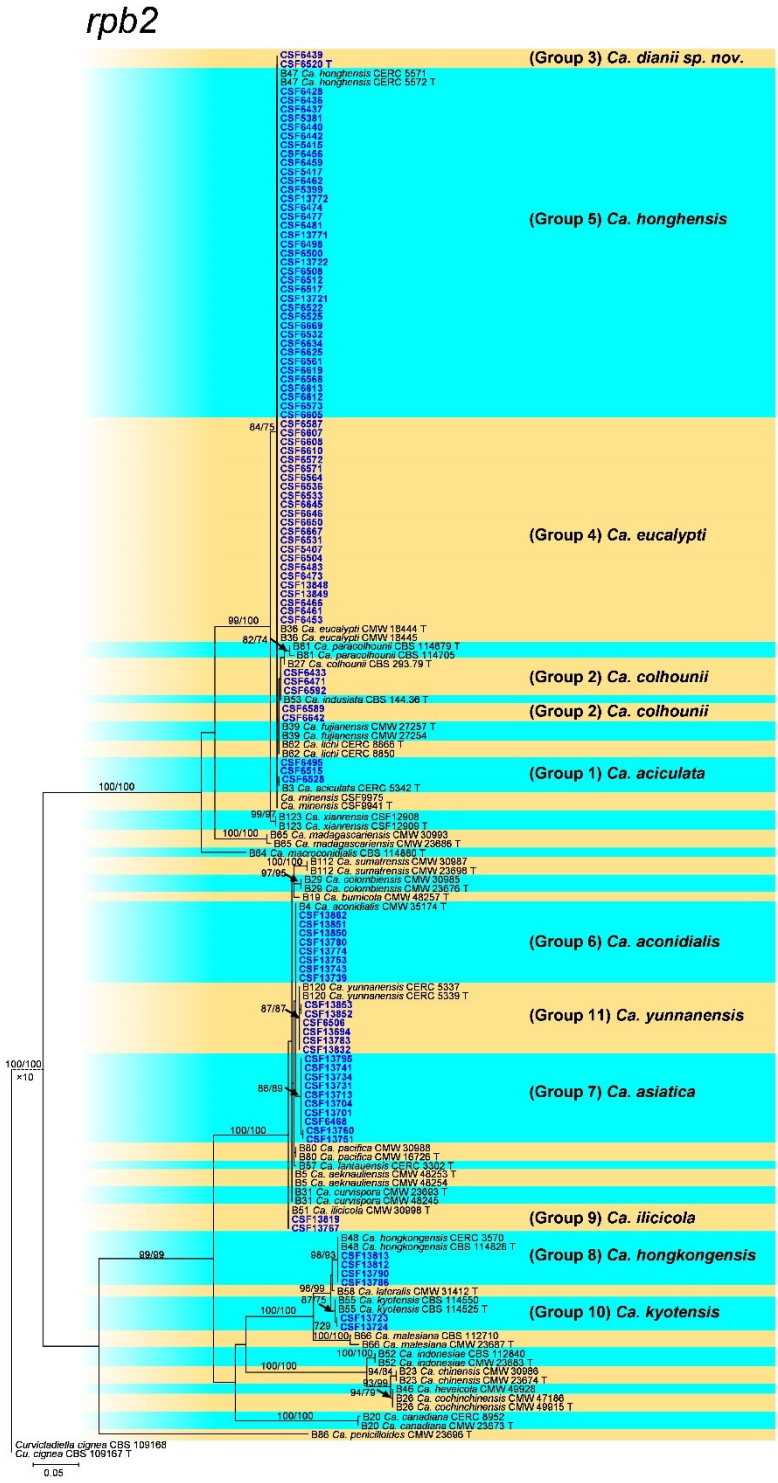
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his3



Additional file 5: Figure S3. The Maximum Likelihood (ML) tree inferred from the *his3* gene sequence. Bootstrap value ≥ 70 % for ML and MP analyses are presented above the branches as ML/MP. Bootstrap values lower than 70 % are marked with "*", whereas absent of clade from a given analysis is indicated with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and **bold**. The "B" species codes are consistent with the recently published results in Liu et al. (2020). The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

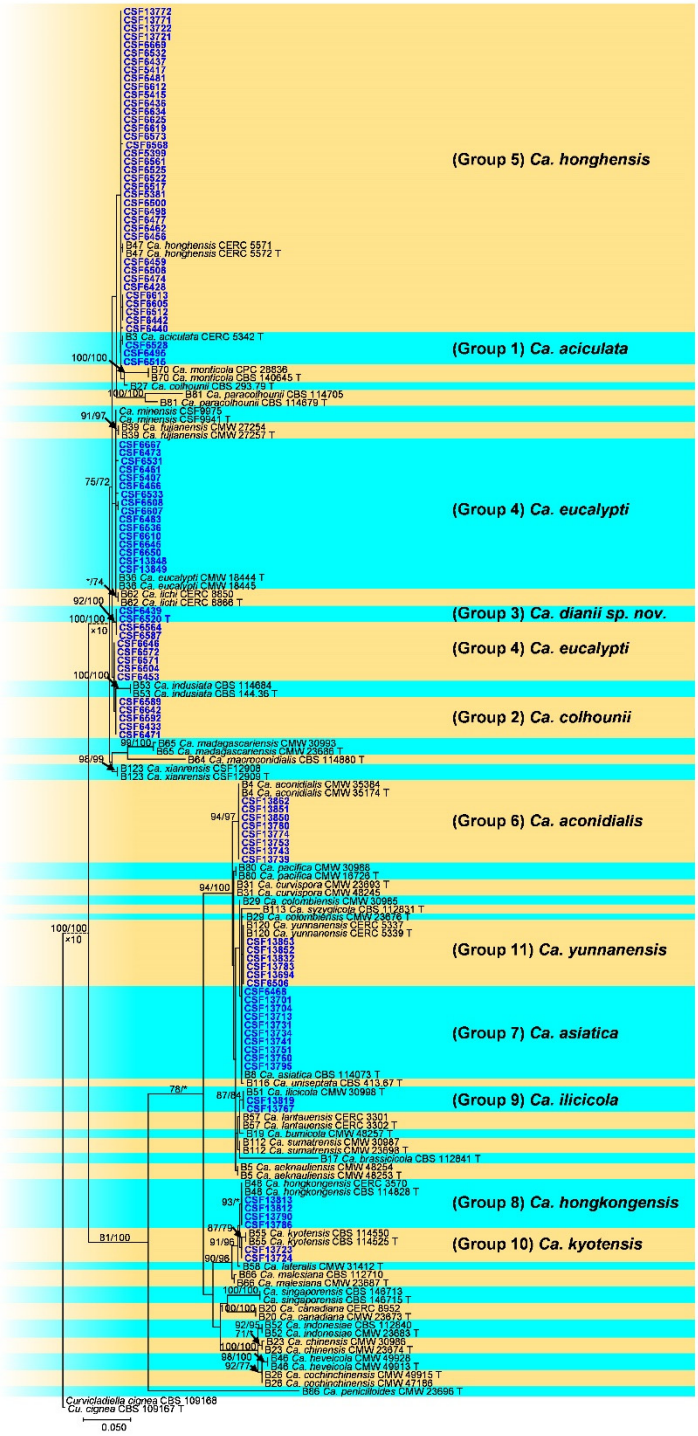
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Additional file 6: Figure S4. The Maximum Likelihood (ML) tree inferred from the *rpb2* gene sequence. Bootstrap value ≥ 70 % for ML and MP analyses are presented above the branches as ML/MP. Bootstrap values lower than 70 % are marked with "*", whereas absent of clade from a given analysis is indicated with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and **bold**. The "B" species codes are consistent with the recently published results in Liu et al. (2020). The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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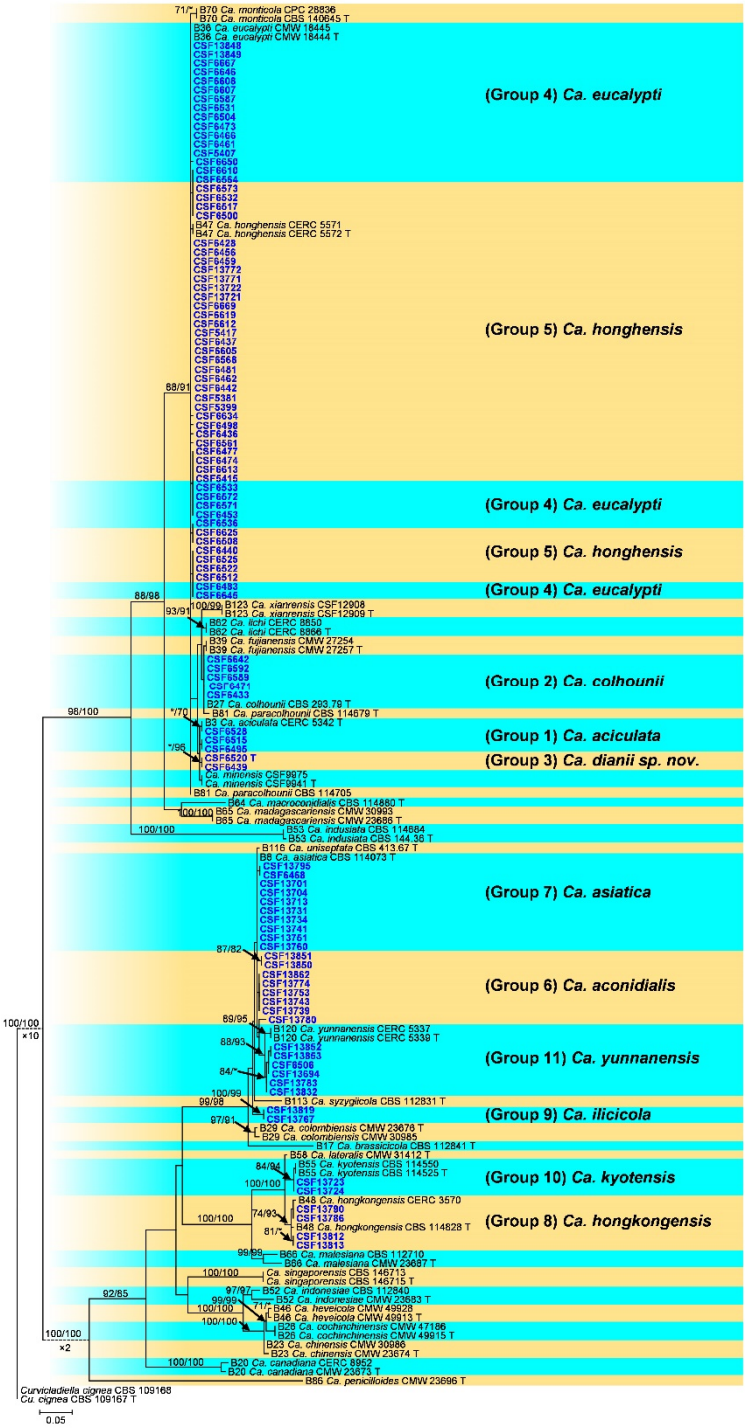
tef1



Additional file 7: Figure S5. The Maximum Likelihood (ML) tree inferred from the *tef1* gene sequence. Bootstrap value ≥ 70 % for ML and MP analyses are presented above the branches as ML/MP. Bootstrap values lower than 70 % are marked with "*", whereas absent of clade from a given analysis is indicated with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and **bold**. The "B" species codes are consistent with the recently published results in Liu et al. (2020). The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168).

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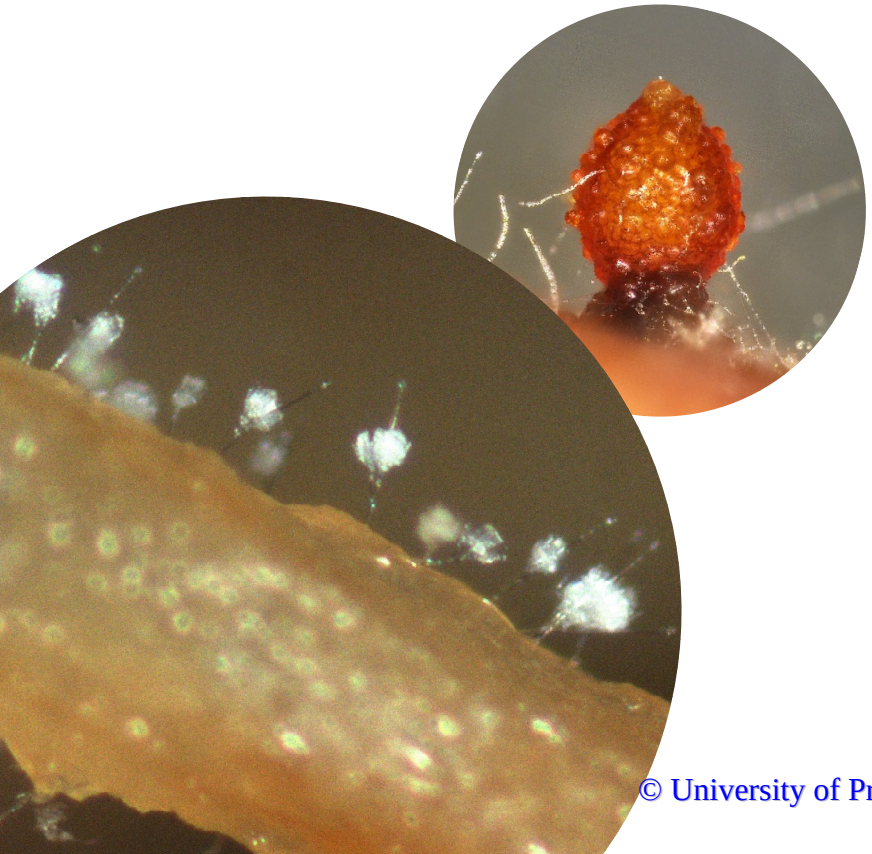
tub2



Additional file 8: Figure S6. The Maximum Likelihood (ML) tree inferred from the *tub2* gene sequence. Bootstrap value ≥ 70 % for ML and MP analyses are presented above the branches as ML/MP. Bootstrap values lower than 70 % are marked with "*", whereas absent of clade from a given analysis is indicated with "-". Ex-type isolates are marked with "T". Isolates sequenced in this study are highlighted in blue and bold. The "B" species codes are consistent with the recently published results in Liu et al. (2020). The tree was rooted to *Curvicladiella cignea* (CBS 109167 and CBS 109168.

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SUMMARY



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SUMMARY

Calonectria is a genus of fungi with a global distribution and with species having a wide range of hosts. Many of the species also cause serious diseases of important crop plants. During the last two decades, there have been numerous and increasing numbers of taxonomic studies on *Calonectria*. However, the taxonomic criteria used to identify *Calonectria* species have been inconsistent in these studies. For this reason, an important aim of the research in this thesis was to re-evaluate and clarify the phylogenetic relationships of all the published *Calonectria* species, and to propose a set of credible and stable criteria for species identification. In this thesis, I re-sequenced eight gene regions (*act*, *cmdA*, *his3*, ITS, LSU, *rpb2*, *tef1* and tub2) for all *Calonectria* species and analyzed the data. Based on these results, combined with the morphological features, I re-evaluated the species boundaries for *Calonectria*. The result was 51 species reduced to synonymy, two novel species being described, and one species validated. The overall result was an of 120 *Calonectria* species reduced from an original 169 species. The results revealed that six loci (*act*, *cmdA*, *his3*, *rpb2*, *tef1* and *tub2*) can be used as robust DNA barcodes for species identification in *Calonectria*.

To explore the diversity and distribution of *Calonectria* species in FuJian Province soils, a larger number of *Calonectria* isolates were retrieved from the soil samples collected from *Eucalyptus* plantations, natural forests and other related hosts. Employing the multigene phylogenetic analyses as well as the morphological characteristics, seven *Calonectria* species were discovered of which one represented novel taxon. To have a better understanding regarding the connections between *Calonectria* species on diseased *Eucalyptus* tissues and in soil samples, a larger number of *Calonectria* isolates were obtained from the diseased *Eucalyptus* leaves and soil samples in YunNan Province, southwestern China, overall, the results revealed some species are predominantly soil inhabitants and the pathogens causing Eucalyptus leaf blight mainly originated from leaves. This study revealed that *Calonectria* species will pose long-term challenges to the development of *Eucalyptus* forestry in southern China.

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论文总结

丽赤壳属（*Calonectria*）真菌是一类重要的植物病原菌，可侵染多种寄主，在全世界范围内广泛分布。在过去的 20 年中，涌现出大量丽赤壳属物种分类学的研究。然而，在这些研究中，对该属物种的分类鉴定缺乏统一的标准。因此，本论文的主要目的之一是对所有已发表的 169 个丽赤壳属物种进行重新鉴定，摸清物种间的系统发育关系，同时构建出一套标准的物种鉴定体系。本论文中，作者对所有已发表的丽赤壳属物种进行了 8 个基因片段（*act*、*cmdA*、*his3*、ITS、LSU、*rpb2*、*tef1* 和 *tub2*）的重新测序。通过基于 8 个基因片段的 DNA 序列，结合形态学特征研究，作者对丽赤壳属物种的边界进行了重新评估，最终将 169 个丽赤壳属物种重新鉴定为 120 个，其中合并物种 51 个，描述新物种 2 个，使 1 个物种的名称合法化，进一步阐明了这 120 个物种间的系统发育关系。同时，本研究筛选出一套可用于准确鉴定丽赤壳属物种的 DNA 条形码。

在中国，桉树主要分布在 11 个省（区），其中广西、广东、云南和福建省的桉树面积占全国桉树面积总和的 75%。为进一步摸清福建省土壤中的丽赤壳属物种多样性及其分布特征，作者对该省的桉树人工林及其毗邻的杉木、毛竹、马尾松林及天然林下的土壤进行了采集，采集范围涉及福建省的 5 个区域 9 个县。基于 6 个基因片段的系统发育分析，结合形态学特征，本研究鉴定出丽赤壳属物种 7 个，其中新物种 1 个。该研究的发表使福建省已记录的丽赤壳属物种达到 11 种。普遍情况下，丽赤壳属物种被认为是一类土栖真菌，在土壤中繁殖及传播。然而，关于导致桉树叶焦枯病的物种是否主要来源于土壤这一问题我们知之甚少。因此，为了进一步阐明丽赤壳属物种在不同介质中的分布及传播特征，作者对中国云南省一片感染叶焦枯病的桉树人工林进行病害调查及样品采集，从感病桉树叶片及其林下土壤中分离到大量的丽赤壳属菌株。本研究表明，在两种介质中丽赤壳属物种的多样性及分布情况存在明显差异。导致桉树叶焦枯病的病原菌主要在叶片上分布及传播，并非主要来源于土壤，而土壤中的优势物种则主要在土壤中分布及传播。以上研究表明，丽赤壳属物种在中国华南地区有着较高的物种多样性，这可能会对中国南方桉树产业的发展构成长期威胁，本研究将对今后丽赤壳属物种的精准防控提供一定的指导意义。

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