SYSTEMATIC STUDY OF BASIDIOMYCOTA

MAOQIANG HE

DOCTOR OF PHILOSOPHY
IN PLANT PATHOLOGY

GRADUATE SCHOOL
CHIANG MAI UNIVERSITY
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ABSTRACT

The Basidiomycota constitutes a major phylum of the kingdom Fungi and is second largest in species numbers to the Ascomycota. Three main subphyla of Basidiomycota are Agaricomycotina, Pucciniomycotina and Ustilaginomycotina. Agaricomycotina produce macroscopic structures for sexual reproduction (basidioma) which are typical mushrooms. Some taxa do not seem to form basidioma but are nevertheless members of the Basidiomycota. These taxa include rusts and smuts, which comprise Pucciniomycotina and Ustilaginomycotina. Yeasts-forming taxa, which are usually found in their asexual life mode, are also members of Basidiomycota, and can be found in all these three subphyla. To establish a natural fungi system, molecular data nowadays becomes one of the main criteria for identification, however, ranking still a problem in classification. By molecular clock analysis we can get the divergence time, and using divergence time as a universal criterion in ranking taxa has been practiced in various level of fungi. In this study, we provide the divergence times of subphyla, classes, orders and families of Basidiomycota, which can be used in the taxonomy and plant pathology. And this is the first study which estimated the divergence time of families in Basidiomycota in the subphylum scale.

Three phylogenetic analyses with combined large subunit ribosomal ribonucleic acid (LSU), small subunit ribosomal ribonucleic acid (SSU), Internal transcribed spacer 5.8s region (5.8s), largest subunit of RNA polymerase II (rpb1), second largest subunit of RNA polymerase II (rpb2), and translation elongation factor 1-alpha (ef1) datasets for the subphyla Agaricomycotina, Pucciniomycotina and Ustilaginomycotina are provided. Divergence time estimates are provided to the family level with 632 species from 62 orders, 168 families and 605 genera. This study indicates that the divergence times of the subphyla in Basidiomycota are 406–430 Mya, classes are 211–383 Mya, and orders are 99–323 Mya, which are largely consistent with previous studies. In this study, all phylogenetically supported families were dated, with the families of Agaricomycotina diverging from 27–178 Mya, Pucciniomycotina from 85–222 Mya, and Ustilaginomycotina from 79–177 Mya.

Fungi can be dispersed by other organism because of their obligate relationship within each other, such as the insect-associated fungi and ectomycorrhizal fungi. In this study, we provide the first study focusing on origin and disperse patterns of saprotrophic fungi. We took *Agaricus* section *Minores* as an example. The genus *Agaricus* is the type genus of Agaricaceae in Agaricales, which embraced more than 500 species worldwide. So far, there are six subgenera and 23 sections of *Agaricus* recognized in current systematic studies. Species in *Agaricus* is mainly characterized by fibrillose scales on the pileus, free lamellae, brown spore print and annulate stipe. In this study, we inferred the origin area and dispersal routes of *Agaricus* section *Minores* with a combined analyses of phylogeny and divergence times. *Agaricus* section *Minores* originated in tropical area at 22 Mya. Four dispersal routes were indicated: (1) species from South Asia migrated through the Tibetan Plateau and reached Europe ca. 9–13 Mya; (2) species from out of South Asia dispersed to Europe in the earlier time of ca. 22 Mya; (3) species from South Asia dispersed through North Asia to Alaska, and reached West America around ca. 9 Mya; and (4) species from South Asia dispersed south and reached Oceania by at least three invading events about ca. 9, 12 and 16–18 Mya, respectively.

Divergence time can help rank taxa in taxonomy, and in this study we applied it for the new taxa we have found in China and Thailand. Ten new taxa of *Agaricus* and *Micropsalliota* were introduced based on specimens collected from China and

Thailand. A new section *Cymbiformes* of *Agaricus* subgenus *Pseudochitonia* was introduced from Thailand based on its distinct phylogenetic position, relatively older divergence time in *Agaricus* and special morphologic characteristics. Two new species of section *Xanthodermatei* and five species of section *Minores* were introduced from China and Thailand, they are *Agaricus memnonius*, *A. langensis*, *A. rufusfibrillosus*, *A. purpurlesquameus*, *A. parvibrunneus*, *A. pseudominipurpureus*, and *A. yanzhiensis*. The related phylogenetic analyses were made. Descriptions, photographs and illustrations were presented. Two new species of *Micropsalliota* were introduced from northern Thailand, they are *M. cylincystidia* and *M. panocana*. This study provided the essential taxonomic summary for each genera in Basidiomycota since 2008, those basic information would greatly promote and make convenience for related studies. Divergence times as additional criterion in ranking taxa could provide additional evidence to resolve taxonomic problems, and also provide a better understanding of phylogeny and evolution of Basidiomycota. New taxa introduced in this study further confirmed the diversities of *Agaricus* from China and Thailand.

The present work also provides an overview of all validly published, currently used basidiomycete genera to date. An outline of all genera of Basidiomycota is provided, which includes 1926 currently used genera names, with 1263 synonyms, which are distributed in 241 families, 68 orders, 18 classes and four subphyla. We provide brief notes for each accepted genus including information on classification, number of accepted species, type species, life mode, habitat, distribution, and sequence information.

หัวข้อดุษฎีนิพนธ์ การศึกษาระบบการจัดจำแนกของเชื้อรา Basidiomycota

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บทคัดย่อ

Basidiomycota เป็นไฟลัมที่สำคัญไฟลัมหนึ่งในอาณาจักรรา มีจำนวนสายพันธุ์มากเป็นอันดับสอง รองจากไฟลัม Ascomycota โดยไฟลัม Basidiomycota นั้นประกอบด้วย 3 ไฟลัมย่อย คือ Agaricomycotina Pucciniomycotina และ Ustilaginomycotina โดยไฟลัมย่อย Agaricomycotina นั้น สมาชิกหลัก คือกลุ่มเห็ดขนาดใหญ่ที่สร้าง basidioma ที่เกิดจากการสืบพันธุ์แบบอาศัยเพศ ส่วนเชื้อราที่ไม่สร้างโครงสร้างดังกล่าว ถูกจัดอยู่ในไฟลัมย่อย Pucciniomycotina และ Ustilaginomycotina คือกลุ่มราสนิม และราเขม่าดำ ตามลำดับ นอกจากนั้นยังพบว่ามีเชื้อราในไฟลัม Basidiomycota หลายชนิด มีการสืบพันธุ์แบบไม่อาศัยเพศในรูปของยีสต์ (yeast-phase) ด้วยเช่นกัน ซึ่งในปัจจุบันการเรียงลำดับขั้นทางอนุกรมวิธานของเชื้อราในไฟลัม Basidiomycota ยังไม่คงไม่สมบูรณ์ ส่งผลให้มีปัญหาในการจัดจำแนกเชื้อราในไฟลัมนี้ ดังนั้นการศึกษาครั้งนี้มีจุดประสงค์เพื่อใช้เทคนิคนาฬิกาโครงสร้างโมเลกุล (molecular clock) มาใช้ร่วมในการจัดลำดับขั้นทางอนุกรมวิธานของเชื้อราในไฟลัม Basidiomycota และประเมินระยะเวลาการแยกสายพันธุ์ของเชื้อราในไฟลัมย่อย Agaricomycotina Pucciniomycotina และ Ustilaginomycotina โดยทำการวิเคราะห์ข้อมูลทางพันธุกรรมของสมาชิกเชื้อราในไฟลัม Basidiomycota ในตำแหน่ง large subunit ribosomal ribonucleic acid (LSU), small subunit ribosomal ribonucleic acid (SSU), Internal transcribed spacer 5.8s region (5.8s), largest subunit of RNA polymerase II (rpb1), second largest

subunit of RNA polymerase II (rpb2) และ translation elongation factor 1-alpha (ef1) จำนวน 632 สปีชีส์ จาก 62 อันดับ 168 วงศ์ และ 605 สกุล พบว่าเชื้อราในไฟลัม Basidiomycota มีการแยกสายพันธุ์ในระดับไฟลัมย่อยในช่วง 406–430 ล้านปีก่อน ในระดับชั้น เกิดขึ้นเมื่อ 211–383 ล้านปีก่อน และในระดับอันดับ เกิดขึ้นเมื่อ 99–323 ล้านปีก่อน โดยการศึกษาครั้งนี้สามารถประมาณระยะเวลาการแยกสายพันธุ์ของเชื้อราในระดับวงศ์ โดยใช้เทคนิค molecular clock ประสบความสำเร็จเป็นครั้งแรก โดยพบว่าเชื้อราในไฟลัมย่อย Agaricomycotina มีการแยกสายพันธุ์ในระดับวงศ์เมื่อ 27–178 ล้านปีก่อน ไฟลัมย่อย Pucciniomycotina เกิดขึ้นเมื่อ 85–222 ล้านปีก่อน และไฟลัมย่อย Ustilaginomycotina เกิดขึ้นเมื่อ 79–177 ล้านปีก่อน

นอกจากนี้การศึกษาครั้งนี้ยังประสบความสำเร็จในการใช้เทคนิคนาฬิกาโครงสร้างโมเลกุลในการประเมินการกระจายตัวของเชื้อรากลุ่มที่เจริญบนซากสิ่งมีชีวิต (saprobe) เป็นครั้งแรก โดยเลือกเชื้อราสกุล *Agaricus* ชั้น (section) *Minores* เป็นตัวแทนในการศึกษา ซึ่งเชื้อราสกุลนี้เป็นสกุลต้นแบบ (type genus) ของเชื้อราในวงศ์ Agaricaceae ในอันดับ Agaricales ไฟลัมย่อย Agaricomycotina มีสมาชิกมากกว่า 500 สปีชีส์ทั่วโลก จำแนกเป็น 6 สกุลย่อย และ 23 ชั้น (section) โดยได้ทำการวิเคราะห์ร่วมกับความสัมพันธ์ทางพันธุกรรม (phylogenetic relationship) พบว่าเชื้อราสกุล *Agaricus* ชั้น *Minores* ซึ่งมีแหล่งต้นกำเนิดจากพื้นที่เขตร้อน มีเส้นทางการกระจายตัวไปยังพื้นที่ต่างๆ ทั่วโลก 4 เส้นทาง คือ (1) สปีชีส์จากเอเชียใต้มีการกระจายตัวผ่านที่ราบสูงทิเบตไปยังยุโรปเมื่อ 9–13 ล้านปีก่อน (2) สปีชีส์จากแอฟริกาได้กระจายตัวไปยังยุโรปประมาณ 22 ล้านปีก่อน (3) สปีชีส์จากเอเชียใต้ได้มีการกระจายตัวไปยังแถบตะวันตกของอเมริกาผ่านทางเอเชียเหนือและอลาสก้า ประมาณ 9 ล้านปีก่อน และ (4) สปีชีส์จากเอเชียใต้ได้มีการกระจายตัวไปทางใต้ไปยังหมู่เกาะในมหาสมุทรแปซิฟิก อย่างน้อย 3 ครั้ง คือในช่วง 9, 12 และ 16–8 ล้านปีก่อน ตามลำดับ

การจัดจำแนกเชื้อรา *Agaricus* ในระดับสกุล สามารถใช้ลักษณะสัณฐานวิทยาที่มีลักษณะเฉพาะ ที่ประกอบด้วยการเกิด fibrillose บนหมวกเห็ด ลักษณะคลีบเห็ดไม่ติดกับก้านเห็ด มีลายพิมพ์สปอร์สีน้ำตาล และมีวงแหวนบนก้านเห็ดได้ แต่ไม่สามารถจัดจำแนกในระดับสปีชีส์ได้จำเป็นต้องใช้เทคนิคทางโมเลกุลร่วมด้วย ซึ่งในการศึกษาครั้งนี้ได้นำเทคนิคนาฬิกาโครงสร้างโมเลกุล ความ สัมพันธ์ทางพันธุกรรม และลักษณะสัณฐานวิทยา วิเคราะห์ร่วมกัน ในการระบุสปีชีส์ของเชื้อราสกุล *Agaricus* ที่พบในประเทศไทยและประเทศจีน โดยได้ค้นพบชั้นใหม่ คือชั้น *Cymbiformes* ภายใต้สกุลย่อย *Pseudochitonia* จากตัวอย่างของประเทศไทย ซึ่งมีลักษณะทางสัณฐานวิทยาพิเศษต่างจากเชื้อรา *Agaricus* ในชั้นอื่น และพบว่าเชื้อราในชั้น *Cymbiformes* มีช่วงระยะเวลาการแยกสายพันธุ์ก่อนเชื้อรา *Agaricus* ชั้นอื่นๆ และได้ค้นพบเชื้อราสปีชีส์ใหม่จำนวน 2 สปีชีส์ในชั้น *Xanthodermatei* จำนวน 5 สปีชีส์ในชั้น *Minores* ได้แก่ *Agaricus memnonius,*

A. langensis, A. rufusfibrillosus, *A. purpurlesquameus*, *A. parvibrunneus*, *A. pseudominipurpureus* และ *A. yanzhiensis* และจำนวน 2 สปีชีส์ในสกุล *Micropsalliota* ได้แก่ *M. cylincystidia* และ *M. panocana* และได้จัดทำรายชื่อเชื้อราในไฟลัม Basidiomycota ทั้งหมด ประกอบด้วย 1,926 สกุล และ 1,263 ชื่อพ้อง หรือ synonyms ซึ่งจัดอยู่ใน 241 วงศ์ 68 อันดับ 18 ชั้น และ 4 ไฟลัมย่อย และนำเสนอ หมายเหตุการจัดจำแนกเชื้อราในแต่ละสกุล สปีชีส์ที่ได้รับการยอมรับ สปีชีส์ต้นแบบ (type species) ลักษณะการดำรงชีวิต แหล่งอาศัย การกระจายตัว และข้อมูลพันธุกรรม ที่มีการรายงานตั้งแต่ปี พ.ศ. 2551 โดยการศึกษาครั้งนี้ทำให้เข้าใจถึงความสัมพันธ์ทางพันธุกรรม และวิวัฒนาการของเชื้อราในไฟลัม Basidiomycota มากขึ้น และการค้นพบเชื้อราสปีชีส์ใหม่ในการศึกษาครั้งนี้ ได้แสดงให้เห็นถึงความหลากหลายของเชื้อราในสกุล *Agaricus* ในพื้นที่ประเทศไทย และประเทศจีนที่ควรมีการศึกษาเพิ่มเติมต่อไป

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STATEMENTS OF ORIGINALITY

This is to certify that to the best of my knowledge, the content of this thesis is my own work. All the photo plates or figures are drawn or made on my own. This thesis has not been submitted for any other degree, diploma or written by other person. I'm completely responsible for the content of this thesis.

ข้อความแห่งการริเริ่ม

วิทยานิพนธ์ฉบับนี้ ข้าพเจ้าจัดทำขึ้นมาเพื่อวัดความรู้ ความสามารถ ของข้าพเจ้า ผ่านการวิเคราะห์ตัวเลข รูปภาพ โดยการนำข้อมูลต่างๆ ที่ข้าพเจ้าได้แสวงหา และทดสอบ ทดลองด้วยตนเอง ดังนั้น ข้าพเจ้าขอรับรองว่า เนื้อหาของวิทยานิพนธ์ฉบับนี้ เป็นของข้าพเจ้าโดยแท้จริง

CHAPTER 1
INTRODUCTION

1.1 Introduction

The *Outlines of the Fungi* provide essential taxonomic information which are easy to use by workers in various disciplines incorporating mycological fields especially for the plant pathogenic works and studies (Wijayawardene et al. 2017, 2018a, b). In the Kingdom Fungi, the phyla Ascomycota and Basidiomycota cover around 97% of all fungal species (Willis et al. 2018). Rust and smut fungi are two important groups in plant pathogen, and these taxa are in two subphyla of Basidiomycota, they are Pucciniomycotina and Ustilaginomycotina.

Wijayawardene et al. (2017) provided notes on 6450 genera of Ascomycota and Wijayawardene et al. (2018a) provided an outline for this group. Notes and outlines of the early diverging fungi were provided by Wijayawardene et al. (2018b). Studies on Basidiomycota on the other hand, have not followed such an approach, in spite of there being a real need for this to happen. Notes on all genera of Basidiomycota and an *Outline of the Basidiomycota* are urgently needed.

Deciphering and uncovering evolutionary relationships of organisms are underlying topics for taxonomists (Samarakoon et al. 2016). The molecular revolution in fungal taxonomy commenced in the early 1990s, with analyses of PCR-amplified ribosomal RNA genes (White et al. 1990) makes DNA sequence data becomes one of the main criteria for classification, and makes the ordinal level and above become more stable (Hibbett et al. 2007). However, the gene selection and classification of the clade still the problems to establish a natural fungi system (Zhao et al. 2017c). Use divergence time as a universal criterion which raised by Hennig (1966) now becomes feasible and has been practiced in various level of fungi, such as genus *Agaricus* L. (Zhao et al. 2016), class Dothideomycetes O.E. Erikss. & Winka 1997 (Liu et al. 2017) and phylum Basidiomycota R.T. Moore 1980 (Zhao et al. 2017c). The divergence times of

Basidiomycota are provided to Order level by Zhao et al. (2017c). However, there is no studies with respect on divergence times of the families in Basidiomycota.

1.2 Research objectives

To provide an outline and an account of all genera of Basidiomycota which including the important plant pathogenic taxa smut and rust with short notes on basic taxonomic information and references to recent studies since 2008.

To estimate the divergence times of Basidiomycota to families level based on the molecular data published.

1.3 Outline of the thesis

In chapter 1, brief introductions are made for outline and genera notes of fungi based on the most recently studies on Ascomycetes. A brief introduction is made for using divergence time as a criterion in taxonomic studies. Also, the objectives and thesis outline are explained.

In chapter 2, an outline is presented for the genera of Basidiomycota. Also the brief notes for each genera are made. Those genera include the pathogenic genera of smut and rust fungi.

In chapter 3, the origin and dispersal routes are speculated for *Agaricus* section *Minores* based on the phylogenetic analyses, geographical information and divergence times.

In chapter 4, there are eight new species of *Agaricus* introduced from China and Thailand introduced based on the molecular data and morphological characteristics. Furthermore, based on molecular clock analysis, one new species is ranked as a new section in *Agaricus*.

In chapter 5, there are two new species of *Micropsalliota* from northern Thailand introduced based on the molecular data and morphological characteristics.

In chapter 6, the general discussion are made with respect on how the outline and notes of genera in Basidiomycota could help people especially in the plant pathogenic

studies and works. Also the discussion focused on divergence times are presented with respect on solving problems in ranking taxa and possibility of applying in the phylogeography study of the pathogen taxa rust and smut fungi.

CHAPTER 2
NOTES, OUTLINE AND DIVERGENCE TIMES OF BASIDIOMYCOTA

2.1 Introduction

Basidiomycota constitute a major phylum of the kingdom Fungi and is second in species numbers to the Ascomycota (Wijayawardene et al. 2017, 2018a). Other phyla are Aphelidiomycota, Blastocladiomycota, Calcarisporiellomycota, Chytridiomycota, Entomophthoromycota, Entorrhizomycota, Glomeromycota, Kickxellomycota, Microsporidiomycota, Mortierellomycota, Mucoromycota, Olpidiomycota, Rozellomycota and Zoopagomycota (Tedersoo et al. 2018), although the acceptance of some phyla is disputed (Spatafora et al. 2016).

Species of Basidiomycota are characterized by basidia as meiosporocyst in the sexual life stage. Karyogamy and meosis proceed in the basidia and basidiospores are produced. The basidiomycetous hyphae, which have an electron-dense (multi-layered or visually single-layered) wall, are divided by septa into mononucleate, binucleate, or multinucleate segments. The septal pore may resemble a simple pore as in the Ascomycota, being closed with a compact electron-dense formation, but for many representatives it has a thickening on both sides appearing barrel-like (doliolum) in electronic microphotographs. The basidiomycetous cell wall is composed of chitin, whose fibrils are immersed in a matrix formed of (1→3)-β/(1→6)β-glucans and also mannans in yeast cells. Unlike the ascomycetes, the content of GC pairs of the total DNA typically exceeds 50% in basidiomycetous species. In addition, basidiomycetes differ from ascomycetes in a number of biochemical traits, such as the formation of urease, siderochromes, and the type of ubiquinone system, which enables, for example, a clear distinction between basidiomycete and ascomycete yeasts. Like in all dikarya, mitosis in basidiomycetes proceeds with preservation of the nuclear membrane (intranuclear pleuromitosis) and only in some Urediniomycetes, the nuclear membrane partially degrades during mitosis (semi-open pleuromitosis). The nuclear spindle polar

bodies in some early diverging basidiomycetes, as well as in ascomycetes are discoid, but many representatives have hemispherical and bi-globular spindle polar bodies (Zmitrovich and Wasser 2011). Agaricomycotina produce macroscopic structures for sexual reproduction (basidioma) which are typical mushrooms, boletes, puffballs, earthstars or other structures and may be above ground or sequestrate. Some taxa do not seem to form basidioma but are nevertheless members of the Basidiomycota. These taxa include rusts and smuts, which comprise Pucciniomycotina and Ustilaginomycotina. Yeasts-forming taxa, which are usually found in their asexual life mode, are also members of Basidiomycota, and can be found in all these three subphyla. According to the latest version of Ainsworth & Bisby's Dictionary of the Fungi (Kirk et al. 2008), there are 1589 genera and more than 30,000 species of Basidiomycota, which comprise nearly 32% of all described fungal taxa (Dai et al. 2015).

Deciphering and uncovering evolutionary relationships of organisms are underlying topics for taxonomists (Samarakoon et al. 2016). Molecular phylogenies have provided increased knowledge concerning the evolution of fungi (McTaggart et al. 2016a; Kijpornyongpan et al. 2018; Varga et al. 2019). Studies over the last decade used innovative methods to support traditional morphology-based classifications (e.g. Lutzoni et al. 2004; Blackwell et al. 2006; James et al. 2006; Hibbett et al. 2007) and many new perspectives have been derived in fungal systematics. Divergence times have recently been used as important criteria to rank taxa and have been accepted in many fungal systematic studies (Drummond et al. 2012a; Hongsanan et al. 2017; Liu et al. 2017c). Zhao et al. (2016f) used divergence times as an additional criterion to infer a modern taxonomic system for the genus *Agaricus*. The authors proposed the following criteria to rank taxa above species level: (i) the taxa must be monophyletic and statistically well-supported in multi-gene analyses; (ii) their respective stem ages should be roughly equivalent, and higher taxon stem ages must be older than lower level taxa stem ages; and (iii) the taxa should be identifiable phenotypically, whenever possible. Subsequently, several studies have ranked higher taxa using divergence times, such as for Ascomycota (Dothideomycetes and Sordariomycetes), Basidiomycota and for the kingdom Fungi (Hongsanan et al. 2017; Hyde et al. 2017a; Liu et al. 2017; Zhao et al. 2017c; Tedersoo et al. 2018). The time ranges for Basidiomycota, with the phylum

originating ca. 530 Mya, the subphyla 406–490 Mya, most classes 245–393 Mya and orders 120–290 Mya were inferred by Zhao et al. (2017c)

2.2 Materials and Methods

2.2.1 Notes and Outline

All generic names gathered from Index Fungorum (2019) were checked through Kirk et al. (2008, 2013) and Species Fungorum (2019). Nomen invalidum names, nomen rejiciendum names and synonyms were excluded. The basic information of each note is classification (family, order, class), synonyms, accepted species number, type species, life mode, habitat, distribution, and sequence information. Species numbers are based on Kirk et al. (2008), plus new taxa and data published between 2008 and 2019. Furthermore, the latest research information of each note is presented in following three parts if available: (i) studies of selected important species (edible, medicinal, industrial, pathogenic and saprobic); (ii) selected studies on taxonomy and phylogeny published between 2008 and 2019; (iii) new taxon studies between 2008 and 2019.

2.2.2 Phylogenetic analyses

Sequences were downloaded from GenBank (Benson et al. 2017). Six genes (LSU, SSU, 5.8s, ef1, rpb1 and rpb2) were included in this study. Only species for which two or more gene sequences were available were included in the phylogenetic analyses. Sequence information is listed in Table 1. Sequences were checked in BioEdit V.7.0.4 first (Hall 2007). Alignments were made by Muscle 3.8.31 (Edgar 2004) for each region separately, then adjusted manually. In order to avoid substitutional saturation in third codon position, we used translated amino acid sequences for ef1, rpb1 and rpb2 (Matheny et al. 2007b). For each data set, we then combined with DNA from rDNA genes and amino acid sequences. Divergence times were estimated in BEAST 1.8.4 (Drummond et al. 2012). An XML file was constructed with BEAUTI v1.8., and per-gene alignments were imported as separate partitions. Clock and substitution models were set to be unlinked (independently estimated for each gene partition). Substitution models for nucleotides were determined from jModelTest v2 and the settings were as follows: for the Agaricomycotina tree, the GTR+I+G for SSU, LSU and 5.8S and WAG for ef1, rpb1 and rpb2; for Pucciniomycotina, GTR for LSU and 5.8S,

HKY for SSU and WAG for ef1, rpb1 and rpb2; for Ustinaginomycotina, GTR for LSU, SSU and 5.8S, and WAG for ef1, rpb1 and rpb2. A Yule speciation model was selected as prior assuming a constant speciation rate per lineage. We used the uncorrelated lognormal relaxed clock model, specifying a gamma distribution for the ulcd.mean parameter with a shape of 1.0, scale of 0.001, and offset 0. The calibrations of each tree are cited from the previous study (Zhao et al. 2017c) by applying a normal distribution prior (SD=1) that mean age 406 Mya for Agaricomycotina, Pucciniomycotina, and 430 Mya for Ustilaginomycotina. We ran four independent Monte Carlo Markov Chains of 50 million generations for each, logging states every 10000 generations. Log files were checked for convergence and mixing in Tracer v1.6 (Rambaut et al. 2014; http://tree.bio. ed.ac.uk/software/tracer/). A Maximum-clade-credibility (MCC) tree was summarized using TreeAnnotator 1.8, discarding 10% of states as burn-in and annotating clades with ≥0.8 posterior probability (PP).

Table 1 Sequence information used in the divergence time estimation for Basidiomycota

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1	*Amanita muscaria*	HKAS61888	MH486651			MH486100	MH508439	MH508908	Cui et al. 2018
2	*Catatrama costaricensis*	DAOM 211663	KT833804					KT833834	Cui et al. 2018
3	*Limacella delicata*	ZT Myc 55818	KT833807			KT833822		KT833835	Cui et al. 2018
4	*Agaricus campestris*	AFTOL-ID 1492	DQ110871	DQ113914	DQ516068		DQ486682		Kirk et al. 2001
5	*Limacellopsis guttata*	MB-100157	KT833813			KT833828		KT833841	Cui et al. 2018
6	*Calvatia gigantea*	DSH 96-032	AF518603	AF026622			AJ617492		Brandon et al. 2006
7	*Chlorophyllum agaricoides*	AFTOL ID 440	AY700187	AY657010	DQ447889		DQ200928		Brandon et al. 2006
8	*Galerella floriformis*	WU22833	JX968371				JX968254	JX968458	To´th et al. 2013
9	*Clarkeinda trachodes*	xml2014104	KY418837			KY418989	LT716022		Zhao et al. 2017
10	*Pholiotina aeruginosa*	WU27104	JX968364				JX968247		To´th et al. 2013
11	*Coniolepiota spongodes*	png012	HM488774			HM488796	HM488756	HM488883	Velliga et al. 2011
12	*Coprinus comatus*	AFTOL ID 626	AY635772	AY665772	AY857983	AY780934	AY854066		Brandon et al. 2006
18	*Eriocybe chionea T*	ecv3616	HM488772			HM488801	HM488753		Vellinga et al. 2011
20	*Heinemannomyces sp*	ZRL185	KT951527				KT951346	KT951657	Zhao et al. 2011
21	*Hymenagaricus sp*	AFTOL ID 1383	DQ457680	DQ089016			DQ490633		Brandon et al. 2006
22	*Lepiota cristata*	ZRL20151133	KY418841	KY418910	KY418963	KY418992	LT716026	KY419048	Zhao et al. 2017
25	*Leucocoprinus fragilissimus*	ZRL20151466	KY418844	KY418913	KY418965	KY418994	LT716029	KY419049	Zhao et al. 2017
26	*Lycoperdon ericaeum*	ZRL20151498	KY418845	KY418914	KY418966	KY418995	LT716030		Zhao et al. 2017

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
27	*Conocybe deliquescens*	SZMC-NL-0574	JX968327				JX968210	JX968428	To´th et al. 2013
28	*Cortinarius scotoides*	G8	KC842465	KC171237			KC842394		Stensrud et al. 2014
29	*Macrolepiota dolichaula*	xml2013058	KY418836			KY418988	LT716021	KY419044	Zhao et al. 2017
31	*Micropsalliota globocystis*	ZRL2013465	KY418839			KY418991	LT716024	KY419046	Zhao et al. 2017
33	*Cortinarius renidens*	OS582	KC842529	KC171301			KC842459		Stensrud et al. 2014
34	*Rigidotubus tephroleucus*	Cui 13717	MF290415				MF290417		Song et al. 2017
41	*Cystidiodontia laminifera*	KHL 13057	EU118622				EU118622		Song et al. 2017
43	*Cystostereum murraii*	KHL 12496	EU118623				EU118623		Song et al. 2017
44	*Verrucospora flavofusca*	AFTOL-ID 655	DQ470825				DQ241779		Mantheny et al. 2006
45	*Entoloma pluteisimilis*	C. Hermosilla 2001-12-08	GQ289180			GQ289251			Co-David et al. 2009
46	*Entoloma kermandii*	G. Gates E227	GQ289173			GQ289244			Co-David et al. 2009
47	*Rhodocybe stangliana*	N. Dam 05094	GQ289218			GQ289285			Co-David et al. 2009
54	*Auritella aureoplumosa*	PBM 2212	AY635765			AY635781			Matheny et ak. 2009
61	*Camarophyllopsis hymenocephala*	AFTOL-ID 1892	DQ457679	DQ444862	DQ516070	DQ472726	DQ484066		Kirk et al. 2001; Brandon et al. 2006
62	*Clavaria zollingeri*	AFTOL-ID 563	AY639882	AY657008	AY857987	AY780940	AY854071		Kirk et al. 2001; Brandon et al. 2006
63	*Clavulinopsis coralinorosacea*	PBM3380	HQ877707			KP257265	KP257144		Birkebak et al. 2016

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
64	*Inocybe jarrahae*	PBM 2207	AY380381		AY351806	AY337382			Matheny et al. 2009
65	*Hodophilus foetens*	Ceska110301	KP257228			KP257272	KP257157		Birkebak et al. 2016
66	*Inocybe sp.*	ZT 8944	EU600903		EU600901	EU600902			Matheny et ak. 2009
67	*Lamelloclavaria petersenii*	SAV F-3493	KP257244			KP257285	KP257171		Birkebak et al. 2016
69	*Ramariopsis avellaneo-inversa T*	TFB55712	KP399950			KP399951			Birkebak et al. 2016
71	*Naucoria escharioides*	PBM 1719	AY380405		AY351840	AY337411	AJ585430		Brandon et al. 2006
72	*Harmajaea harperi*	TUR 173042	MG321400				MG321367		Alvarado et al. 2018
73	*Cortinarius iodes*	AFTOL-ID 285	AY702013	AY771605	AY857984	AY536285	AF389133		Kirk et al. 2001
74	*Musumecia vermicularis*	LUG18975	KJ681037	KJ681070		KJ681061	KF941322	KJ681083	Alvarado et al. 2018
75	*Clitopaxillus alexandri*	AMB 18221	MG321392				MG321339	MG334536	Alvarado et al. 2018
76	*Hebeloma cf cavipes*	ZRL20151612	KY418849			KY418997	LT716034	KY419053	Zhao et al. 2017
77	*Pseudoclitocybe cyathiformi*	AFTOL ID-1998	EF551313	GU187659		GU187815	GU187553	GU187742	Alvarado et al. 2018
78	*Pogonoloma spinulosum*	KM:107286	KJ417238	KU058571		KJ424401	KP453705		Alvarado et al. 2018
79	*Radulomyces copelandii*	Dai 15061	KU535672				KU535664		Zhao et al. 2016
81	*Radulotubus resupinatus*	Cui 8383	KU535668				KU535660		Zhao et al. 2016
82	*Quadrispora oblongispora*	Trappe 18111	AF388746				AF325566		Peintner et al. 2001
83	*Neopaxillus dominicanus*	MCVE 26928	JN033217				JN033216		Vizzini et al. 2012

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
86	*Aphanobasidium pseudotsugae*	UC 2023153	AY586696				KP814353		Larsson 2007
89	*Entocybe trachyospora*	ZRL20151426	KY418852	KY418919	KY418968		LT716037	KY419055	Zhao et al. 2017
91	*Pterula echo*	AFTOL-ID 711	AY629315			GU187805	DQ494693	GU187743	Larsson 2007
92	*Merulicium fusisporum*	Hjm s.n.	EU118647				EU118647		Larsson 2007
93	*Entoloma strictior*	Moncalvo96/10	AF042620	AF287832		AY218483	DQ494680		Brandon et al. 2006
107	*Cuphophyllus basidiosus*	AFTOL ID 1759	DQ457651	DQ435809	DQ435805	DQ470828	DQ486684		Brandon et al. 2006;Kirk et al. 2001;Moncalvo et al. 2002
108	*Hygrophorus canescens*	AFTOL-ID 1800	DQ457652	DQ435810	DQ435807	DQ470829	DQ486685		Kirk et al 2001Singer 1986
113	*Chromosera cyanophylla*	AFTOL-1684	DQ457655	DQ435813		KF381509	DQ486688		Manthny et al. 2004
115	*Gliophorus psittacinus*	DEN-25	KF291076	KF291077		KF291078	KF291075		Lodge et al. 2014
117	*Humidicutis sp.*	3923	KF291111	KF291112			KF291110		Lodge et al. 2014
118	*Hygroaster albellus*	AFTOL-1997	EF551314	KF381532			KF381521		Manthny et al. 2004
119	*Hygrocybe coccinea*	DEN-13	EU435146	KF291113		KF291114	EU435146		Lodge et al. 2014
122	*Neohygrocybe ovina*	GWG H. ovina Rhosisaf ABS	KF291234	KF291235		KF291236	KF291233		Lodge et al. 2014
123	*Porpolomopsis calyptriformis*	ENG-3	KF291243	KF291244		KF291245	KF291242		Lodge et al. 2014
126	*Pachylepyrium fulvidula*	T1495	KF830080	KF830072		KF830063	KF830091		Mantheny et al. 2015
127	*Psathyloma catervatim*	PBM3420	HQ840664	HQ840665		HQ840666	HQ840663		unpublished

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
133	*Crepidotus cf applanatus*	PBM 717	AY380406	AY705951	AY333303	AY333311	DQ202273		Kirk et al 2001Singer 1986
139	*Pleuroflammula praestans*	ZRL2015066	KY418859	KY418925	KY418971	KY419005	LT716043		Zhao et al. 2017
140	*Simocybe serrulata*	AFTOL ID 970	AY745706	DQ465343	DQ447940	DQ484053	DQ494696		Brandon et al 2006
142	*Flammulaster sp.*	PBM3449	HQ827177	HQ827178			HQ827176		unpublished
152	*Asterophora agaricoides*	CBS170.86		DQ367417	EF421021	DQ367431	AF357037	DQ367424	Hofstetter et al. 2014
153	*Blastosporella zonata*	TJB8371	EU708337	EU708333			EU708340		Baroni et al. 2007
156	*Gerhardtia Gerhardtia sp*	HC01/025	EF421091		EF421028	EF420994	EF421103	EF421060	Hofstetter et al. 2014
157	*Hypsizygus ulmarius*	DUKE-JM/HW	AF042584		EF421030	EF420996	EF421105	EF421062	Hofstetter et al. 2014
158	*Lyophyllum ambustum*	CBS452.87	AF223216		EF421031	EF420997	AF357057	EF421063	Hofstetter et al. 2014
159	*Myochromella inolens T*	CBS330.85	AF223201		EF421038	EF421004	AF357045	EF421071	Hofstetter et al. 2014
160	*Ossicaulis lachnopus*	DUKE-D604VT	AF261397		DQ825420	DQ825410	DQ825426	EF421072	Hofstetter et al. 2014
162	*Sagaranella tylicolor T*	IE-BSG-BSI92/245	AF223195		EF421040	EF421006	AF357040	EF421074	Hofstetter et al. 2014
163	*Tephrocybe rancida T*	CBS204.47	AF223203		EF421042	EF421008	AF357025	EF421076	Hofstetter et al. 2014
166	*Tricholomella constricta*	IE-BSG-HC84/75	AF223188		DQ825422	DQ825412	AF357036	EF421079	Hofstetter et al. 2014
167	*Campanella sp*	MCA1689	AY916668	AY916669	AY916671		AY916670		Kirk et al 2001;Ku¨hner 1980;Moncalvo et al 2002;Brandon et al 2006
168	*Chaetocalathus liliputianus*	MCA485	AY916680	AY916681	AY916683		AY916682		Brandon et al 2006

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
169	*Clitocybula oculus*	AFTOL ID 1554	DQ151452	DQ440636			DQ192178		Brandon et al 2006
170	*Crinipellis sp*	ZRL20151369	KY418866	KY418932	KY418974	KY419012	LT716050	KY419068	Zhao et al. 2017
175	*Marasmius oreades*	ZRL2015086	KY418864	KY418930	KY418972	KY419010	LT716048	KY419066	Zhao et al. 2017
176	*Megacollybia marginata*	ZRL20151245	KY418865	KY418931	KY418973	KY419011	LT716049	KY419067	Zhao et al. 2017
177	*Megacollybia platyphylla T*	AFTOL ID 560	AY635778	AY786053	DQ447923	DQ385887	DQ249275		Brandon et al 2006
178	*Moniliophthora perniciosa*	DIS71	AY916738	AY916739	AY916740		AY317136		Kirk et al 2001;Ku¨hner 1980;Moncalvo et al 2002;Brandon et al 2006
182	*Campanella subdendrophora*	ATCC 42449	AY445115	AY445118			AY445121		Vinnere et al. 2005
183	*Chaetocalathus cf. columellifer*	MCA2538	AY916684		AY916687		AY916686	AY916688	Aime and Phillips-Mora 2005
184	*Clitocybula atroalba*	AFTOL-ID 1529	DQ457659	DQ437682			DQ192179		Matheny et al. 2006
199	*Mycena plumbea*	AFTOL-ID 1631	DQ470813	DQ457697	DQ447928		DQ494677		Moncalvo et al2002
200	*Panellus stipticus*	DSH 93-213	AF518634	AF026589			AB084488		Moncalvo et al2002
208	*Halocyphina villosa T*	IFO32086	AF426957	AF426951			AY571042		Brandon et al 2006
209	*Flagelloscypha minutissima*	CBS 823.88	AY571006				AY571040		Binder et al. 2006
210	*Lachnella villosa*	AFTOL-ID 525		AY705959			DQ097362		Binder et al. 2006
212	*Anthracophyllum archeri*	AFTOL ID 973	AY745709	DQ092915	DQ435799	DQ385877	DQ404387		Brandon et al 2006
213	*Gymnopus confluens*	ZRL20151148	KY418870	KY418936	KY418976	KY419016	LT716054	KY419070	Zhao et al. 2017
217	*Lentinula edodes*	TMI1941	AF261557	AF082686			AY636053		Moncalvo et al 2002;Brandon et al 2006

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
218	*Mycetinis alliaceus T*	AFTOL ID 556	AY635776	AY787214	AY860525	AY786060	AY854076		Moncalvo et al 2002;Brandon et al 2006
219	*Omphalotus olearius*	AFTOL ID 1718	DQ470816	DQ459374			DQ494681		Brandon et al 2006
221	*Rhodocollybia maculata T*	AFTOL ID 540	AY639880	AY752966	DQ447936	AY787220	DQ404383		Moncalvo et al 2002;Brandon et al 2006
224	*Marasmiellus istanbulensis T*	3596	KX184796			KY250437	KX184795	KY250436	Sesli et al. 2017
227	*Armillaria mellea*	AFTOL ID 449	AY700194	AY787217	AY788849	AY780938	AY789081		Moncalvo et al 2002;Brandon et al 2006
228	*Cylindrobasidium laeve*	AFTOL ID 453	DQ234541	AF518576	DQ447896	AY536283	DQ205682		Brandon et al 2006
229	*Cyptotrama asprata*	ZRL2015093	KY418873	KY418939	KY418977	KY419018	LT716057	KY419072	Zhao et al. 2017
230	*Flammulina velutipes*	AFTOL ID 558	AY639883	AY665781	AY858966	AY786055	AY854073		Brandon et al 2006
231	*Hymenopellis radicata*	AFTOL ID 561	AY645051	AY654884	DQ447946	AY786067	DQ241780		Brandon et al 2006
233	*Mycaureola dilseae*	BM17/85	DQ097348	DQ097342			DQ097364		Brandon et al 2006
234	*Physalacria bambusae*	CBS712 83	DQ097349	AY705953	DQ447934	DQ474123	DQ097367		Moncalvo et al 2002;Brandon et al 2006
235	*Xerula sinopudens*	ZRL20151504	KY418875	KY418941		KY419020	LT716059		Zhao et al. 2017
236	*Cibaomyces glutinis T*	HKAS80855	KJ024106				KJ024101		Hao et al. 2014
238	*Dactylosporina glutinosa*	MCA 1775	HM005137			KY359142	HM005074	KU170936	unpublished
240	*Guyanagaster necrorhizus*	MCA 3950				KY359144	KU170947	KU289107	Koch et al. 2017
247	*Rhodotus asperior T*	HKAS 56754	KC179745			KC179755	NR 154396	KC179730	Tang et al. 2014
256	*Coprinopsis atramentaria*	PBM 992	DQ457661	DQ115781			DQ486694		Brandon et al 2006

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
257	*Lacrymaria lacrymabunda*	AFTOL ID 478	AY700198	AY654885		DQ472733	DQ490639		Brandon et al 2006
259	*Parasola conopilus*	ZRL20151990	KY418880	KY418946		KY419025	LT716064		Zhao et al. 2017
260	*Psathyrella candolleana*	ZRL20151400	KY418879	KY418945	KY418978	KY419024	LT716063	KY419075	Zhao et al. 2017
262	*Coprinellus curtus*	SZMC-NL-2339	FM876273				FM878016	FM897246	Nagy et al. 2012
263	*Cystoagaricus strobilomyces*	30-V-1997	AY176348				AY176347		Nagy et al. 2012
273	*Agrocybe praecox*	AFTOL ID 728	AY646101	AY705956	DQ516069	DQ385876	AY818348		Brandon et al 2006
280	*Pholiota veris*	AFTOL ID 1676	DQ457684	DQ457624	DQ447918	DQ472730	DQ490638		Brandon et al 2006
286	*Callistosporium sp*	AFTOL ID 978	AY745702	AY752974	DQ825413	DQ825406	DQ484065		Brandon et al 2006
287	*Catathelasma ventricosum*	AFTOL-ID 1488	DQ089012	DQ435811		DQ470830	DQ486686		P Brandon Matheny et al2006
297	*Tricholoma aestuans*	AFTOL-ID 497	AY700197	AY757267		DQ484055	DQ494699		P Brandon Matheny et al2006
311	*Corneriella bambusarum T*	DED5462	KJ417185			KJ424370	NR 153878		Sánchez-García et al. 2014
312	*Dennisiomyces sp.*	BZ-916	KF291064			KF291066	KF291063		Sánchez-García et al. 2014
313	*Dermoloma sp.*	ECV4208		KU058569	KU139027	KU138994	KU058494		Sánchez-García et al. 2016
319	*Leucopaxillus alboalutaceus*	LAS00/082	KJ417195			KJ424377	KJ417275		Sánchez-García et al. 2014
330	*Porpoloma portentosum*	REH5788	KJ417211			KJ424387	KJ417299		Sánchez-García et al. 2014
332	*Pseudobaeospora sp.*	ECV5553	KU058539	KU058575		KU139003	KU058502		Sanchez-Garcia and Matheny 2016
343	*Typhula phacorrhiza*	DSH96-059	AF393079	AF026630		AY218525	AF134710		Kirk et al 2001,This studyfamily/tribe/clade

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
345	*Amylocorticium cebennense*	HHB 2808	GU187561	GU187612	GU187439	GU187770	GU187505	GU187675	Binder et al 2010
347	*Podoserpula ailaoshanensis*	ZJL2015015	KU324487	KU324491			KU324484	KU324494	Zhao et al. 2017
349	*Ceraceomyces serpens*	HHB-15692-Sp	KP135200		KP134785		KP135031		Justo et al. 2017
350	*Serpulomyces borealis*	CFMR:L-8014	GU187570	GU187624	GU187446	GU187782	GU187512	GU187686	Binder et al. 2010
351	*Athelia arachnoidea*	CBS418 72	GU187557	GU187616	GU187436	GU187769	GU187504	GU187672	Binder et al 2010
352	*Leptosporomyces raunkiaerii*	HHB 7628	GU187588	GU187640	GU187471	GU187791	GU187528	GU187719	Binder et al 2010
357	*Piloderma fallax*	S-12	GU187591	GU187644			GU187535	GU187738	Binder et al. 2010
359	*Auricularia heimuer*	Xiaoheimao	KY418890		KY418982	KY419035	LT716074	KY419083	Zhao et al. 2017
361	*Exidia sp*	PBM2527	AY700191				DQ241774		Brandon et al 2006
362	*Eichleriella alliciens*	Burdsall 7194	KX262169				KX262120		Malysheva and Spirin 2017
363	*Exidiopsis effusa*	Miettinen 19136 H	KX262193				KX262145		Malysheva and Spirin 2017
364	*Heterochaete delicata*	TUFC33717	AB871747				AB871766		Sotome et al. 2014
367	*Austroboletus aff fusisporus*	HKAS52683	KF112484		KF112571	KF112766		KF112213	Wu et al 2014
369	*Boletus edulis*	HMJAU4637	KF112455		KF112586	KF112704		KF112202	Wu et al 2014
370	*Borofutus dhakanus*	HKAS73789	JQ928616		JQ928586	JQ928597		JQ928576	Wu et al 2014
375	*Retiboletus zhangfeii*	HKAS59699	JQ928627		JQ928592	JQ928603		JQ928582	Wu et al 2014
378	*Sutorius eximius*	HKAS52672	KF112399		KF112584	KF112802		KF112207	Wu et al 2014
379	*Tylopilus felleus*	HKAS54926	KF112411		KF112575	KF112737		HQ326866	Wu et al 2014

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
380	*Veloporphyrellus alpinus*	HKAS57490	KF112380		KF112555	KF112733		KF112209	Wu et al 2014
381	*Xerocomellmus cisalpinus*	PDD94421	JQ924322		KF112525	KF112686		KF112171	Wu et al 2014
383	*Afroboletus luteolus*	00-436	KF030238		KF030392			KF030397	Wu et al 2014
388	*Boletellus ananas*	NY815459	JQ924336			KF112760		KF112308	Wu et al 2014
389	*Bothia castanella*	MB03-053	DQ867117				DQ867110	KF030421	Halling et al. 2007; Nuhn et al. 2013
390	*Buchwaldoboletus lignicola*	HKAS76674	KF112350		KF112642	KF112819		KF112277	Wu et al 2014
392	*Corneroboletus indecorus*	HKAS 63126	JN205457			JN205455	JN205456		Zeng et al. 2012
400	*Harrya chromapes*	HKAS50527	KF112437		KF112580	KF112792		KF112270	Wu et al. 2014
409	*Leccinellum corsicum*	Buf 4507	KF030347		KF030389			KF030435	Wu et al. 2014
410	*Leccinum albellum*	MB 06-040	JQ327007					JQ327038	Wu et al. 2014
411	*Mucilopilus castaneiceps*	HKAS75045	KF112382			KF112735		KF112211	Wu et al. 2014
415	*Phylloporus pelletieri*	Pp1	AF456818		KF030390			JQ327036	Nuhn et al. 2013
416	*Porphyrellus porphyrosporus*	AFTOL-1779	DQ534643	DQ534689	GU187475	GU187800	DQ534563	GU187734	Mantheny et al. 2006
419	*Pulveroboletus brunneopunctatus*	N.K. Zeng 2479	KX453824				KX453806	KX453847	Zeng et al. 2017
422	*Royoungia reticulata T*	HKAS52253	KT990592		KT990940	KT990427		KT990786	Wu et al. 2016
425	*Spongiforma thailandica*	BBH DED 7873	NG042464		KF030387	MG212648	NR119699	KF030436	Desjardin et al. 2009

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
426	*Strobilomyces latirimosus*	HKAS53348	KF112462		KF112602	KF112811		KF112257	Wu et al. 2014
429	*Xanthoconium stramineum*	3518	KF030353		KF030386			KF030428	Nuhn et al. 2013
430	*Xerocomus badius*	MB 03-098a	KF030355		KF030393			KF030423	Nuhn et al. 2013
434	*Coniophora arida*	FP 104367	GU187573	GU187622	GU187445	GU187775	GU187510	GU187684	Binder et al 2010
435	*Gyrodontium sacchari*	MUCL40589	GU187579	GU187632	GU187460	GU187764	GU187522	GU187703	Binder et al 2010
442	*Leucogyrophana lichenicola*	DAOM194172	GU187583	GU187638	GU187467	GU187789	GU187531	GU187715	Binder et al 2010
443	*Hygrophoropsis aurantiaca*	AFTOL-ID 714	AY684156	AY662663	AY858961	AY786059	AY854067	AY883427	Mantheny et al. 2006
454	*Serpula lacrymans*	REG 383	GU187596	GU187649	GU187485	GU187809	GU187542	GU187752	Binder et al 2010
455	*Austropaxillus statuum*	Pst2	HM135709	HM135789		HM135764	HM135659	HM135560	Håvard et al. 2011
458	*Bondarcevomyces taxi*	Dai2524	DQ534672	DQ534677			DQ534575	GU187683	Binder et al. 2010
459	*Pseudomerulius curtisii*	REH8912	GU187589	GU187641	GU187472	GU187796	GU187533	GU187725	Binder et al. 2010
466	*Multiclavula mucida*	AFTOL ID 1130	AY885163	DQ521416			DQ521417		Matheny et al. 2006
471	*Hydnum albomagnum*	AFTOL-ID 471	AY700199	AY665777	DQ234570	DQ234553	DQ218305	DQ234568	Matheny et al. 2006
473	*Sistotrema coronilla*	AFTOL-ID 618	DQ457641	AY757259		DQ381838	DQ397337		Matheny et al. 2006
476	*Burgella lutea T*	Etayo 27623	KC336075				KC336076		Diederich et al. 2014
478	*Minimedusa obcoronata*	CBS:120605	GQ303309				GQ303278		Cheewangkoon et al. 2009
479	*Schildia sancti-luxurii*	MCVE 28639	KT357479				NR 154421		Schildia et al. 2015

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
480	*Corticium roseum*	MG46	AY463401				GU590877		Ghobad-Nejhad et al 2010
486	*Dentocorticium portoricense*	He2161	MF626380			MF626397	MF626356		Liu et al. 2018
487	*Erythricium laetum*	MG73	GU590879				GU590874		Ghobad-Nejhad and Hallenberg 2011
490	*Laetisaria lichenicola*	CBS 128705		HQ168399			NR 121484		Diederich et al. 2011
491	*Leptocorticium tenellum*	MG143	KU183720				KU183719		unpublished
493	*Marchandiomyces lignicola*	ATCC MYA 299	AY583332				AY583328		DePriest et al. 2005
494	*Punctularia strigosozonata*	AFTOL-ID 1248			DQ831031	DQ381843	DQ398958	DQ408147	Mantheny et al. 2006
495	*Waitea circinata*	AFTOL-ID 1129	AY885164			DQ846899			Mantheny et al. 2006
499	*Schenella pityophilus*	59743	DQ218519			DQ219057		DQ219232	Hosaka et al 2006
500	*Geasteroides taylorii*	59760	DQ218520			DQ219060		DQ219235	Hosaka et al 2006
502	*Sphaerobolus iowensis*	ATCC 52850	AY439014				AY487958	AY487984	Geml et al. 2005
506	*Gloeophyllum trabeum*	1320	HM536067	HM536068		HM536112	HM536094	HM536113	Garcia-Sandoval et al. 2011
509	*Neolentinus lepideus*	DAOM208724	HM536077	HM536078		HM536121		HM536122	Garcia-Sandoval et al. 2011
512	*Veluticeps fimbriata*	L 10628	HM536083	HM536084		HM640260	HM536100	HM536127	Garcia-Sandoval et al 2011
513	*Boreostereum radiatum*	RLG-9717-sp	HM536050	HM536051		HM536101	HM536085		Garcia-Sandoval et al. 2017
518	*Clavariadelphus truncatus*	67280	AY574649			DQ219064		DQ219240	Hosaka et al 2006
520	*Gautieria crispa*	61308	DQ218484			DQ219068		DQ219244	Hosaka et al 2006

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
524	*Phaeoclavulina grandis*	122773	DQ218618			DQ219074		DQ219252	Hosaka etal 2006
525	*Ramaria araiospora*	M739	AF213068			DQ219076		DQ219254	Hosaka etal 2006
528	*Kavinia alboviridis*	O102140	AY574692			DQ219073		DQ219250	Hosaka et al. 2005
529	*Cyclomyces lamellatus*	Cui7629	JQ279617				JQ279603		He and Dai 2012
530	*Hydnochaete asetosa*	Dai10756	JQ279642				JQ279559		He and Dai 2012
531	*Inonotus griseus*	Dai 13436	KX364823		KX364871	KX364919	KX364802		Bian and Dai 2017
532	*Arambarria destruens*	CIEFAPcc 347	KP347523				KP347538		Rajchenberg et al. 2015 monograph
535	*Fomitiporella austroasiana T*	Dai 16244	MG657320				MG657328		Ji et al. 2018
536	*Fomitiporia mediterranea*	AFTOL-ID 688	AY684157	AY662664	AY864870	AY803748	AY854080	AY885149	Mantheny et al. 2006
537	*Fulvifomes hainanensis T*	Dai 11573	JX866779				KC879263		Zhou et al. 2014
540	*Hymenochaete bambusicola T*	He 4116	KY425681				KY425674		Nie et al. 2017
541	*Inocutis dryophila*	DLL2012-001	KU139255			KU139317	KU139186		Brazee 2015
544	*Nothophellinus andinopatagonicus*	MR10431B	KP347529				KP347534		Rajchenberg et al. 2015
545	*Onnia leporina*	BRNM 712782					FJ775542	FJ775573	Tomsovsky et al. 2010
547	*Phellinopsis asetosa*	Dai 13553	KJ425523				KJ425524		Zhou et al. 2015
548	*Phellinotus neoaridus*	URM80362	KM211286				KM211294		Drechsler-Santos et al. 2016
549	*Phellinus ellipsoideus*	Cui 4270	JQ837955				JQ837948		Cui and Decock 2013

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
550	*Porodaedalea chinensis*	Cui 10252	MH152358			MH101479	KX673606	MG585301	Dai et al. 2017
551	*Pseudochaete subrigidula T*	He1157	JQ716409				JQ716403		He and Li 2013
566	*Palifer verecunda*	KHL 12261	DQ873643				DQ873642		Larsson et al. 2006
568	*Rogersella griselinae*	5289b	DQ873651				DQ873651		Larsson et al. 2006
570	*Oxyporus corticola*	ZRL20151459	KY418899	KY418954		KY419038	LT716075	KY419087	Zhao et al. 2017
573	*Cotylidia pannosa*	V. Haikonen 25824		MF319000			MF319061		unpublished
579	*Peniophorella praetermissum*	AFTOL-ID 518	AY700185	AY707094	AY864871	AY787221	AY854081	AY885150	Matheny et al. 2006
582	*Austrogautieria sp1*	OSC 80139	DQ218479			DQ218953		DQ219130	Hosaka etal 2006
584	*Gallacea dingleyae*	OSC 59606	DQ218539			DQ218959		DQ219137	Hosaka etal 2006
587	*Aroramyces gelatinosporus*	H4010	DQ218524			DQ218941		DQ219118	Hosaka etal 2006
592	*Hysterangium neotunicatum*	OSC T15545	DQ218550			DQ218986		DQ219161	Hosaka et al. 2008
595	*Boninogaster phalloides*	TNS-F-59692	KJ629154				KJ629155		Hosaka 2014
597	*Chondrogaster pachysporus*	OSC 49298	DQ218538			DQ218958		DQ219136	Hosaka et al. 2008
599	*Gummiglobus joyceae*	OSC 59485	DQ218488			DQ218968			Hosaka et al. 2008
600	*Malajczukia amicosum*	OSC59295	DQ218508			DQ219030		DQ219208	Hosaka et al 2006
601	*Mesophellia clelandii*	OSC59292	DQ218511			DQ219033		DQ219211	Hosaka et al 2006
602	*Nothocastoreum cretaceum*	OSC79925	DQ218594			DQ219037		DQ219216	Hosaka et al 2006

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
603	*Andebbia pachythrix*	OSC58809	DQ218523			DQ218940		DQ219117	Hosaka et al 2006
604	*Castoreum sp.*	OSC122814	DQ218536			DQ218956		DQ219134	Hosaka et al 2006
605	*Mesophellia arenaria*	OSC59306	DQ218589			DQ219032		DQ219210	Hosaka et al 2006
606	*Phallogaster saccatus*	OSCT13202	DQ218595			DQ219038		DQ219217	Hosaka et al 2006
607	*Protubera hautuensis*	OSC59673	DQ218517			DQ219039		DQ219218	Hosaka et al 2006
611	*Trappea pinyonensis*	OSFAHF530	DQ218597			DQ219043		DQ219221	Hosaka et al 2006
612	*Phallobata alba*	PDD76197	DQ218642			DQ219103		DQ219278	Hosaka et al 2006
614	*Jaapia argillacea*	CBS252 74	GU187581	AF518581	GU187463	GU187788	GU187524	GU187711	Binder et al 2010
618	*Gelopellis sp*	H4397	DQ218630			DQ219090		DQ219269	Hosaka et al 2006
619	*Kjeldsenia aureispora*	56970	DQ218637			DQ219097		DQ219274	Hosaka et al 2006
625	*Lysurus borealis*	39531	DQ218641			DQ219100		DQ219276	Hosaka et al 2006
629	*Aseroë rubra*	OSC122632	DQ218625			DQ219082		DQ219261	Hosaka et al 2006
630	*Clathrus chrysomycelinus*	PDD75096	DQ218626			DQ219083		DQ219262	Hosaka et al 2006
634	*Lysurus mokusin*	MB-02-012	DQ218507			DQ219101		DQ219277	Hosaka et al 2006
635	*Mutinus elegans*	OSC107657	AY574643			DQ219102			Hosaka et al 2006
636	*Phallus hadriani*	AFTOL-ID 683	AY885165	AY771601		DQ408114	DQ404385	DQ435792	Matheny et al. 2006
637	*Ganoderma australe*	ZRL20151500	KY418900	KY418955			LT716076	KY419088	Zhao et al. 2017
639	*Tomophagus colossus*	TC-02 TNM			KJ143963		KJ143923	KJ143943	Zhou et al. 2015
641	*Anomoloma albolutescens*	CFMR:L-6088	GU187563	GU187618	GU187438	GU187768	GU187507	GU187671	Binder et al. 2010

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
642	*Anomoporia bombycina*	CFMR:L-6240	GU187564	GU187611		GU187765	GU187508	GU187674	Binder et al. 2010
648	*Daedalea africana*	O 15372	KP171216	KR605871		KR610795	KP171196	KR610704	Han et al. 2016
652	*Fomitopsis pinicola*	Cui 10312	KR605720	KR605856		KR610780	KR605781	KR610689	Han et al. 2016
653	*Fragifomes niveomarginatus*	Cui 10108	KR605717	KR605851		KR610776	KR605778	KR610684	Han et al. 2016
655	*Ischnoderma resinosum*	FD-328	KP135225		KP134884	KP134972	KP135303		Justo et al. 2017
656	*Laetiporus sulphureus*	Dai 12154	KF951302	KR605924		KR610841	KF951295	KR610752	Song et al. 2014
657	*Niveoporofomes spraguei*	JV 0509/62	KR605725	KR605864		KR610788	KR605786	KR610697	Han et al. 2016
662	*Fomitopsis betulinus*	L-15603	KC585202		KY949005		KC585373		Justo et al. 2017
665	*Rhodofomitopsis feei*	Oinonen 6011906	KC844856	KR605837		KR610767	KC844851	KR610671	Han and Cui 2015
667	*Ungulidaedalea fragilis*	Cui 10919	KF937290	KR605840		KR610770	KF937286	KR610674	Han et al. 2014
668	*Fragiliporia fragilis T*	Dai 13080	KJ734264			KJ790248	KJ734260	KJ790245	Zhao et al. 2015
671	*Pycnoporus sanguineus*	ZRL2015009	KY418902	KY418957	KY418983	KY419040	LT716078	KY419090	Zhao et al. 2017
672	*Trametes versicolor*	ZRL20151477	KY418903	KY418958	KY418984	KY419041	LT716079	KY419091	Zhao et al. 2017
676	*Aurantiporus albidus*	CIEFAP-117	KY948848		KY948925		KY948739		Justo et al. 2017
680	*Coriolopsis polyzona*	Cui 11040	KR605767	KR605932	KX880836	KR610849	KR605824	KR610760	Han et al. 2016
681	*Cryptoporus volvatus*	DOM21791	AF393050	AF334907		AY218479			Wang et al. 2004
682	*Daedaleopsis confragosa*	WD747	AB368062			AB368120	GU731549		Sotome et al. 2009

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
683	*Datronia mollis*	RLG6304	JN164791	AF334909	JN164818	JN164872	JN165002	JN164901	Justo and Hibbett 2011
684	*Datroniella melanocarpa T*	Cui 10646	KC415194			KC415201	KC415186	KX838429	Li et al. 2014
685	*Dentocorticium sulphurellum*	FP11801	JN164815		JN164841	JN164875	JN165015	JN164903	Justo and Hibbett 2011
688	*Earliella scabrosa*	PR1209	JN164793	AY336766	JN164819	JN164866	JN165009	JN164894	Justo and Hibbett 2011
691	*Epithele macarangae*	FP-150881	KY948843		KY948909		KY948713		Justo et al. 2017
692	*Favolus acervatus*	Cui 11053	KU189805	KU189835	KU189889	KU189994	KU189774	KU189920	Zhou et al. 2016
697	*Grammothele aff. Fuligo*	FP-150657	KY948840		KY948908		KY948716		Justo et al. 2017
698	*Grammothelopsis subtropica*	Cui 9035 T	JQ845097				JQ845094	KF181124	Zhao et al. 2012
700	*Haploporus odorus*	Yuan 2365	KU941870			KU941917	KU941846	KU941933	Shen et al. 2016
701	*Heliocybe sulcata*	IBUG 9930	HM536069	HM536070		HM536114	HM536095	HM536115	Garcia-Sandoval et al. 2011
702	*Hexagonia tenuis*	Niemela€-9032	KY948842		KY949042		KY948738		Justo et al. 2017
706	*Leptoporus mollis*	TJV-93-174-T	EU402510		KY948957		KY948795		Justo et al. 2017
707	*Lignosus hainanensis*	Dai 10670 T	GU580886				NR 154112		Cui et al. 2011
708	*Lopharia cinerascens*	FP105043sp	JN164813			JN164874	JN165019	JN164900	Justo and Hibbett 2011
710	*Megasporoporia bannaensis*	Dai 12306 T	JQ314379				JQ314362	KF494979	Zhao et al. 2015; Li and Cui 2013
711	*Megasporoporiella lacerata*	Yuan 3880 T	JQ314395				JQ314377	KF286334	Li and Cui 2013
712	*Melanoderma microcarpum*	Cui 10970	KX900712		KX900791	KX900814	KX900662	KX900845	unpublished

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
714	*Microporus xanthopus*	PEN79	AB368075	AY336756		AB368133			Sotome et al. 2016
716	*Neodatronia sinensis*	Dai 11921 T	JX559283			JX559320	JX559272		Li et al. 2014
717	*Neofavolus alveolaris*	Dai 11290	KU189799	KU189828	KU189885	KU189982	KU189768	KU189913	Zhou et al. 2016
718	*Neofomitella polyzonata*	Cui 11035	KX900717		KX900794		KX900667	KX900850	unpublished
721	*Perenniporia hainaniana*	Cui 6364	JQ861759				JQ861743	KF181138	Zhao et al., 2014
722	*Perenniporiella chaquenia*	MUCL 47647	FJ393855				FJ411083	HM467609	Robledo et al., 2009
723	*Picipes badius*	Cui 11136	KU189812	KU189845	KU189895	KU189990	KU189781	KU189930	Zhou et al. 2016
724	*Polyporus squamosus*	Cui 10595	KU189809	KU189840	KU189892	KU189988	KU189778	KU189925	Zhou et al. 2016
725	*Porogramme albocincta*	PR-1478-T	KY948838		KY948906		KY948725		Justo et al. 2017
726	*Pseudofavolus cucullatus*	Dai 13894	KX880664				KX880626	KX880882	unpublished
733	*Sparsitubus nelumbiformis*	Cui 8497	KX880670			KX880856	KX880631	KX880887	unpublished
735	*Theleporus minisporus*	Dai 12011	KX880675		KX880821		NR119986	KX880891	Zhou et al. 2012
736	*Tinctoporellus epimiltinus*	CRM-55	KY948837		KY948905		KY948720		Justo et al. 2017
738	*Trametopsis cervina*	TJV 93 216T	JN164796		JN164839	JN164877	JN165020	JN164882	Justo and Hibbett 2011
741	*Vanderbylia fraxinea*	Dai 7182	KX081173		KX880847	KX880872	KX081123	KX880921	unpublished
742	*Wolfiporia dilatohypha*	CS-635913	KC585234		KY949026		KC585400		Ortiz-Santana et al. 2013
744	*Grifola frondosa*	DSH s n	AY629318	AY705960	AY864876	AY786057	AY854084	AY885153	Brandon Matheny

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
745	*Hydnopolyporus fimbriatus*	Meijer3729 O	JN649346			JX109875		JX109904	Binder et al. 2013
746	*Meripilus giganteus*	FP-135344-Sp	KP135228		KP134873	KP134894	KP135307		Floudas and Hibbett 2015
748	*Rigidoporus undatus*	Miettinen-13591	KY948870		KY948945		KY948731		Justo et al. 2017
749	*Irpex lacteus*	DO 421/951208	JX109852			JX109882	JX109852	JX109911	Binder et al 2013
752	*Bjerkandera adusta*	HHB-12826-Sp	KP135198		KP134784	KP134913	KP134983		Floudas and Hibbett 2015
760	*Hydnophlebia chrysorhiza*	FD-282	KP135217		KP134848	KP134897	KP135338		Floudas and Hibbett 2015
764	*Mycoacia fuscoatra*	HHB-10782-Sp	KP135265		KP134857		KP135365		Floudas and Hibbett 2015
768	*Phlebia radiata*	AFTOL-ID 484	AF287885		AY864881	AY218502	AY854087	AY885156	Matheny et al. 2006
770	*Pirex concentricus*	OSC-41587-Sp	KP135275		KP134843	KP134940	KP134984		Floudas and Hibbett 2015
773	*Sarcodontia crocea*	OMC-1488	KY948903		KY948928		KY948798		Justo et al. 2017
774	*Scopuloides rimosa*	RLG-5104	KP135283		KP134852	KP134904	KP135351		Floudas and Hibbett 2015
776	*Climacodon septentrionalis*	ZW	AY684165	AY705964	AY864872	AY780941	AY854082	AY885151	P Brandon Matheny
777	*Phanerochaete chrysosporium*	FPL5175	AF287883	AF026593	AY864880		AY854086	AY885155	Floudas & Hibbett 2015
779	*Byssomerulius corium*	FP-102382	KP135230		KP134802	KP134921	KP135007		Floudas and Hibbett 2015
780	*Candelabrochaete langloisii*	FP-110343-sp	KY948886		KY948981		KY948793		Justo et al. 2017
782	*Ceriporiopsis carnegieae*	RLG-7277-T	KY948854		KY948935		KY948792		Justo et al. 2017
783	*Efibula americana*	FP-102165	KP135256		KP134808	KP134916	KP135016		Floudas and Hibbett 2015
784	*Hyphodermella rosae*	FP-150552	KP135223		KP134823	KP134939	KP134978		Floudas and Hibbett 2015

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
785	*Meruliopsis albostramineus*	HHB-10729	KP135229		KP134787	KP134926	KP135051		Floudas and Hibbett 2015
790	*Rhizochaete americana*	FP-102188	KP135277		KP134815	KP134934	KP135409		Floudas and Hibbett 2015
791	*Terana caerulea*	FP-104073	KP135276		KP134865	KP134960	KP134980		Floudas and Hibbett 2015
797	*Phaeophlebiopsis caribbeana*	HHB-6990	KP135243		KP134810	KP134931	KP135415		Floudas and Hibbett 2015
800	*Byssoporia terrestris*	Hjm18172	EU118608				EU118608		Larsson 2007
802	*Polyporoletus sublividus*	JA030918	DQ389663				DQ389663		Larsson 2007
803	*Albatrellus roseus*	GJ1511	MF110295				MF110285		Khan et al. 2018
808	*Bondarzewia montana*	DAOM415	DQ234539		DQ256049	AY218474	DQ200923	DQ059044	Matheny et al. 2006
809	*Heterobasidion annosum*	DAOM73191			DQ667160	AY544206	DQ206988	DQ028584	Matheny et al. 2006
811	*Bondarzewia berkeleyi*	Dai 12759	KJ583216		KX066152	KX066162	KJ583202	KX066138	Song et al. 2016
812	*Heterobasidion annosum*	06129/6	KJ583225		KF033133	KF006499	KJ583211	KX252741	Song et al. 2016
814	*Echinodontium tinctorium*	DAOM16666	AF393056		AY864882	AY218482	AY854088	AY885157	Matheny et al. 2006
817	*Hericium americanum*	PBM2498	DQ411538				DQ206987	DQ028585	Matheny et al. 2006
819	*Dentipellicula austroafricana*	Dai 12580 T	KJ855275				KJ855274		Chen et al. 2015
821	*Lachnocladium sp.*	AFTOL-ID 155	DQ154110	DQ457625			DQ192176		Matheny et al. 2006
822	*Vararia abortiphysa*	CBS 630.81	KR364133			KR364266	KR364005		De Crop et al. 2017
823	*Russula cyanoxantha*	HMAS253220	KX441297	—	KX441791	KX442038	KX441050		Zhao et al. 2017

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
824	*Russula rosea*	HMAS253340	KX441299	—	KX441793	KX442040	KX441052		Zhao et al. 2017
829	*Lactarius lignyotus*	PBM2424	AY631898	DQ457626			DQ221107	DQ435787	Matheny et al. 2006
831	*Lactifluus deceptivus*	PBM2462	AY631899	AY707093	AY864884	AY803749	AY854089	AY885158	Matheny et al. 2006
834	*Multifurca ochricompacta*	BB02 107	DQ421984			DQ421940	DQ421984		unpublished
844	*Cristinia sp.*	FP-100305	GU187585	GU187637	GU187470	GU187793	GU187526	GU187718	Binder et al. 2010
845	*Mayamontana coccolobae*	Tle1294	KM086913				KM086819	KM087000	Lebel et al. 2014
846	*Stephanospora caroticolor*	KM20126	KM086918				KM086824	KM087008	Lebel et al. 2014
849	*Acanthofungus rimosus*	Wu9601-1	AY039333				MF043521		Dai et al. 2017
850	*Acanthophysellum cerussatum*	He2208	KY450785				KX306874		Dai et al. 2017
851	*Acanthophysium cerussatum*	FPL-11527	AY039335	AF518568					Hibbett and Binder 2002
852	*Aleurobotrys botryosus*	He2712	KY450788				KX306877		Dai and He 2017
854	*Aleurodiscus amorphus*	Ghobad-Nejhad2464	KU574832				KU559342	KU992717	Dai and He 2016
855	*Neoaleurodiscus fujii*	Wu0807-40	FJ799923				FJ799921		Wu et al. 2012
856	*Stereum hirsutum*	AFTOL-ID 492			AY864886	AY218520	AY854063	AY885159	Matheny et al. 2006
857	*Xylobolus frustulatus*	He2231	KU574825					KU992704	Dai and He 2017
863	*Larssoniporia incrustatocystidiata*	Dai 13608 T	KM107881				KM107864		Chen et al. 2016
866	*Pseudowrightoporia cylindrospora*	0810/1a	KJ807078				GU594161		Chen et al. 2016

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
867	*Wrightoporiopsis amylohypha*	Yuan 3579 T	KM107896				KM107877		Chen et al. 2016
868	*Sebacina incrustans*	AFTOL ID 1626	DQ521406	DQ521407					Matheny et al. 2006
870	*Sebacina sp.*	AFTOL-ID 1517	DQ521412	DQ521413			DQ911617		Matheny et al. 2006
871	*Tremellodendron pallidum*	AFTOL-ID 699	AY745701	AY766081		DQ408132	DQ411526	DQ029196	Matheny et al. 2006
876	*Bankera fuligineoalba*	REB-285				KF007978	JN135196		unpublished
878	*Sarcodon joeides*	REB-270				KF007968	KC571772		unpublished
879	*Thelephora ganbajun*	ZRL20151295	KY418908	KY418962	KY418987	KY419043	LT716082	KY419093	Zhao et al. 2017
880	*Tomentella sp*	AFTOL ID 1016	DQ835997	DQ092920		DQ835999	DQ835998		Matheny et al. 2006
881	*Lenzitopsis daii*	Yuan 2959 T	JN169795				JN169799		Zhou and Koljalg 2013
882	*Polyozellus multiplex*	AFTOL-ID 677	AY634275	AY771600		DQ408134	DQ411528	DQ028604	Matheny et al. 2006
885	*Subulicystidium sp*	KHL10780	AY586714				AY463468		Larsson et al. 2004
886	*Brevicellicium exile*	MA-Fungi 26554	HE963778				HE963777		Telleria et al. 2013
888	*Trechispora alnicola*	AFTOL-ID 665	AY635768	AY657012		DQ408135	DQ411529	DQ059052	Matheny et al. 2006
890	*Cerinomyces pallidus*	FP-150848		AB712488		AB712530	AB712446		Shirouzu et al. 2013
893	*Dacrymyces stillatus*	TUFC12835		AB712506		AB712548	AB712464		Shirouzu et al. 2013
894	*Dacryopinax spathularia*	AFTOL ID 454	AY701525	AY771603	AY857981		AY854070	AY881020	Matheny et al. 2006
895	*Ditiola radicata*	HHB12010	AB712435	AB712517		AB712559	AB712475		Shirouzu et al. 2013
896	*Guepiniopsis buccina*	AFTOL ID 888	AY745711	DQ667157		DQ385875	DQ206986		Matheny et al. 2006

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
898	*Unilacryma unisporus*	TNS-F-38904		AB712512		AB712554	AB712470		Shirouzu et al. 2013
899	*Cystofilobasidium bisporidii T*	CBS 6346	EU085532	AB072225	KF036419	KF036832	KF036597	KF037103	Liu et al 2015
900	*Itersonilia perplexans T*	CBS 363.85	AJ235274	AB072228		KF036900	AB072233		Liu et al 2015
901	*Mrakia blollopis T*	CBS 8921	AY038814	KF036683	KF036509	KF036923	AY038826	KF037184	Liu et al 2015
903	*Phaffia dendrorhous*	CBS 7918	AF075496	D31656	KF036582	KF036998	AF139628	KF037253	Liu et al 2015
904	*Tausonia pullulans T*	CBS 2532	EF551318	AB001766	KF036478	KF036892	AF444417	KF037155	Liu et al 2015
905	*Krasilnikovozyma huempii T*	CBS 8186	NG 058324		KF036377	KF036790	NR 073214	KF037062	Schoch et al. 2014
906	*Udeniomyces pyricola T*	CBS 6754	AF075507	D31659	KF036581	KF036997	AF444402	KF037252	Liu et al 2015
907	*Mrakia aquatic*	CBS 5443		AB032621	KF036516	KF036930	AF410469	KF037191	Scorzetti et al. 2002
908	*Filobasidium globisporum EXT*	CBS 7642	AF075495	AB075546	KF036476	KF036890	AF444336	KF037153	Liu et al 2015
909	*Goffeauzyma agrionensis T*	CBS 10799	EU627786	KF036611	KF036337	KF036749	KF036584	KF037020	Liu et al2015
910	*Piskurozyma capsuligenum*	CBS 1906	AF363642	AB075544	KF036473	KF036887	AF444381	KF037152	Liu et al2005
911	*Solicoccozyma aerius T*	CBS 155	AF075486	AB032614	KF036336	KF036748	AF145324	KF037019	Liu et al 2015
912	*Holtermannia corniformis R*	CBS 6979	AF189843	AF053718	KF036485		AF410472		Liu et al2015
913	*Holtermanniella festucosa T*	CBS 10162	AY462119	KF036633	KF036367	KF036779	AY462120	KF037052	Liu et al2015
920	*Bulleribasidium begonia T*	CBS 10762	AB119462	AB118874	KF036500	KF036914	AB118874	KF037177	Liu et al2015
921	*Derxomyces anomala T*	CBS 9607	EF682504	AF453291	KF036424	KF036838	AF453289	KF037110	Liu et al2015

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
923	*Dioszegia antarctica T*	CBS 10920	FJ640575	KF036667	KF036444	KF036858	DQ402529	KF037129	Liu et al2015
925	*Hannaell sinensis T*	CBS 7238	AF189884	D78328	KF036483	KF036897	AF444468	KF037160	Liu et al 2015
926	*Nielozyma formosana T*	CBS 10306	AB119465	AB118873	KF036321	KF036734	AB118873		Liu et al 2015
928	*Carcinomyces arundinariae T*	CBS 9931	AF547661	AF547660	KF036319	KF036732	AF547662		Liu et al2005
929	*Heterocephalacria arrabidensis*	CBS 8678	AF181535	KF036621	KF036349	KF036762	AF444362	KF037034	Liu et al. 2015
930	*Syzygospora alba*	AM147	JN043616	JN043563			JN053509		Millanes et al. 2011
931	*Kwoniella dendrophila T*	CBS 6074	AF189870	D31649	KF036320	KF036733	AF444443	KF037005	Liu et al 2015
932	*Fellomyces borneensis T*	CBS 8282	AF189877	AB032659	KF036458	KF036872	AJ608642	KF037141	Liu et al2015
934	*Kockovaella thailandica T*	CBS 7552	AF075516	D64133	KF036496	KF036910	AB054095	KF037173	Liu et al 2015
935	*Sterigmatosporidium polymorphum*	CBS9644	AY032662	KF036664	KF036418	KF036831	KF036596	KF037102	Liu et al. 2015
936	*Naematelia aurantia R*	CBS 6965	AF189842	KF036693	KF036522	KF036937	AF444315	KF037199	Liu et al2015
937	*Dimennazyma cistialbidi T*	CBS 10049	AY562135	KF036626	KF036358	KF036770	KF036589	KF037043	Liu et al. 2015
938	*Gelidatrema spencermartinsiae T*	CBS 10760	DQ513279	KF036654	KF036404	KF036818	EU249514	KF037089	Liu et al. 2015
944	*Tremella flava R*	CBS 8471	AF042221	KF036699	KF036527	KF036943	AF042403	KF037205	Liu et al 2015
946	*Cryptococcus neoformans*	CBS 132	AF075484	HQ596559	KF036472	KF036886	AF444326	KF037151	Liu et al. 2015
947	*Dioszegia athyri*	CBS 10119	EU070931	KF036668	KF036445	KF036859	EU070926	KF037130	Liu et al. 2015
948	*Naganishia saitoi*	CBS 1975	AF181540	KF036651	KF036400	KF036814	AF444372	KF037085	Liu et al. 2015

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
949	*Tremella mesenterica*	CBS 6973	AF075518	KF036705	KF036533	KF036949	AF444433	KF037210	Liu et al. 2015
950	*Trimorphomyces papilionaceus*	CBS 443.92	AF075491	KF036726	KF036576	KF036993	AF444483	KF037249	Liu et al. 2015
951	*Tsuchiyaea wingfieldii*	CBS 7118		D64121	KF036577	KF036994	AF444327	KF037250	Liu et al. 2015
952	*Saitozyma podzolica T*	CBS 6819	AF075481	AB032645	KF036396	KF036810	AF444321	KF037081	Liu et al 2015
953	*Sugitazyma miyagiana*	CBS 7526	AF189858	D31651	KF036328	KF036740	AF444409	KF037011	Liu et al. 2015
954	*Takashimella formosensis*	CBS 9812	AY787858	AB072235	KF036322	KF036735	AY787859	KF037006	Liu et al 2015
955	*Tetragoniomyces uliginosus*	AM186	JN043621	JN043564			JN053514		Millanes et al. 2011
956	*Cryptotrichosporon anacardii*	CBS 9551	AY550002	DQ242636	KF036417	KF036830	AY549985	KF037101	Liu et al. 2015
958	*Apiotrichum dulcitum T*	CBS 8257	AF075517	AB001755	KF036551	KF036967	AF444428	KF037227	Liu et al 2015
960	*Cutaneotrichosporon cutaneum T*	CBS 2466	AF075483	KF036712	KF036545	KF036961	AF444325	KF037221	Liu et al 2015
961	*Trichosporon inkin T*	CBS 5585	AF105396	AB001757	KF036555	KF036971	AF444420	KF037231	Liu et al 2015
962	*Vanrija musci T*	CBS 8899	AB126586	AB039378	KF036387	KF036800	AB035579	KF037072	Liu et al 2015
963	*Effuseotrichosporon vanderwaltii*	CBS 12124	KY107670				NR 153975		Vu et al. 2016
964	*Haglerozyma chiarellii T*	CBS 11177	NG 058301				KY103494		Vu et al. 2016
965	*Trichosporon aquatile*	CBS 5973	AF075520	AB001730	KF036538	KF036954	AF410475	KF037215	Liu et al. 2015
966	*Pseudobensingtonia ingoldii T*	JCM 7445		D38234	KJ707961	KJ708148	AF444519	KJ707752	Wang et al 2015

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
967	*Sterigmatomyces halophilus T*	CBS 4609	AF177416	D64119	KF036521	KF036936	AF444556	KF037198	Liu et al2005
968	*Sterigmatomyces hyphaenes*	CBS 7811	AF177406	AY665775	KJ707965	KJ708145	AF444553	KJ707749	Wang et al 2015
969	*Sterigmatomyces pulcherrimum*	f219	L20277	AY373391					Berres et al 1995; McLaughlin et al 2004
970	*Ballistosporomyces sasicola*	AS 2 1933	AF177412	AB021688	KJ707990	KJ708335	AF444548	KJ707900	Wang et al 2015
1018	*Ballistosporomyces xanthus T*	AS 2957	AF177414	D64118	KJ707993	KJ708343	AF444547	KJ707902	Wang et al 2015
971	*Chionosphaera apobasidialis T*	CBS7430	AF177407	U77662					Sampaio et al 1999b; Swann et al 1999
972	*Kurtzmanomyces nectairei T*	AS 2 1950	AF177409	D64122	KJ707980	KJ708176	AF444494	KJ707884	Wang et al 2015
973	*Mycogloea sp.*	TUBFO40962	AY512868	DQ198791					Wang et al 2015
979	*Cystobasidiopsis nirenbergiae T*	BBA 65452	FJ536254				GQ180106		Wang et al 2015
974	*Jianyunia sakaguchii T*	JCM 10047	AF363646	AB001746	KJ707958	KJ708155	AF444626	KJ707891	Wang et al. 2015
975	*Mycogloea nipponica*	CBS 11308	KJ708456	KJ708370	KJ707982	KJ708194	KJ778629	KJ707882	Wang et al. 2015
976	*Bensingtonia ciliata T*	AS 2 1945	AF189887	D38233	KF706509	KF706536	AF444563	KF706486	Wang et al 2015
977	*Kondoa malvinella T*	AS 2 1946	AF189903	D13776	KJ708021	KJ708173	AF444498	KJ707896	Wang et al 2015
978	*Ruinenia rubra T*	AS 2958	AF189992	AB021686	KJ707983	KJ708333	AF444550	KJ707899	Wang et al 2015
981	*Helicogloea lagerheimii T*	DB 1025	AY512849	AY124476					Begerow et al 2003unpublished; Bauer et al 2003

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
982	*Platygloea vestita*	TUB FO39734	AY512872	AY124480					Begerow et al 2003 unpublished;Bauer et al 2003
983	*Atractiella solani*	TUB F107	AY512831	DQ198797					Oberwinkler et al. 2006
984	*Phleogena faginea*	AFTOL-ID 1889	DQ831021	DQ831022					Matheny et al. 2006
985	*Proceropycnis hameedii*	PMI 927 T	MG765270	MG765269			KF428609		Aime et al. 2018
987	*Buckleyzyma armeniaca T*	JCM 8977	AF189920	AB126644	KP216521	KJ708211	AF444523	KJ707762	Wang et al 2015
986	*Classicula fluitans T*	ATCC 64713	AY512838	AY124478					Begerow et al 2003 unpublished;Bauer et al 2003
992	*Cyphobasidium hypogymniicola T*	S-F264671	KU587694	KU587705			KU587700		MILLANES et al. 2016
988	*Cystobasidium benthicum*	JCM 10901		AB126647	KJ708081	KJ708214	AB026001	KJ707842	Wang et al 2015
989	*Cystobasidium fimetarium*	DB1489	AY512843	AY124479				LM644071	Wang et al 2015
990	*Cystobasidium pallidum*	CBS 320	AF189962	AB126651					Fell et al 2000;Nagahama et al 2003 unpublished
991	*Occultifur externus*	IGC4823	AF189911	AY124475					Fell et al 2000;Bauer et al 2003
993	*Bannoa bischofiae T*	JCM 10338	AB082572	AB035721	KJ708018	KJ708292	AB035721	KJ707777	Wang et al 2015
994	*Erythrobasidium hasegawianum T*	AS 2 1923	AF189899	D12803	KF706506	KF706534	AF444522	KJ707776	Wang et al 2015
995	*Cyrenella elegans T*	CBS 274 82	KJ708454	KJ708360	KJ708080	KJ708168	KJ778626	KJ707830	Wang et al 2015
996	*Hasegawazyma lactosa T*	CBS 5826	AF189936	D45366					Fell et al 2000;Suh et al 1996a
1036	*Helicobasidium mompa*	CBS 278.51	AY254179	U77064					Lutz et al 2004a;Swann et al 1999

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1037	*Tuberculina maxima*	CBS 137.66	AY292408				AY292437		Zhao et al. 2017
1001	*Heterogastridium pycnidioideum T*	TUB F76	AY512851	U41567					Begerow et al 2003 unpublished;1651 Swann and Taylor 1995
1002	*Colacogloea peniophorae T*	CBS 684.93	AY629313	DQ234565	DQ234569	DQ234550	DQ202270	DQ234566	Wang et al 2015
1003	*Pycnopulvinus aurantiacus T*	MCA2548	KJ676979				NR 138394		Toome et al. 2014
1020	*Bannozyma yamatoana T*	AS 2956	AF189896	D38239	KJ708141	KJ708160	AF444634	KJ707948	Wang et al. 2015
1021	*Chrysozyma griseoflava T*	JCM 5653		D66884	KJ708143	KJ708305	AF444557	KJ707950	Wang et al. 2015
1022	*Fellozyma inositophila T*	JCM 5654	AF189987	AB021673	KJ708136	KJ708306	AF444559	KJ707951	Wang et al. 2015
1023	*Hamamotoa singularis T*	JCM 5356	AF189996	AB021690	KJ708140	KJ708336	AF444600	KJ707957	Wang et al. 2015
1017	*Sporobolomyces oryzicola*	CBS 7228	AF189990	AB021677					Fell et al 2000;Hamamoto and Nakase 2000
1024	*Curvibasidium pallidicorallinum*	CBS:9091	KY107299				KY102982	KJ707767	Vu et al. 2016
1025	*Glaciozyma martinii*	CBS:10620	KY107753				KY103469		Vu et al. 2016
1026	*Oberwinklerozyma yarrowii T*	JCM 8232	AF189971	AB032658		KJ708275	AF444628	KJ707938	Wang et al. 2015
1027	*Pseudohyphozyma buffonii T*	JCM 3929	AF189924	KJ708362	KJ708127	KJ708217	AF444526	KJ707946	Wang et al. 2015
1028	*Sampaiozyma ingeniosa T*	JCM 9031	AF189934	KJ708445	KJ708004	KJ708237	AF444534	KJ707803	Wang et al. 2015
1029	*Slooffia tsugae T*	JCM 2960	AF189998	AB021692		KJ708340	AF444580	KJ707945	Wang et al. 2015
1030	*Spencerozyma crocea T*	CBS 2029	AY372179	KJ708410	KJ708007	KJ708223	FM957565	KP216513	Wang et al. 2015

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1031	*Trigonosporomyces hylophilus T*	JCM 1805	AF363645	KJ708431	KJ708008	KJ708236	AF444622	KJ707764	Wang et al. 2015
1032	*Udeniozyma ferulica T*	JCM 8231	AF363653	KJ708379	KJ708129	KJ708229	AF444528	KJ707940	Wang et al. 2015
1033	*Vonarxula javanica T*	JCM 9032	AF189935	KJ708446	KJ708006	KJ708238	AF444532	KJ707766	Wang et al. 2015
1034	*Yunzhangia auriculariae T*	JCM 1597	AF189922	KJ708429	KJ708134	KJ708213	AF444507	KJ707935	Wang et al. 2015
1004	*Meredithblackwellia eburnea T*	MCA4105	JX508798	JX508797					Toome et al. 2014
1005	*Phenoliferia psychrophenolica T*	CBS 10438	EF151255	KJ708382	KJ708071	KJ708259	EF151246	KJ707859	Wang et al. 2015
1006	*Yamadamyces rosulata T*	CBS 10977	EU872490	KJ708384		KJ708263	EU872492	KJ707854	Wang et al 2015
1007	*Leucosporidium intermedium*	IGC 5340T	AY512859	D38235					Begerow et al 2003 unpublished;Takashima et al 1995a
1008	*Leucosporidium scottii T*	CBS 5930	AF070419	KF036682	KF036499	KF036913	AF444495	KF037176	Liu et al2005
1009	*Microbotryum reticulatum*	RB 2057	AY213003	U79566					Sampaio et al 2003;Swann et al 1999
1011	*Sphacelotheca hydropiperis T*	CBS 179.24	KJ708463	KJ708394	KJ708041	KJ708281		KJ707807	Want et al. 2015
1012	*Ustilentyloma fluitans*	RB 900	AF009882	AY124481					Begerow et al 1997;Bauer et al 2003
1013	*Ustilentyloma graminis*	AFTOL-ID 674	AY631901	AY657013					Matheny et al 2004 unpublished;Matheny et al 2004 unpublished
1035	*Mixia osmundae T*	IAM14511	AB052840	D14163					Sjamsuridzal et al 2002;Nishida et al 1995
997	*Naohidea sebacea T*	CBS 8477	DQ831020	KP216515	KF706508	KF706535	DQ911616	KF706487	Wang et al 2015

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1039	*Eocronartium muscicola*	MIN796447	AF014825	AY123323					Bruns and Szaro 1997 unpublished;Wingfield et al 2004
1040	*Jola cf. javensis*	DJM739	DQ416207	DQ416206					Aime et al 2006
1041	*Insolibasidium deformans T*	AFTOL-ID 722	AY646099	AY123292					Matheny et al 2004 unpublished;Wingfield et al 2004
1042	*Platygloea disciformis*	AFTOL-ID 710	AY629314	DQ234563					Matheny et al 2004 unpublished;Matheny et al 2005 unpublished
1043	*Maravalia cryptostegiae*	BRIP:56898	KT199401	KT199387					McTaggart et al. 2016
1044	*Chrysomyxa arctostaphyli*	AFTOL-ID 442	AY700192	AY657009					Aime et al 2006
1045	*Coleosporium asterum*	TDB1464	AF522164	AY123286					Aime et al 2006
1046	*Cronartium ribicola*	TDB27354	AF522166	M94338					Aime et al 2006
1047	*Cronartium harknessii*	AFTOL-ID 456	AY700193	AY665785					Aime et al 2006
1085	*Aecidium kalanchoes*	BPI 843633	NG 056952	DQ354524					Aime et al. 2006
1086	*Caeoma torreyae*	U1168/U808	MG907207	MG907197					Aime et al. 2018
1087	*Hemileia vastatrix T*	BRIP 61233	KT199399	DQ354565					McTaggart et al. 2016
1088	*Sphenorchidium xylopiae T*	NY s.n.248	KM217355	KM217372					Beenken and Wood 2015
1048	*Melampsora lini*	5261	L20283	AY125396					Bauer et al 2006
1049	*Phakopsora myrtacearum*	PREM 61155	NG060142				NR132913		Maier et al. 2016
1050	*Phragmidium sp.*	WM 1024	AF426215	AY125405		AY485630			Matheny et al 2007

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1051	*Gymnoconia peckiana*	AFTOL-ID 1630		DQ521422			DQ521421		Mathney et al. 2006
1052	*Hamaspora acutissima*	BRIP:55606	KT199398	KT199385					McTaggart et al. 2016
1053	*Kuehneola uredinis*	AFTOL-ID 987	AY745696	DQ092919			DQ911604		Mathney et al. 2006
1054	*Phragmidium punjabense*	ISL-10509	KX358854				KX358856		Ali et al. 2017
1055	*Trachyspora intrusa*	BPI 84328		DQ354549			DQ354550		Aime et al 2006
1056	*Pileolaria toxicodendri*	AFTOL-ID 988	AY745699	DQ092921					Mathney et al. 2006
1057	*Uromycladium fusisporum*	BRIP 57526	KJ632991	KJ633031			KJ633009		Doungsa-ard et al. 2014
1058	*Gymnosporangium juniperi-virginianae*	AFTOL-ID 712	AY629316	DQ667158					Aime et al 2006
1059	*Allodus podophylli T*	BPI 842277		DQ354544			DQ354543		Aime et al 2006
1060	*Cumminsiella mirabilissima*	BPI 871101	DQ354531	DQ354530					Aime et al 2006
1061	*Cystopsora notelaeae*	BRIP 58325	KT199396	KT199384					McTaggart et al. 2016
1062	*Gymnosporangium huanglongense*	BJFC-R01985	KT719162				KT719168		Cao et al. 2016
1063	*Puccinia hordei*	AFTOL-ID 1402	DQ354527	DQ831030					Matheny et al. 2006
1064	*Uromyces appendiculatus T*	AFTOL-ID 976	AY745704				DQ411531	DQ028595	Matheny et al. 2006
1065	*Hyalopsora polypodii*	DB 1681	AY512852	AB011015					Aime et al 2006
1066	*Pucciniastrum goeppertianum*	TDB1497	AF522180	AY123305					Aime et al 2006
1067	*Hyalopsora polypodii*	PDD 71999	KJ698627	KJ746817					Padamsee and McKenzie 2014

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1068	*Dietelia duguetiae*	PUR 87978		KM217382			KM217365		unpublished
1069	*Triphragmium ulmariae T*	WM 1027	AF426219	AY125401					Aime et al 2006
1070	*Diorchidium woodii T*	ZT Myc 582		KM217370			KM217352		Beenken and Wood 2015
1071	*Endoraecium acaciae T*	BPI 871098	DQ323916	DQ323917					Scholler and Aime 2006
1072	*Kernkampella breyniae*	BRIP:56909	KJ862346	KJ862428					McTaggart et al. 2015
1073	*Nyssopsora thwaitesii*	AMH:9528		KF850482			KF550283		unpublished
1074	*Racospermyces koae*	MCA2961	DQ323918	MG907203					Aime et al. 2018
1075	*Ravenelia acaciaepennatulae*	U115	MG907213	MG907204					Aime et al. 2018
1076	*Sphaerophragmium acaciae T*	BRIP 56910	KJ862350	KJ862429					McTaggart et al. 2016
1077	*Sphenospora kevorkianii*	BPI 863558		DQ354520			DQ354521		Aime et al. 2006
1078	*Dasyspora amazonica*	BPI 0116382	JF263460	JF263496					McTaggart et al. 2016
1079	*Leucotelium cerasi T*	KR-M-0037198	KX228776				KX228771		unpublished
1080	*Macruropyxis fraxini T*	ZT Myc 56551		KP858144			KP858145		Beenken and Wood 2015
1082	*Porotenus biporus*	ZT Myc 3414	JF263494	JF263510					Beenken et al. 2012
1083	*Prospodium lippiae*	AFTOL-ID 1401	DQ354555	DQ831024					Matheny et al. 2006
1084	*Tranzschelia arthurii*	MCA4540	MG907212	MG907202					Aime et al. 2018
998	*Microsporomyces magnisporus T*	JCM 11898	AB111954	KJ708428	KJ708013	KJ708317	AB112078	KJ707780	Wang et al 2015

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
999	*Sakaguchia lamellibrachiae*	CBS 9598	AB025999	AB126646	KJ708098	KJ708314	AB025999	KJ707876	Wang et al 2015
1000	*Symmetrospora coprosmae*	JCM 8772	AF189980	D66880	KJ707966	KJ708296	AF444577	KJ707798	Wang et al 2015
1089	*Septobasidium canescens*	DUKE:DAH323	DQ241479	DQ241410					Bauer et al 2006
1090	*Auriculoscypha anacardiicola T*	AFTOL-ID 1885	DQ419920	DQ419921					Matheny et al. 2006
1091	*Uredinella coccidiophaga T*	DUKE:DAH217c	DQ241504	DQ241435					Henk and Vilgalys 2007
980	*Phyllozyma novozealandica*	JCM 8756	KJ708467	KJ708443	KJ708073	KJ708319	AB038048	KJ707851	Wang et al 2015
1019	*Rhodotorula glutinis T*	JCM 8208	AF070429	X69853			AF444539	KJ707869	Wang et al. 2015
1015	*Rhodosporidiobolus azoricus*	JCM 11251	AF321977	AB073269	KJ708053	KJ708202	AB073229	KJ707813	Wang et al 2015
1016	*Rhodotorula diobovata*	JCM 3787	AF070421	AB073271	KJ708091	KJ708277	AF444502	KJ707865	Wang et al 2015
1092	*Tritirachium roseum*	CBS 183.42	KF258731	JF779655			JF779669		Schell et al 2011，Nguyen et al. 2014
1093	*Paratritirachium curvibasidium*	DAOM 242439	KF258729	KF258735			KF258725		Nguyen et al. 2014
1096	*Ceraceosorus bombacis T*	ATCC22867	KP413033	DQ875377					Begerow et al. 2006, Riess et al. 2016
1097	*Doassansia hygrophilae*	HUV 15474	AF007524	DQ198788					Begerow et al 2007
1098	*Rhamphospora nymphaeae T*	CBS72 38	DQ831032	DQ831033		DQ831035	DQ831034	DQ831036	Wang et al. 2014
1099	*Tilletiopsis washingtonensis T*	CBS544 50 T	AJ235278	AJ271382		DQ835995	DQ835994	DQ835996	Wang et al. 2014
1100	*Entyloma calendulae*	CBS 746.85	DQ663687	KP322948		DQ663690	DQ663689	KP323124	Wang et al 2015

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1101	*Dicellomyces scirpi*	RB 1032 TUB	AF487385	DQ363304					Begerow et al 2007
1102	*Meira geulakonigii T*	CBS 436.72	AY158668	KP322954	KP322919	KP323083	AY158674	KP323141	Wang et al. 2015
1104	*Acaromyces ingoldii T*	CBS 110050	AY158665		KP322920	KP323078	AY158671	KP323145	Wang et al. 2015
1105	*Laurobasidium lauri T*	MAFF238665	AB177562				AB180359		Wang et al 2014
1106	*Clinoconidium sawadae*	R. Kirschner 4219	KX196603				KX196600		Jiang and Kirschner 2016
1107	*Exobasidium rhododendri*	CBS 101457	DQ667151	DQ667152	DQ667155	DQ667154	DQ667153	DQ667156	Wang et al. 2014
1108	*Exobasidium gracile*	AFTOL-ID 1643	DQ663699	DQ785786	DQ663702	DQ663701	DQ663700	DQ663703	Matheny et al. 2006
1110	*Graphiola phoenicis T*	FO 29350 TUB	AF009862	DQ363306					Begerow et al 2007
1112	*Georgefischeria riveae T*	HUV 15614	AF009861	DQ363312					Begerow et al 2007
1113	*Jamesdicksonia dactylidis*	RB 915 TUB	AF009853	DQ363310					Begerow et al 2007
1114	*Gjaerumia minor*	CBS 543.50	AJ235287				KP322989		Boekhout et al. 1995
1115	*Phragmotaenium derxii*	CBS 110078	AB052823				AB045707		Wang et al 2014
1116	*Tilletiaria anomala T*	CBS 436.72	AJ235284	AY803752		AY803750	DQ234558	DQ835991	Wang et al. 2015
1117	*Golubevia pallescens T*	CBS364 85 T	AJ235292	KP322973	KP322943	KP323101	DQ317636	KP323123	Wang et al 2015
1118	*Jaminaea angkoriensis T*	C5b	EU587489	EU604148			EU604147		Wang et al. 2014
1119	*Pseudomicrostroma glucosiphilum*	MCA4718	KR912072	KR912075			KR912070		Kijpornyongpan and Aime 2017
1120	*Microstroma juglandis*	CBS287 63	AF009867	DQ789987	DQ789990	DQ789989	DQ789988	DQ789991	Wang et al. 2014

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1121	*Sympodiomycopsis kandeliae*	CBS 10858	DQ990016				DQ990017		Wang et al. 2014
1122	*Quambalaria cyanescens*	CBS876 73	DQ317616	KF706440		KF706531	DQ317623	KF706485	Wang et al. 2014
1123	*Volvocisporium triumfetticola T*	RB 2070 TUB	AF352053	DQ875384					Begerow et al. 2001
1124	*Robbauera albescens T*	CBS608 83 T	AJ235289	KP322968	KP322942	KP323095	KP322986	KP323127	Wang et al 2015
1125	*Erratomyces patelii T*	MP 1991 M	AF009855	DQ363309					Begerow et al 2007
1126	*Conidiosporomyces ayresii T*	HUV 15197	AF009848	DQ363303					Begerow et al 2007
1127	*Tilletia goloskokovii*	LMC 321	AY818998	DQ832247	DQ832250	DQ832249	DQ832248	DQ832251	Wang et al. 2014
1128	*Malassezia restricta*	CBS 7877	AF064026	EU192367	KF706496	KF706520	AY743636	KF706471	Wang et al 2014
1129	*Moniliella acetoabutens T*	CBS 169 66	AF335523	KF706443	KF706500	KF706523	EU252153	KF706476	Wang et al 2014
1130	*Violaceomyces palustris T*	SA 807	KM591583	KM591584			KM591585	KM591586	Albu et al. 2015
1131	*Doassansiopsis limnocharidis*	HUV 15198	AF009850				DQ875344		Aime et al 2006
1132	*Fereydounia khargensis T*	IBRCM30116	KJ490641				KJ490642		Wang et al. 2014
1133	*Antherospora hortensis*	KR ml1645	KC175330				KC175337		Piątek et al. 2013
1134	*Floromyces anemarrhenae T*	HUV 21482	EU221284				JN104591		Piątek et al. 2013
1135	*Thecaphora spilanthis*	JAG53	DQ832241				DQ832243		Wang et al. 2014
1136	*Urocystis eranthidis*	hmk292	JN367324	JN367352	JN367428		JN367299	JN367375	Wang et al. 2014

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1137	*Flamingomyces ruppiae T*	TUB012165	DQ185436				EF635909		Bauer et al. 2007
1138	*Melanoxa oxalidis T*	HUV1436	EF635908				EF635907		wang et al. 2014
1139	*Mundkurella kalopanacis*	HUV16732	AF009869				DQ875351		wang et al. 2014
1140	*Ustacystis waldsteiniae T*	FO 38439TUB	AF009880				DQ875356		Aime et al 2006
1141	*Vankya ornithogali T*	TUB015993	EF210712				EF635910		Wang et al. 2014
1142	*Cintractia limitata*	HAJB 10488	DQ645506	DQ645507	DQ645510	DQ645509	DQ645508	DQ645511	Wang et al. 2014
1143	*Farysia acheniorum*	AS 2 3198	AF190001	AJ496256	KF706499	KF706522	AB038128	KF706474	Wang et al. 2014
1144	*Heterotolyposporium piluliforme*	HUV 15732	AF009871				DQ875345		Begerow et al. 2007 Begerow et al. 2006
1145	*Leucocintractia aff. leucodermoides*	AFTOL-ID 1642	DQ667166	DQ667167			DQ667168		Mantheny et al. 2006
1146	*Moreaua bulbostylidis*	56581 M	DQ875366				DQ875349		Wang et al. 2014
1147	*Schizonella melanogramma T*	CBS174 42	DQ832210	DQ832211	DQ832214	DQ832213	DQ832212	DQ832215	Wang et al. 2014
1148	*Stegocintractia luzulae T*	MP2340	AJ236148				DQ875353		Wang et al. 2014
1149	*Testicularia cyperi T*	MCA3645	KU147242	KU147241			KU147240		Kijpornyongpan and Aime unpublished, Kijpornyongpan et al. 2018
1150	*Tolyposporium junci T*	HUV17168	AF009876				AY344994		Wang et al 2014
1151	*Trichocintractia utriculicola T*	MP 2075	AF009877				DQ875354		Begerow et al 2007
1152	*Ustanciosporium gigantosporum*	HRK023	JN367325		JN367429		JN367300	JN367376	Wang et al. 2014

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1153	*Dermatosorus cyperi*	HUV15991	AJ236157				DQ875343		Wang et al. 2014
1154	*Farysizyma itapuensis T*	BI120	DQ767831				DQ767831		Inacio et al. 2008
1155	*Melanopsichium pennsylvanicum*	HUV 17548	AY740093	DQ363314			AY740040		Begerow et al 2007
1156	*Melanotaenium euphorbiae T*	HUV17733	JN367314	JN367342			JN367289	JN367365	Wang et al. 2014
1157	*Uleiella chilensis*	TUB 020322	KF061293		KF061319				Riess et al. 2016
1158	*Anomalomyces panici T*	BRIP46421	DQ459347				DQ459348		Wang et al. 2014
1159	*Anthracocystis pampara*	JCM 2007	KP322980	KP322961	KP322908	KP323066	KP322980		Wang et al. 2014
1160	*Franzpetrakia microstegii T*	HUV 21217	GU139170				GU139171		Vanky and Lutz unpubl. data
1161	*Kalmanozyma fusiformata*	CBS 6951	AB089367				AB089366		Wang et al. 2014
1162	*Langdonia aristidae*	HUV 19145	JN367317		JN367422		JN367292	JN367369	Wang et al. 2014
1163	*Macalpinomyces eriachnes T*	CBS 131454	JN367312		JN367417	KP323074	JN367287	KP323142	Wang et al 2014
1164	*Moesziomyces bullatus T*	CBS 425.34	DQ831011	DQ831012	DQ831015	DQ831014	DQ831013		Wang et al 2014
1165	*Pattersoniomyces tillandsiae T*	UFMG-CM-Y1455	KT784807				KT321120		Piątek et al. 2017
1166	*Pseudozyma prolifica T*	CBS 319.87	AJ235298	AF294724	DQ352825	KP323089	AF294700	DQ352831	Wang et al 2014
1167	*Shivasia solida T*	H.U.V. 17649	JF966730				JF966731		Lutz et al. 2012
1168	*Sporisorium reilianum*	CBS131460	KF706430	KF706441		KF706511	KF706438	KF706472	Wang et al. 2014
1169	*Stollia ewartii T*	BRIP51818	HQ013127				HQ013087		Wang et al 2014

Table 1 Sequence information used in the divergence time estimation for Basidiomycota (continued)

Number	Species	Collection No	LSU	SSU	RPB1	RPB2	ITS5 8S	EF1	Reference
1170	*Tranzscheliella williamsii*	CBS 131475	JN367338	KP322974	KP322923	KP323068	JN367310	KP323156	Wang et al. 2014
1171	*Triodiomyces altilis T*	BRIP52543	HQ013136				AY740166		Wang et al. 2014
1172	*Tubisorus pachycarpus T*	HUV 21891	JN871717				JN871718		Wang et al. 2014
1173	*Ustilago hordei T*	CBS131470	KF706429	KF706442	KF706498	KF706521	KF706437	KF706473	Wang et al. 2014
1174	*Websdanea lyginiae T*	HUV 17900	AJ236159				DQ875357		Wang et al. 2014
1175	*Basidioascus undulatus T*	CBS133763	JX242883	JX242889			JX242863		Nguyen et al. 2013
1176	*Geminibasidium donsium T*	DAOM241966	JX242886	JX242892			JX242877		Nguyen et al. 2013
1177	*Wallemia ichthyophaga T*	EXF994	DQ847516	AY741382	DQ847522	DQ847519	AY302521	DQ847525	Matheny et al. 2007

2.3 Results

The phylogenetic and dating analyses of Basidiomycota were conducted based on three datasets, composed of six-gene (LSU, SSU, 5.8s, rpb1, rpb2, ef1) sequences from species of subphyla Agaricomycotina, Pucciniomycotina, Ustilaginomycotina and Wallemiomycotina.

2.3.1 The phylogeny and divergence time analyses of Agaricomycotina

In the phylogenetic analyses of Agaricomycotina, 430 species from Agaricomycotina and six outgroup species from Pucciniomycotina were included. Those species belong to three classes, 26 orders, 98 familes and 412 genera. Figure 1 shows the backbone-constrained tree at the order level, and Figure 2 is the same tree with more detail at the family and genus levels. Generally, orders and higher taxa including Agaricomycetes, Dacrymycetes and Tremellomycetes were well supported (Fig. 1). However, the subclass Agaricomycetidae, comprising by Agaricales, Amylocorticiales, Atheliales, Boletales and Jaapiales, did not receive statistic support. Phallomycetidae, comprising Hysterangiales, Phallales, Gomphales and Geastrales, was monophyletic with 0.9 PP support. The phylogenetic relationships of the main clades in Boletales roughly agree with Binder and Hibbett 2006 which gave a phylogenetic relationships among suborders based on a five-genes dataset. In Boletacae, Zangiodeae represented by *Zangia* and *Harrya* is recognized and supported statistically, which agrees with Wu et al. 2014. However, phylogenetic relationships of the other genera are not resolved because of low statistical support. The well-supported taxa were dated with an estimated divergence time for Agaricomycotina as 406 Mya; the classes ranged from 298–341 Mya; and orders from 108–259 Mya.

The analyses involving Agaricomycetes comprised 77 families and 352 genera, the Dacrymycetes cmprised three families and six genera, and the Tremellomycetes with 18 families and 54 genera (Fig. 2). A total of 45 monophyletic families were recognized with well-supported PP values, and these families belong to 14 orders as Agaricales, Boletales, Cystofilobasidiales, Dacrymycetales, Filobasidiales, Gomphales, Hymenochaetales, Hysterangiales, Phallales, Polyporales, Russulales, Thelephorales,

Tremellales and Trichosporonales. The divergence times of these well-supported families were estimated, ranging from 27 to 178 Mya.

2.3.2 The phylogeny and divergence time analyses of Pucciniomycotina

For the phylogenetic analyses of Pucciniomycotina, the MCC tree was generated from the six-gene sequences of 125 species from Pucciniomycotina and six species from Agaricomycotina as the outgroup (Fig. 3). In this tree, Pucciniomycetes comprised four orders, 17 families, 56 genera, and occupied the base position; whilst Agaricostilbomycetes, Atractiellomycetes, Classiculomycetes, Cystobasidiomycetes, Microbotryomycetes, Mixiomycetes, Spiculogloeomycetes and Tritirachiomycetes comprised of 16 orders, 24 families and 61 genera formed a clade without statistical support.

All classes and orders were monophyletic with high supports. The classes originated from 211 to 383 Mya and orders from 128 to 244 Mya. Families in Agaricostilbales (Agaricostilbaceae, Chionosphaeraceae, Kondoaceae and Ruineniaceae), Microbotryales (Leucosporidiaceae, Microbotryaceae and Ustilentylomataceae), Pucciniales (Coleosporiaceae, Mikronegeriaceae, Phakopsoraceae, Phragmidiaceae, Pileolariaceae, Pucciniaceae, Raveneliaceae, and Sphaerophragmiaceae), and Platygloeales (Eocronartiaceae and Platygloeaceae) were well supported and diverged between 85 to 222 Mya. Three monophyletic and highly supported lineages (*Mycogloea* sp./TUBFO40962; *Slooffia tsugae*/JCM 2960 and *Udeniozyma ferulica*/JCM 8231; *Spencerozyma crocea*/CBS 2029 and *Vonarxula javanica*/JCM 9032) did not nest with any known families (Fig. 3). Divergence times of these clades are 266 Mya, 188 Mya and 156 Mya, respectively.

2.3.3 The phylogeny and divergence time analyses of Ustilaginomycotina and Wallemiomycotina

In the phylogenetic analyses of Ustilaginomycotina, a six-gene (LSU, SSU, 5.8s, rpb1, rpb2 and ef1) dataset was used, which comprised of 74 species from Ustilaginomycotina, three species from Wallemiomycotina, and two species from Pucciniomycotina as the outgroup. Wallemiomycotina occupied the basal position with strong support with a divergence time of 430 Mya in MCC tree (Fig. 4). There were

four classes In Ustilaginomycotina, of which Moniliellomycetes and Malasseziomycetes were each represented by a single sample. Ustilaginomycetes included four orders, 12 families and 45 genera and formed a strongly-supported monophyletic clade. Exobasidiomycetes was polyphyletic and comprised seven orders, 13 families and 27 genera. The estimated divergence time for Ustilaginomycotina was 430 Mya, orders originated from 172 to 260 Mya and families originated from 79 to 177 Mya.

There were also several well-supported lineages with similar divergence times to those of families in Ustilaginomycotina, but they did not nest within any known family. They are two clades in Ustilaginales, one formed by *Farysia acheniorum*/AS 2 3198, *Farysizyma itapuensis*/BI120, *Schizonella melanogramma*/CBS174 42, *Stegocintractia luzulae*/MP2340 and *Shivasia solida*/H.U.V.17649 with a divergence time of 114 Mya, and another one includes *Moreaua bulbostylidis*/56581 (M) with a divergence time of 114 Mya. One clade in Microstromatales comprising *Jaminaea angkoriensis*/C5b and *Sympodiomycopsis kandeliae*/CBS 10858 had a divergence time of 98 Mya.

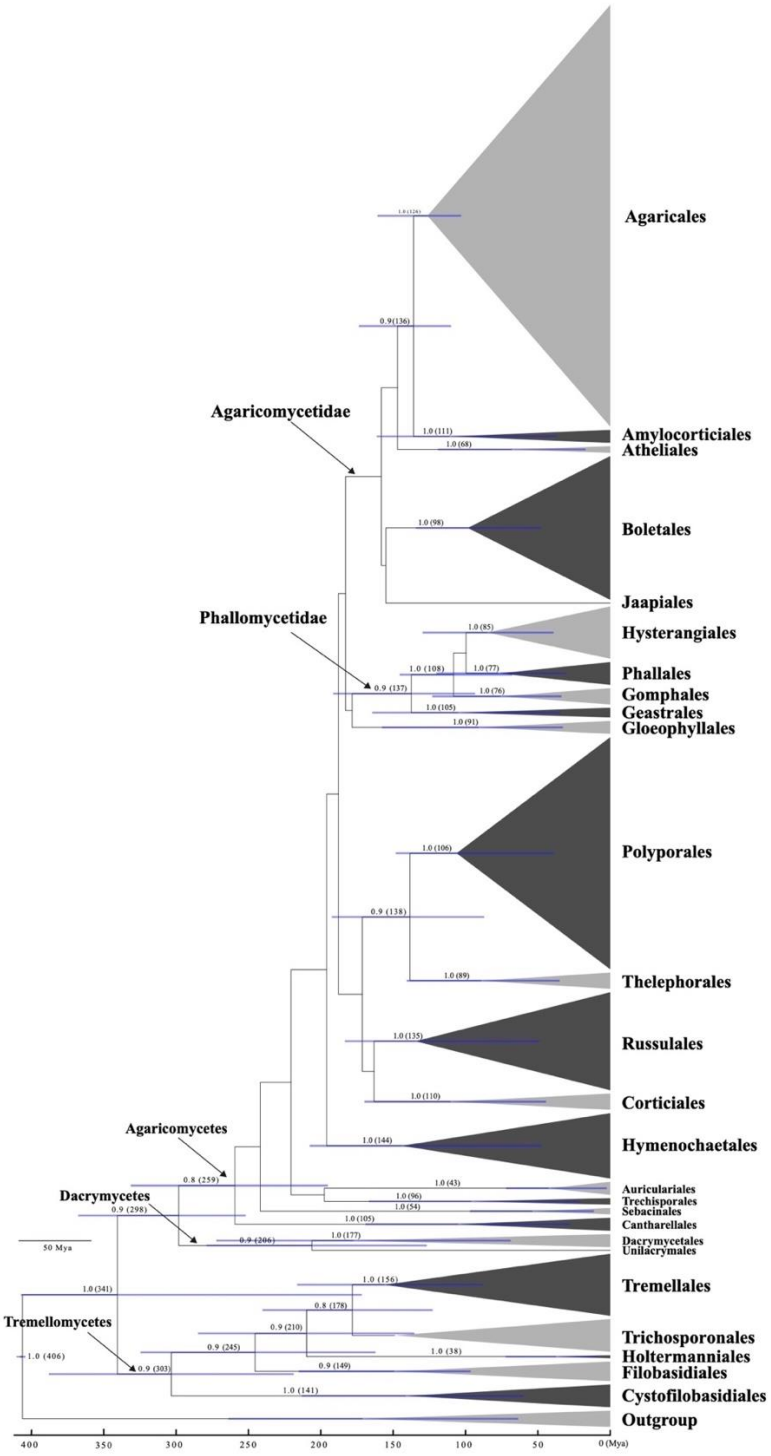

Figure 1 Maximum Clade Credibility tree showing the relationships among classes and orders of Agaricomycotina based on LSU, SSU, rpb1, rpb2, 5.8s and ef1 genes with Pucciniomycotina as the outgroup. Posterior probabilities equal to or greater than 0.8 are annotated at the internodes. The 95% highest posterior densities of divergence time estimates are marked by horizontal bars.

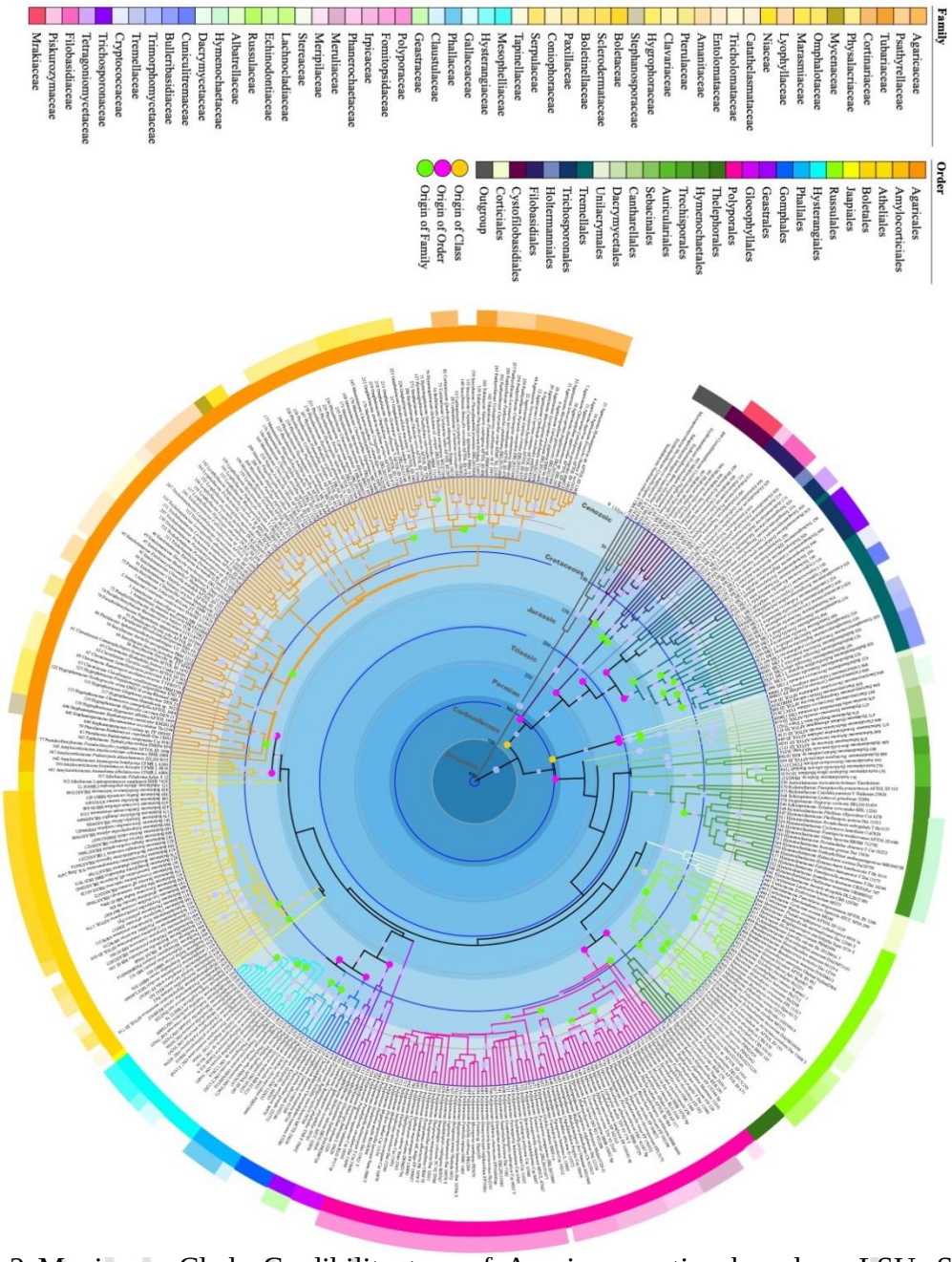

Figure 2 Maximum Clade Credibility tree of Agaricomycotina based on LSU, SSU, rpb1, rpb2, 5.8s and ef1 genes with Pucciniomycotina as the outgroup. Posterior probabilities that are equal to or greater than 0.8 are annotated at the internodes as purple dots. The coloured dots refer to the positions of the mean stem age of classes, orders and families respectively.

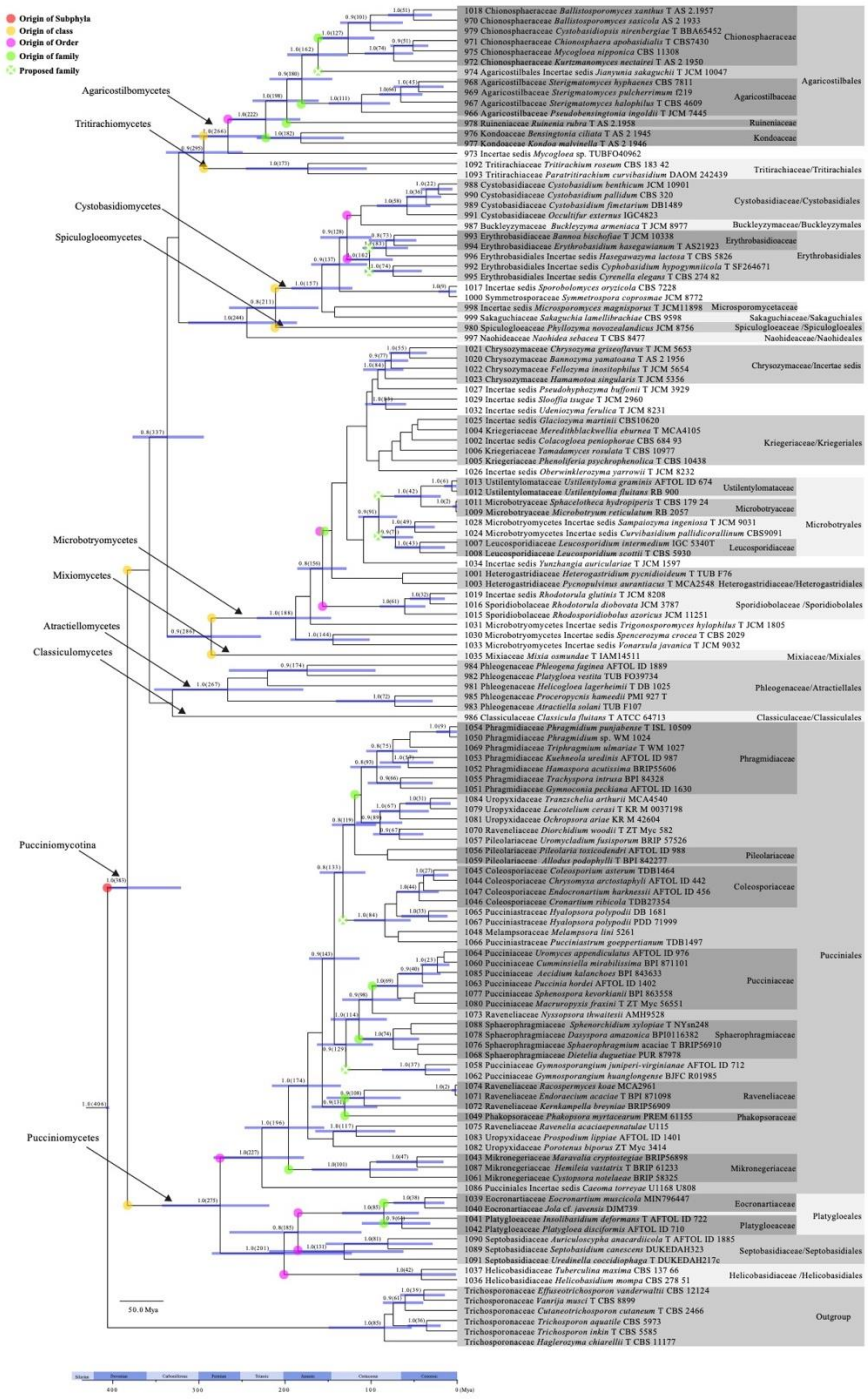

Figure 3 Maximum Clade Credibility tree of Pucciniomycotina based on LSU, SSU, rpb1, rpb2, 5.8s and ef1 genes with the Agaricomycotina as outgroup. Posterior probabilities which equal to or greater than 0.8 are annotated at the internodes. The 95% highest posterior density of divergence time estimates are marked by horizontal bars. The coloured dots refer to the positions of the mean stem age of subphyla, classes, orders, families and potentially new families respectively.

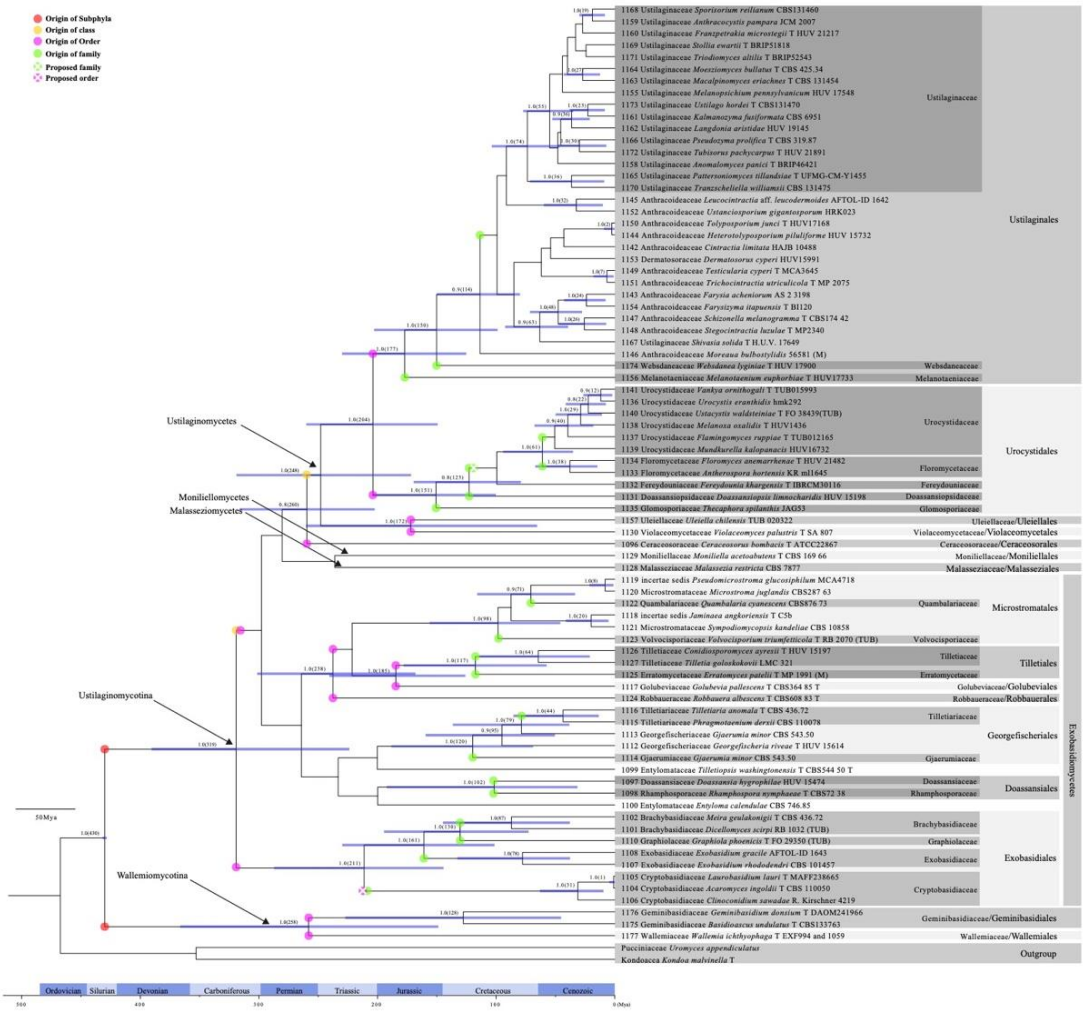

Figure 4 Maximum Clade Credibility tree of Ustilaginomycotina based on LSU, SSU, rpb1, rpb2, 5.8s and ef1 genes with Pucciniomycotina as the outgroup. Posterior probabilities which equal to or greater than 0.8 are annotated at the internodes. The 95% highest posterior density of divergence time estimates are marked by horizontal bars. The coloured dots refer to the positions of the mean stem age of subphyla, classes, orders, families, and potentially new families and orders respectively.

2.3.4 Outline of Basidiomycota

Phylum Basidiomycota R.T. Moore 1980
Subphylum Agaricomycotina Doweld 2001
Class Agaricomycetes Doweld 2001
Order Agaricales Underw. 1899
Family Agaricaceae Chevall. 1826
Abstoma G. Cunn. 1926
Acutocapillitium P. Ponce de León 1976
Agaricus L. 1753
= *Araneosa* Long 1941
= *Gyrophragmium* Mont. 1843
= *Hypophyllum* Paulet 1793
= *Longula* Zeller 1945
= *Psalliota* (Fr.) P. Kumm. 1871
= *Pratella* (Pers.) Gray 1821
Arachnion Schwein. 1822
= *Scoleciocarpus* Berk. 1843
Barcheria T. Lebel 2004
Battarrea Pers. 1801
= *Dendromyces* Libosch. 1810
= *Sphaericeps* Welw. & Curr. 1868
Battarreoides T. Herrera 1953
= *Battarraeastrum* R. Heim & T. Herrera 1960
Calvatiopsis Hollós 1929
Chamaemyces Battarra ex Earle 1909
= *Drosella* Maire 1935
= *Lepiotella* (E.-J. Gilbert) Konrad 1934
Chlamydopus Speg. 1898
Chlorolepiota Sathe & S.D. Deshp. 1979
Chlorophyllum Massee 1898
Clarkeinda Kuntze 1891
= *Chitonia* (Fr.) P. Karst. 1879
= *Chitoniella* Henn. 1898
= *Chitonis* Clem. 1909
Clavogaster Henn. 1896
Coniolepiota Vellinga 2011
Coprinus Pers. 1797
= *Coprinusella* (Peck) Zerov 1979
= *Onchopus* P. Karst. 1879
Crucispora E. Horak 1971
Cystolepiota Singer 1952
= *Pulverolepiota* Bon 1993
Dictyocephalos L.M. Underwood ex V.S. White 1901
= *Battarreopsis* Henn. 1902
= *Whetstonia* Lloyd 1906
Disciseda Czern. 1845
= *Bovistina* Long & Stouffer 1941

= *Catastoma* Morgan 1892
Echinoderma (Locq. ex Bon) Bon 1991
Endolepiotula Singer 1963
Eriocybe Vellinga 2011
Gasterellopsis Routien 1940
Glyptoderma R. Heim & Perr.-Bertr. 1971
Heinemannomyces Watling 1999
Hiatulopsis Singer & Grinling 1967
Holocotylon Lloyd 1906
Hymenagaricus Heinem. 1981
Janauaria Singer 1986
Japonogaster Kobayasi 1989
Lepiota (Pers.) Gray 1821
= *Amogaster* Castellano 1995
= *Cribrospora* Pacioni & P. Fantini 2000
= *Cryptolepiota* Kropp & Trappe 2012
= *Fusispora* Fayod 1889
= *Lepiota* P. Browne 1756
= *Lepiotula* (Maire) Locq. ex E. Horak 1968
= *Morobia* E. Horak 1979
Leucoagaricus Locq. ex Singer 1948
= *Sericeomyces* Heinem. 1978
Leucocoprinus Pat. 1888
= *Mastocephalus* Battarra ex Earle 1909
Lycoperdopsis Henn. 1900
Macrolepiota Singer 1948
= *Lepiotella* Rick 1938
= *Volvolepiota* Singer 1959
Melanophyllum Velen. 1921
= *Chlorosperma* Murrill 1922
= *Chlorospora* Massee 1898
= *Glaucospora* Rea 1922
Metrodia Raithelh. 1971
Micropsalliota Höhn. 1914
= *Allopsalliota* Nauta & Bas 1999
Montagnea Fr. 1836
Mycenastrum Desv. 1842
= *Endonevrum* Czern. 1845
Neosecotium Singer & A.H. Sm. 1960
Panaeolopsis Singer 1969
Phellorinia Berk. 1843
= *Areolaria* Kalchbr. 1884
= *Cyphellomyces* Speg. 1906
= *Xylopodium* Mont. 1845
Phyllogaster Pegler 1969
Podaxis Desv. 1809
= *Catachyon* (Ehrenb. ex Fr.) Fr. 1832
= *Cauloglossum* Grev. ex Fr. 1829

= *Chainoderma* Massee 1890
= *Schweinitzia* Grev. 1823
Pseudoauricularia Kobayasi 1982
Pseudolepiota Z.W. Ge 2017
Queletia Fr. 1872
Rugosospora Heinem. 1973
Schinzinia Fayod 1889
Schizostoma Ehrenb. ex Lév. 1846
Singerina Sathe & S.D. Deshp. 1981
Smithiogaster J.E. Wright 1975
Smithiomyces Singer 1944
Termiticola E. Horak 1979
Tulostoma Pers. 1794
= *Tulasnodea* Fr. 1849
Xanthagaricus (Heinem.) Little Flower, Hosag. & T.K. Abraham 1997
Xerocoprinus Maire 1907

Family Amanitaceae E.-J. Gilbert 1940
Amanita Pers. 1797
= *Agaricus* Raf. 1830
= *Amanitaria* E.-J. Gilbert 1940
= *Amanitina* E.-J. Gilbert 1940
= *Amanitella* Earle 1909
= *Amanitopsis* Roze 1876
= *Amarrendia* Bougher & T. Lebel 2002
= *Amidella* E.-J. Gilbert 1940
= *Amplariella* E.-J. Gilbert 1940
= *Ariella* E.-J. Gilbert 1940
= *Aspidella* E.-J. Gilbert 1940
= *Boletium* Clem. 1909
= *Lepidella* E.-J. Gilbert 1925
= *Leucomyces* Battarra ex Earle 1909
= *Pseudofarinaceus* Battarra ex Kuntze 1891
= *Saproamanita* Redhead, Vizzini, Drehmel & Contu 2016
= *Torrendia* Bres. 1902
= *Vaginaria* Forq. 1886
= *Vaginarius* Roussel 1806
= *Vaginata* Nees ex Gray 1821
= *Volvella* E.-J. Gilbert & Beeli 1940
= *Volvoamanita* (Beck) E. Horak 1968
= *Volvoboletus* Henn. 1898
Catatrama Franco-Mol. 1991
Limacella Earle 1909
= *Amanitella* Maire 1913
Limacellopsis Zhu L. Yang, Q. Cai & Y.Y. Cui 2018
Zhuliangomyces Redhead 2019
= *Myxoderma* Fayod ex Kühner 1926

Family Bolbitiaceae Singer 1948
Agrogaster D.A. Reid 1986

Bolbitius Fr. 1838
= *Pluteolus* (Fr.) Gillet 1876
Conocybe Fayod 1889
= *Gastrocybe* Watling 1968
= *Pseudoconocybe* Hongo 1967
= *Raddetes* P. Karst. 1887
Cyttarophyllopsis R. Heim 1968
Descolea Singer 1952
= *Descomyces* Bougher & Castellano 1993
= *Hymenangium* Klotzsch 1839
= *Pseudodescolea* Raithelh. 1980
= *Setchelliogaster* Pouzar 1958
= *Timgrovea* G. Cunn. 1993
Galerella Earle 1909
Galeropsis Velen. 1930
= *Cyttarophyllum* (R. Heim) Singer 1936
= *Psammomyces* Lebedeva 1932
Gymnoglossum Massee 1891
Pholiotina Fayod 1889
Ptychella Roze & Boud. 1879
Rhodoarrhenia Singer 1964
Tubariella E. Horak & Hauskn. 2002
Tubariopsis R. Heim 1931
Tympanella E. Horak 1971
Wielandomyces Raithelh. 1988

Family Broomeiaceae Zeller 1948
Broomeia Berk. 1844

Family Biannulariaceae Jülich 1981
= Catathelasmataceae Wasser 1985
Anupama K.N.A. Raj, K.P.D. Latha & Manim. 2019
Callistosporium Singer 1944
Catathelasma Lovejoy 1910
= *Biannularia* Beck 1922
Guyanagarika Sánchez-García, T.W. Henkel & Aime 2016
Macrocybe Pegler & Lodge 1998
Pleurocollybia Singer 1947
Pseudolaccaria Vizzini, Contu & Z.W. Ge 2015

Family Chromocyphellaceae Knudsen 2010
Chromocyphella De Toni & Levi 1888
= *Cymbella* Pat. 1886
= *Phaeocarpus* Pat. 1887
= *Phaeocyphella* Pat. 1900
= *Phaeocyphella* Speg. 1909
Phaeosolenia Speg. 1902

Family Clavariaceae Chevall. 1826
Camarophyllopsis Herink 1958
= *Hygrotrama* Singer 1959
Clavaria Vaill. ex L. 1753

= *Clavaria* P. Micheli 1729
= *Holocoryne* (Fr.) Bonord. 1851
= *Stichoclavaria* Ulbr. 1928
Clavicorona Doty 1947
Clavulinopsis Overeem 1923
= *Donkella* Doty 1950
= *Ramaria* Holmsk. 1790
Hirticlavula J.H. Petersen & Læssøe 2014
Hodophilus R. Heim 1958
Hyphodontiella Å. Strid 1975
Lamelloclavaria Birkebak & Adamčík 2016
Ramariopsis (Donk) Corner 1950
Setigeroclavula R.H. Petersen 1988

Family Cortinariaceae R. Heim ex Pouzar 1983
Cortinarius (Pers.) Gray 1821
= *Bulbopodium* Earle 1909
= *Cereicium* Locq. 1979
= *Cuphocybe* R. Heim 1951
= *Cyanicium* Locq. 1979
= *Cystocybe* Velen. 1921
= *Dermocybe* (Fr.) Wünsche 1877
= *Gomphos* Kuntze 1891
= *Hydrocybe* (Fr. ex Rabenh.) Wünsche 1877
= *Hydrocybium* Earle 1909
= *Hydrotelamonia* Rob. Henry 1957
= *Hygramaricium* Locq. 1979
= *Hygromyxacium* Locq. 1979
= *Inoloma* (Fr.) Wünsche 1877
= *Locellina* Gillet 1876
= *Meliderma* Velen. 1920
= *Myxacium* (Fr.) P. Kumm. 1871
= *Myxopholis* Locq. 1979
= *Phlegmacium* (Fr.) Wünsche 1877
= *Raphanozon* P. Kumm. 1871
= *Rapacea* E. Horak 1999
= *Rozites* P. Karst. 1879
= *Sericeocybe* Rob. Henry 1993
= *Sphaerotrachys* Fayod 1889
= *Squamaphlegma* Locq. 1979
= *Telamonia* (Fr.) Wünsche 1877
= *Thaxterogaster* Singer 1951
= *Volvigerum* (E. Horak & M.M. Moser) R. Heim 1966
= *Weinzettlia* Velen. 1921
Protoglossum Massee 1891
= *Cortinomyces* Bougher & Castellano 1993
Pyrrhoglossum Singer 1944
Quadrispora Bougher & Castellano 1993
Stephanopus M.M. Moser & E. Horak 1975

Family Crassisporiaceae Vizzini, Consiglio & M. Marchetti 2019

Crassisporium Matheny, P.-A. Moreau & Vizzini 2014

Romagnesiella Contu, Matheny, P.-A. Moreau, Vizzini & A. de Haan 2014

Family Crepidotaceae (S. Imai) Singer 1951

Crepidotus (Fr.) Staude 1857

= *Calathinus* Quél. 1886

= *Cyphellathelia* Jülich 1972

= *Dochmiopus* Pat. 1887

= *Octojuga* Fayod 1889

= *Phaeoglabrotricha* W.B. Cooke 1961

= *Phaeomyces* E. Horak 2005

= *Phialocybe* P. Karst. 1879

= *Pleurotellus* Fayod 1889

= *Tremellastrum* Clem. 1909

= *Tremellopsis* Pat. 1903

Episphaeria Donk 1962

Nanstelocephala Oberw. & R.H. Petersen 1990

Pellidiscus Donk 1959

Pleuroflammula Singer 1946

Simocybe P. Karst. 1879

= *Ramicola* Velen. 1929

Family Cyphellaceae Lotsy 1907

Asterocyphella W.B. Cooke 1961

Campanophyllum Cifuentes & R.H. Petersen 2003

Catilla Pat. 1915

Cheimonophyllum Singer 1955

Chondrostereum Pouzar 1959

Cunninghammyces Stalpers 1985

Cyphella Fr. 1822

= *Dendrocyphella* Petch 1922

Gloeocorticium Hjortstam & Ryvarden 1986

Gloeostereum S. Ito & S. Imai 1933

Granulobasidium Jülich 1979

Hyphoradulum Pouzar 1987

Incrustocalyptella Agerer 1983

Phaeoporotheleum (W.B. Cooke) W.B. Cooke 1961

Seticyphella Agerer 1983

Sphaerobasidioscypha Agerer 1983

Thujacorticium Ginns 1988

Family Cystostereaceae Jülich 1982

Cericium Hjortstam 1995

Crustomyces Jülich 1978

Cystidiodontia Hjortstam 1983

Cystostereum Pouzar 1959

Parvobasidium Jülich 1975

Parvodontia Hjortstam & Ryvarden 2004

Rigidotubus J. Song, Y.C. Dai & B.K. Cui 2018

Family Entolomataceae Kotl. & Pouzar 1972

Clitocella Kluting, T.J. Baroni & Bergemann 2014
Clitopilopsis Maire 1937
Clitopilus (Fr. ex Rabenh.) P. Kumm. 1871
= *Hexajuga* Fayod 1889
= *Orcella* Battarra ex Clem. 1896
Entocybe T.J. Baroni, V. Hofst. & Largent 2011
Entoloma P. Kumm. 1871
= *Alboleptonia* Largent & R.G. Benedict 1970
= *Arenicola* Velen. 1947
= *Calliderma* (Romagn.) Largent 1994
= *Claudopus* Gillet 1876
= *Eccilia* (Fr.) P. Kumm. 1871
= *Fibropilus* (Noordel.) Largent 1994
= *Inocephalus* (Noordel.) P.D. Orton 1991
= *Inopilus* (Romagn.) Pegler 1983
= *Latzinaea* Kuntze 1891
= *Leptonia* (Fr.) P. Kumm. 1871
= *Leptoniella* Earle 1909
= *Nigropogon* Coker & Couch 1928
= *Nolanea* (Fr.) P. Kumm. 1871
= *Omphaliopsis* (Noordel.) P.D. Orton 1991
= *Paraeccilia* Largent 1994
= *Paraleptonia* (Romagn. ex Noordel.) P.D. Orton 1991
= *Pouzarella* Mazzer 1976
= *Pouzaromyces* Pilát 1953
= *Rhodocybella* T.J. Baroni & R.H. Petersen 1987
= *Rhodogaster* E. Horak 1964
= *Rhodophyllus* Quél. 1886
= *Richoniella* Costantin & L.M. Dufour 1900
= *Trichopilus* (Romagn.) P.D. Orton 1991
Rhodocybe Maire 1926
Rhodophana Kühner 1971

Family Hemigasteraceae Gäum. & C.W. Dodge 1928
Hemigaster Juel 1895

Family Hydnangiaceae Gäum. & C.W. Dodge 1928
Hydnangium Wallr. 1839
Laccaria Berk. & Broome 1883
= *Russuliopsis* J. Schröt. 1889
Maccagnia Mattir. 1922
Podohydnangium G.W. Beaton, Pegler & T.W.K. Young 1984

Family Hygrophoraceae Lotsy 1907
Acantholichen P.M. Jørg. 1998
Aeruginospora Höhn. 1908
Ampulloclitocybe Redhead, Lutzoni, Moncalvo & Vilgalys 2002
= *Clavicybe* Harmaja 2002
Aphroditeola Redhead & Manfr. Binder 2013
Arrhenia Fr. 1849
= *Boehmia* Raddi 1806

= *Corniola* Gray 1821
= *Dictyolus* Quél. 1886
= *Geotus* Pilát & Svrček 1953
= *Leptotus* P. Karst. 1879
Cantharellula Singer 1936
Cantharocybe H.E. Bigelow & A.H. Sm. 1973
Chromosera Redhead, Ammirati & Norvell 1995
Chrysomphalina Clémençon 1982
= *Chrysobostrychodes* G. Kost 1985
Cora Fr. 1825
= *Wainiocora* Tomas. 1950
Corella Vain. 1890
Cuphophyllus (Donk) Bon 1985
= *Dermolomopsis* Vizzini 2012
Cyphellostereum D.A. Reid 1965
Dictyonema C. Agardh ex Kunth 1822
= *Coraemyces* Cif. & Tomas. 1954
= *Dichonema* Blume & T. Nees 1826
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= *Gyrolophium* Kunze ex Krombh. 1831
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= *Rhipidonematomyces* Cif. & Tomas. 1954
= *Rhizonema* Thwaites 1849
Eonema Redhead, Lücking & Lawrey 2009
Gliophorus Herink 1958
Haasiella Kotl. & Pouzar 1966
Humidicutis (Singer) Singer 1959
Hygroaster Singer 1955
Hygrocybe (Fr.) P. Kumm. 1871
= *Bertrandia* R. Heim 1936
= *Bertrandia* R. Heim 1966
= *Godfrinia* Maire 1902
= *Hydrophorus* Battarra ex Earle 1909
= *Pseudohygrocybe* (Bon) Kovalenko 1988
Hygrophorus Fr. 1836
= *Camarophyllus* (Fr.) P. Kumm. 1871
= *Limacium* (Fr. ex Rabenh.) P. Kumm. 1871
Lichenomphalia Redhead, Lutzoni, Moncalvo & Vilgalys 2002
= *Botrydiopsis* Trevis. 1845
= *Coriscium* Vain. 1890
= *Phalomia* Nieuwl. 1916
= *Phytoconis* Bory 1797
Neohygrocybe Herink 1958
Porpolomopsis Bresinsky 2008
Pseudoarmillariella Singer 1956
Semiomphalina Redhead 1984
Sinohygrocybe C.Q. Wang, Ming Zhang & T.H. Li 2018

Family Hymenogastraceae Vittad. 1831

Anamika K.A. Thomas, Peintner, M.M. Moser & Manim. 2002
Flammula (Fr.) P. Kumm. 1871
Galerina Earle 1909
= *Galerula* P. Karst. 1879
= *Pseudogalera* Velen. 1947
= *Phaeogalera* Kühner 1973
= *Pholidotopsis* Earle 1909
Gymnopilus P. Karst. 1879
Hebeloma (Fr.) P. Kumm. 1871
= *Hebelomatis* Earle 1909
= *Hebelomina* Maire 1935
= *Myxocybe* Fayod 1889
= *Picromyces* Battarra ex Earle 1909
Hymenogaster Vittad. 1831
= *Dendrogaster* Bucholtz 1901
= *Fechtneria* Velen. 1939
= *Hysterogaster* C.W. Dodge 1928
= *Radiogaster* Lloyd 1924
= *Rhizopogoniella* Soehner 1953
= *Roumeguerites* P. Karst. 1879
= *Sarcoloma* Locq. 1979
Naucoria (Fr.) P. Kumm. 1871
= *Alnicola* Kühner 1926
Phaeocollybia R. Heim 1931
= *Quercella* Velen. 1921
Psathyloma Soop, J.A. Cooper & Dima 2016
Psilocybe (Fr.) P. Kumm. 1871
= *Delitescor* Earle 1909
= *Naematoloma* P. Karst. 1879
= *Stropholoma* (Singer) Balletto 1989
= *Weraroa* Singer 1958

Family Inocybaceae Jülich 1982
Auritella Matheny & Bougher 2006
Inocybe (Fr.) Fr. 1863
= *Agmocybe* Earle 1909
= *Astrosporina* J. Schröt. 1889
= *Astrosporina* S. Imai 1938
= *Clypeus* (Britzelm.) Fayod 1889
= *Inocibium* Earle 1909
= *Inocybella* Zerova 1974
Tubariomyces Esteve-Rav. & Matheny 2010

Family Limnoperdaceae G.A. Escobar 1976
Limnoperdon G.A. Escobar 1976

Family Lycoperdaceae Chevall. 1826
Apioperdon (Kreisel & D. Krüger) Vizzini 2017
= *Lycoperdon* subgenus *Apioperdon* (Kreisel & D. Krüger) Jeppson & E. Larss. 2008
Bovista Pers. 1794
= *Globaria* Quél. 1873

= *Piesmycus* Raf. 1808
= *Pseudolycoperdon* Velen. 1947
= *Sackea* Rostk. 1844
Bryoperdon Vizzini 2017
Calbovista Morse ex M.T. Seidl 1995
= *Calbovista* Morse 1935
Calvatia Fr. 1849
= *Bovistaria* (Fr.) P. Karst. 1889
= *Eriosphaera* Reichardt 1866
= *Hypoblema* Lloyd 1902
= *Langermannia* Rostk. 1839
Gastropila Homrich & J.E. Wright 1973
= *Pila* Speg. 1923
Lycoperdon Pers. 1794
= *Bovistella* Morgan 1892
= *Calvatiella* C.H. Chow 1936
= *Capillaria* Velen. 1947
= *Cerophora* Raf. 1814
= *Handkea* Kreisel 1989
= *Priapus* Raf. 1808
= *Sufa* Adans. 1763
= *Utraria* Quél. 1873
= *Vascellum* F. Šmarda 1958
Morganella Zeller 1948

Family Lyophyllaceae Jülich 1982
Asterophora Ditmar 1809
= *Asterophora* Corda 1840
= *Asterophora* Fr. 1849
= *Asterotrichum* Bonord. 1851
Blastosporella T.J. Baroni & Franco-Mol. 2007
Calocybe Kühner ex Donk 1962
= *Calocybe* Kühner 1938
Calocybella Vizzini, Consiglio & Setti 2015
Clitolyophyllum Sesli, Vizzini & Contu 2016
Gerhardtia Bon 1994
Hypsizygus Singer 1947
Lyophyllopsis Sathe & J.T. Daniel 1981
Lyophyllum P. Karst. 1881
= *Caesposus* Nüesch 1937
Myochromella V. Hofst., Clémençon, Moncalvo & Redhead 2015
Ossicaulis Redhead & Ginns 1985
Rugosomyces Raithelh. 1979
Sagaranella V. Hofst., Clémençon, Moncalvo & Redhead 2014
Sphagnurus Redhead & V. Hofst. 2014
= *Bryophyllum* Vizzini 2014
Tephrocybe Donk 1962
Tephrocybella Picillo, Vizzini & Contu 2015
Termitomyces R. Heim 1942

= *Podabrella* Singer 1945
= *Rajapa* Singer 1945
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Tricholomella Zerova ex Kalamees 1992
= *Echinosporella* Contu 1992

Family Macrocystidiaceae Kühner 1980
Macrocystidia Joss. 1934
= *Galeromycena* Velen. 1947

Family Marasmiaceae Roze ex Kühner 1980
Amyloflagellula Singer 1966
Brunneocorticium Sheng H. Wu 2007
Campanella Henn. 1895
Chaetocalathus Singer 1943
Crinipellis Pat. 1889
Hymenogloea Pat. 1900
Marasmius Fr. 1836
= *Androsaceus* (Pers.) Pat. 1887
= *Chamaeceras* Rebent. ex Kuntze 1898
= *Discocyphella* Henn. 1900
= *Heliomyces* Lév. 1844
= *Hymenoconidium* Zukal 1888
= *Polymarasmius* Murrill 1915
= *Protomarasmius* Overeem 1927
= *Scorteus* Earle 1909
= *Tephrophana* Earle 1909
Moniliophthora H.C. Evans, Stalpers, Samson & Benny 1978
Neocampanella Nakasone, Hibbett & Goranova 2009
Tetrapyrgos E. Horak 1987
= *Pterospora* Métrod 1949

Family Mycenaceae Overeem 1926
Atheniella Redhead, Moncalvo, Vilgalys, Desjardin & B.A. Perry 2012
Cruentomycena R.H. Petersen, Kovalenko & O.V. Morozova 2008
Decapitatus Redhead & Seifert 2000
Favolaschia (Pat.) Pat. 1892
= *Hologloea* Pat. 1900
= *Mycomedusa* R. Heim 1945
= *Mycomedusa* R. Heim 1966
= *Poroauricula* McGinty 1917
= *Porolaschia* Pat. 1897
= *Porolaschia* Pat. 1898
Flabellimycena Redhead 1984
Heimiomyces Singer 1942
Hemimycena Singer 1938
= *Perona* Pers. 1825
Hydropus Kühner ex Singer 1948
Mycena (Pers.) Roussel 1806
= *Bactroboletus* Clem. 1909
= *Basidopus* Earle 1909

= *Collopus* Earle 1909
= *Corrugaria* Métrod 1949
= *Dictyoploca* Mont. ex Pat. 1890
= *Eomycenella* G.F. Atk. 1902
= *Filoboletus* Henn. 1900
= *Galactopus* Earle 1909
= *Hiatula* (Fr.) Mont. 1854
= *Insiticia* Earle 1909
= *Leiopoda* Velen. 1947
= *Leptomyces* Mont. 1856
= *Linopodium* Earle 1909
= *Mycenoporella* Overeem 1926
= *Mycenopsis* Velen. 1947
= *Phlebomycena* R. Heim 1945
= *Phlebomycena* R. Heim 1966
= *Poromycena* Overeem 1926
= *Prunulus* Gray 1821
= *Pseudomycena* Cejp 1929
= *Stereopodium* Earle 1909
= *Zephirea* Velen. 1947
Mycopan Redhead, Moncalvo & Vilgalys 2013
Panellus P. Karst. 1879
= *Dictyopanus* Pat. 1900
= *Scytinotus* P. Karst. 1879
= *Urospora* Fayod 1889
= *Urosporellina* E. Horak 1968
Resinomycena Redhead & Singer 1981
Roridomyces Rexer 1994
= *Roridella* E. Horak 2005
Sarcomyxa P. Karst. 1891
Tectella Earle 1909
Xeromphalina Kühner & Maire 1934
= *Phlebomarasmius* R. Heim 1967
= *Valentinia* Velen. 1939

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Mythicomyces Redhead & A.H. Sm. 1986
Stagnicola Redhead & A.H. Sm. 1986

Family Niaceae Jülich 1982
Digitatispora Doguet 1962
Flagelloscypha Donk 1951
Halocyphina Kohlm. & E. Kohlm. 1965
Lachnella Fr. 1836
Maireina W.B. Cooke 1961
Merismodes Earle 1909
= *Cyphellopsis* Donk 1931
= *Phaeocyphellopsis* W.B. Cooke 1961
= *Pseudodasyscypha* Velen. 1939
Nia R.T. Moore & Meyers 1961

Peyronelina P.J. Fisher, J. Webster & D.F. Kane 1976
Woldmaria W.B. Cooke 1961

Family Omphalotaceae Bresinsky 1985
Anthracophyllum Ces. 1879
Caripia Kuntze 1898
Connopus R.H. Petersen 2010
Gymnopanella Sand.-Leiva, J.V. McDonald & Thorn 2016
Gymnopus (Pers.) Gray 1821
= *Setulipes* Antonín 1987
Hymenoporus Tkalčec, Mešić & Chun Y. Deng 2015
Lentinula Earle 1909
Marasmiellus Murrill 1915
= *Collybiopsis* (J. Schröt.) Earle 1909
Mycetinis Earle 1909
Neonothopanus R.H. Petersen & Krisai 1999
Omphalotus Fayod 1889
= *Lampteromyces* Singer 1947
= *Monodelphus* Earle 1909
Rhodocollybia Singer 1939
Paragymnopus J.S. Oliveira 2019
Pusillomyces J.S. Oliveira 2019

Family Physalacriaceae Corner 1970
Anastrophella E. Horak & Desjardin 1994
Armillaria (Fr.) Staude 1857
= *Armillariella* (P. Karst.) P. Karst. 1881
= *Aphotistus* Humb. 1793
= *Polymyces* Battarra ex Earle 1909
= *Rhizomorpha* Roth 1791
Cibaomyces Zhu L. Yang, Y.J. Hao & J. Qin 2014
Cribbea A.H. Sm. & D.A. Reid 1962
Cryptomarasmius T.S. Jenkinson & Desjardin 2014
Cylindrobasidium Jülich 1974
Cyptotrama Singer 1960
= *Xerulina* Singer 1962
Dactylosporina (Clémençon) Dörfelt 1985
Desarmillaria (Herink) R. A. Koch & Aime 2017
Epicnaphus Singer 1960
Flammulina P. Karst. 1891
= *Collybidium* Earle 1909
= *Myxocollybia* Singer 1936
Gloiocephala Massee 1892
Guyanagaster T.W. Henkel, M.E. Sm. & Aime 2010
Hymenopellis R.H. Petersen 2010
Laccariopsis Vizzini 2013
Manuripia Singer 1960
Mucidula Pat. 1887
Mycaureola Maire & Chemin 1922
Naiadolina Redhead, Labbé & Ginns 2013

Oudemansiella Speg. 1881
= *Coprinopsis* Beeli 1929
= *Oudemansia* Speg. 1880
= *Phaeolimacium* Henn. 1899
Paraxerula R.H. Petersen 2010
Physalacria Peck 1882
= *Baumanniella* Henn. 1897
= *Eoagaricus* L. Krieg. 1923
= *Hormomitaria* Corner 1950
Ponticulomyces R.H. Petersen 2010
Protoxerula R.H. Petersen 2010
Rhizomarasmius R.H. Petersen 2000
Rhodotus Maire 1926
Strobilurus Singer 1962
Xerula Maire 1933

Family Pleurotaceae Kühner 1980
Agaricochaete Eichelb. 1906
Hohenbuehelia Schulzer 1866
= *Acanthocystis* (Fayod) Kühner 1926
= *Nematoctonus* Drechsler 1941
Lignomyces R.H. Petersen & Zmitr. 2015
Pleurotus (Fr.) P. Kumm. 1871
= *Antromycopsis* Pat. & Trab. 1897
= *Crepidopus* Nees ex Gray 1821
= *Lentodiopsis* Bubák 1895
= *Nothopanus* Singer 1944
= *Pterophyllus* Lév. 1844
= *Scleroma* Fr. 1838
= *Velolentinus* Overeem 1927
Resupinatus Nees ex Gray 1821
= *Asterotus* Singer 1943
= *Phyllotremella* Lloyd 1920
= *Phyllotus* P. Karst. 1879
= *Pleurotopsis* (Henn.) Earle 1909
= *Rhodocyphella* W.B. Cooke 1961
= *Scytinotopsis* Singer 1943
= *Stigmatolemma* Kalchbr. 1882
= *Urceolus* Velen. 1939

Family Pluteaceae Kotl. & Pouzar 1972
Pluteus Fr. 1836
= *Annularia* (Schulzer) Gillet 1876
= *Chamaeota* (W.G. Sm.) Earle 1909
= *Hyporrhodius* (Fr.) Staude 1857
= *Rhodosporus* J. Schröt. 1889
Volvariella Speg. 1898
= *Volva* Adans. 1763
= *Volvaria* (Fr.) P. Kumm. 1871
= *Volvariopsis* Murrill 1911

= *Volvarius* Roussel 1806
Volvopluteus Vizzini, Contu & Justo 2011
= *Pseudofarinaceus* Earle 1909
Family Porotheleaceae Murrill 1916
Phloeomana Redhead 2013
Porotheleum Fr. 1818
= *Stromatoscypha* Donk 1951
Family Psathyrellaceae Vilgalys, Moncalvo & Redhead 2001
Coprinellus P. Karst. 1879
= *Annularius* Roussel 1806
= *Ephemerocybe* Fayod 1889
= *Pseudocoprinus* Kühner 1928
Coprinopsis P. Karst. 1881
= *Pselliophora* P. Karst. 1879
Cystoagaricus Singer 1947
Gasteroagaricoides D.A. Reid 1986
Homophron (Britzelm.) Örstadius & E. Larss. 2015
Hormographiella Guarro & Gené 1992
Kauffmania Örstadius & E. Larss. 2015
Lacrymaria Pat. 1887
= *Cortiniopsis* J. Schröt. 1889
= *Glyptospora* Fayod 1889
Macrometrula Donk & Singer 1948
Parasola Redhead, Vilgalys & Hopple 2001
Psathyrella (Fr.) Quél. 1872
= *Astylospora* Fayod 1889
= *Drosophila* Quél. 1886
= *Gymnochilus* Clem. 1896
= *Hypholomopsis* Earle 1909
= *Pannucia* P. Karst. 1879
= *Pluteopsis* Fayod 1889
= *Psalliotina* Velen. 1939
= *Psathyra* (Fr.) P. Kumm. 1871
= *Psilocybe* Fayod 1889
Rhacophyllus Berk. & Broome 1871
Typhrasa Örstadius & E. Larss. 2015
Family Pseudoclitocybaceae Vizzini, Consiglio, P.-A. Moreau & P. Alvarado 2018
Bonomyces Vizzini 2014
Cleistocybe Ammirati, A.D. Parker & Matheny 2007
Clitopaxillus G. Moreno, Vizzini, Consiglio & P. Alvarado 2018
Harmajaea Dima, P. Alvarado & Kekki 2018
Musumecia Vizzini & Contu 2011
Pogonoloma (Singer) Sánchez-García 2014
Pseudoclitocybe (Singer) Singer 1956
Family Pterulaceae Corner 1970
Actiniceps Berk. & Broome 1876
= *Dimorphocystis* Corner 1950
= *Wiesnerina* Höhn. 1907

Allantula Corner 1952
Aphanobasidium Jülich 1979
Chaetotyphula Corner 1950
Coronicium J. Erikss. & Ryvarden 1975
Deflexula Corner 1950
Lepidomyces Jülich 1979
Merulicium J. Erikss. & Ryvarden 1976
Parapterulicium Corner 1952
Pterula Fr. 1825
= *Phaeopterula* (Henn.) Sacc. & D. Sacc. 1905
Pterulicium Corner 1950
Radulomyces M.P. Christ. 1960
= *Adustomyces* Jülich 1979
= *Cerocorticium* Henn. 1900
= *Chrysoderma* Boidin & Gilles 1991
= *Flavophlebia* (Parmasto) K.H. Larss. & Hjortstam 1977
Radulotubus Y.C. Dai, S.H. He & C.L. Zhao 2016

Family Schizophyllaceae Quél. 1888
Auriculariopsis Maire 1902
Porodisculus Murrill 1907
= *Enslinia* Fr. 1836
= *Porodiscus* Murrill 1903
Schizophyllum Fr. 1815
= *Apus* Gray 1821
= *Hyponevris* Earle 1909
= *Petrona* Adans. 1763
= *Phaeoschizophyllum* W.B. Cooke 1962
= *Rhipidium* Wallr. 1833
= *Scaphophoeum* Ehrenb. ex Wallr. 1833
= *Scaphophorum* Ehrenb. 1820
= *Schizonia* Pers. 1828

Family Stephanosporaceae Oberw. & E. Horak 1979
Athelidium Oberw. 1965
Cristinia Parmasto 1968
= *Dacryobasidium* Jülich 1982
Lindtneria Pilát 1938
Mayamontana Castellano, Trappe & Lodge 2007
Stephanospora Pat. 1914

Family Strophariaceae Singer & A.H. Sm. 1946
Agrocybe Fayod 1889
= *Bulla* Battarra ex Earle 1909
= *Bulla* Battarra 1755
= *Cyclopus* (Quél.) Barbier 1907
= *Togaria* W.G. Sm. 1908
Bogbodia Redhead 2013
Brauniella Rick ex Singer 1955
= *Braunia* Rick 1934
Deconica (W.G. Sm.) P. Karst. 1879

Hypholoma (Fr.) P. Kumm. 1871
Leratiomyces Bresinsky & Manfr. Binder ex Bridge, Spooner, Beever & D.C. Park 2008
= *Cytophyllopsis* R. Heim 1958
Melanotus Pat. 1900
Pholiota (Fr.) P. Kumm. 1871
= *Derminus* (Fr.) Staude 1857
= *Dryophila* Quél. 1886
= *Flammopsis* Fayod 1889
= *Gymnocybe* P. Karst. 1879
= *Hemipholiota* (Singer) Romagn. 1980
= *Hemipholiota* (Singer) Bon 1986
= *Hypodendrum* Paulet ex Earle 1909
= *Kuehneromyces* Singer & A.H. Sm. 1948
= *Nemecomyces* Pilát 1933
= *Nivatogastrium* Singer & A.H. Sm. 1959
= *Phaeonematoloma* (Singer) Bon 1994
= *Ryssospora* Fayod 1889
= *Visculus* Earle 1909
Protostropharia Redhead, Moncalvo & Vilgalys 2013
Pseudogymnopilus Raithelh. 1974
Stropharia (Fr.) Quél. 1872
Family Tricholomataceae R. Heim ex Pouzar 1983
Albomagister Sánchez-García, Birkebak & Matheny 2014
Corneriella Sánchez-García 2014
Dennisiomyces Singer 1955
Dermoloma J.E. Lange ex Herink 1958
= *Dermoloma* J.E. Lange ex Singer 1951
= *Dermoloma* J.E. Lange ex Singer 1955
Leucopaxillus Boursier 1925
Porpoloma Singer 1952
Pseudobaeospora Singer 1942
Pseudoporpoloma Vizzini & Consiglio 2016
Pseudotricholoma (Singer) Sánchez-García & Matheny 2014
Tricholoma (Fr.) Staude 1857
= *Cortinellus* Roze 1876
= *Glutinaster* Earle 1909
= *Gyrophila* Quél. 1886
= *Mastoleucomyces* Battarra ex Kuntze 1891
= *Megatricholoma* G. Kost. 1984
= *Monomyces* Battarra ex Earle 1909
= *Phlebophora* Lév. 1841
= *Sphaerocephalus* Battarra ex Earle 1909
Family Tubariaceae Vizzini 2008
Cyclocybe Velen. 1939
Flammulaster Earle 1909
Hemistropharia Jacobsson & E. Larss. 2007
Pachylepyrium Singer 1958
Phaeomarasmius Scherff. 1897

= *Epicorticium* Velen. 1926
= *Flocculina* P.D. Orton 1960
= *Marasmiopsis* Henn. 1898
Pleuromyces Dima, P.-A. Moreau & V. Papp 2018
Tubaria (W.G. Sm.) Gillet 1876

Family Typhulaceae Jülich 1982
Lutypha Khurana, K.S. Thind & Berthier 1977
Macrotyphula R.H. Petersen 1972
Tygervalleyomyces Crous 2017
Typhula (Pers.) Fr. 1818
= *Cnazonaria* Corda 1829
= *Dacryopsella* Höhn. 1915
= *Gliocoryne* Maire 1909
= *Phacorhiza* Pers. 1822
= *Pistillaria* Fr. 1821
= *Pistillina* Quél. 1881
= *Scleromitra* Corda 1829
= *Sphaerula* Pat. 1883

Agaricales genera *incertae sedis*
Acanthocorticium Baltazar, Gorjón & Rajchenb. 2015
Acinophora Raf. 1808
Aleurocystis Lloyd ex G. Cunn. 1956
Amparoina Singer 1958
Amylolepiota Harmaja 2002
Aphyllotus Singer 1973
Arthromyces T.J. Baroni & Lodge 2007
Arthrosporella Singer 1970
= *Nothoclavulina* Singer 1970
Asproinocybe R. Heim 1970
Aspropaxillus Kühner & Maire 1934
Atractosporocybe P. Alvarado, G. Moreno & Vizzini 2015
Austroclitocybe Raithelh. 1972
Austroomphaliaster Garrido 1988
Baeospora Singer 1938
Callistodermatium Singer 1981
Calyptella Quél. 1886
Caulorhiza Lennox 1979
Cellypha Donk 1959
Cephaloscypha Agerer 1975
Cercopemyces T.J. Baroni, Kropp & V.S. Evenson 2014
Clavomphalia E. Horak 1987
Clitocybe (Fr.) Staude 1857
= *Pseudolyophyllum* Raithelh. 1977
= *Rubeolarius* Raithelh. 1981
= *Singerella* Harmaja 1974
= *Trigonipes* Velen. 1939
Clitocybula (Singer) Singer ex Métrod 1952
Coccobotrys Boud. & Pat. 1900

Collybia (Fr.) Staude 1857
= *Microcollybia* Métrod 1952
= *Microcollybia* Lennox 1979
Conchomyces Overeem 1927
Crucibulum Tul. & C. Tul. 1844
Cyathus Haller 1768
= *Cyathia* P. Browne 1756
= *Cyathodes* P. Micheli ex Kuntze 1891
= *Peziza* L. 1753
Cymatella Pat. 1899
Cymatellopsis Parmasto 1985
Cynema Maas Geest. & E. Horak 1995
Cyphellocalathus Agerer 1981
Cystoderma Fayod 1889
Cystodermella Harmaja 2002
Deigloria Agerer 1980
Delicatula Fayod 1889
= *Retocybe* Velen. 1947
Dendrocollybia R.H. Petersen & Redhead 2001
= *Sclerostilbum* Povah 1932
= *Tilachlidiopsis* Keissl. 1924
Dendrothele Höhn. & Litsch. 1907
= *Aleurocorticium* P.A. Lemke 1964
Disporotrichum Stalpers 1984
Fayodia Kühner 1930
Fibulochlamys A.I. Romero & Cabral 1989
Fistulina Bull. 1791
= *Agarico-carnis* Paulet 1793
= *Buglossus* Wahlenb. 1820
= *Hypodrys* Pers. 1825
Fissolimbus E. Horak 1979
Floccularia Pouzar 1957
Gamundia Raithelh. 1979
= *Stachyomphalina* H.E. Bigelow 1979
Gerronema Singer 1951
Giacomia Vizzini & Contu 2012
Glabrocyphella W.B. Cooke 1961
Gloioxanthomyces Lodge, Vizzini, Ercole & Boertm. 2013
Gramincola Velen. 1947
Henningsomyces Kuntze 1898
= *Solenia* Pers. 1794
Hispidocalyptella E. Horak & Desjardin 1994
Hygrophorocybe Vizzini & Contu 2014
Infundibulicybe Harmaja 2003
Lactocollybia Singer 1939
= *Bertrandiella* R. Heim 1959
= *Bertrandiella* R. Heim 1966
Lecanocybe Desjardin & E. Horak 1999

Lepista (Fr.) W.G. Sm. 1870
= *Rhodopaxillus* Maire 1913
Lepistella T.J. Baroni & Ovrebo 2007
Leucocalocybe X.D. Yu & Y.J. Yao 2011
Leucocortinarius (J.E. Lange) Singer 1945
Leucocybe Vizzini, P. Alvarado, G. Moreno & Consiglio 2015
Leucoinocybe Singer ex Antonín, Borovička, Holec & Kolařík 2019
Leucopholiota (Romagn.) O.K. Mill., T.J. Volk & Bessette 1996
Lignomphalia Antonín, Borovička, Holec & Kolařík 2019
Lulesia Singer 1970
Lycogalopsis E. Fisch. 1886
= *Enteromyxa* Ces. 1879
Megacollybia Kotl. & Pouzar 1972
Melanoleuca Pat. 1897
= *Kinia* Consiglio, Contu, Setti & Vizzini 2008
= *Psammospora* Fayod 1893
Melanomphalia M.P. Christ. 1936
= *Horakomyces* Raithelh. 1983
Meottomyces Vizzini 2008
Mesophelliopsis Bat. & A.F. Vital 1957
Metraria (Cooke) Cooke & Massee 1891
Metulocyphella Agerer 1983
Mucronella Fr. 1874
= *Myxomycidium* Massee 1901
Mycenella (J.E. Lange) Singer 1938
Mycoalvimia Singer 1981
Mycocalia J.T. Palmer 1961
Mycospongia Velen. 1939
Myxomphalia Hora 1960
Neoclitocybe Singer 1962
Neopaxillus Singer 1948
Nidula V.S. White 1902
Nidularia Fr. 1817
= *Granularia* Roth 1791
Nochascypha Agerer 1983
Notholepista Vizzini & Contu 2012
Omphaliaster Lamoure 1971
Omphalina Quél. 1886
= *Phaeotellus* Kühner & Lamoure 1972
Palaeocephala Singer 1962
Panaeolina Maire 1933
Panaeolus (Fr.) Quél. 1872
= *Anellaria* P. Karst. 1879
= *Campanularius* Roussel 1806
= *Chalymmota* P. Karst. 1879
= *Copelandia* Bres. 1912
= *Coprinarius* (Fr.) P. Kumm. 1871
Paralepistopsis Vizzini 2012

Peglerochaete Sarwal & Locq. 1983
Pegleromyces Singer 1981
Phaeodepas D.A. Reid 1961
Phaeolepiota Maire ex Konrad & Maubl. 1928
Phaeomycena R. Heim ex Singer & Digilio 1952
Phaeopholiota Locq. & Sarwal 1983
Phlebonema R. Heim 1929
Phlebophyllum R. Heim 1969
Phyllotopsis E.-J. Gilbert & Donk ex Singer 1936
= *Tilotus* Kalchbr. 1881
= *Tomentifolium* Murrill 1903
Physocystidium Singer 1962
Pleurella E. Horak 1971
Pleurocybella Singer 1947
Plicatura Peck 1872
Polygaster Fr. 1823
Pseudoclitopilus Vizzini & Contu 2012
Pseudofistulina O. Fidalgo & M. Fidalgo 1963
Pseudohiatula (Singer) Singer 1938
Pseudohygrophorus Velen. 1939
Pseudolasiobolus Agerer 1983
Pseudoomphalina (Singer) Singer 1956
= *Neohygrophorus* Singer 1962
Pseudotyphula Corner 1953
Radulomycetopsis Dhingra, Priyanka & J. Kaur 2012
Rectipilus Agerer 1973
Rhizocybe Vizzini, G. Moreno, P. Alvarado & Consiglio 2015
Rimbachia Pat. 1891
= *Mniopetalum* Donk & Singer 1962
= *Pleuromycenula* Singer 1973
Ripartitella Singer 1947
Ripartites P. Karst. 1879
Secotium Kunze 1840
Singerocybe Harmaja 1988
Skepperiella Pilát 1927
Squamanita Imbach 1946
= *Coolia* Huijsman 1943
= *Dissoderma* (A.H. Sm. & Singer) Singer 1973
Stanglomyces Raithelh. 1986
Stemastrum Raf. 1808
Stromatocyphella W.B. Cooke 1961
Tephroderma Contu & Musumeci 2014
Trichocybe Vizzini 2010
Tricholomopsis Singer 1939
Tricholosporum Guzmán 1975
Trogia Fr. 1836
Ugola Adans. 1763
Vanromburghia Holterm. 1898

Verrucospora E. Horak 1967

Order Amylocorticiales K.H. Larss., Manfr. Binder & Hibbett 2010

Family Amylocorticiaceae Jülich 1982

Amyloathelia Hjortstam & Ryvarden 1979

Amylocorticiellum Spirin & Zmitr. 2002

Amylocorticium Pouzar 1959

Amyloxenasma (Oberw.) Hjortstam & Ryvarden 2005

Anomoloma Niemelä & K.H. Larss. 2007

Anomoporia Pouzar 1966

Ceraceomyces Jülich 1972

Irpicodon Pouzar 1966

Plicaturopsis D.A. Reid 1964

Podoserpula D.A. Reid 1963

Serpulomyces (Zmitr.) Zmitr. 2002

Order Atheliales Jülich 1981

Family Atheliaceae Jülich 1982

Amphinema P. Karst. 1892

= *Diplonema* P. Karst. 1889

Athelia Pers. 1822

= *Fibularhizoctonia* G.C. Adams & Kropp 1996

Athelicium K.H. Larss. & Hjortstam 1986

Athelocystis Hjortstam & Ryvarden 2010

Athelopsis Oberw. ex Parmasto 1968

Butlerelfia Weresub & Illman 1980

Byssocorticium Bondartsev & Singer 1944

= *Byssocorticium* Bondartsev & Singer 1941

= *Caerulicium* Jülich 1982

Elaphocephala Pouzar 1983

Hypochnella J. Schröt. 1888

Hypochniciellum Hjortstam & Ryvarden 1980

Leptosporomyces Jülich 1972

= *Fibulomyces* Jülich 1972

Lobulicium K.H. Larss. & Hjortstam 1982

Lyoathelia Hjortstam & Ryvarden 2004

Melzericium Hauerslev 1975

Mycostigma Jülich 1976

Piloderma Jülich 1969

Pteridomyces Jülich 1979

Taeniospora Marvanová 1977

Tretomyces K.H. Larss., Kotir. & Saaren. 2011

Tylospora Donk 1960

= *Tylosperma* Donk 1957

Order Auriculariales J. Schröt. 1887

Family Auriculariaceae Fr. 1838

Amphistereum Spirin & Malysheva 2017

Auricularia Bull. 1780

= *Auricula* Battarra 1755

= *Auricula* Battarra ex Kuntze 1891

= *Auriculariella* (Sacc.) Clem. 1909
= *Conchites* Paulet 1793
= *Oncomyces* Klotzsch 1843
= *Patila* Adans. 1763
= *Seismosarca* Cooke 1889
Eichleriella Bres. 1903
Elmerina Bres. 1912
Exidia Fr. 1822
= *Spicularia* Chevall. 1826
= *Tremellochaete* Raitv. 1964
= *Ulocolla* Bref. 1888
Exidiopsis (Bref.) Möller 1895
Fibulosebacea K. Wells & Raitv. 1987
Heterochaete Pat. 1892
Heteroradulum Lloyd ex Spirin & Malysheva 2017
Protodaedalea Imazeki 1955
Pseudostypella McNabb 1969
Sclerotrema Spirin & Malysheva 2017

Family Hyaloriaceae Lindau 1897
Helicomyxa R. Kirschner & Chee J. Chen 2004
Hyaloria Möller 1895
Myxarium Wallr. 1833

Auriculariales genera *incertae sedis*
Basidiodendron Rick 1938
Bourdotia (Bres.) Bres. & Torrend 1913
Ceratosebacina P. Roberts 1993
Dendrogloeon Spirin & Miettinen 2015
Ductifera Lloyd 1917
= *Gloeotromera* Ervin 1956
Endoperplexa P. Roberts 1993
Gelacantha V. Malysheva & Spirin 2019
Grammatus H.S. Yuan & C. Decock 2018
Guepinia Fr. 1825
Hauerslevia P. Roberts 1998
Heterorepetobasidium Chee J. Chen & Oberw. 2002
Heteroscypha Oberw. & Agerer 1979
Hyalodon V. Malysheva & Spirin 2018
Hydrophana V. Malysheva & Spirin 2019
Metabourdotia L.S. Olive 1957
Microsebacina P. Roberts 1993
Mycostilla Spirin & V. Malysheva 2018
Myxariellum Spirin & V. Malysheva 2019
Ofella Spirin & V. Malysheva 2019
Porpopycnis R. Kirschner 2012
Protoacia Spirin & V. Malysheva 2019
Protodontia Höhn. 1907
Protograndinia Rick 1933
Protohydnum Möller 1895

Protomerulius Möller 1895
= *Aporpium* Bondartsev & Singer 1941
= *Aporpium* Bondartsev & Singer 1944
Protoradulum Rick 1933
Pseudohydnum P. Karst. 1868
= *Hydnogloea* Curr., Berk. & Broome 1871
Renatobasidium Hauerslev 1993
Stypella Möller 1895
= *Gloeosebacina* Neuhoff 1924
= *Heterochaetella* (Bourdot) Bourdot & Galzin 1928
Stypellopsis Spirin & V. Malysheva 2018
Tremellacantha Jülich 1980

Order Boletales E.-J. Gilbert 1931

Family Boletaceae Chevall. 1826

Afroboletus Pegler & T.W.K. Young 1981
Afrocastellanoa M.E. Sm. & Orihara 2017
Alessioporus Gelardi, Vizzini & Simonini 2014
Aureoboletus Pouzar 1957
Australopilus Halling & N.A. Fechner 2012
Austroboletus (Corner) Wolfe 1980
Baorangia G. Wu & Zhu L. Yang 2015
Binderoboletus T.W. Henkel & M.E. Sm. 2016
Boletellus Murrill 1909
= *Boletogaster* Lohwag 1926
= *Strobilofungus* McGinty 1915
Boletochaete Singer 1944
Boletus L. 1753
= *Ceriomyces* Murrill 1909
= *Dictyopus* Quél. 1886
= *Tubiporus* P. Karst. 1881
= *Xerocomopsis* Reichert 1940
Borofutus Hosen & Zhu L. Yang 2012
Bothia Halling, T.J. Baroni & Manfr. Binder 2007
Buchwaldoboletus Pilát 1969
Butyriboletus Arora & J.L. Frank 2014
Caloboletus Vizzini 2014
Carolinigaster M.E. Sm. & S. Cruz 2018
Castellanea T.W. Henkel & M.E. Sm. 2015
Chalciporus Bataille 1908
Chamonixia Rolland 1899
Chiua Y.C. Li & Zhu L. Yang 2016
Corneroboletus N.K. Zeng & Zhu L. Yang 2012
Costatisporus T.W. Henkel & M.E. Sm. 2015
Crocinoboletus N.K. Zeng, Zhu L. Yang & G. Wu 2014
Cupreoboletus Simonini, Gelardi & Vizzini 2015
Cyanoboletus Gelardi, Vizzini & Simonini 2014
Durianella Desjardin, A.W. Wilson & Manfr. Binder 2008
Erythrophylloporus Ming Zhang & T.H. Li 2018

Fistulinella Henn. 1901
= *Gastrotylopilus* T.H. Li & Watling 1999
= *Ixechinus* R. Heim 1968
Gastroboletus Lohwag 1926
Gastroleccinum Thiers 1989
Guyanaporus T.W. Henkel & M.E. Sm. 2016
Gymnogaster J.W. Cribb 1956
Harrya Halling, Nuhn & Osmundson 2012
Heimioporus E. Horak 2004
Heliogaster Orihara & K. Iwase 2010
Hemileccinum Šutara 2008
Hortiboletus Simonini, Vizzini & Gelardi 2015
Hourangia Xue T. Zhu & Zhu L. Yang 2015
Hymenoboletus Y.C. Li & Zhu L. Yang 2016
Imleria Vizzini 2014
Imperator G. Koller, Assyov, Bellanger, Bertéa, Loizides, G. Marques, P.-A. Moreau, J.A. Muñoz, Oppicelli, Puddu & F. Richard 2015
Indoporus A. Parihar, K. Das, Hembrom & Vizzini 2018
Ionosporus O. Khmelnitsky 2019
Jimtrappea T.W. Henkel, M.E. Sm. & Aime 2015
Kombocles Castellano, T.W. Henkel & Dentinger 2016
Lanmaoa G. Wu & Zhu L. Yang 2015
Leccinellum Bresinsky & Manfr. Binder 2003
Leccinum Gray 1821
= *Krombholziella* Maire 1937
= *Trachypus* Bataille 1908
Mackintoshia Pacioni & Sharp 2000
Mucilopilus Wolfe 1979
Mycoamaranthus Castellano, Trappe & Malajczuk 1992
Neoboletus Gelardi, Simonini & Vizzini 2014
Nigroboletus Gelardi, Vizzini, E. Horak, T.H. Li & Ming Zhang 2015
Octaviania Vittad. 1831
= *Maccagnea* Zeller & C.W. Dodge 1928
Parvixerocomus G. Wu & Zhu L. Yang 2015
Paxillogaster E. Horak 1966
Phylloboletellus Singer 1952
Phyllobolites Singer 1942
Phylloporus Quél. 1888
Porphyrellus E.-J. Gilbert 1931
Pseudoaustroboletus Y.C. Li & Zhu L. Yang 2014
Pseudoboletus Šutara 1991
Pulchroboletus Gelardi, Vizzini & Simonini 2014
Pulveroboletus Murrill 1909
Retiboletus Manfr. Binder & Bresinsky 2002
Rheubarbariboletus Vizzini, Simonini & Gelardi 2015
Rhodactina Pegler & T.W.K. Young 1989
Rossbeevera T. Lebel, Orihara & N. Maek. 2012
Royoungia Castellano, Trappe & Malajczuk 1992

Rubroboletus Kuan Zhao & Zhu L. Yang 2014
Rugiboletus G. Wu & Zhu L. Yang 2015
Setogyroporus Heinem. & Rammeloo 1982
Singerocomus T.W. Henkel & M.E. Sm. 2016
Singeromyces M.M. Moser 1966
Solioccasus Trappe, Osmundson, Manfr. Binder, Castellano & Halling 2013
Spongiforma Desjardin, Manfr. Binder, Roekring & Flegel 2009
Spongispora G. Wu, S.M.L. Lee, E. Horak & Zhu L. Yang 2018
Strobilomyces Berk. 1851
= *Eriocorys* Quél. 1886
Suillellus Murrill 1909
Sutorius Halling, Nuhn & N.A. Fechner 2012
Tengioboletus G. Wu & Zhu L. Yang 2016
Tubosaeta E. Horak 1967
Turmalinea Orihara & N. Maek. 2015
Tylocinum Y.C. Li & Zhu L. Yang 2016
Tylopilus P. Karst. 1881
= *Leucogyroporus* Snell 1942
= *Phaeoporus* Bataille 1908
= *Rhodobolites* Beck 1923
= *Rhodoporus* Quél. ex Bataille 1908
Veloporphyrellus L.D. Gómez & Singer 1984
Wakefieldia Corner & Hawker 1953
Xanthoconium Singer 1944
Xerocomellus Šutara 2008
Xerocomus Quél. 1887
= *Versipellis* Quél. 1886
Zangia Y.C. Li & Zhu L. Yang 2011

Family Boletinellaceae P.M. Kirk, P.F. Cannon & J.C. David 2001
Boletinellus Murrill 1909
Phlebopus (R. Heim) Singer 1936
= *Phaeogyroporus* Singer 1944

Family Calostomataceae E. Fisch. 1900
Calostoma Desv. 1809
= *Gyropodium* E. Hitchc. 1825
= *Husseia* Berk. 1847
= *Mitremyces* Nees 1816

Family Coniophoraceae Ulbr. 1928
Chrysoconia McCabe & G.A. Escobar 1979
Coniophora DC. 1815
= *Coniophorella* P. Karst. 1889
Coniophoropsis Hjortstam & Ryvarden 1986
Gyrodontium Pat. 1900
= *Boninohydnum* S. Ito & S. Imai 1940
Sedecula Zeller 1941

Family Diplocystidiaceae Kreisel 1974
Astraeus Morgan 1889
= *Diploderma* Link 1816

Diplocystis Berk. & M.A. Curtis 1868
Endogonopsis R. Heim 1966
Tremellogaster E. Fisch. 1924
Family Gasterellaceae Zeller 1948
Gasterella Zeller & L.B. Walker 1935
Family Gomphidiaceae Maire ex Jülich 1982
Chroogomphus (Singer) O.K. Mill. 1964
= *Brauniellula* A.H. Sm. & Singer 1959
Cystogomphus Singer 1942
Gomphidius Fr. 1836
= *Leucogomphidius* Kotl. & Pouzar 1972
Gomphogaster O.K. Mill. 1973
Family Gyroporaceae (Singer) Manfr. Binder & Bresinsky 2002
Gyroporus Quél. 1886
= *Coelopus* Bataille 1908
= *Leucobolites* Beck 1923
= *Leucoconius* Beck 1923
Family Hygrophoropsidaceae Kühner 1980
Hygrophoropsis (J. Schröt.) Maire ex Martin-Sans 1929
Leucogyrophana Pouzar 1958
Family Paxillaceae Lotsy 1907
Alpova C.W. Dodge 1931
Austrogaster Singer 1962
Gyrodon Opat. 1836
= *Anastomaria* Raf. 1820
= *Campbellia* Cooke & Massee 1890
= *Gilbertina* R. Heim 1966
= *Pseudogyrodon* Heinem. & Rammeloo 1983
= *Rodwaya* Syd. & P. Syd. 1901
= *Uloporus* Quél. 1886
Hoehnelogaster Lohwag 1926
Hydnomerulius Jarosch & Besl 2001
Meiorganum R. Heim 1966
Melanogaster Corda 1831
= *Argylium* Wallr. 1833
= *Bulliardia* Jungh. 1830
Neoalpova Vizzini 2014
Paragyrodon (Singer) Singer 1942
Paxillus Fr. 1836
= *Paxillopsis* E.-J. Gilbert 1931
= *Rhymovis* Pers. ex Rabenh. 1844
= *Ruthea* Opat. 1836
Family Protogastraceae Zeller 1934
Protogaster Thaxt. 1934
Family Rhizopogonaceae Gäum. & C.W. Dodge 1928
Fevansia Trappe & Castellano 2000
Rhizopogon Fr. 1817
= *Anthracophlous* Mattir. ex Lloyd 1913

= *Hysteromyces* Vittad. 1844
= *Splanchnomyces* Corda 1831
= *Trappeindia* Castellano, S.L. Mill., L. Singh bis & T.N. Lakh. 2012
Rhopalogaster J.R. Johnst. 1902

Family Sclerodermataceae Corda 1842
Chlorogaster Læssøe & Jalink 2004
Favillea Fr. 1849
Horakiella Castellano & Trappe 1992
Pisolithus Alb. & Schwein. 1805
= *Durosaccum* Lloyd 1924
= *Endacinus* Raf. 1814
= *Lycoperdodes* Haller ex Kuntze 1891
= *Pisocarpium* Link 1808
= *Polypera* Pers. 1818
= *Polysaccum* F. Desp. & DC. 1807
Scleroderma Pers. 1801
= *Actigea* Raf. 1814
= *Actinodermium* Nees 1816
= *Caloderma* Petri 1900
= *Goupilia* Mérat 1834
= *Mycastrum* Raf. 1813
= *Neosaccardia* Mattir. 1921
= *Nepotatus* Lloyd 1925
= *Phlyctospora* Corda 1841
= *Pirogaster* Henn. 1901
= *Pompholyx* Corda 1834
= *Sclerangium* Lév. 1848
= *Stella* Massee 1889
= *Sterrebekia* Link 1816
= *Veligaster* Guzmán 1970

Family Serpulaceae Jarosch & Bresinsky 2001
Austropaxillus Bresinsky & Jarosch 1999
Gymnopaxillus E. Horak 1966
Serpula (Pers.) Gray 1821
= *Gyrophana* Pat. 1897
= *Plicaturella* Murrill 1910
= *Xylomyzon* Pers. 1825
= *Xylophagus* Link 1809

Family Suillaceae Besl & Bresinsky 1997
Psiloboletinus Singer 1945
Suillus Gray 1821
= *Boletinus* Kalchbr. 1867
= *Boletopsis* Henn. 1898
= *Cricunopus* P. Karst. 1881
= *Euryporus* Quél. 1886
= *Fuscoboletinus* Pomerl. & A.H. Sm. 1962
= *Gastrosuillus* Thiers 1989
= *Ixocomus* Quél. 1888

= *Mariaella* Šutara 1987
= *Peplopus* (Quél.) Quél. ex Moug. & Ferry 1887
= *Pinuzza* Gray 1821
= *Rostkovites* P. Karst. 1881
= *Solenia* Hill ex Kuntze 1898
= *Viscipellis* (Fr.) Quél. 1886
Truncocolumella Zeller 1939
= *Dodgea* Malençon 1939

Family Tapinellaceae C. Hahn 1999
Bondarcevomyces Parmasto 1999
Pseudomerulius Jülich 1979
Tapinella E.-J. Gilbert 1931
= *Sarcopaxillus* Zmitr., Malysheva & E.F. Malysheva 2004
= *Tapinia* (Fr.) P. Karst. 1879

Boletales genera *incertae sedis*
Corditubera Henn. 1897
Corneromyces Ginns 1976
Marthanella States & Fogel 1999
Phaeoradulum Pat. 1900

Order Cantharellales Gäum. 1926
= **Botryobasidiales** Jülich 1981
= **Sistotrematales** Jülich 1981

Family Aphelariaceae Corner 1970
Aphelaria Corner 1950
Phaeoaphelaria Corner 1953
Tumidapexus D.A. Crawford 1954

Family Botryobasidiaceae Jülich 1982
Acladium Link 1809
Allescheriella Henn. 1897
Alysidium Kunze 1817
Botryobasidium Donk 1931
= *Haplotrichum* Link 1824
Suillosporium Pouzar 1958

Family Ceratobasidiaceae G.W. Martin 1948
= Family Cejpomycetaceae Jülich 1981
Ceratobasidium D.P. Rogers 1935
= *Uthatobasidium* Donk 1956
= *Koleroga* Donk 1958
Ceratoporia Ryvarden & de Meijer 2002
Ceratorhiza R.T. Moore 1987
Rhizoctonia DC. 1805
Scotomyces Jülich 1978
Thanatephorus Donk 1956

Family Hydnaceae Chevall. 1826
= Family Clavulinaceae Donk 1970
= Family Cantharellaceae J. Schröt. 1888
= Family Sistotremataceae Jülich 1982
= Family Pterygellaceae Jülich 1982

= Family Heteroacanthellaceae P. Roberts 1998
= Family Repetobasidiaceae Jülich 1982
Burgoa Goid. 1937
Burgella Diederich & Lawrey 2007
Burgellopsis Diederich & Lawrey 2014
Cantharellus Adans.ex Fr. 1821
= *Afrocantharellus* (Eyssart. & Buyck) Tibuhwa 2012
= *Goossensia* Heinem. 1958
Clavulicium Boidin 1957
Clavulina J. Schröt. 1888
Corallofungus Kobayasi 1983
Craterellus Pers. 1825
= *Pseudocraterellus* Corner 1958
= *Pterygellus* Corner 1966
Gloeomucro R.H. Petersen 1980
Heteroacanthella Oberw. 1990
Hydnum L. 1753
= *Malacodon* Bataille 1923
Ingoldiella D.E. Shaw 1972
Membranomyces Jülich 1975
Multiclavula R.H. Petersen 1967
Neoburgoa Diederich, E. Zimm. & Lawrey 2016
Parastereopsis Corner 1976
Osteomorpha G. Arnaud ex Watling & W.B. Kendr. 1979
Paullicorticium J. Erikss. 1958
Repetobasidiellum J. Erikss. & Hjortstam 1981
Repetobasidium J. Erikss. 1958
Rogersiomyces J.L. Crane & Schokn. 1978
= *Hyphobasidiofera* K. Matsush. & Matsush. 1996
Sistotrema Fr. 1821
= *Galziniella* Parmasto 1968
= *Heptasporium* Bref. 1908
= *Hydnotrema* Link 1833
Sistotremella Hjortstam 1984
Family Oliveoniaceae P. Roberts 1998
Oliveonia Donk 1958
Family Tulasnellaceae Juel 1897
Pseudotulasnella Lowy 1964
Tulasnella J. Schröt. 1888
= *Epulorhiza* R.T. Moore 1987
Cantharellales genera *incertae sedis*
Boidinella Nakasone 2011
Bulbilla Diederich, Flakus & Etayo 2014
= *Adamflakia* Diederich & Lawrey 2016
Minimedusa Weresub & P.M. LeClair 1971
= *Pneumatospora* B. Sutton, Kuthub. & Muid 1984
= *Tricellulortus* Matsush. 1995
Odontiochaete Rick 1940

Radulochaete Rick 1940
Schildia Franchi & M. Marchetti 2015
Stilbotulasnella Oberw. & Bandoni 1982

Order Corticiales K.H. Larss. 2007

Family Corticiaceae Herter 1910
Capillosclerotium Prameela & Deeba 2013
Corticirama Pilát 1957
Corticium Pers. 1794
= *Lyomyces* P. Karst. 1882
= *Mycinema* C. Agardh 1824
Erythricium J. Erikss. & Hjortstam 1970
= *Marchandiobasidium* Diederich & Schultheis 2003
Galzinia Bourdot 1922
Giulia Tassi 1904
Laetisaria Burds. 1979
= *Limonomyces* Stalpers & Loer. 1982
Lawreymyces Lücking & Moncada 2017
Marchandiomyces Diederich & D. Hawksw. 1990
= *Marchandiopsis* Ghobad-Nejhad & Hallenb. 2010
Necator Massee 1898
Tretopileus B.O. Dodge 1946
Waitea Warcup & P.H.B. Talbot 1962

Family Dendrominiaceae Ghobad-Nejhad 2015
Dendrominia Ghobad-Nejhad & Duhem 2013

Family Punctulariaceae Donk 1964
Dendrocorticium M.J. Larsen & Gilb. 1974
Punctularia Pat. 1895
= *Phaeophlebia* W.B. Cooke 1956
Punctulariopsis Ghobad-Nejhad 2010

Family Vuilleminiaceae Maire ex Lotsy 1902
Australovuilleminia Ghobad-Nejhad & Hallenb. 2010
Cytidia Quél. 1888
= *Lomatina* (Fr.) P. Karst. 1892
Vuilleminia Maire 1902

Corticiales genera *incertae sedis*
Ambivina Katz 1974
Amylobasidium Ginns 1988
Leptocorticium Hjortstam & Ryvarden 2002
Melzerodontia Hjortstam & Ryvarden 1980
Nothocorticium Gresl. & Rajchenb. 1999
Papyrodiscus D.A. Reid 1979
Ripexicium Hjortstam 1995

Order Geastrales K. Hosaka & Castellano 2007

Family Geastraceae Corda 1842
Geasteroides Long 1917
= *Terrostella* Long 1945
Geastrum Pers. 1794
= *Astrocitum* Raf. 1806

= *Astrycum* Raf. 1809
= *Coilomyces* Berk. & M.A. Curtis 1854
= *Geasteropsis* Hollós 1903
= *Plecostoma* Desv. 1809
= *Radiigera* Zeller 1944
= *Trichaster* Czern. 1845
Myriostoma Desv. 1809
= *Bovistoides* Lloyd 1919
= *Polystoma* Gray 1821
Nidulariopsis Greis 1935
Phialastrum Sunhede 1989
Schenella T. Macbr. 1911
= *Pyrenogaster* Malençon & Riousset 1977
Sphaerobolus Tode 1790
= *Carpobolus* P. Micheli 1729
= *Carpobolus* P. Micheli ex Willd. 1787
= *Carpobolus* P. Micheli ex Paulet 1808
= *Siropeltis* Arx & R. Garnier 1960

Family Sclerogastraceae Locq. ex P.M. Kirk 2008
Sclerogaster R. Hesse 1891

Geastrales genera *incertae sedis*
Boninogaster Kobayasi 1937

Order Gloeophyllales Thorn 2007

Family Gloeophyllaceae Jülich 1982
Boreostereum Parmasto 1968
Campylomyces Nakasone 2004
Chaetodermella Rauschert 1988
= *Chaetoderma* Parmasto 1968
Gloeophyllum P. Karst. 1882
= *Anisomyces* Theiss. & Syd. 1914
= *Ceratophora* Humb. 1793
= *Phaeocoriolellus* Kotl. & Pouzar 1957
= *Reisneria* Velen. 1922
= *Serda* Adans. 1763
= *Sesia* Adans. 1763
Griseoporia Ginns 1984
Heliocybe Redhead & Ginns 1985
Hispidaedalea Y.C. Dai & S.H. He 2014
Mycothele Jülich 1976
Neolentinus Redhead & Ginns 1985
Osmoporus Singer 1944
Stiptophyllum Ryvarden 1973
Veluticeps Cooke 1879
= *Chaetocarpus* P. Karst. 1889
= *Columnocystis* Pouzar 1959

Gloeophyllales genera *incertae sedis*
Pileodon P. Roberts & Hjortstam 1998

Order Gomphales Jülich 1981

Family Clavariadelphaceae Corner 1970

Beenakia D.A. Reid 1956

= *Psathyrodon* Maas Geest. 1977

Clavariadelphus Donk 1933

Family Gomphaceae Donk 1961

Araeocoryne Corner 1950

Ceratellopsis Konrad & Maubl. 1937

= *Ceratella* Pat. 1887

Delentaria Corner 1970

Destuntzia Fogel & Trappe 1985

Gautieria Vittad. 1831

= *Ciliciocarpus* Corda 1831

= *Uslaria* Nieuwl. 1916

Gloeocantharellus Singer 1945

= *Alectorolophoides* Battarra ex Earle 1909

= *Linderomyces* Singer 1947

Gomphus Pers. 1797

= *Gomphora* Fr. 1825

Phaeoclavulina Brinkmann 1897

= *Chloroneuron* Murrill 1911

Protogautieria A.H. Sm. 1965

Pseudogomphus R. Heim 1970

Ramaria Fr. ex Bonord. 1851

= *Capitoclavaria* Lloyd 1922

= *Cladaria* Ritgen 1828

= *Clavariella* P. Karst. 1881

= *Corallium* G. Hahn 1883

= *Coralloidea* Roussel 1806

= *Coralloides* Tourn. ex Battarra 1755

= *Dendrocladium* (Pat.) Lloyd 1919

Ramaricium J. Erikss. 1954

Terenodon Maas Geest. 1971

Turbinellus Earle 1909

Family Lentariaceae Jülich 1982

Hydnocristella R.H. Petersen 1971

Kavinia Pilát 1938

Lentaria Corner 1950

Order Hymenochaetales Oberw. 1977

Family Hymenochaetaceae Donk 1948

Arambarria Rajchenb. & Pildain 2015

Asterodon Pat. 1894

= *Aciella* (P. Karst.) P. Karst. 1899

= *Hydnochaetella* Sacc. 1898

Aurificaria D.A. Reid 1963

Botryodontia (Hjortstam & Ryvarden) Hjortstam 1987

Clavariachaete Corner 1950

= *Clavariachaeta* Lloyd 1922

Coltricia Gray 1821

= *Coltriciopsis* Teixeira 1991
= *Cycloporus* Murrill 1904
= *Pelloporus* Quél. 1886
= *Polystictus* Fr. 1851
= *Strilia* Gray 1821
= *Volvopolyporus* McGinty 1909
= *Xanthochrous* Pat. 1897
Coltriciella Murrill 1904
Coniferiporia L.W. Zhou & Y.C. Dai 2016
Cylindrosporus L.W. Zhou 2015
Deviodontia (Parmasto) Hjortstam & Ryvarden 2009
Dichochaete Parmasto 2001
Erythromyces Hjortstam & Ryvarden 1990
Fomitiporella Murrill 1907
Fomitiporia Murrill 1907
Fulvifomes Murrill 1914
Fuscoporia Murrill 1907
Hastodontia (Parmasto) Hjortstam & Ryvarden 2009
Hydnochaete Bres. 1896
Hymenochaete Lév. 1846
= *Cerrenella* Murrill 1905
= *Cyclomycetella* Murrill 1904
= *Cycloporellus* Murrill 1907
= *Hymenochaetella* P. Karst. 1889
= *Leptochaete* Lév. 1846
= *Stipitochaete* Ryvarden 1985
Hymenochaetopsis S.H. He & Jiao Yang 2016
= *Hydnoporia* Murrill 1907
= *Pseudochaete* T. Wagner & M. Fisch. 2002
Inocutis Fiasson & Niemelä 1984
Inonotopsis Parmasto 1973
Inonotus P. Karst. 1879
= *Flaviporellus* Murrill 1905
= *Phaeoporus* J. Schröt. 1888
= *Polystictoides* Lázaro Ibiza 1916
Mensularia Lázaro Ibiza 1916
Neomensularia F. Wu, L.W. Zhou & Y.C. Dai 2016
Nothophellinus Rajchenb. 2015
Onnia P. Karst. 1889
= *Mucronoporus* Ellis & Everh. 1889
Phellinidium (Kotl.) Fiasson & Niemelä 1984
Phellinopsis Y.C. Dai 2010
Phellinotus Drechsler-Santos, Robledo & Rajchenb. 2016
Phellinus Quél. 1886
= *Boletus* Dill. 1719
= *Boletus* Dill. ex Gray 1821
= *Boudiera* Lázaro Ibiza 1916
= *Fuscoporella* Murrill 1907

= *Ochroporus* J. Schröt. 1888
= *Ochrosporellus* (Bondartseva & S. Herrera) Bondartseva & S. Herrera 1992
= *Pseudofomes* Lázaro Ibiza 1916
= *Pyropolyporus* Murrill 1903
= *Scalaria* Lázaro Ibiza 1916
= *Scindalma* Hill ex Kuntze 1898
Phellopilus Niemelä, T. Wagner & M. Fisch. 2001
Phylloporia Murrill 1904
= *Cryptoderma* Imazeki 1943
= *Daedaloides* Lázaro Ibiza 1916
= *Phaeolopsis* Murrill 1905
Porodaedalea Murrill 1905
Pseudoinonotus T. Wagner & M. Fisch. 2001
Pyrrhoderma Imazeki 1966
Sanghuangporus Sheng H. Wu, L.W. Zhou & Y.C. Dai 2015
Tropicoporus L.W. Zhou, Y.C. Dai & Sheng H. Wu 2015
Tubulicrinis Donk 1956
Xanthoporia Murrill 1916

Family Neoantrodiellaceae Y.C. Dai, B.K. Cui, Jia J. Chen & H.S. Yuan 2015
Neoantrodiella Y.C. Dai, B.K. Cui, Jia J. Chen & H.S. Yuan 2015

Family Nigrofomitaceae Jülich 1982
Nigrofomes Murrill 1904
= *Melanoporella* Murrill 1907
= *Melanoporia* Murrill 1907

Family Oxyporaceae Zmitr. & V. Malysheva 2014
Oxyporus (Bourdot & Galzin) Donk 1933

Family Rickenellaceae Vizzini 2010
Alloclavaria Dentinger & D.J. McLaughlin 2007
Atheloderma Parmasto 1968
Contumyces Redhead, Moncalvo, Vilgalys & Lutzoni 2002
= *Jacobia* Contu 1998
Cotylidia P. Karst. 1881
= *Bresadolina* Brinkmann 1909
= *Craterella* Pers. 1794
= *Stereophyllum* P. Karst. 1889
Globulicium Hjortstam 1973
Peniophorella P. Karst. 1889
Resinicium Parmasto 1968
Rickenella Raithelh. 1973

Family Schizoporaceae Jülich 1982
Alutaceodontia (Parmasto) Hjortstam & Ryvarden 2002
Basidioradulum Nobles 1967
Echinoporia Ryvarden 1980
= *Echinodia* Pat. 1918
Fibrodontia Parmasto 1968
Hyphodontia J. Erikss. 1958
= *Chaetoporellus* Bondartsev & Singer 1941
Lagarobasidium Jülich 1974

Leucophellinus Bondartsev & Singer 1944
= *Oxyflavus* Ryvarden 1973
Odontiopsis Hjortstam & Ryvarden 1980
Paratrichaptum Corner 1987
Poriodontia Parmasto 1982
Rogersella Liberta & A.J. Navas 1978
Schizopora Velen. 1922
Xylodon (Pers.) Gray 1821
= *Palifer* Stalpers & P.K. Buchanan 1991

Hymenochaetales genera *incertae sedis*

Caeruleomyces Stalpers 2000
Cantharellopsis Kuyper 1986
Cyanotrama Ghobad-Nejhad & Y.C. Dai 2010
Fibricium J. Erikss. 1958
Ginnsia Sheng H. Wu & Hallenb. 2010
Gyroflexus Raithelh. 1981
= *Sphagnomphalia* Redhead, Moncalvo, Vilgalys & Lutzoni 2002
Kurtia Karasiński 2014
Lawrynomyces Karasiński 2013
Muscinupta Redhead, Lücking & Lawrey 2009
Physodontia Ryvarden & H. Solheim 1977
Sidera Miettinen & K.H. Larss. 2011
Skvortzovia Bononi & Hjortstam 1987
Subulicium Hjortstam & Ryvarden 1979
Trichaptum Murrill 1904
= *Hirschioporus* Donk 1933
Tsugacorticium Nakasone & Burds. 2011

Order Hysterangiales K. Hosaka & Castellano 2007

Family Gallaceaceae Locq. ex P.M. Kirk 2008

Austrogautieria E.L. Stewart & Trappe 1985
Gallacea Lloyd 1905
Hallingea Castellano 1996

Family Hysterangiaceae E. Fisch. 1899

Aroramyces Castellano & Verbeken 2000
Circulocolumella S. Ito & S. Imai 1957
= *Stalactocolumella* S. Imai 1950
Clathrogaster Petri 1900
Hysterangium Vittad. 1831

Family Mesophelliaceae Jülich 1982

Andebbia Trappe, Castellano & Amar. 1996
Castoreum Cooke & Massee 1887
Chondrogaster Maire 1926
Gummiglobus Trappe, Castellano & Amar. 1996
Gummivena Trappe & Bougher 2002
Malajczukia Trappe & Castellano 1992
Mesophellia Berk. 1857
= *Potoromyces* Müll. bis ex Hollós 1902
Nothocastoreum G.W. Beaton 1984

Family Phallogastraceae Locq. 1974

Phallogaster Morgan 1893

Protubera Möller 1895

= *Protophallus* Murrill 1910

Family Trappeaceae P.M. Kirk 2008

Phallobata G. Cunn. 1926

Restingomyces Sulzbacher, Grebenc & Baseia 2016

Trappea Castellano 1990

Order Jaapiales Manfr. Binder, K.H. Larss. & Hibbett 2010

Family Jaapiaceae Manfr. Binder, K.H. Larss. & Hibbett 2010

Jaapia Bres. 1911

= *Coniobotrys* Pouzar 1958

Order Lepidostromatales B.P. Hodk. & Lücking 2014

Family Lepidostromataceae Ertz, Eb. Fisch., Killmann, Sérus. & Lawrey 2008

Ertzia B.P. Hodk. & Lücking 2014

Lepidostroma Mägd. & S. Winkl. 1967

Sulzbacheromyces B.P. Hodk. & Lücking 2014

Order Phallales E. Fisch. 1898

Family Claustulaceae G. Cunn. 1931

Claustula K.M. Curtis 1926

Gelopellis Zeller 1939

Kjeldsenia W. Colgan, Castellano & Bougher 1995

Phlebogaster Fogel 1980

Pseudogelopellis K. Tao & B. Liu 1996

Family Gastrosporiaceae Pilát 1934

Gastrosporium Mattir. 1903

Family Phallaceae Corda 1842

Abrachium Baseia & T.S. Cabral 2012

Aporophallus Möller 1895

Aseroë Labill. 1800

Blumenavia Möller 1895

Calvarula Zeller 1939

Clathrus P. Micheli ex L. 1753

= *Anthurus* Kalchbr. & MacOwan 1880

= *Aserophallus* Mont. & Lepr. 1845

= *Clathrella* E. Fisch. 1898

= *Cletria* P. Browne 1756

= *Colonnaria* Raf. 1808

= *Dycticia* Raf. 1808

= *Linderiella* G. Cunn. 1942

Colus Cavalier & Séchier 1835

Echinophallus Henn. 1898

Endoclathrus B. Liu, Yin H. Liu & Z.J. Gu 2000

Endophallus M. Zang & R.H. Petersen 1989

Ileodictyon Tul. & C. Tul. 1844

Itajahya Möller 1895

= *Alboffiella* Speg. 1898

Kobayasia S. Imai & A. Kawam. 1958

Laternea Turpin 1822
Ligiella J.A. Sáenz 1980
Lysurus Fr. 1823
= *Calathiscus* Mont. 1841
= *Desmaturus* (Schltdl.) Kalchbr. 1880
= *Dictyobole* G.F. Atk. & Long 1902
= *Kalchbrennera* Berk. 1876
= *Kupsura* Lloyd 1924
= *Mycopharus* Petch 1926
= *Pharus* Petch 1919
= *Schizmaturus* (Corda) Kalchbr. 1880
= *Simblum* Klotzsch ex Hook. 1831
= *Sinolloydia* C.H. Chow 1936
Mutinus Fr. 1849
= *Aedycia* Raf. 1808
= *Caromyxa* Mont. 1856
= *Corynites* Berk. & M.A. Curtis 1853
= *Cynophallus* (Fr.) Corda 1842
= *Floccomutinus* Henn. 1895
= *Foetidaria* A. St.-Hil. 1835
= *Jansia* Penz. 1899
Neolysurus O.K. Mill., Ovrebo & Burk 1991
Phallus Junius ex L. 1753
= *Clautriavia* (Pat.) Lloyd 1909
= *Cryptophallus* Peck 1897
= *Dictyopeplos* Kuhl & Hasselt 1824
= *Dictyophallus* Corda 1842
= *Dictyophora* Desv. 1809
= *Hymenophallus* Nees 1816
= *Jaczewskia* Mattir. 1912
= *Kirchbaumia* Schulzer 1866
= *Morellus* Eaton 1818
= *Omphalophallus* Kalchbr. 1883
= *Phalloidastrum* Battarra 1755
= *Retigerus* Raddi 1829
= *Satyrus* Bosc 1811
= *Sophronia* Pers. 1827
Protuberella S. Imai & A. Kawam. 1958
Pseudoclathrus B. Liu & Y.S. Bau 1980
Pseudocolus Lloyd 1907
Staheliomyces E. Fisch. 1921
Staurophallus Mont. 1845
Stephanophallus MacOwan 1880
Xylophallus (Schltdl.) E. Fisch. 1933

Phallales genera *incertae sedis*

Saprogaster Fogel & States 2001
Vandasia Velen. 1922

Order Polyporales Gäum. 1926

Family Cerrenaceae Miettinen, Justo & Hibbett 2017

Cerrena Gray 1821

= *Phyllodontia* P. Karst. 1883

Irpiciporus Murrill 1905

Pseudolagarobasidium J.C. Jang & T.Chen 1985

Radulodon Ryvarden 1972

Family Dacryobolaceae Jülich 1981

Amylocystis Bondartsev & Singer ex Singer 1944

Dacryobolus Fr. 1849

= *Gloeocystidium* P. Karst. 1889

Jahnoporus Nuss 1980

Oligoporus Bref. 1888

= *Strangulidium* Pouzar 1967

Osteina Donk 1966

Postia Fr. 1874

= *Hemidiscia* Lázaro Ibiza 1916

= *Ptychogaster* Corda 1838

Spongiporus Murrill 1905

Family Fomitopsidaceae Jülich 1982

= Daedaleaceae Jülich 1981

= Piptoporaceae Jülich 1981

Adustoporia Audet 2017

Anthoporia Karasiński & Niemelä 2016

Antrodia P. Karst. 1879

= *Cartilosoma* Kotl. & Pouzar 1958

= *Coriolellus* Murrill 1905

Antrodiopsis Audet 2017

Brunneoporus Audet 2017

Buglossoporus Kotl. & Pouzar 1966

Daedalea Pers. 1801

= *Agarico-suber* Paulet 1793

= *Striglia* Adans. 1763

Dentiporus Audet 2017

Flavidoporia Audet 2017

Fomitopsis P. Karst. 1881

= *Pilatoporus* Kotl. & Pouzar 1990

= *Placoderma* (Ricken) Ulbr. 1928

= *Ungularia* Lázaro Ibiza 1916

Fragifomes B.K. Cui, M.L. Han & Y.C. Dai 2016

Laricifomes Kotl. & Pouzar 1957

= *Agaricon* Tourn. ex Adans. 1763

= *Agarico-pulpa* Paulet 1793

= *Agaricum* P. Micheli ex Haller 1768

= *Agaricum* Paulet 1812

Lentoporia Audet 2017

Neoantrodia Audet 2017

Neolentiporus Rajchenb. 1995

Niveoporofomes B.K. Cui, M.L. Han & Y.C. Dai 2016

Ranadivia Zmitr. 2018
Resinoporia Audet 2017
Rhizoporia Audet 2017
Rhodofomes Kotl. & Pouzar 1990
Rhodofomitopsis B.K. Cui, M.L. Han & Y.C. Dai 2016
Rubellofomes B.K. Cui, M.L. Han & Y.C. Dai 2016
Subantrodia Audet 2017
Ungulidaedalea B.K. Cui, M.L. Han & Y.C. Dai 2016
Wolfiporia Ryvarden & Gilb. 1984
= *Pachyma* Fr. 1822

Family Fragiliporiaceae Y.C. Dai, B.K. Cui & C.L. Zhao 2015
Fragiliporia Y.C. Dai, B.K. Cui & C.L. Zhao 2015

Family Gelatoporiaceae Miettinen, Justo & Hibbett 2017
Cinereomyces Jülich 1982
Gelatoporia Niemelä 1985
Obba Miettinen & Rajchenb. 2012
Sebipora Miettinen 2012

Family Grifolaceae Jülich 1982
Aegis Gómez-Montoya, Rajchenb. & Robledo 2017
Grifola Gray 1821
= *Cladodendron* Lázaro Ibiza 1916
= *Polypilus* P. Karst. 1881

Family Hyphodermataceae Jülich 1981
Hyphoderma Fr. 1833
= *Mutatoderma* (Parmasto) C.E. Gómez 1976
= *Pycnodon* Underw. 1898

Family Incrustoporiaceae Jülich 1982
Gloeoporellus Zmitr. 2018
Incrustoporia Domanski 1963
Piloporia Niemelä 1982
Skeletocutis Kotl. & Pouzar 1958
= *Leptotrimitus* Pouzar 1966
Tyromyces P. Karst. 1881

Family Irpicaceae Spirin & Zmitr. 2003
Byssomerulius Parmasto 1967
Ceriporia Donk 1933
Cytidiella Pouzar 1954
Efibula Sheng H. Wu 1990
Emmia Zmitr., Spirin & Malysheva 2006
Flavodon Ryvarden 1973
Gloeoporus Mont. 1842
= *Vitreoporus* Zmitr. 2018
Hydnopolyporus D.A.Reid 1962
Irpex Fr. 1825
Leptoporus Quél. 1886
Meruliopsis Bondartsev 1959
Raduliporus Spirin & Zmitr. 2006
Resiniporus Zmitr. 2018

Trametopsis Tomšovský 2008

Family Ischnodermataceae Jülich 1981

Ischnoderma P. Karst. 1879

= *Lasiochlaena* Pouzar 1990

Family Laetiporaceae Jülich 1981

= Phaeolaceae Jülich 1981

Kusaghiporia J. Hussein, S. Tibell & Tubuhwa 2018

Laetiporus Murrill 1904

= *Cladoporus* (Pers.) Chevall. 1826

Phaeolus (Pat.) Pat. 1900

= *Choriphyllum* Velen. 1922

= *Spongiosus* Lloyd ex Torrend 1920

Family Meripilaceae Jülich 1982

= Rigidoporaceae Jülich 1981

Meripilus P. Karst. 1882

= *Flabellopilus* Kotl. & Pouzar 1957

Pseudonadsoniella T.O. Kondr. & S.Y. Kondr. 2015

Rigidoporus Murrill 1905

= *Leucofomes* Kotl. & Pouzar 1957

Family Meruliaceae Rea 1922

= Climacodontaceae Jülich 1981

= Phlebiaceae Jülich 1981

Aurantiopileus Ginns, D.L. Lindner & T.J. Baroni 2010

Aurantiporus Murrill 1905

Ceriporiopsis Domański 1963

Climacodon P. Karst. 1881

Crustodontia Hjortstam & Ryvarden 2005

Geesterania Westphalen, Tomšovský & Rajchenb. 2018

Hermanssonia Zmitr. 2018

Hydnophanerochaete Sheng H. Wu & C.C. Chen 2018

Hydnophlebia Parmasto 1967

Lilaceophlebia (Parmasto) Spirin & Zmitr. 2004

Luteoporia F. Wu, Jia J. Chen & S.H. He 2016

Merulius Fr. 1821

Mycoacia Donk 1931

Mycoaciella J. Erikss. & Ryvarden 1978

= *Ceraceohydnum* Jülich 1978

Odoria V. Papp & Dima 2017

Pappia Zmitr. 2018

Phlebia Fr. 1821

= *Jacksonomyces* Jülich 1979

Phlebiporia Jia J. Chen, B.K. Cui & Y.C. Dai 2014

Physisporinus P. Karst. 1889

Sarcodontia Schulzer 1866

= *Oxydontia* L.W. Mill. 1933

Scopuloides (Massee) Höhn. & Litsch. 1908

Stereophlebia Zmitr. 2018

Family Panaceae Miettinen, Justo & Hibbett 2017

Cymatoderma Jungh. 1840
= *Actinostroma* Klotzsch 1843
= *Beccariella* Ces. 1879
= *Cladoderris* Pers. ex Berk. 1842
Panus Fr. 1838
= *Lentinopanus* Pilát 1941

Family Phanerochaetaceae Jülich 1982
= Hapalopilaceae Jülich 1981
= Bjerkanderaceae Jülich 1981
Bjerkandera P. Karst. 1879
= *Myriadoporus* Peck 1884
Donkia Pilát 1937
Efibulella Zmitr. 2018
Geliporus Yuan Yuan, Jia J. Chen & S.H. He 2017
Hapalopilus P. Karst. 1881
Hyphodermella J. Erikss. & Ryvarden 1976
Odontoefibula C.C. Chen & Sheng H. Wu 2018
Oxychaete Miettinen 2016
Phaeophlebiopsis D. Floudas & Hibbett 2015
Phanerina Miettinen 2016
Phanerochaete P. Karst. 1889
= *Atheliachaete* Spirin & Zmitr. 2011
= *Grandiniella* P. Karst. 1895
= *Hjortstamia* Boidin & Gilles 2003
= *Xerocarpus* P. Karst. 1881
Phlebiopsis Jülich 1978
Pirex Hjortstam & Ryvarden 1985
Porostereum Pilát 1937
Rhizochaete Gresl., Nakasone & Rajchenb. 2004
Riopa D.A. Reid 1969
= *Sporotrichum* Link 1809
Terana Adans. 1763
= *Pulcherricium* Parmasto 1968

Family Podoscyphaceae D.A. Reid 1965
Abortiporus Murrill 1904
= *Heteroporus* Lázaro Ibiza 1916
= *Irpicium* Bref. 1912
= *Sporotrichopsis* Stalpers 2000
Podoscypha Pat. 1900
Pouzaroporia Vampola 1992

Family Polyporaceae Fr. ex Corda 1839
= Ganodermataceae (Donk) Donk 1948
= Coriolaceae Singer 1961
= Cryptoporaceae Jülich 1981
= Echinochaetaceae Jülich 1981
= Fomitaceae Jülich 1981
= Grammotheleaceae Jülich 1981
= Haddowiaceae Jülich 1981

= Microporaceae Jülich 1981
= Pachykytosporaceae Jülich 1981
= Perenniporiaceae Jülich 1981
= Sparsitubaceae Jülich 1981
= Lophariaceae Boidin, Mugnier & Canales 1998
= Trametaceae Boidin, Mugnier & Canales 1998
Abundisporus Ryvarden 1999
Amauroderma Murrill 1905
= *Magoderna* Steyaert 1972
Atroporus Ryvarden 1973
= *Cladomeris* Quél. 1886
= *Dendropolyporus* (Pouzar) Jülich 1982
= *Mycelithe* Gasp. 1841
Australoporus P.K. Buchanan & Ryvarden 1988
Bresadolia Speg. 1883
Cerarioporia F. Wu, L.W. Zhou & J. Si 2016
Cerioporus Quél. 1886
= *Grandinioides* Banker 1906
= *Melanopus* Pat. 1887
= *Mycobonia* Pat. 1894
= *Petaloides* Lloyd ex Torrend 1920
Cinereomycetella Zmitr. 2018
Colospora Miettinen & Spirin 2015
Coriolopsis Murrill 1905
Cryptoporus (Peck) Shear 1902
Daedaleopsis J. Schröt. 1888
= *Apoxona* Donk 1969
Datronia Donk 1966
Datroniella B.K. Cui, Hai J. Li & Y.C. Dai 2014
Dentocorticium (Parmasto) M.J. Larsen & Gilb. 1974
= *Dendrodontia* Hjortstam & Ryvarden 1980
Dextrinoporus H.S. Yuan 2018
Dichomitus D.A. Reid 1965
Donkioporia Kotl. & Pouzar 1973
Donkioporiella L.W. Zhou 2016
Earliella Murrill 1905
Echinochaete D.A. Reid 1963
= *Dendrochaete* G. Cunn. 1965
Endopandanicola Tibpromma & K.D. Hyde 2018
Epithele (Pat.) Pat. 1900
Epithelopsis Jülich 1976
Favolus Fr. 1828
Flammeopellis Y.C. Dai, B.K. Cui & C.L. Zhao 2014
Fomes (Fr.) Fr. 1849
= *Elfvingiella* Murrill 1914
Globifomes Murrill 1904
= *Placodes* Quél. 1886
= *Ungulina* Pat. 1900

Fomitella Murrill 1905
Foraminispora Robledo, Costa-Rezende & Drechsler-Santos 2017
Funalia Pat. 1900
Furtadoa Costa-Rezende, Robledo & Drechsler-Santos 2017
Ganoderma P. Karst. 1881
= *Elfvingia* P. Karst. 1889
Grammothele Berk. & M.A. Curtis 1868
Grammothelopsis Jülich 1982
Haddowia Steyaert 1972
Haploporus Bondartsev & Singer 1944
Hexagonia Fr. 1835
Hornodermoporus Teixeira 1993
Humphreya Steyaert 1972
Laccocephalum McAlpine & Tepper 1895
Leifiporia Y.C. Dai, F. Wu & C.L. Zhao 2016
Lentinus Fr. 1825
= *Lentodiellum* Murrill 1915
= *Lentodium* Morgan 1895
= *Leucoporus* Quél. 1886
= *Polyporellus* P. Karst. 1879
Lignosus Lloyd ex Torrend 1920
Lopharia Kalchbr. & MacOwan 1881
= *Lloydella* Bres. 1901
= *Thwaitesiella* Massee 1892
Megasporia B.K. Cui, Y.C. Dai & Hai J. Li 2013
Megasporoporia Ryvarden & J.E. Wright 1982
Megasporoporiella B.K. Cui, Y.C. Dai & Hai J. Li 2013
Melanoderma B.K. Cui & Y.C. Dai 2011
Microporellus Murrill 1905
Microporus P. Beauv. 1805
Mollicarpus Ginns 1984
Murinicarpus B.K. Cui & Y.C. Dai 2019
Myriothele Nakasone 2013
Navisporus Ryvarden 1980
Neodatronia B.K. Cui, Hai J. Li & Y.C. Dai 2014
Neodictyopus Palacio, Robledo, Reck & Drechsler-Santos 2017
Neofavolus Sotome & T. Hatt. 2013
Neofomitella Y.C. Dai, Hai J. Li & Vlasák 2014
Pachykytospora Kotl. & Pouzar 1963
Perenniporia Murrill 1942
= *Physisporus* Chevall. 1826
Perenniporiella Decock & Ryvarden 2003
Perenniporiopsis C.L. Zhao 2017
Phaeotrametes Lloyd ex J.E. Wright 1966
= *Phaeotrametes* Lloyd 1915
Picipes Zmitr. & Kovalenko 2016
Pilatotrama Zmitr. 2018
Podofomes Pouzar 1966

Polyporopsis Audet 2010
Polyporus [P. Micheli ex Adans.] Fr. 1821
Porogramme (Pat.) Pat. 1900
= *Tinctoporia* Murrill 1907
Pseudofavolus Pat. 1900
Pseudomegasporoporia X.H. Ji & F. Wu 2017
Pseudopiptoporus Ryvarden 1980
Pyrofomes Kotl. & Pouzar 1964
Rubroporus Log.-Leite, Ryvarden & Groposo 2002
Sparsitubus L.W. Hsu & J.D. Zhao 1980
Szczepkamyces Zmitr. 2018
Theleporus Fr. 1847
Thermophymatospora Udagawa, Awao & Abdullah 1986
Tinctoporellus Ryvarden 1979
Tomophagus Murrill 1905
Trametes Fr. 1836
= *Artolenzites* Falck 1909
= *Cellularia* Bull. 1788
= *Cellulariella* Zmitr. & Malysheva 2014
= *Coriolus* Quél. 1886
= *Cubamyces* Murrill 1905
= *Leiotrametes* Welti & Courtec. 2012
= *Lenzites* Fr. 1836
= *Pseudotrametes* Bondartsev & Singer 1944
= *Pycnoporus* P. Karst. 1881
= *Tomentoporus* Ryvarden 1973
= *Trametella* Pinto-Lopes 1952
Truncospora Pilát 1953
= *Loweporus* J.E. Wright 1976
Vanderbylia D.A. Reid 1973
Yuchengia B.K. Cui & K.T. Steffen 2013

Family Sparassidaceae Jülich 1981
Crustoderma Parmasto 1968
Pycnoporellus Murrill 1905
= *Aurantiporellus* Murrill 1905
Sparassis Fr. 1819
= *Masseeola* Kuntze 1891

Family Steccherinaceae Parmasto 1968
= Mycorraphiacaeae Jülich 1981
Antella Miettinen 2016
Antrodiella Ryvarden & I. Johans. 1980
Atraporiella Ryvarden 2007
Austeria Miettinen 2016
Butyrea Miettinen 2016
Cabalodontia Piątek 2004
Caudicicola Miettinen, M. Kulju & Kotir. 2017
Citripora Miettinen 2016
Elaphroporia Z.Q. Wu & C.L. Zhao 2018

Flabellophora G. Cunn. 1965
Flaviporus Murrill 1905
= *Baeostratoporus* Bondartsev & Singer 1944
Frantisekia Spirin & Zmitr. 2007
Junghuhnia Corda 1842
= *Chaetoporus* P. Karst. 1890
Lamelloporus Ryvarden 1987
Loweomyces (Kotl. & Pouzar) Jülich 1982
Metuloidea G. Cunn. 1965
Mycorrhaphium Maas Geest. 1962
Niemelaea Zmitr., Ezhov & Khimich 2015
Nigroporus Murrill 1905
Steccherinum Gray 1821
= *Etheirodon* Banker 1902
= *Odontina* Pat. 1887
Trullella Zmitr. 2018
Xanthoporus Audet 2010

Polyporales genera *incertae sedis*

Aegeritopsis Höhn. 1903
Amaropostia B.K. Cui, L.L. Shen & Y.C. Dai 2019
Amaurohydnum Jülich 1978
Amauromyces Jülich 1978
Amethicium Hjortstam 1983
Amyloporia Singer 1944
Aquascypha D.A. Reid 1965
Auriporia Ryvarden 1973
Australicium Hjortstam & Ryvarden 2002
Australohydnum Jülich 1978
Austrolentinus Ryvarden 1991
Bourdotiella Duhem & Schultheis 2011
Bulbillomyces Jülich 1974
= *Aegerita* Pers. 1794
= *Crocysporium* Corda 1837
= *Dermosporium* Link 1816
Calcipostia B.K. Cui, L.L. Shen & Y.C. Dai 2019
Candelabrochaete Boidin 1970
Climacocystis Kotl. & Pouzar 1958
Columnodontia Jülich 1979
Conohypha Jülich 1975
Coralloderma D.A. Reid 1965
Cordochaete Sanyal, Samita, Dhingra & Avn.P. Singh 2013
Cryptomphalina R. Heim 1966
Cyanodontia Hjortstam 1987
Cyanosporus McGinty 1909
Cystidiopostia B.K. Cui, L.L. Shen & Y.C. Dai 2019
Dendrophlebia Dhingra & Priyanka 2011
Diacanthodes Singer 1945
Diplomitoporus Domański 1970

= *Fabisporus* Zmitr. 2001
Erastia Niemelä & Kinnunen 2005
Faerberia Pouzar 1981
= *Geopetalum* Pat. 1887
Fibroporia Parmasto 1968
Fuscopostia B.K. Cui, L.L. Shen & Y.C. Dai 2019
Gilbertsonia Parmasto 2001
Globosomyces Jülich 1980
Globuliciopsis Hjortstam & Ryvarden 2004
Gyrophanopsis Jülich 1979
= *Hyphodermopsis* Jülich 1982
Henningsia Möller 1895
Hymenogramme Mont. & Berk. 1844
Hyphodontiastra Hjortstam 1999
Hypochnicium J. Erikss. 1958
Inflatostereum D.A. Reid 1965
Irpicochaete Rick 1940
Laetifomes T. Hatt. 2001
Macrohyporia I. Johans. & Ryvarden 1979
Meruliophana Duhem & Buyck 2011
Mycoleptodonoides Nikol. 1952
Mycorrhaphoides Hembrom, K. Das & Hallenb. 2017
Nigrohydnum Ryvarden 1987
Phaneroites Hjortstam & Ryvarden 2010
Phanerodontia Hjortstam & Ryvarden 2010
Phlebiella P. Karst. 1890
Piptoporellus B.K. Cui, M.L. Han & Y.C. Dai 2016
Pseudofibroporia Yuan Y. Chen, B.K. Cui & Y.C. Dai 2017
Repetobasidiopsis Dhingra & Avn.P. Singh 2008
Rhodonia Niemelä 2005
= *Caloporus* P. Karst. 1881
Rickiopora Westphalen, Tomšovský & Rajchenb. 2016
Roseofavolus T. Hatt. 2003
Roseograndinia Hjortstam & Ryvarden 2005
Ryvardenia Rajchenb. 1994
Sarcoporia P. Karst. 1894
Skeletohydnum Jülich 1979
Sparassiella Schwarzman 1964
Spathulina Pat. 1900
Spongioides Lázaro Ibiza 1916
Spongipellis Pat. 1887
Stegiacantha Maas Geest. 1966
Taiwanofungus Sheng H. Wu, Z.H. Yu, Y.C. Dai & C.H. Su 2004
Uncobasidium Hjortstam & Ryvarden 1978

Order Russulales Kreisel ex P.M. Kirk, P.F. Cannon & J.C. David 2001

Family Albatrellaceae Nuss 1980

Albatrellopsis Teixeira 1993
Albatrellus Gray 1821

= *Ovinus* (Lloyd) Torrend 1920
Byssoporia M.J. Larsen & Zak 1978
Leucogaster R. Hesse 1882
Leucophleps Harkn. 1899
= *Cremeogaster* Mattir. 1924
Mycolevis A.H. Sm. 1965
Polyporoletus Snell 1936
Scutiger Paulet 1808

Family Auriscalpiaceae Maas Geest. 1963
Amylonotus Ryvarden 1975
Artomyces Jülich 1982
Auriscalpium Gray 1821
= *Pleurodon* Quél. ex P. Karst. 1881
Dentipratulum Domański 1965
Lentinellus P. Karst. 1879
= *Hemicybe* P. Karst. 1879
Stalpersia Parmasto 2001

Family Bondarzewiaceae Kotl. & Pouzar 1957
Amylaria Corner 1955
Amylosporus Ryvarden 1973
= *Rigidoporopsis* I. Johans. & Ryvarden 1979
Bondarzewia Singer 1940
Gloiodon P. Karst. 1879
= *Leaia* Banker 1906
= *Sclerodon* P. Karst. 1889
Heterobasidion Bref. 1888
Laurilia Pouzar 1959
Lauriliella Nakasone & S.H. He 2017
Steccherícium D.A. Reid 1963
Wrightoporia Pouzar 1966

Family Echinodontiaceae Donk 1961
= Amylostereaceae Boidin, Mugnier & Canales 1998
Amylostereum Boidin 1958
= *Lloydellopsis* Pouzar 1959
= *Trichocarpus* P. Karst. 1889
Echinodontiellum S.H. He & Nakasone 2017
Echinodontium Ellis & Everh. 1900
= *Hydnofomes* Henn. 1900
Larssoniporia Y.C. Dai, Jia J. Chen & B.K. Cui 2015

Family Hericiaceae Donk 1964
Dentipellicula Y.C. Dai & L.W. Zhou 2013
Dentipellis Donk 1962
= *Amylodontia* Nikol. 1967
Hericium Pers. 1794
= *Friesites* P. Karst. 1879
= *Hericium* Schrank 1786
= *Hericius* Juss. 1789
= *Martella* Endl. 1836

= *Medusina* Chevall. 1826
Laxitextum Lentz 1956
Pseudowrightoporia Y.C. Dai, Jia J. Chen & B.K. Cui 2015
Wrightoporiopsis Y.C. Dai, Jia J. Chen & B.K. Cui 2015
Family Hybogasteraceae Jülich 1982
Hybogaster Singer 1964
Family Peniophoraceae Lotsy 1907
= Lachnocladiaceae Jülich 1982
Amylofungus Sheng H. Wu 1996
Asterostroma Massee 1889
Baltazaria Leal-Dutra, Dentinger & G.W. Griff. 2018
Dendrophora (Parmasto) Chamuris 1987
Dichostereum Pilát 1926
Duportella Pat. 1915
Entomocorticium H.S. Whitney, Bandoni & Oberw. 1987
Gloiothele Bres. 1920
Lachnocladium Lév. 1846
= *Eriocladus* Lév. 1846
= *Stelligera* R. Heim 1938
= *Stelligera* R. Heim ex Doty 1948
Licrostroma P.A. Lemke 1964
= *Michenera* Berk. & M.A. Curtis 1868
Metulodontia Parmasto 1968
Peniophora Cooke 1879
= *Cryptochaete* P. Karst. 1889
= *Gloeopeniophora* Höhn. & Litsch. 1907
= *Sterellum* P. Karst. 1889
Sceptrulum K.H. Larss. 2014
Scytinostroma Donk 1956
Vararia P. Karst. 1898
= *Asterostromella* Höhn. & Litsch. 1907
= *Denrophysellum* Parmasto 1968
Vesiculomyces E. Hagstr. 1977
Family Russulaceae Lotsy 1907
Boidinia Stalpers & Hjortstam 1982
Gloeopeniophorella Rick 1934
Lactarius Pers. 1797
= *Arcangeliella* Cavara 1900
= *Galorrheus* (Fr.) Fr. 1825
= *Gastrolactarius* R. Heim 1971
= *Gastrolactarius* R. Heim ex J.M. Vidal 2005
= *Gloeocybe* Earle 1909
= *Lactariella* J. Schröt. 1889
= *Zelleromyces* Singer & A.H. Sm. 1960
Lactifluus (Pers.) Roussel 1806
= *Lactariopsis* Henn. 1901
= *Pleurogala* Redhead & Norvell 1993
Multifurca Buyck & V. Hofst. 2008

Pseudoxenasma K.H. Larss. & Hjortstam 1976
Russula Pers. 1796
= *Bucholtzia* Lohwag 1924
= *Cystangium* Singer & A.H. Sm. 1960
= *Dixophyllum* Earle 1909
= *Elasmomyces* Cavara 1897
= *Gymnomyces* Massee & Rodway 1898
= *Lactarelis* Earle 1909
= *Macowanites* Kalchbr. 1882
= *Martellia* Mattir. 1900
= *Omphalomyces* Battarra ex Earle 1909
= *Phaeohygrocybe* Henn. 1901
= *Russulina* J. Schröt. 1889

Family Stereaceae Pilát 1930
Acanthobasidium Oberw. 1965
Acanthofungus Sheng H. Wu, Boidin & C.Y. Chien 2000
Acanthophysellum Parmasto 1967
Acanthophysium (Pilát) G. Cunn. 1963
Aleurobotrys Boidin 1986
Aleurodiscus Rabenh. ex J. Schröt. 1888
= *Aleurodiscus* Rabenh. 1874
= *Aleurodiscus* Cooke 1885
Aleuromyces Boidin & Gilles 2002
Amylohyphus Ryvarden 1978
Amylosporomyces S.S. Rattan 1977
Confertextum Priyanka & Dhingra 2014
Conferticium Hallenb. 1980
Dextrinocystidium Sheng H. Wu 1996
Gloeocystidiellum Donk 1931
Gloeocystidiopsis Jülich 1982
Gloeomyces Sheng H. Wu 1996
Gloeosoma Bres. 1920
Matula Massee 1888
Megalocystidium Jülich 1978
Neoaleurodiscus Sheng H. Wu 2010
Scotoderma Jülich 1974
Stereum Hill ex Pers. 1794
= *Haematostereum* Pouzar 1959
Xylobolus P. Karst. 1881

Family Xenasmataceae Oberw. 1965
Xenasma Donk 1957
Xenasmatella Oberw. 1965
Xenosperma Oberw. 1965

Russulales genera *incertae sedis*
Aleurocystidiellum P.A. Lemke 1964
Dentipellopsis Y.C. Dai & L.W. Zhou 2013
Dichantharellus Corner 1966
Dichopleuropus D.A. Reid 1965

Gloeoasterostroma Rick 1938
Gloeodontia Boidin 1966
Gloeohypochnicium (Parmasto) Hjortstam 1987
Haloaleurodiscus N. Maek., Suhara & K. Kinjo 2005
Laeticutis Audet 2010
Neoalbatrellus Audet 2010
Perplexostereum Ryvarden & S. Tutka 2014
Polypus Audet 2010
Scopulodontia Hjortstam 1998
Scytinostromella Parmasto 1968
= *Confertobasidium* Jülich 1972
Xeroceps Audet 2010

Order Sebacinales M. Weiss, Selosse, Rexer, A. Urb. & Oberw. 2004

Family Sebacinaceae K. Wells & Oberw. 1982
Chaetospermum Sacc. 1892
Ditangium P. Karst. 1867
= *Craterocolla* Bref. 1888
= *Poroidea* Göttinger ex G. Winter 1885
Efibulobasidium K. Wells 1975
Globulisebacina Oberw., Garnica & K. Riess 2014
Helvellosebacina Oberw., Garnica & K. Riess 2014
Paulisebacina Oberw., Garnica & K. Riess 2014
Sebacina Tul. & C. Tul. 1871
= *Atkinsonia* Lloyd 1916
= *Collodendrum* Clem. 1909
= *Corticioides* Lloyd 1908
= *Cristella* Pat. 1887
= *Opadorhiza* T.F. Andersen & R.T. Moore 1996
= *Soppittiella* Massee 1892
= *Tremellodendron* G.F. Atk. 1902
Tremelloscypha D.A. Reid 1979
= *Tremellostereum* Ryvarden 1986

Family Serendipitaceae M. Weiss, Waller, A. Zuccaro & Selossé 2016
Serendipita P. Roberts 1993
= *Piriformospora* Sav. Verma, Aj. Varma, Rexer, G. Kost & P. Franken 1998

Order Stereopsidales Sjökvist, E. Larss., B.E. Pfeil & K.H. Larss. 2013

Family Stereopsidaceae Sjökvist, E. Larss., B.E. Pfeil & K.H. Larss. 2013
Stereopsis D.A. Reid 1965

Order Thelephorales Corner ex Oberw. 1976

Family Bankeraceae Donk 1961
Bankera Coker & Beers ex Pouzar 1955
Boletopsis Fayod 1889
Corneroporus T. Hatt. 2001
Hydnellum P. Karst. 1879
= *Calodon* P. Karst. 1881
= *Phaeodon* J. Schröt. 1888
Sarcodon Quél. ex P. Karst. 1881

Family Thelephoraceae Chevall. 1826

Amaurodon J. Schröt. 1888
Gymnoderma Humb. 1793
Lenzitopsis Malençon & Bertault 1963
Parahaplotrichum W.A. Baker & Partr. 2001
Phellodon P. Karst. 1881
Polyozellus Murrill 1910
= *Phyllocarbon* Lloyd 1920
Pseudotomentella Svrček 1958
Skepperia Berk. 1857
Thelephora Ehrh. ex Willd. 1787
= *Merisma* Pers. 1797
= *Phylacteria* (Pers.) Pat. 1887
= *Pseudothelephora* Lloyd 1919
= *Scyphopilus* P. Karst. 1881
Tomentella Pers. ex Pat. 1887
= *Acrotamnium* Nees 1816
= *Caldesiella* Sacc. 1877
= *Cyphellina* Rick 1959
= *Hypochnus* Fr. 1818
= *Karstenia* Britzelm. 1897
Tomentellopsis Hjortstam 1970
= *Byssocristella* M.P. Christ. & J.E.B. Larsen 1970

Thelephorales genera *incertae sedis*

Thelephorella P. Karst. 1889

Order Trechisporales K.H. Larss. 2007

Family Hydnodontaceae Jülich 1982

Brevicellicium K.H. Larss. & Hjortstam 1978
Dextrinocystis Gilb. & M. Blackw. 1988
Dextrinodontia Hjortstam & Ryvarden 1980
Hydnodon Banker 1913
= *Pseudohydnum* Rick 1904
Litschauerella Oberw. 1965
Luellia K.H. Larss. & Hjortstam 1974
Porpomyces Jülich 1982
Scytinopogon Singer 1945
Sistotremastrum J. Erikss. 1958
Sphaerobasidium Oberw. 1965
Subulicystidium Parmasto 1968
Trechispora P. Karst. 1890
= *Cristelloporia* I. Johans. & Ryvarden 1979
= *Echinotrema* Park.-Rhodes 1955
= *Fibriciellum* J. Erikss. & Ryvarden 1975
= *Fibuloporia* Bondartsev & Singer 1941
= *Fibuloporia* Bondartsev & Singer 1944
= *Murrilloporus* Ryvarden 1985
= *Tomentella* P. Karst. 1889
Tubulicium Oberw. 1965
= *Tubulixenasma* Parmasto 1965

Order Tremellodendropsidales Vizzini 2014

Family Tremellodendropsidaceae Jülich 1982

Tremellodendropsis (Corner) D.A. Crawford 1954

= *Polyozus* P. Karst. 1881

= *Pseudotremellodendron* D.A. Reid 1957

Agaricomycetes genera *incertae sedis*

Akenomyces G. Arnaud ex D. Hornby 1984

Aldridgea Massee 1892

Arthrodochium R.F. Castañeda & W.B. Kendr. 1990

Arualis Katz 1980

Blasiphalia Redhead 2007

Bridgeoporus T.J. Volk, Burds. & Ammirati 1996

Cenangiomyces Dyko & B. Sutton 1979

Ceraceopsis Hjortstam & Ryvarden 2007

Cilicia Fr. 1825

Corticomyces A.I. Romero & S.E. López 1989

Cruciger R. Kirschner & Oberw. 1999

Dendrosporomyces Nawawi, J. Webster & R.A. Davey 1977

Ellula Nag Raj 1980

Fibulocoela Nag Raj 1978

Fibulotaeniella Marvanová & Bärl. 1988

Geotrichopsis Tzean & Estey 1991

Gloeosynnema Seifert & G. Okada 1988

Glomerulomyces A.I. Romero & S.E. López 1989

Glutinoagger Sivan. & Watling 1980

Hallenbergia Dhingra & Priyanka 2011

Intextomyces J. Erikss. & Ryvarden 1976

Korupella Hjortstam & P. Roberts 2000

Loreleia Redhead, Moncalvo, Vilgalys & Lutzoni 2002

Minostroscyta Hjortstam & Ryvarden 2001

Mylittopsis Pat. 1895

Myriococcum Fr. 1823

Odonticium Parmasto 1968

= *Leifia* Ginns 1998

Pagidospora Drechsler 1960

Phlyctibasidium Jülich 1974

Purpureocorticium S.H. Wu 2017

Pycnovellomyces R.F. Castañeda 1987

Riessia Fresen. 1852

Riessiella Jülich 1985

Taiwanoporia T.T. Chang & W.N. Chou 2003

Titaeella G. Arnaud ex K. Ando & Tubaki 1985

Trechinothus E.C. Martini & Trichiès 2004

Trimitiella Dhingra 2008

= *Trimitiella* Dhingra 2006

Tubulicrinopsis Hjortstam & Kotir. 2007

Xerotus Fr. 1828

= *Xerotinus* Rchb. 1828

Class Dacrymycetes Doweld 2001
Order Dacrymycetales Henn. 1897
Family Cerinomycetaceae Jülich 1982
Cerinomyces G.W. Martin 1949
Family Dacrymycetaceae J. Schröt. 1888
Calocera (Fr.) Fr. 1828
= *Calopposis* Lloyd 1925
= *Corynoides* Gray 1821
= *Dacryomitra* Tul. & C. Tul. 1872
Cerinosterus R.T. Moore 1987
Dacrymyces Nees 1816
= *Arrhytidia* Berk. & M.A. Curtis 1849
= *Hydromycus* Raf. 1808
= *Septocolla* Bonord. 1851
Dacryonaema Nannf. 1947
Dacryopinax G.W. Martin 1948
Dacryoscyphus R. Kirschner & Zhu L. Yang 2005
Ditiola Fr. 1822
= *Dacryopsis* Massee 1891
Femsjonia Fr. 1849
Guepiniopsis Pat. 1883
Heterotextus Lloyd 1922
Order Unilacrymales Shirouzu, Tokum. & Oberw. 2013
Family Unilacrymaceae Shirouzu, Tokum. & Oberw. 2013
Unilacryma Shirouzu, Tokum. & Oberw. 2013
Class Tremellomycetes Doweld 2001
Order Cystofilobasidiales Fell, Roeijmans & Boekhout 1999
Family Cystofilobasidiaceae K. Wells & Bandoni 2001
Cystofilobasidium Oberw. & Bandoni 1983
Family Mrakiaceae X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015
Itersonilia Derx 1948
Krasilnikovozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015
Mrakia Y. Yamada & Komag. 1987
Phaffia M.W. Mill., Yoney. & Soneda 1976
= *Rhodomyces* Wettst. 1885
= *Xanthophyllomyce* Golubev 1995
Tausonia Babeva 1998
Udeniomyces Nakase & Takem. 1992
Vustinia Kachalkin, Turchetti & Yurkov 2019
Order Filobasidiales Jülich 1981
Family Filobasidiaceae L.S. Olive 1968
Filobasidium L.S. Olive 1968
Goffeauzyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015
Heterocephalacria Berthier 1980
Naganishia S. Goto 1963
Syzygospora G.W. Martin 1937
Family Piskurozymaceae X. Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015
Piskurozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Solicoccozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Order Holtermanniales Libkind, Wuczk., Turchetti & Boekhout 2011

Family Holtermanniaceae Redhead 2015

Holtermannia Sacc. & Traverso 1910

Holtermanniella Libkind, Wuczk., Turchetti & Boekhout 2011

Order Tremellales Fr. 1821

Family Bulleraceae X. Zh. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Bullera Derx 1930

= *Bulleromyces* Boekhout & Á. Fonseca 1991

Fonsecazyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Genolevuria X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Pseudotremella X.Z. Liu, F.Y. Bai, A.M. Yurkov, M. Groenew. & Boekhout 2015

Family Bulleribasidiaceae X. Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Bulleribasidium J.P. Samp., M. Weiss & R. Bauer 2002

= *Mingxiaea* F.Y. Bai, Q.M. Wang, Boekhout & Nakase 2011

Derxomyces F.Y. Bai & Q.M. Wang 2008

Dioszegia Zsolt 1957

Hannaella F.Y. Bai & Q.M. Wang 2008

Nielozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Vishniacozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Family Carcinomycetaceae Oberw. & Bandoni 1982

Carcinomyces Oberw. & Bandoni 1982

Family Cryptococcaceae Kütz. ex Castell. & Chalm. 1919

Cryptococcus Vuill. 1901

= *Atelosaccharomyces* Beurm. & Gougerot 1909

= *Cryptococcus* Kütz. 1833

= *Filobasidiella* Kwon-Chung 1976

= *Tsuchiyaea* Y. Yamada, H. Kawas., Itoh, I. Banno & Nakase 1988

Kwoniella Statzell & Fell 2008

Family Cuniculitremaceae J.P. Samp., R. Kirschner & M. Weiss 2001

Fellomyces Y. Yamada & I. Banno 1984

Kockovaella Nakase, I. Banno & Y. Yamada 1991

Sterigmatosporidium G. Kraep. & U. Schulze 1983

= *Cuniculitrema* J.P. Samp. & R. Kirschner 2001

Family Naemateliaceae X. Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Dimennazyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Naematelia Fr. 1818

Family Phaeotremellaceae A.M. Yurkov & Boekhout 2015

Gelidatrema A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Phaeotremella Rea 1912

Family Phragmoxenidiaceae Oberw. & R. Bauer 1990

Phragmoxenidium Oberw. 1990

Family Rhynchogastremaceae Oberw. & B. Metzler 1989

Papiliotrema J.P. Samp., M. Weiss & R. Bauer 2002

Rhynchogastrema B. Metzler & Oberw. 1989

= *Bandoniozyma* Boekhout, P. Valente, Pagnocca, C.A. Rosa, C.F. Lee, S.O. Suh, M. Blackw., G. Péter & Fell 2012

Tetragoniomyces Oberw. & Bandoni 1981

Family Sirobasidiaceae Lindau 1897

Fibulobasidium Bandoni 1979

Family Tremellaceae Fr. 1821

Hormomyces Bonord. 1851

Mycocryptococcus Pollacci & Nann. 1927

Tremella Pers. 1794

= *Dermatangium* Velen. 1926

= *Encephalium* Link 1816

= *Epidochium* Fr. 1849

= *Gelatina* Raf. 1808

= *Gyraria* Nees 1816

= *Hepataria* Raf. 1808

= *Tremella* Dill. ex L. 1753

Family Trimorphomycetaceae X. Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Carlosrosaea A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Saitozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Sugitazyma A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Trimorphomyces Bandoni & Oberw. 1983

Tremellales genera *incertae sedis*

Biatoropsis Räsänen 1934

Dictyotremella Kobayasi 1971

Neotremella Lowy 1979

Sigmogloea Bandoni & J.C. Krug 2000

Sirobasidium Lagerh. & Pat. 1892

Sirotrema Bandoni 1986

Tremellina Bandoni 1986

Xenolachne D.P. Rogers 1947

Order Trichosporonales Boekhout & Fell 2001

Family Tetragoniomycetaceae Oberw. & Bandoni 1981

Bandonia A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Cryptotrichosporon Okoli & Boekhout 2007

Takashimella Q.M. Wang 2015

Family Trichosporonaceae Nann. 1934

Apiotrichum Stautz 1931

Cutaneotrichosporon X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Effuseotrichosporon A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Haglerozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015

Pascua Takashima, Manabe, Nishimura, Sriswasdi, Ohkuma, Iwasaki & Sugita 2019

Prillingera Takashima, Manabe, Nishimura, Sriswasdi, Ohkuma, Iwasaki & Sugita 2019

Trichosporon Behrend 1890

Vanrija R.T. Moore 1980

= *Asterotremella* Prillinger, Lopandić & Sugita 2007

Tremellomycetes genera *incertae sedis*

Heteromycophaga P. Roberts 1997

Phyllopta (Fr.) Fr. 1825

Trichosporonoides Haskins & J.F.T. Spencer 1967

Subphylum Pucciniomycotina R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Class Agaricostilbomycetes R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Order Agaricostilbales Oberw. & R. Bauer 1989

Family Agaricostilbaceae Oberw. & R. Bauer 1989

Agaricostilbum J.E. Wright 1970

= *Amerobotryum* Subram. & Natarajan 1976

Pseudobensingtonia F.Y. Bai, Q.M. Wang, M. Groenewald & Boekhout 2015

Sterigmatomyces Fell 1966

Family Chionosphaeraceae Oberw. & Bandoni 1982

Ballistosporomyces Nakase, G. Okada & Sugiy. 1989

Chionosphaera D.E. Cox 1976

= *Fibulostilbum* Seifert & Oberw. 1992

Cystobasidiopsis R. Bauer, B. Metzler, Begerow & Oberw. 2009

Kurtzmanomyces Y. Yamada, Itoh, H. Kawas., I. Banno & Nakase 1989

Stilbum Tode 1790

Family Kondoaceae R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Bensingtonia Ingold 1986

Kondoa Y. Yamada, Nakagawa & I. Banno 1989

Family Ruineniaceae Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Ruinenia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Agaricostilbales genera *incertae sedis*

Jianyunia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Mycogloea L.S. Olive 1950

Class Atractiellomycetes R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Order Atractiellales Oberw. & Bandoni 1982

Family Atractogloeaceae Oberw. & R. Bauer 1989

Atractogloea Oberw. & Bandoni 1982

Family Hoehnelomycetaceae Jülich 1982

Basidiopycnis Oberw., R. Kirschner, R. Bauer, Begerow & Arenal 2006

= *Basidiopycnides* J. Reid, Eyjólfsd. & Georg Hausner 2008

Proceropycnis M. Villarreal, Arenal, V. Rubio, Begerow, R. Bauer, R. Kirschner & Oberw. 2006

Family Phleogenaceae Gäum. 1926

Atractidochium Oono, Urbina & Aime 2018

Atractiella Sacc. 1886

= *Hoehnelomyces* Weese 1920

= *Pilacrella* J. Schröt. 1887

Bourdotigloea Aime 2018

Helicogloea Pat. 1892

= *Exobasidiellum* Donk 1931

= *Infundibura* Nag Raj & W.B. Kendr. 1981

= *Leucogloea* R. Kirschner 2004

= *Neogloea* Aime 2018

= *Saccoblastia* Möller 1895

Hobsonia Berk. ex Massee 1891

Phleogena Link 1833

= *Ecchyna* Fr. ex Boud. 1885

= *Martindalia* Sacc. & Ellis 1885

Saccosoma Spirin 2018

Class Classiculomycetes R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Order Classiculales R. Bauer, Begerow, Oberw. & Marvanová 2003

Family Classiculaceae R. Bauer, Begerow, Oberw. & Marvanová 2003

Classicula R. Bauer, Begerow, Oberw. & Marvanová 2003

Jaculispora H.J. Huds. & Ingold 1960

Class Cryptomycocolacomycetes R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Order Cryptomycocolacales Oberw. & R. Bauer 1990

Family Cryptomycocolacaceae Oberw. & R. Bauer 1990

Colacosiphon R. Kirschner, R. Bauer & Oberw. 2001

Cryptomycocolax Oberw. & R. Bauer 1990

Class Cystobasidiomycetes R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Order Buckleyzymales R.L. Zhao & K.D. Hyde 2017

Family Buckleyzymaceae Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Buckleyzyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Order Cystobasidiales R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Family Cystobasidiaceae Gäum. 1926

Cystobasidium (Lagerh.) Neuhoff 1924

Halobasidium Z. Guo, Y.R. Wang, Q.C. Hou, W.C. Li, H.J. Zhao, Z.H. Sun & Z.D. Zhang 2019

Occultifur Oberw. 1990

Order Erythrobasidiales R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Family Erythrobasidiaceae Denchev 2009

Bannoa Hamam. 2002

Erythrobasidium Hamam., Sugiy. & Komag. 1988

Erythrobasidiales genera *incertae sedis*

Cyphobasidium Millanes, Diederich & Wedin 2016

Cyrenella Goch. 1981

Hasegawazyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Order Naohideales R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Family Naohideaceae Denchev 2009

Naohidea Oberw. 1990

Order Sakaguchiales R.L. Zhao & K.D. Hyde 2017

Family Sakaguchiaceae Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2017

Sakaguchia Y. Yamada, K. Maeda & Mikata 1994

Cystobasidiomycetes families *incertae sedis*

Family Microsporomycetaceae Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Microsporomyces Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Family Symmetrosporaceae Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Symmetrospora Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Cystobasidiomycetes genera *incertae sedis*

Queiroziella C.R. Félix, J.D.P. Bezerra, R.P. Neves & Landell 2018

Class Microbotryomycetes R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Order Heterogastridiales Oberw. & R. Bauer 1990

Family Heterogastridiaceae Oberw. & R. Bauer 1990

Hyalopycnis Höhn. 1918

= *Heterogastridium* Oberw. & R. Bauer 1990

Krieglsteinera Pouzar 1987

Pycnopulvinus Toome & Aime 2014

Order Kriegeriales Toome & Aime 2013

Family Camptobasidiaceae R.T. Moore 1996

Camptobasidium Marvanová & Suberkr. 1990

= *Crucella* Marvanová & Suberkr. 1990

Glaciozyma Turchetti, Connell, Thomas-Hall & Boekhout 2011

Family Kriegeriaceae Toome & Aime 2013

Kriegeria Bres. 1891

= *Xenogloea* Syd. & P. Syd. 1919

= *Zymoxenogloea* D.J. McLaughlin & Doublés 1992

Meredithblackwellia Toome & Aime 2013

Phenoliferia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Yamadamyces Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Order Leucosporidiales Sampaio, Weiss & Bauer 2003

Family Leucosporidiaceae Sampaio, Weiss & Bauer 2003

Leucosporidium Fell, Statzell, I.L. Hunter & Phaff 1970

= *Mastigobasidium* Golubev 1999

= *Leucosporidiella* Samp. 2003

Order Microbotryales R. Bauer & Oberw. 1997

Family Microbotryaceae R.T. Moore 1996

Bauerago Vánky 1999

Microbotryum Lév. 1847

= *Bauhinus* R.T. Moore 1992

= *Haradaea* Denchev 2006

= *Liroa* Cif. 1933

Sphacelotheca de Bary 1884

Zundeliomyces Vánky 1987

Family Ustilentylomataceae R. Bauer & Oberw. 1997

Aurantiosporium M. Piepenbr., Vánky & Oberw. 1996

Fulvisporium Vánky 1997

Microbotryozyma S.O. Suh, D.A. Maslov, Molestina & J.J. Zhou 2012

Ustilentyloma Savile 1964

Order Sporidiobolales Doweld 2001

Family Sporidiobolaceae R.T. Moore 1980

Rhodosporidiobolus Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Rhodotorula F.C. Harrison 1927

= *Chromotorula* F.C. Harrison 1927

= *Rhodosporidium* I. Banno 1967

Sporobolomyces Kluyver & C.B. Niel 1924

= *Amphiernia* Grüss 1927

= *Aessosporon* Van der Walt 1970

= *Blastoderma* B. Fisch. & Breback 1894

= *Prosporobolomyces* E.K. Novák & Zsolt 1961

= *Sporidiobolus* Nyland 1950

Microbotryomycetes families *incertae sedis*

Family Chrysozymaceae Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Bannozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Chrysozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Fellozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Hamamotoa Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Family Colacogloeaceae Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Colacogloea Oberw. & Bandoni 1991

Microbotryomycetes genera *incertae sedis*

Atractocolax R. Kirschner, R. Bauer & Oberw. 1999

Curvibasidium Samp. & Golubev 2004

Heitmania X.Z. Liu, F.Y. Bai, M. Groenew. & T. Boekhout 2018

Libkindia Mašínová, A. Pontes, J.P. Samp. & Baldrian 2017

Oberwinklerozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Pseudohyphozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Pseudoleucosporidium V. de Garcia, M.A. Coelho, T. Maia, L.H. Rosa, A.B.M. Vaz, C.A. Rosa, J.P. Samp., P. Gonç., M.R. Van Broock & Libkind 2015

Sampaiozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Slooffia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Spencerozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Trigonosporomyces Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Udeniozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Vonarxula Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Yunzhangia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Yurkovia Mašínová, A. Pontes, J.P. Samp. & Baldrian 2016

Class Mixiomycetes R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Order Mixiales R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Family Mixiaceae C.L. Kramer 1987

Mixia C.L. Kramer 1959

= *Phytoceratiomyxa* Sawada 1929

Class Pucciniomycetes R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Order Helicobasidiales R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Family Helicobasidiaceae P.M. Kirk 2008

Helicobasidium Pat. 1885

= *Helicobasis* Clem. & Shear 1931

= *Stypinella* J. Schröt. 1887

Tuberculina Tode ex Sacc. 1880

= *Cordalia* Gobi 1885

= *Uredinula* Speg. 1880

Order Pachnocybales R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Family Pachnocybaceae Oberw. & R. Bauer 1989

Pachnocybe Berk. 1836

Order Platygloeales R.T. Moore 1990

Family Eocronartiaceae Jülich 1982

Eocronartium G.F. Atk. 1902

= *Protopistillaria* Rick 1933

Herpobasidium Lind 1908

Jola Möller 1895

Platycarpa Couch 1949

Ptechetelium Oberw. & Bandoni 1984

Family Platygloeaceae Racib. 1909

Glomerogloea Doweld 2013

Glomopsis D.M. Hend. 1961

= *Glomerularia* Peck 1880

Insolibasidium Oberw. & Bandoni 1984
Platygloea J. Schröt. 1887
= *Collopezis* Clem. 1909
= *Tjibodasia* Holterm. 1898

Order Pucciniales Clem. & Shear 1931

Family Chaconiaceae Cummins & Y. Hirats. 1983
Achrotelium Syd. 1928
Aplopsora Mains 1921
Botryorhiza Whetzel & Olive 1917
Ceraceopsora Kakish., T. Sato & S. Sato 1984
Chaconia Juel 1897
= *Bitzea* Mains 1939
= *Desmotelium* Syd. 1937
Goplana Racib. 1900
Maravalia Arthur 1922
= *Acervulopsora* Thirum. 1945
= *Angusia* G.F. Laundon 1964
= *Argomycetella* Syd. 1922
= *Scopella* Mains 1939
= *Scopellopsis* T.S. Ramakr. & K. Ramakr. 1947
Olivea Arthur 1917
= *Tegillum* Mains 1940
Telomapea G.F. Laundon 1967

Family Coleosporiaceae Dietel 1900
Ceropsora B.K. Bakshi & Suj. Singh 1960
Chrysomyxa Unger 1840
= *Barclayella* Dietel 1890
= *Coleosporium* subgen. *Melampsoropsis* J. Schröt. 1879
= *Hiratsukaia* Hara 1948
= *Melampsoropsis* (J. Schröt.) Sacc. 1888
= *Melampsoropsis* (J. Schröt.) Arthur 1906
= *Stilbechrysomyxa* M.M. Chen 1984
Coleosporium Lév. 1847
= *Erannium* Bonord. 1860
= *Stichopsora* Dietel 1899 [1900]
= *Synomyces* Arthur 1924
Diaphanopellis P.E. Crane 2005
Gallowaya Arthur 1906

Family Cronartiaceae Dietel 1900
Cronartium Fr. 1815
Endocronartium Y. Hirats. 1969
Peridermium (Link) J.C. Schmidt & Kunze 1817

Family Melampsoraceae Dietel 1897
Melampsora Castagne 1843
= *Chnoopsora* Dietel 1906
= *Mesopsora* Dietel 1922
= *Necium* Arthur 1907
= *Podocystis* Fr. 1849

= *Podosporium* Lév. 1847

Family Mikronegeriaceae Cummins & Y. Hirats. 1983

Blastospora Dietel 1908

= *Pelastoma* M. Salazar, A.A. Carvalho & J.F. Hennen 2012

Chrysocelis Lagerh. & Dietel 1914

= *Stomatisora* J.M. Yen 1971

Mikronegeria Dietel 1899

Family Phakopsoraceae Cummins & Hirats. f. 1983

Aeciure Buriticá & J.F. Hennen 1994

Arthuria H.S. Jacks. 1931

Cerotelium Arthur 1906

= *Catenulopsora* Mundk. 1943

Crossopsora Syd. & P. Syd. 1919

Dasturella Mundk. & Khesw. 1943

Kweilingia Teng 1940

= *Tunicopsora* Suj. Singh & P.C. Pandey 1971

Macabuna Buriticá & J.F. Hennen 1994

Monosporidium Barclay 1888

= *Kulkarniella* Gokhale & Patel 1952 [1951]

Newinia Thaung 1973

Nothoravenelia Dietel 1910

Phakopsora Dietel 1895

= *Angiopsora* Mains 1934

= *Bubakia* Arthur 1906

= *Batistopsora* Dianese, R.B. Medeiros & L.T.P. Santos 1993

= *Malupa* Y. Ono, Buriticá & J.F. Hennen 1992

= *Physopella* Arthur 1906

= *Stakmania* Kamat & Sathe 1968

= *Uredostilbe* Buriticá & J.F. Hennen 1994

= *Uredendo* Buriticá & J.F. Hennen 1994 [nom. inval.]

Phragmidiella Henn. 1905

= *Santapauella* Mundk. & Thirum. 1945

Pucciniostele Tranzschel & K.L. Kom. 1899

= *Klastopsora* Dietel 1904

= *Phragmostele* Clem. 1909

Scalarispora Buriticá & J.F. Hennen 1994

Uredopeltis Henn. 1908

Family Phragmidiaceae Corda 1837

Arthuriomyces Cummins & Y. Hirats. 1983

Campanulospora Salazar-Yepes, Pardo-Card. & Buriticá 2007

Gerwasia Racib. 1909

= *Mainsia* H.S. Jacks. 1931

Gymnoconia Lagerh. 1894

= *Kunkelia* Arthur 1917

Hamaspora Körn. 1877

= *Hamasporella* Höhn. 1912

Joerstadia Gjaerum & Cummins 1982

Kuehneola Magnus 1898

= *Spirechina* Arthur 1907
Morispora Salazar-Yepes, Pardo-Card. & Buriticá 2007
Phragmidium Link 1816
= *Ameris* Arthur 1906
= *Aregma* Fr. 1815
= *Earlea* Arthur 1906
= *Epitea* Fr. 1832
= *Frommea* Arthur 1917
= *Frommeëlla* Cummins & Y. Hirats. 1983
= *Lecythea* Lév. 1847
= *Phragmidium* A *Phragmidiopsis* G. Winter 1881 [1884]
= *Phragmidiopsis* (G. Winter) Mussat 1901
= *Teloconia* Syd. 1921
= *Trolliomyces* Ulbr. 1938
Physonema Lév. 1847
Scutelliformis Salazar-Yepes, Pardo-Card. & Buriticá 2007
Trachyspora Fuckel 1861
= *Trachysporella* Syd. 1921
Xenodochus Schltdl. 1826

Family Pileolariaceae Cummins & Y. Hirats. 1983
Atelocauda Arthur & Cummins 1933
Pileolaria Castagne 1842
= *Discospora* Arthur 1907
Skierka Racib. 1900
= *Ctenoderma* Syd. & P. Syd. 1919
Uromycladium McAlpine 1905
= *Macalpinia* Arthur 1906

Family Pucciniaceae Chevall. 1826
Allodus Arthur 1906
Chrysella Syd. 1926
Chrysocyclus Syd. 1925
= *Holwayella* H.S. Jacks. 1926
Chrysopsora Lagerh. 1892
Cleptomyces Arthur 1918
Coleopucciniella Hara ex Hirats. 1937
= *Coleopucciniella* Hara 1936
Corbulopsora Cummins 1940
Cumminsiella Arthur 1933
Cystopsora E.J. Butler 1910
Endophyllum Lév. 1826
Gymnosporangium R. Hedw. ex DC. 1805
= *Ceratitium* Rabenh. 1851
= *Ceratitium* Ces. 1879
= *Ciglides* Chevall. 1826
= *Gymnotelium* Syd. 1921
= *Podisoma* Link 1809
Kernella Thirum. 1949
= *Kernia* Thirum. 1946

Miyagia Miyabe ex Syd. & P. Syd. 1913
= *Peristemma* Syd. 1921
Polioma Arthur 1907
Puccinia Pers. 1794
= *Argomyces* Arthur 1912
= *Argotelium* Arthur 1906
= *Bullaria* DC. 1805
= *Coronotelium* Syd. 1921
= *Cutomyces* Thüm. 1878
= *Dicaeoma* Gray 1821
= *Eriosporangium* Bertero ex Ruschenb. 1831
= *Jackya* Bubák 1902
= *Leptinia* Juel 1897
= *Leptopuccinia* (G. Winter) Rostr. 1902
= *Lindrothia* Syd. 1922
= *Linkiella* Syd. 1921
= *Lysospora* Arthur 1906
= *Micropuccinia* Rostr. 1902
= *Persooniella* Syd. 1922
= *Pleomeris* Syd. 1921
= *Poliomella* Syd. 1922
= *Puccinia* subgen. *Leptopuccinia* G. Winter 1881 [1884]
= *Puccinidia* Mayr 1890
= *Rostrupia* Lagerh. 1889
= *Schroeterella* Syd. 1922
= *Sclerotelium* Syd. 1921
= *Solenodonta* Castagne 1845
= *Trailia* Syd. 1922
Ramakrishnania Ramachar & Bhagyan. 1979
Roestelia Rebent. 1804
= *Cancellaria* Brongn. 1825
= *Centridium* Chevall. 1826
Stereostratum Magnus 1899
Uromyces (Link) Unger 1833
= *Alveomyces* Bubák 1914
= *Capitularia* Rabenh. 1851
= *Coeomurus* Gray 1821
= *Dichlamys* Syd. & P. Syd. 1920 [1919]
= *Groveola* Syd. 1921
= *Haplopyxis* Syd. & P. Syd. 1920 [1919]
= *Haplotelium* Syd. 1922
= *Hypodermium* subgen. *Uromyces* Link 1816 [1815]
= *Klebahnia* Arthur 1906
= *Nielsenia* Syd. 1921
= *Ontotelium* Syd. 1921
= *Poliotelium* Syd. 1922
= *Puccinella* Fuckel 1860
= *Pucciniola* L. Marchand 1829

= *Teleutospora* Arthur & Bisby 1921
= *Telospora* Arthur 1906
= *Trochodium* Syd. & P. Syd. 1920 [1919]
= *Uromycopsis* Arthur 1906
Xenostele Syd. & P. Syd. 1921
Zaghouania Pat. 1901

Family Pucciniastraceae Gäum. ex Leppik 1972
Hyalopsora Magnus 1902
Melampsorella J. Schröt. 1874
Melampsoridium Kleb. 1899
Milesia F.B. White 1878
Milesina Magnus 1909
Naohidemyces S. Sato, Katsuya & Y. Hirats. 1993
Peridiopsora Kamat & Sathe 1969
Pucciniastrum G.H. Otth 1861
= *Calyptospora* J.G. Kühn 1869
= *Phragmopsora* Magnus 1875
= *Pomatomyces* Oerst. 1864
Thekopsora Magnus 1875
Uredinopsis Magnus 1893

Family Pucciniosiraceae Cummins & Y. Hirats. 1983
Alveolaria Lagerh. 1892
Baeodromus Arthur 1905
Ceratocoma Buriticá & J.F. Hennen 1991
Chardoniella F. Kern 1939
Cionothrix Arthur 1907
Didymopsora Dietel 1899
Dietelia Henn. 1897
= *Endophylloides* Whetzel & Olive 1917
= *Jacksonia* J.C. Lindq. 1970
= *Jacksoniella* J.C. Lindq. 1972
= *Jacksoniella* Kamat & Sathe 1972
= *Thirumalachariella* Sathe 1975 [1974]
Gambleola Massee 1898
Pucciniosira Lagerh. 1892
= *Aecidiella* Ellis & Kelsey 1897
= *Didymosira* Clem. 1909
= *Schizospora* Dietel 1895
Trichopsora Lagerh. 1892

Family Raveneliaceae Leppik 1972
Allotelium Syd. 1939
Anthomyces Dietel 1899
Anthomycetella Syd. & P. Syd. 1916
= *Reyesiella* Sacc. 1917
Apra J.F. Hennen & F.O. Freire 1979
Bibulocystis J. Walker, Beilharz, Pascoe & Priest 2006
Cumminsina Petr. 1955
Cystomyces Syd. 1926

Diabole Arthur 1922
Diabolidium Berndt 1995
Dicheirinia Arthur 1907
Diorchidiella J.C. Lindq. 1957
Diorchidium Kalchbr. 1882
= *Diphragmium* Boedijn (1960) [1959]
Endoraecium Hodges & D.E. Gardner 1984
= *Racospermyces* J. Walker 2001
Esalque J.F. Hennen, Figueiredo & A.A. Carvalho 2000
Hapalophragmium Syd. & P. Syd. 1901
= *Hapalophragmiopsis* Thirum. 1950
= *Triactella* Syd. 1921
Kernkampella Rajendren 1970
Lipocystis Cummins 1937
Nyssopsora Arthur 1906
= *Oplophora* Syd. 1921
Ravenelia Berk. 1853
= *Cephalotelium* Syd. 1921
= *Cystingophora* Arthur 1907
= *Cystotelium* Syd. 1921
= *Dendroecia* Arthur 1906
= *Haploravenelia* Syd. 1921
= *Longia* Syd. 1921
= *Neoravenelia* Long 1903
= *Pleoravenelia* Long 1903
Sphenospora Dietel 1892
Spumula Mains 1935
Triphragmiopsis Naumov 1914
= *Nyssopsorella* Syd. 1921
Triphragmium Link 1825
Ypsilospora Cummins 1941

Family Sphaerophragmiaceae Cummins & Y. Hirats. 1983
Austropuccinia Beenken 2017
Sphaerophragmium Magnus 1891

Family Uncolaceae Buriticá 2000
Calidion Syd. & P. Syd. 1919
Uncol Buriticá & P.A. Rodr. 2000

Family Uropyxidaceae (P. Syd. & Syd.) Cummins & Y. Hirats. 1983
Canasta A.A. Carvalho & J.F. Hennen 2010
Dasyspora Berk. & M.A. Curtis 1854
= *Sartvellia* Berk. 1857
Didymopsorella Thirum. 1950
= *Gymnopuccinia* K. Ramakr. 1951
Dipyxis Cummins & J.W. Baxter 1967
Kimuromyces Dianese, L.T.P. Santos, R.B. Medeiros & Furlan. 1995
Leucotelium Tranzschel 1935
Macruropyxis Azbukina 1972
Mimema H.S. Jacks. 1931

Ochropsora Dietel 1895
Phragmopyxis Dietel 1897
= *Tricella* Long 1912
Poliomopsis A.W. Ramaley 1987
Porotenus Viégas 1960
Prospodium Arthur 1907
= *Coinostelium* Syd. 1939
= *Nephlyctis* Arthur 1907
Sorataea Syd. 1930
= *Allopuccinia* H.S. Jacks. 1931
Tranzschelia Arthur 1906
= *Polythelis* Arthur 1906
= *Lipospora* Arthur 1942
Uropyxis J. Schröt. 1875
= *Calliospora* Arthur 1905

Pucciniales genera *incertae sedis*

Aecidiconium Vuill. 1892
Aecidiolum Unger 1833
Aecidium Pers. 1796
= *Sphaerotheca* Desv. 1817
= *Symperidium* Klotzsch 1843
Caeoma Link 1809
= *Hypodermium* Link 1815
Caetea Salazar-Yepes & A.A. Carvalho 2012
Cerradoa J.F. Hennen & Y. Ono 1978
Coleopuccinia Pat. 1889
= *Coleoma* Clem. 1909
Desmella Syd. & P. Syd. 1919 [1918]
Desmellopsis J.M. Yen 1969
Desmosorus Ritschel, Oberw. & Berndt 2005
Edythea H.S. Jacks. 1931
Elateraecium Thirum., F. Kern & B.V. Patil 1966
= *Hiratsukamyces* Thirum., F. Kern & B.V. Patil 1975
Flaminia Sacc. & P. Syd. 1902
Hemileia Berk. & Broome 1869
= *Hemileiopsis* Racib. 1900
= *Wardia* J.F. Hennen & M.M. Hennen 2003
Hennenia Buriticá 1995
Intrapes J.F. Hennen & Figueiredo 1979
Masseeëlla Dietel 1895
= *Kamatomyces* Sathe 1966
Mehtamyces Mundk. & Thirum. 1945
Phragmotelium Syd. 1921
Puccorchidium Beenken 2015
Schroeteriaster Magnus 1896
= *Uromycodes* Clem. 1909
Sphenorchidium Beenken 2015
Uraecium Arthur 1933

Uredo Pers. 1801
= *Mapea* Pat. 1906
= *Nigredo* (Pers.) Roussel 1806
= *Peridipes* Buriticá & J.F. Hennen 1994
= *Rubigo* (Pers.) Roussel 1806
= *Trichobasis* Lév., in Orbigny 1849
= *Uredo* ** *Nigredo* Pers. 1801

Order Septobasidiales Couch ex Donk 1964

Family Septobasidiaceae Racib. 1909

Aphelariopsis Jülich 1982
Auriculoscypha D.A. Reid & Manim. 1985
Coccidiodictyon Oberw. 1989
Johncouchia S. Hughes & Cavalc. 1983
Septobasidium Pat. 1892
= *Ordonia* Racib. 1909
= *Campylobasidium* Lagerh. ex F. Ludw. 1892
= *Glenospora* Berk. & Desm. 1849
= *Mohortia* Racib. 1909
= *Rudetum* Lloyd 1919
Uredinella Couch 1937

Class Spiculogloeomycetes Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015

Order Spiculogloeales R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw. 2006

Family Spiculogloeaceae Denchev 2009

Phyllozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015
Spiculogloea P. Roberts 1996

Class Tritirachiomycetes Aime & Schell 2011

Order Tritirachiales Aime & Schell 2011

Family Tritirachiaceae Aime & Schell 2011

Tritirachium Limber 1940
= *Spirotrichum* Saito ex J.F.H. Beyma 1940
Paratritirachium Beguin, Pyck & Detandt 2012

Pucciniomycotina genera *incertae sedis*

Kryptastrina Oberw. 1990
Paraphelaria Corner 1966
Zygogloea P. Roberts 1994

Subphylum Ustilaginomycotina Doweld 2001

Class Exobasidiomycetes Begerow, M. Stoll & R. Bauer 2007

Order Ceraceosorales Begerow, M. Stoll & R. Bauer 2007

Family Ceraceosoraceae Denchev & R.T. Moore 2009

Ceraceosorus B.K. Bakshi 1976

Order Doassansiales R. Bauer & Oberw. 1997

Family Doassansiaceae R.T. Moore ex P.M. Kirk, P.F. Cannon & J.C. David 2001

Burrillia Setch. 1891
= *Stereosorus* Sawada 1943
Doassansia Cornu 1883
= *Setchellia* Magnus 1896
Doassinga Vánky, R. Bauer & Begerow 1998
Entylomaster Vánky & R.G. Shivas 2006

Heterodoassansia Vánky 1993
Nannfeldtiomyces Vánky 1981
Narasimhania Thirum. & Pavgi 1952
Pseudodermatosorus Vánky 1999
Pseudodoassansia (Setch.) Vánky 1981
Pseudotracya Vánky 1999
Tracya Syd. & P. Syd. 1901
= *Cornuella* Setch. 1891
= *Tracyella* Zambett. 1970

Family Melaniellaceae R. Bauer, Vánky, Begerow & Oberw. 1999
Melaniella R. Bauer, Vánky, Begerow & Oberw. 1999

Family Rhamphosporaceae R. Bauer & Oberw. 1997
Rhamphospora D.D. Cunn. 1888

Order Entylomatales R. Bauer & Oberw. 1997

Family Entylomataceae R. Bauer & Oberw. 1997
Entyloma de Bary 1874
Tilletiopsis Derx 1948

Order Exobasidiales Henn. 1898

Family Brachybasidiaceae Gäum. 1926
Brachybasidium Gäum. 1922
Dicellomyces L.S. Olive 1945
Kordyana Racib. 1900
= *Lelum* Racib. 1900
Meira Boekhout, Scorzetti, Gerson & Sztejnb. 2003
Proliferobasidium J.L. Cunn. 1976

Family Cryptobasidiaceae Malençon ex Donk 1956
Acaromyces Boekhout, Scorzetti, Gerson & Sztejnb. 2003
Botryoconis Syd. & P.Syd. 1906
= *Cryptobasidium* Lendn. 1921
Clinoconidium Pat. 1898
Coniodictyum Har. & Pat. 1909
= *Hyalodema* Magnus 1910
Drepanoconis J. Schröt. & Henn. 1896
Phacellula Syd. 1927

Family Exobasidiaceae J. Schröt. 1888
Arcticomyces Savile 1959
Austrobasidium Palfner 2006
Exobasidium Woronin 1867
Muribasidiospora Kamat & Rajendren 1968

Family Graphiolaceae Clem. & Shear 1931
Graphiola Poit. 1824
= *Dacryodochium* P. Karst. 1896
= *Elpidophora* Ehrenb. ex Link 1824
= *Trichodesmium* Chevall. 1826
Stylina Syd. & P. Syd. 1921

Family Laurobasidiaceae Pinruan, Sommai, Suetrong, Somrith. & E.B.G. Jones 2018
Laurobasidium Jülich 1982

Order Georgefischeriales R. Bauer, Begerow & Oberw. 1997

Family Eballistraceae R. Bauer, Begerow, A. Nagler & Oberw. 2001
Eballistra R. Bauer, Begerow, A. Nagler & Oberw. 2001
Family Georgefischeriaceae R. Bauer, Begerow & Oberw. 1997
Georgefischeria Thirum. & Naras. 1963
Jamesdicksonia Thirum., Pavgi & Payak 1961
Family Gjaerumiaceae R. Bauer, M. Lutz & Oberw. 2005
Gjaerumia R. Bauer, M. Lutz & Oberw. 2005
Family Tilletiariaceae R.T. Moore 1980
Phragmotaenium R. Bauer, Begerow, A. Nagler & Oberw. 2001
Tilletiaria Bandoni & B.N. Johri 1972
Tolyposporella G.F. Atk. 1897
Order Golubeviales Q.M. Wang, Begerow, F.Y. Bai & Boekhout 2015
Family Golubeviaceae Q.M. Wang, F.Y. Bai, Begerow & Boekhout 2015
Golubevia Q.M. Wang, F.Y. Bai, Begerow & Boekhout 2015
Order Microstromatales R. Bauer & Oberw. 1997
Family Microstromataceae Jülich 1982
Microstroma Niessl 1861
= *Helostroma* Pat. 1902
= *Leptophyma* Sacc. 1889
Family Quambalariaceae Z.W. de Beer, Begerow & R. Bauer 2006
Quambalaria J.A. Simpson 2000
Family Volvocisporiaceae Begerow, R. Bauer & Oberw. 2001
Volvocisporium Begerow, R. Bauer & Oberw. 2001
Microstromatales genera *incertae sedis*
Jaminaea Sipiczki & Kajdacsi ex T. Kij. & Aime 2017
Parajaminaea T. Kij. & Aime 2017
Pseudomicrostroma T. Kij. & Aime 2017
Sympodiomycopsis Sugiy., Tokuoka & Komag. 1991
Order Robbauerales Boekhout, Begerow, Q.M. Wang & F.Y. Bai 2015
Family Robbaueraceae Boekhout, Begerow, Q.M. Wang & F.Y. Bai 2015
Robbauera Boekhout, Begerow, Q.M. Wang & F.Y. Bai 2015
Order Tilletiales Kreisel ex R. Bauer & Oberw. 1997
Family Erratomycetaceae Denchev & T. Denchev 2013
Erratomyces M. Piepenbr. & R. Bauer 1997
Family Tilletiaceae J. Schröt. 1887
Conidiosporomyces Vánky 1992
Ingoldiomyces Vánky 1996
Neovossia Körn. 1879
= *Vossia* Thüm. 1879
Oberwinkleria Vánky & R. Bauer 1995
Salmacisia D.R. Huff & A. Chandra 2008
Tilletia Tul. & C. Tul. 1847
Class Malasseziomycetes Q.M. Wang & F.Y. Bai 2014
Order Malasseziales R.T. Moore 1980
Family Malasseziaceae Denchev & R.T. Moore 1980
Malassezia Baillon 1889
= *Pityrosporum* Sabour. 1904
Class Monilielliomycetes Q.M. Wang, F.Y. Bai & Boekhout 2014

Order Moniliellales Q.M. Wang, F.Y. Bai & Boekhout

Family Moniliellaceae Q.M. Wang, F.Y. Bai & Boekhout

Moniliella Stolk & Dakin 1966

Class Ustilaginomycetes R. Bauer, Oberw. & Vánky 1997

Uleiellales Garnica, K. Riess, M. Schön, H. Butin, M. Lutz, Oberw. & R. Bauer 2016

Family Uleiellaceae Vánky 2001

Uleiella J. Schröt. 1894

= *Ulea* J. Schröt. 1892

Order Urocystidales R. Bauer & Oberw. 1997

Family Doassansiopsidaceae Begerow, R. Bauer & Oberw. 1998

Doassansiopsis (Setch.) Dietel 1897

Family Fereydouniaceae S. Nasr, Soudi, H.D.T. Nguyen, M. Lutz & Piątek 2014

Fereydounia S. Nasr, M.R. Soudi, H.D.T. Nguyen, M. Lutz & Piątek 2014

Family Floromycetaceae S. Nasr, Soudi, H.D.T. Nguyen, M. Lutz & Piątek 2014

Antherospora R. Bauer, M. Lutz, Begerow, Piątek & Vánky 2008

Floromyces Vánky, M. Lutz & R. Bauer 2008

Family Glomosporiaceae Cif. 1963

Thecaphora Fingerh. 1836

= *Angiosorus* Thirum. & M.J. O'Brien 1974

= *Poikilosporium* Dietel 1897

= *Sorosporium* F. Rudolphi 1829

= *Thecaphorella* H. Scholz & I. Scholz 1988

= *Tothiella* Vánky 1999

Family Mycosyringaceae R. Bauer & Oberw. 1997

Mycosyrinx Beck 1894

Family Urocystidaceae Begerow, R. Bauer & Oberw. 1998

Flamingomyces R. Bauer, M. Lutz, Piątek, Vánky & Oberw. 2007

Melanoxa M. Lutz, Vánky & R. Bauer 2013

Melanustilospora Denchev 2003

Mundkurella Thirum. 1944

Urocystis Rabenh. ex Fuckel 1870

= *Ginanniella* Cif. 1938

= *Polycystis* Lév. 1846

= *Polysaccopsis* Henn. 1898

= *Tuburcinia* Fr. 1832

= *Tuburcinia* Woronin 1882

= *Tuburciniella* Zambett. 1970

Ustacystis Zundel 1945

= *Whetzelia* Zundel 1945

Vankya Ershad 2000

Order Ustilaginales G. Winter 1880

Family Anthracoideaceae Denchev 1997

Anthracoidea Bref. 1895

= *Cintractiomyxa* Golovin 1952

Cintractia Cornu 1883

Dermatosorus Sawada ex L. Ling 1949

= *Zundelula* Thirum. & Naras. 1952

Farysia Racib. 1909

= *Elateromyces* Bubák 1912
Farysporium Vánky 1999
Heterotolyposporium Vánky 1997
Kuntzeomyces Henn. ex Sacc. & P. Syd. 1899
= *Didymochlamys* Henn. 1897
= *Perichlamys* Clem. & Shear 1931
Leucocintractia M. Piepenbr., Begerow & Oberw. 1999
Moreaua Liou & H.C. Cheng 1949
Orphanomyces Savile 1974
Pilocintractia Vánky 2004
Planetella Savile 1951
Portalia V. González, Vánky & Platas 2007
Schizonella J. Schröt. 1877
Stegocintractia M. Piepenbr., Begerow & Oberw. 1999
Testicularia Klotzsch 1832
Tolyposporium Woronin ex J. Schröt. 1887
Trichocintractia M. Piepenbr. 1995
Ustanciosporium Vánky 1999
= *Gymnocintractia* M. Piepenbr., Begerow & Oberw. 1999
Family Cintractiellaceae Vánky 2003
Cintractiella Boedijn 1937
Family Clintamraceae Vánky 2001
Clintamra Cordas & Durán 1977
Family Geminaginaceae Vánky 2001
Geminago Vánky & R. Bauer 1996
Family Melanotaeniaceae Begerow, R. Bauer & Oberw. 1998
Exoteliospora R. Bauer, Oberw. & Vánky 1999
Melanotaenium de Bary 1874
Yelsemia J. Walker 2001
Family Pericladiaceae Vánky 2011
Pericladium Pass. 1875
= *Xylosorium* Zundel 1939
Family Ustilaginaceae Tul. & C. Tul. 1847
Ahmadiago Vánky 2004
Aizoago Vánky 2013
Anomalomyces Vánky, M. Lutz & R.G. Shivas 2006
Anthracocystis Bref. 1912
Bambusiomyces Vánky 2011
Centrolepidosporium R.G. Shivas & Vánky 2007
Dirkmeia F.Y. Bai, Q.M. Wang, Begerow & Boekhout 2015
Eriocaulago Vánky 2005
Eriomoeszia Vánky 2005
Eriosporium Vánky 2005
Franzpetrakia Thirum. & Pavgi 1957
Kalmanozyma Q.M. Wang, F.Y. Bai, Begerow & Boekhout 2015
Langdonia McTaggart & R.G. Shivas 2012
Macalpinomyces Langdon & Full. 1977
= *Endosporisorium* Vánky 1995

Melanopsichium Beck 1894
Moesziomyces Vánky 1977
= *Tolyposporidium* Thirum. & Neerg. 1978
Mycosarcoma Bref. 1912
Parvulago R. Bauer, M. Lutz, Piątek, Vánky & Oberw. 2007
Pattersoniomyces Piątek, M. Lutz & C.A. Rosa 2017
Pseudozyma Bandoni 1985
Shivasia Vánky, M. Lutz & Piątek 2012
Sporisorium Ehrenb. ex Link 1825
= *Endothlaspis* Sorokīn 1884
Stollia McTaggart & R.G. Shivas 2012
Tranzscheliella Lavrov 1936
Triodiomyces McTaggart & R.G. Shivas 2012
Ustilago (Pers.) Roussel 1806
= *Crozalsiella* Maire 1917
= *Farinaria* Sowerby 1803
= *Pericoelium* Bonord. 1851
= *Tubisorus* Vánky & M. Lutz 2011
= *Ustilagidium* Herzberg 1895
= *Yenia* Liou 1949
Yunchangia L. Guo & B. Xu 2013

Family Websdaneaceae Vánky 2001
Restiosporium Vánky 2000
Websdanea Vánky 1997

Order Violaceomycetales Albu, Toome & Aime 2015

Family Violaceomycetaceae Albu, Toome & Aime 2015
Violaceomyces Albu, Toome & Aime 2015

Ustilaginomycetes genera *incertae sedis*
Capitulocladosporium L.Y. Sun, X. Sun & L.D. Guo 2017
Eriocortex Vánky & R.G. Shivas 2013

Subphylum Wallemiomycotina Doweld 2014

Class Wallemiomycetes Zalar, de Hoog & Schroers 2005

Order Geminibasidiales H.D.T. Nguyen, N.L. Nick. & Seifert 2013

Family Geminibasidiaceae H.D.T. Nguyen, N.L. Nick. & Seifert 2013
Basidioascus Matsush. 2003
Geminibasidium H.D.T. Nguyen, N.L. Nick. & Seifert 2013

Order Wallemiales Zalar, de Hoog & Schroers 2005

Family Wallemiaceae R.T. Moore 1996
Wallemia Johan-Olsen 1887
= *Bargellinia* Borzí 1888
= *Hemispora* Vuill. 1906

Wallemiomycetes genus *incertae sedis*
Chernovia A.M. Yurkov & Begerow 2016

Basidiomycota genera *incertae sedis*
Anastomyces W.P. Wu, B. Sutton & Gange 1997
Anguillomyces Marvanová & Bärl. 2000
Arcispora Marvanová & Bärl. 1998
Arrasia Bernicchia, Gorjón & Nakasone 2011

Bartheletia G. Arnaud ex Scheuer, R. Bauer, M. Lutz, Stabenth., Melnik & Grube 2008
= *Bartheletia* G. Arnaud 1954
Brevicellopsis Hjortstam & Ryvarden 2008
Celatogloea P. Roberts 2005
Cystogloea P. Roberts 2006
Microstella K. Ando & Tubaki 1984
Neotyphula Wakef. 1934
Radulodontia Hjortstam & Ryvarden 2008
Restilago Vánky 2008

2.3.5 Notes of genera in Basidiomycota

Abortiporus Murrill 1904, Podoscyphaceae, Polyporales, Agaricomycetes, asexual morph *Sporotrichopsis* Stalpers 2000, four species, type species *A. distortus* (Schwein.) Murrill (current name: *A. biennis* (Bull.) Singer), basidioma pileate-stipitate, hymenophore poroid to daedaleoid, terrestrial or wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), new sp. see Læssøe and Ryvarden 2010a (morphology, Ecuador).

Abrachium Baseia & T.S. Cabral 2012, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *A. floriforme* (Baseia & Calonge) Baseia & T.S. Cabral, saprobic, terrestrial, Brazil, sequence data available, see Cabral et al. 2012 (monograph).

Abstoma G. Cunn. 1926, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, eight species, type species *A. purpureum* (Lloyd) G. Cunn., terrestrial, saprobic, worldwide, see Moreno et al. 2007 (new combination of *A. stuckertii*), see Kirk et al. 2013 (genus accepted), sequence data available, see Bidartondo et al. 2009 (taxonomy).

Abundisporus Ryvarden 1999, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, eight species, type species *A. fuscopurpureus* (Pers.) Ryvarden, basidioma resupinate to pileate, hymenophore poroid, wood-rotting, white rot, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Robledo et al. 2009 (phylogeny), Li and Cui 2013b (phylogeny), Zhao et al. 2013b (morphology, China), Jargalmaa et al. 2015 (Korea), Jang et al. 2016 (polyporoid fungi, corticioid fungi, Korea), new sp. see Zhao et al. 2015b (phylogeny, monograph, China).

Acanthobasidium Oberw. 1965, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, six species, type species *A. delicatus* (Wakef.) Oberw. ex Jülich, wood-rotting, Europe, genus accepted, see Kirk et al. 2013, sequence data available, new spp. and new combination see Dai and He 2017 (phylogeny, *Aleurodiscus* s.l., China).

Acanthocorticium Baltazar, Gorjón & Rajchenb. 2015, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *A. brueggemannii*

Baltazar, Gorjón & Rajchenb., South Brazil, basidioma resupinate, adnate, cartilaginous, hymenophore smooth to poroid, sequence data available, see Baltazar et al. 2015 (phylogeny, Brazil).

Acanthofungus Sheng H. Wu, Boidin & C.Y. Chien 2000, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, six species, type species *A. rimosus* Sheng H. Wu, Boidin & C.Y. Chien, saprobes, worldwide, see Wu et al. 2000 (taxonomy), sequence data available, see Wu et al. 2001 (phylogeny).

Acantholichen P.M. Jørg. 1998, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *A. pannarioides* P.M. Jørg., lichenized, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Dal-Forno et al. 2016 (South and Central America).

Acanthophysellum Parmasto 1967, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, 14 species, type species *A. lividocoeruleum* (P. Karst.) Parmasto, wood-rotting, worldwide, genus accepted, see Kirk et al. 2013, sequence data available, see Dai and He 2017 (phylogeny, *Aleurodiscus s. l.*).

Acanthophysium (Pilát) G. Cunn. 1963, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, c. 20 species, worldwide, crust fungus, see Kirk et al. 2013 (genus accepted), sequence data available, see Vu et al. 2019 (DNA sequences).

Acaromyces Boekhout, Scorzetti, Gerson & Sztejnberg 2003, Cryptobasidiaceae, Exobasidiales, Exobasidiomycetes, one species, known only from saprobic yeast states, anamorphic genus, plant material, Israel, Japan, Vietnam, see Kurtzman et al. 2011 (taxonomy), cultures available, sequence data available, see Begerow et al. 2014 (taxonomy), Wang et al. 2015c (phylogeny).

Achrotelium Syd. 1928, Chaconiaceae, Pucciniales, Pucciniomycetes, five species, type species *A. ichnocarpi* Syd., biotrophic on Apocynaceae, Sapotaceae, Urticaceae, terrestrial, Africa, Cuba, Philippines, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Acinophora Raf. 1808, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *A. aurantiaca* Raf., sequence data unavailable, see Kirk et al. 2008.

Acladium Link 1809, Botryobasidiaceae, Cantharellales, Agaricomycetes, sexual morph unknown, 20 species, type species *A. conspersum* Link, polyphyletic across

orders, in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Actiniceps Berk. & Broome 1876, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *A. thwaitesii* Berk. & Broome, saprobes, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Dentinger and McLaughlin 2006 (phylogeny).

Acutocapillitium P. Ponce de León 1976, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *A. torrendii* (Lloyd) P. Ponce de León, tropical America, Spain, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Aecidiconium Vuill. 1892, *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *A. bartetii* Vuill., France, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Adustoporia Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. sinuosa* (Fr.) Audet, basidioma resupinate, sequence data available, see Ortiz-Santana et al. 2013 (antrodia clade of Polyporales, phylogeny), Spirin et al. 2015d (phylongeny, *Antrodia s. s.*), Audet 2017d (new combination).

Aecidiolum Unger 1833, *incertae sedis*, Pucciniales, Pucciniomycetes, twelve species, type species *A. exanthematicum* Unger, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Aecidium Pers. 1796 (= *Sphaerotheca* Desv. 1817; = *Symperidium* Klotzsch 1843), *incertae sedis*, Pucciniales, Pucciniomycetes, asexual morph particularly of *Puccinia*, *Tranzschelia*, *Uromyces*, c. 800 species, type species *A. berberidis* Pers., biotrophic on many plant families, terrestrial, worldwide, see Azbukina and Gjærum 2008 (new variety, nom. inval.), Hernández and Cline 2010 (new name), Hernández and Cline 2010 (replaced *Aecidium dioscoreae* J.C. Lindq., nom. illeg. with *Aecidium tumbayensis*), Jage et al. 2010 (new variety, nom. inval.), Kirk et al. 2013 (genus accepted), sequence data available, see Van Der Merwe et al. 2008 (coevolution, *Puccinia*/*Uromyces*), Morin et al. 2009 (species hybrid of *Puccinia lagenophorae*, phylogeny), Padamsee et al. 2017 (phylogeny, New Zealand), new spp. see Kavale and

Patil 2008, Sultan et al. 2008, Walker and van der Merwe 2009, Mohanan 2010, Berndt 2013a (account of rust fungi in French Guiana), Beenken 2014, Duarte et al. 2016.

Aeciure Buriticá & J.F. Hennen 1994, Phakopsoraceae, Pucciniales, Pucciniomycetes, one species, type species *A. crotonis* (Henn.) Buriticá & J.F. Hennen, biotrophic on Euphorbiaceae, terrestrial, Brazil, see Cummins and Hiratsuka 2003 (synonym of *Caeoma*), new spp. see Yepes and Céspedes 2008 (*Aeciure ancizari* = *Puccinia ancizari* Mayor), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Aegeritopsis Höhn. 1903, *incertae sedis*, Polyporales, Agaricomycetes, sexual morph unknown, one species, type species *A. nulliporoides* Höhn, wood-rotting, sequence data unavailable, see Kirk et al. 2008.

Aegis Gómez-Montoya, Rajchenb. & Robledo 2017, Grifolaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. boa* Gómez-Montoya, Rajchenb. & Robledo, basidioma resupinate, effused-reflexed to pileate, hymenophore poroid, wood-rotting, white rot, sequence data available, see Gómez-Montoya et al. 2017b (phylogeny, Argentina).

Aeruginospora Höhn. 1908, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *A. singularis* Höhn., Australia, Southeast Asia, see Kirk et al. 2013 (genus accepted), sequence data unavailable, see Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae).

Afroboletus Pegler & T.W.K. Young 1981, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, eight species, type species *A. pterosporus* (Singer) Pegler & T.W.K. Young, mostly stipitate-pileate, ectomycorrhizal, Africa, *A. luteolus* reported edible and consumed see Boa 2004, Kirk et al. 2013 (genus accepted), sequence data available, see Han et al. 2017 (new, sequestrate species, Zambia), Sato et al. 2017 (phylogeny, biogeography), Crous et al. 2018b (new species, Vietnam, generic placement doubtful).

Afrocastellanoa M.E. Sm. & Orihara 2017, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one described species but DNA evidence of more, type species *A. ivoryana* (Castellano, Verbeken & Thoen) M.E. Sm. & Orihara, sequestrate, ectomycorrhizal, Africa, sequence data available, see Orihara and Smith 2017 (phylogeny).

Agaricochaete Eichelb. 1906, Pleurotaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *A. mirabilis* Eichelb., Africa, Asia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Agaricostilbum J.E. Wright 1970, Agaricostilbaceae, Agaricostilbales, Agaricostilbomycetes, sexual and asexual morph known, c. four species, type species *A. palmicola* J.E. Wright, sequence data available, see Kurtzman et al. 2011 (taxonomy), McLaughlin et al. 2017 (phylogeny, evolution).

Agaricus L. 1753, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 500 species, type species *A. campestris* L., six subgenera: *Minores*, *Minoriopsis*, *Flavoagaricus*, *Spissicaules*, *Pseudochitonia*, *Agaricus*, 23 sections, agaricoid, sequestrate, saprobes, terrestrial, worldwide, some species edible, button mushroom [*A. bisporus* (J.E. Lange) Imbach], see Largeteau et al. 2011 (cultivation), Dai et al. 2010b (China, edible mushrooms), Kirk et al. 2013 (genus accepted), sequence data available, see Geml et al. 2004, 2008a (North America, arctic and boreal spp.), Kerrigan et al. 2008 (section *Bivelares*), Parra 2008 (Europe, monograph), Zhao et al. 2011 (phylogeny), Lebel and Syme 2012 (Australia, sequestrate species), Parra 2013 (Europe, monograph), Chen et al. 2015a (section *Brunneopicti*), Kerrigan 2016 (North America, monograph), Zhao et al. 2016 (phylogeny, taxonomy), Zhou et al. 2016c (section *Xanthodermatei*, phylogeny), new spp. see Parra et al. 2011 (Italy), Chen et al. 2012a, 2017b (Thailand, subgenus *Minores*, Europe, Greater Mekong Subregion), Lebel and Syme 2012 (Australia), Wisitrassameewong et al. 2012 (Thailand, *A. subrufescens*), Zhao et al. 2012, 2013d (Thailand), Lebel 2013 (Australia), Li et al. 2014e (China), Karunarathna et al. 2014 (Thailand), Thongklang et al. 2014 (tropical Asia), (Thailand), Parra et al. 2014 (Spain), Gui et al. 2015 (China), He and Zhao 2015 (China), Wang et al. 2015j (China), Bates et al. 2016 (new combinations), Drewinski et al. 2017 (Brazil), He et al. 2017a 2018a, b (section *Minores*, China, Thailand, new section), Angelini et al. 2018 (Caribbean).

Agrocybe Fayod 1889, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 100 species, type species *A. praecox* (Pers.) Fayod, worldwide, some species edible [*A. aegerita* (V. Brig.) Singer (current name: *Cyclocybe aegerita* (V. Brig.) Vizzini)], see Hall. et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), Chen et al. 2012c (China, *A. aegerita*), Kirk et al. 2013 (genus

accepted), sequence data available, Malysheva and Kiyashko 2011 (Russia, *A. pediades*), new spp. see Uhart and Albertó 2009 (mating tests).

Agrogaster D.A. Reid 1986, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *A. coneae* D.A. Reid, terrestrial, New Zealand, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Ahmadiago Vánky 2004, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species plant parasite on Euphorbiaceae, India, cultures unavailable, sequence data unavailable, see Vánky 2004 (description).

Aizoago Vánky 2013, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, two species, type species *A. tetragoniae* Vánky & R.G. Shivas, plant parasites (stems, fruits) on *Tetragonia* spp. (Aizoaceae), Australia, cultures unavailable, sequence data unavailable, see Vanky and Shivas 2013 (description).

Akenomyces G. Arnaud ex D. Hornby 1984, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *A. costatus* D. Hornby, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Albatrellopsis Teixeira 1993, Albatrellaceae, Russulales, Agaricomycetes, asexual morph unknown, eight species, type species *A. confluens* (Alb. & Schwein.) Teixeira, basidioma piletae-stipitate, confluent, hymenophore poroid, ectomycorrhizal, edible species (*A. confluens*), see Zheng and Liu 2008 (China), sequence data available, see Audet 2010 (phylogeny).

Albatrellus Gray 1821, Albatrellaceae, Russulales, Agaricomycetes, asexual morph unknown, 22 species, type species *A. albidus* Gray, worldwide, basidioma piletae-stipitat, hymenophore poroid, fleshy, ectomycorrhizal, some species poisonous [*A. dispansus* (Lloyd) Canf. et Gilb], see Bau et al. 2014 (poisonous mushrooms, China), some species edible (*A. yunnanensis* H.D. Zheng & P.G. Liu, *A. zhuangii* Y.C. Dai & Juan Li), see Dai et al. 2010b (edible mushrooms, China), and *A. ellisii* (Berk.) Pouzar, called “bull tongue” and *A. subrubescens* (Murrill) Pouzar, are sold in Mexico markets), Kirk et al. 2013 (genus accepted), sequence data available, see Gordon and Apple 2011 (genetic markers), Dentinger et al. 2011 (DNA barcode markers), Vadthanarat et al. 2017 (Thailand), new spp. see Cui et al. 2008 (China), Khan et al. 2018 (Pakistan).

Albomagister Sánchez-García, Birkebak & Matheny 2014, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *A.*

subaustralis (A.H. Sm. & Hesler) Sánchez-García, Birkebak & Matheny, North America and Europe, sequence data available, see Sánchez-García et al. 2014 (taxonomy), new spp. see Moreau et al. 2015a (Corsica).

Aldridgea Massee 1892, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *A. gelatinosa* Massee, sequence data unavailable, see Kirk et al. 2008.

Alessioporus Gelardi, Vizzini & Simonini 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *A. ichnusanus* (Alessio, Galli & Littini) Gelardi, Vizzini & Simonini, stipitate-pileate when mature, development secondary angiocarpic, ectomycorrhizal, Europe, North America, sequence data available, see Gelardi et al. 2014b (taxonomy), Frank et al. 2017 (North America, new spp.).

Aleurobotrys Boidin 1986, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, ten species, type species *A. botryosus* (Burt) Boidin, Lanq. & Gilles, see Kirk et al. 2013 (genus accepted), sequence data available, see Dai and He 2017 (phylogeny, *Aleurodiscus s. l.*).

Aleurocystidiellum P.A. Lemke 1964, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, three species, type species *A. subcruentatum* (Berk. & M.A. Curtis) P.A. Lemke, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Dai and He 2017 (phylogeny, *Aleurodiscus s. l.*).

Aleurocystis Lloyd ex G. Cunn. 1956, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *A. hakgallae* (Berk. & Broome) G. Cunn., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Giraldo et al. 2017 (phylogeny).

Aleurodiscus Rabenh. Ex J. Schröt. 1888, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, 27 species, type species *A. amorphus* (Pers.) J. Schröt., worldwide, some species medicinal use (*A. amorphus* Rabenh), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Dai and He 2017 (phylogeny, *Aleurodiscus s. l.*).

Aleuromyces Boidin & Gilles 2002, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *A. gabonicus* (Boidin, Lanq. & Gilles) Boidin & Gilles, Gabon, sequence data unavailable, see Kirk et al. 2008.

Allantula Corner 1952, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *A. diffusa* Corner, terrestrial, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Allescheriella Henn. 1897, Botryobasidiaceae, Cantharellales, Agaricomycetes, sexual morph *Botryobasidium* Donk 1931, see Gónzalez et al. 2016, five species, type species *A. uredinioides* Henn., widespread, polyphyletic across orders, in need of modern interpretation, sequence data unavailable, see Kirk et al. 2008.

Alloclavaria Dentinger & D.J. McLaughlin 2007, Rickenellaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *A. purpurea* (Fr.) Dentinger & D.J. McLaughlin, Europe, sequence data available, see Dentinger and McLaughlin 2006 (taxonomy).

Allodus Arthur 1906, Pucciniaceae, Pucciniales, Pucciniomycetes, one species, type species *A. podophylli* (Schwein.) Arthur, biotrophic on Berberidaceae, terrestrial, eastern Canada and USA, ?China, sequence data available, see Minnis et al. 2012 (genus resurrected, neotype designated, lectotype designated, molecular analysis).

Allotelium Syd. 1939, Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *A. mirabile* Syd., biotrophic on Fabaceae, terrestrial, South America (Ecuador), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Alpova C.W. Dodge 1931, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, 16 species, type species *A. cinnamomeus* C.W. Dodge, ectomycorrhizal, see Kirk et al. 2013 (genus accepted), widespread, sequence data available, see Vizzini et al. 2010b (phylogeny), Rochet et al. 2011 (Europe, host, phylogeny), new spp. see Moreau et al. 2011, 2013 (Europe), Hayward et al. 2014 (North America).

Alutaceodontia (Parmasto) Hjortstam & Ryvarden 2002, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *A. alutacea* (Fr.) Hjortstam & Ryvarden, sequence data unavailable, see Kirk et al. 2008.

Alveolaria Lagerh. 1891 [1892], Pucciniosiraceae, Pucciniales, Pucciniomycetes**,** two species, type species *A. cordiae* Lagerh., biotrophic on Boraginaceae, terrestrial, South America (Ecuador), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Alysidium Kunze 1817, Botryobasidiaceae, Cantharellales, Agaricomycetes, sexual morph *Botryobasidium* see Gónzalez et al. 2016, four species, type species *A.*

fulvum Kunze & J.C. Schmidt, Europe, polyphyletic across orders, in need of modern interpretation on morphology, sequence data unavailable, see Kirk et al. 2008.

Amanita Pers. 1797, Amanitaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 570 species, type species *A. muscaria* (L.) Lam., most species ectomycorrhizal, some saprobic, agaricoid or secotioid, terrestrial, three subgenera: *Amanita*, *Amanitina* and *Lepidella*, eleven sections, worldwide, several species lethal (*A. phalloides* (Fr.: Fr.) Link), some species edible (*A. caesarea* (Scop.) Pers.), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), Justo et al. 2010 (secotioid and gasteroid taxa), Kirk et al. 2013 (genus accepted), sequence data available, see Geml et al. 2008b (*A. muscaria* species complex, phylogeography), Sanmee et al. 2008 (Northern Thailand), Menolli et al. 2009a, b (Brazil), Zhang et al. 2010a (monograph, phylogeny, keys), Cai et al. 2014 (phylogeny, biogeography), Sánchez-Ramírez et al. 2015 (sect. *Caesareae*, biogeography), Tang et al. 2015 (tropical Africa, section *Vaginatae* s.l.), Cai et al. 2016 (review, China, lethal *Amanita*), Tulloss et al. 2016 (taxonomy), Cui et al. 2018 (phylogeny), new spp. see Wartchow et al. 2009 (Brazil), Tulloss et al. 2011 (Central America), Bojantchev and Davis 2013 (North America), Davison et al. 2013 (Australia), Li and Cai 2014 (China), Davison et al. 2015 (Australia), Hosen et al. 2015 (Bangladesh), Li et al. 2015b (China), Wartchow et al. 2015a (Brazil), Thongbai et al. 2016, 2017a (Thailand), Wartchow and Cortez 2016 (Brazil), Truong et al. 2017a (South America, sequestrate spp.), Ebika et al. 2017 (Africa), Hosen et al. 2018b (India), Fraiture et al. 2019 (Africa).

Amaropostia B.K. Cui, L.L. Shen & Y.C. Dai 2019, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *A. stiptica* (Pers.) B.K. Cui, L.L. Shen & Y.C. Dai., China, Europe, USA, wood-rotting, sequence data available, see Shen et al. 2019 (taxonomy, phylogeny).

Amauroderma Murrill 1905, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *A. regulicolor* (Berk. ex Cooke) Murrill, mostly stipitate basidioma, hymenophore poroid, terrestrial or wood-rotting, white rot, widespread (pantropical), parasitic on the roots of living trees, see Glen et al. 2009 (root-rot disease of *Acacia mangium*), some species medicinal use, see Jiao et al. 2013 [anticancer activities, *A. rude* (Berk.) Torrend], Gomes-Silva and Gibertoni 2012 (taxonomy), Kirk et al. 2013 (genus accepted), sequence data available, see Costa-

Rezende et al. 2017 (phylogeny), new spp. see Gomes-Silva et al. 2015 (phylogeny, Brazil), Costa-Rezende et al. 2016 (phylogeny, Brazil), Song et al. 2016b (phylogeny, China).

Amaurodon J. Schröt. 1888, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, ten species, type species *A. viridis* (Alb. & Schwein.) J. Schröt., worldwide, wood-rotting, see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen and Kõljalg 2007 (phylogeny), new spp. see Gardt et al. 2011 (West Africa).

Amaurohydnum Jülich 1978, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. flavidum* Jülich, resupinate basidioma, minutely hydnoid hymenophore, wood-rotting, Australia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Amauromyces Jülich 1978, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. pallidus* Jülich, corticioid basidioma, resupinate, wood-rotting, widespread (Australia, Japan, Réunion), see Kirk et al. 2013 (genus accepted), sequence data unavailable, see Chen and Oberwinkler 2004 (morphology, China).

Ambivina Katz 1974, *incertae sedis*, Corticiales, Agaricomycetes, asexual morph unknown, one species, type species *A. filobasidia* Katz, found in USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Amethicium Hjortstam 1983, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. rimosum* Hjortstam, basidioma resupinate basidioma, hymenophore smooth, wood-rotting, Tanzania, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Amparoina Singer 1958, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *A. spinosissima* (Singer) Singer, terrestrial, South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Amphinema P. Karst. 1892, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, four species, type species *A. sordescens* (P. Karst.) P. Karst., widespread, symbiotic, see Kirk et al. 2013 (genus accepted), sequence data available, see Nygren et al. 2008 (ectomycorrhizal, phylogeny), Menkis et al. 2010 (mycorrhization), Schoch et al. 2012 (DNA barcode marker), Roy et al. 2013

(ectomycorrhizal), Nuñez et al. 2013 (ecology), Luoma and Eberhart 2014 (ectomycorrhizal fungus diversity), Miyamoto et al. 2014 (mid-domain effect in ectomycorrhizal), Malysheva et al. 2017 (mycorrhiza of pyroloids, Russia), Lazarević and Menkis 2018 (ecology).

Amphistereum Spirin & Malysheva 2017, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, two species, type species *A. schrenkii* (Burt) Spirin & Malysheva, wood-rotting, sequence data available, see Malysheva and Spirin 2017 (taxonomy, phylogeny, stereoid basidiocarps, Auriculariales).

Ampulloclitocybe Redhead, Lutzoni, Moncalvo & Vilgalys 2002, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *A. clavipes* (Pers.) Redhead, Lutzoni, Moncalvo & Vilgalys, worldwide, sequence data available, see Walther et al. 2005 (phylogeny), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae).

Amylaria Corner 1955, Bondarzewiaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *A. himalayensis* Corner, Bhutan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Amyloathelia Hjortstam & Ryvarden 1979, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, three species, type species *A. amylacea* (Bourdot & Galzin) Hjortstam & Ryvarden, Europe, South America, see Kirk et al. 2013 (genus accepted), sequence data unavailable.

Amylobasidium Ginns 1988, *incertae sedis*, Corticiales, Agaricomycetes, asexual morph unknown, one species, type species *A. tsugae* Ginns, found in USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Amylocorticiellum Spirin & Zmitr. 2002, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, four species, type species *A. subillaqueatum* (Litsch.) Spirin & Zmitr., widespread, terrestrial, see Zmitrovich 2008 (species manual), Gorjón et al. 2011b (notes, new combination), sequence data available, Binder et al. 2010 (molecular phylogeny).

Amylocorticium Pouzar 1959, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, eleven species, type species *A. subsulphureum* (P. Karst.) Pouzar, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (phylogeny).

Amylocystis Bondartsev & Singer 1944, Dacryobolaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. lapponica* (Romell) Bondartsev & Singer, poroid hymenophore, wood-rotting, brown rot, circumboreal distribution in coniferous forests, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2007b (phylogeny), Justo et al. 2017 (phylogeny, Polyporales).

Amyloflagellula Singer 1966, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *A. pulchra* (Berk. & Broome) Singer, saprophytic, tropical America and Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes). Recognized as a synonym of *Marasmius* (Desjardin unpubl. data).

Amylofungus Sheng H. Wu 1996, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *A. corrosus* (G. Cunn.) Sheng H. Wu, New Zealand, Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Amylohyphus Ryvarden 1978, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *A. africanus* Ryvarden, Rwanda, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Amylolepiota Harmaja 2002, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *A. lignicola* (P. Karst.) Harmaja, Europe, sequence data unavailable, see Kirk et al. 2008.

Amylonotus Ryvarden 1975, Auriscalpiaceae, Russulales, Agaricomycetes, asexual morph unknown, six species, type species *A. africanus* Ryvarden, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Chen et al. 2016b (systematics, *Wrightoporia s. l.*).

Amyloporia Singer 1944, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *A. calcea* (Fr.) Bondartsev & Singer, basidioma resupinate, hymenophore poroid, wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Han et al. 2016a (taxonomy, phylogeny), Justo et al. 2017 (phylogeny, Polyporales), new spp. see Rajchenberg et al. 2011 (new combination, phylogeny, Patagonia, Argentina, Chile?), Cui and Dai 2013 (new combination, phylogeny, China).

Amylosporomyces S.S. Rattan 1977, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *A. echinosporus* S.S. Rattan, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Amylosporus Ryvarden 1973, Bondarzewiaceae, Russulales, Agaricomycetes, asexual morph unknown, twelve species, type species *A. graminicola* (Murrill) Ryvarden, basidioma resupinate, pileate to stipitate, hymenophore poroid, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Chen and Shen 2014 (new sp., morphology, phylogeny, China), Campi et al. 2017 (new sp., taxonomy, phylogeny, Paraguay).

Amylostereum Boidin 1958, Echinodontiaceae, Russulales, Agaricomycetes, asexual morph unknown, five species, type species *A. chailletii* (Pers.) Boidin, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Bergeron et al. 2008 (Canada, new record), Fitza et al. 2016 (host specificity, diversity, Japan), Zhao et al. 2017c (phylogeny), new spp. see Olatinwo et al. 2013 (America).

Amyloxenasma (Oberw.) Hjortstam & Ryvarden 2005, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, six species, type species *A. grisellum* (Bourdot) Hjortstam & Ryvarden, widespread, saprobes, terrestrial, sequence data available, see Binder et al. 2010 (phylogeny).

Anamika K.A. Thomas, Peintner, M.M. Moser & Manim. 2002, Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *A. indica* K.A. Thomas, Peintner, M.M. Moser & Manim. (current name: *Hebeloma indicum* (K.A. Thomas, Peintner, M.M. Moser & Manim.) B.J. Rees 2013), terrestrial, ectomycorrhizal, India, China, sequence data available, see Thomas et al. 2002 (genus accepted), Yang et al. 2005 (phylogeny).

Anastomyces W.P. Wu, B. Sutton & Gange 1997, *incertae sedis*, *incertae sedis*, Basidiomycota, sexual morph unknown, one species, type species *A. microsporus* W.P. Wu, B. Sutton & Gange, fungicolous, China, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Seifert et al. 2011 (genera of Hyphomycetes).

Anastrophella E. Horak & Desjardin 1994, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *A. subpeltata* (Redhead) E. Horak & Desjardin, terrestrial, saprobic, New Zealand, Hawaii, Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Andebbia Trappe, Castellano & Amar. 1996, Mesophelliaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, one species, type species *A. pachythrix* (Cooke & Massee) Trappe, Castellano & Amar., Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2008 (biogeography, Hysterangiales).

Anguillomyces Marvanová & Bärl. 2000, *incertae sedis*, *incertae sedis*, Basidiomycota, sexual morph Basidiomycota, one species, type species *A. acadiensis* Marvanová & Bärl., Canada, fresh water, sequence data unavailable, see Kirk et al. 2008, Seifert et al. 2011 (morphology).

Anomalomyces Vánky, M. Lutz & R.G. Shivas 2006, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, two species, plant parasites (ovaries) on *Panicum* spp. (Poaceae), Australia, cultures unavailable, sequence data available, see McTaggart et al. 2012b (phylogeny), Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Anomoloma Niemelä & K.H. Larss. 2007, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, six species, type species *A. albolutescens* (Romell) Niemelä & K.H. Larss, basidioma resupinate, strongly rhizomorphic, wood-rotting, white rot, widespread, sequence data available, see Binder et al. 2010 (phylogeny, morphology), new spp. see Song et al. 2016a (monograph, phylogeny, China).

Anomoporia Pouzar 1966, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, eight species, type species *A. bombycina* (Fr.) Pouzar, basidioma resupinate, hymenophore poroid, wood-rotting, brown rot, north temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny), Binder et al. 2010 (phylogeny, morphology), Song et al. 2016a (phylogeny, China).

Antella Miettinen 2016, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *A. niemelaei* (Vampola & Vlasák) Miettinen, poroid hymenophore, wood-rotting, subtropical widespread (China, Venezuelan Andes), sequence data available, see Miettinen and Ryvarden 2016 (new genus, new combinations, phylogeny), Zmitrovich 2018a (taxonomy).

Antherospora R. Bauer, M. Lutz, Begerow, Piątek & Vánky 2008, Floromycetaceae, Urocystidales, Ustilaginomycetes, twelve species, type species *A. vaillantii* (Tul. & C. Tul.) R. Bauer, M. Lutz, Begerow, Piątek & Vánky, plant parasites (flowers) on Hyacinthaceae, Africa, North America, Asia, Europe, cultures available, sequence data available, see Piątek et al. 2013b (phylogeny), Begerow et al. 2014 (phylogeny).

Anthomyces Dietel 1899, Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *A. brasiliensis* Dietel, biotrophic on Fabaceae, terrestrial, South America (Brazil), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Anthomycetella Syd. & P. Syd. 1916 (= *Reyesiella* Sacc. 1917), Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *A. canarii* Syd. & P. Syd., biotrophic on Burseraceae, terrestrial, Philippines, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Anthoporia Karasiński & Niemelä 2016, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. albobrunnea* (Romell) Karasiński & Niemelä, basidioma resupinate, hymenophore poroid, wood-rotting, brown rot, widespread (North America, Eurasia), sequence data available, see Karasiński and Niemelä 2016 (new genus, new combination, morphology), Justo et al. 2017 (phylogeny, Polyporales).

Anthracocystis Bref. 1912, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, 134 species, type species *A. destruens* Bref., plant parasites (flowers) on Poaceae, widespread, saprobic yeast states on plants, cultures available, sequence data available, see Begerow et al. 2014 (taxonomy), Piątek et al. 2015 (phylogeny), Wang et al. 2015c (taxonomy, phylogeny).

Anthracoidea Bref. 1895, (= *Cintractiomyxa* Golovin 1952), Anthracoideaceae, Ustilaginales, Ustilaginomycetes, 112 species, type species *A. caricis* (Pers.) Bref., plant parasites (ovaries) on Cyperaceae (mainly *Carex* spp.), circumpolar, arctic-alpine, saprobic states, cultures available, see Kirk et al. 2013 (genus accepted), sequence data available, see Begerow et al. 2014 (taxonomy).

Anthracophyllum Ces. 1879, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, twelve species, type species *A. beccarianum* Ces., worldwide,

on wood, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Matheny et al. 2007b (phylogeny).

Antrodia P. Karst. 1879, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 80 species (needs revision since genus shown to be polyphyletic), type species *A. serpens* (Fr.) P. Karst. (current name: *A. albida* (Fr.) Donk), poroid hymenophore, wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Ortiz-Santana et al. 2013 (phylogeny), Spirin et al. 2013a (phylogeny, morphology, new combinations), new spp. see Kout and Vlasák 2009 (phylogeny, USA), Rivoire 2010 (morphology, France), Cui et al. 2011d (morphology, China), Vlasák et al. 2012 (phylogeny, USA), Spirin et al. 2013a (phylogeny, new records, Russia), Cui 2013a (phylogeny, China), Vlasák et al. 2013 (phylogeny, Slovakia), Park et al. 2014c (phylogeny, South Korea), Spirin et al. 2015d (phylogeny, new combination, *Antrodia crassa* group, Czech Republic, Estonia, USA), Chen and Cui 2016 (phylogeny, *Antrodia heteromorpha* complex, China), Kaipper-Figueiró et al. 2016 (phylogeny, Brazil), Spirin 2016 (phylogeny, taxonomy), Spirin et al. 2016a (phylogeny, new combination, *A. malicola* group, Indonesia, Russia), Chen and Wu 2017 (phylogeny, China), Kout et al. 2017 (phylogeny, Canary Islands), Spirin et al. 2017a (phylogeny, new combinations, *Antrodia serialis* group, Russia, USA), Yuan et al. 2017e (phylogeny, Uzbekistan), new combinations see Ryvarden and Melo 2014 (morphology, polypores, Europe), Ryvarden et al. 2017 (morphology, polypores, Europe).

Antrodiella Ryvarden & I. Johans. 1980, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *A. semisupina* (Berk. & M.A. Curtis) Ryvarden, see Kirk et al. 2013 (genus accepted), poroid hymenophore, wood-rotting, white rot, cosmopolitan but temperate, some species medicinal use, see Lu et al. 2013 (medicinal use), sequence data available, see Cui et al. 2008 (molecular characters), Miettinen et al. 2012 (morphology, phylogeny), new spp. see Vampola and Vlasák 2011 (America), Yuan and Qin 2012 (China), Yuan 2013a (China), Gurpreet et al. 2015 (India), Justo et al. 2017 (phylogeny, Polyporales).

Antrodiopsis Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. oleracea* (R.W. Davidson &

Lombard) Audet, basidioma resupinate, poroid hymenophore, sequence data available, see Audet 2017c (new combination).

Anupama K.N.A. Raj, K.P.D. Latha & Manim. 2019, Biannulariaceae, Agaricales, asexual morph unknown, one species, type species *A. indica* K.N.A. Raj, K.P.D. Latha & Manim., India, sequence data available, see Raj et al. 2019 (taxonomy, phylogeny).

Aphanobasidium Jülich 1979, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, 17 species, type species *A. subnitens* (Bourdot & Galzin) Jülich, worldwide, wood-rotting (*A. subnitens* (Bourdot & Galzin) Jülic), see Zmitrovich 2008 (species manual), Kirk et al. 2013 (genus accepted), see Prasher and Ashok 2013 (wood-inhabiting fungi checklist, Himachal Pradesh), sequence data available, see Binder et al. 2010 (phylogeny).

Aphelaria Corner 1950, Aphelariaceae, Cantharellales, Agaricomycetes, 20 species, type species *A. dendroides* (Jungh.) Corner, widespread, polyphyletic across orders, in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Aphelariopsis Jülich 1982, Septobasidiaceae, Septobasidiales, Pucciniomycetes, sexual morph unknown, two species, type species *A. borneensis* (Jülich) Jülich (current name: *Paraphelaria borneensis* Jülich), Sarawak, south America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Aphroditeola Redhead & Manfr. Binder 2013, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *A. olida* (Quél.) Redhead & Manfr. Binder, Europe, sequence data available, see Redhead 2013a (taxonomy), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae).

Aphyllotus Singer 1973, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *A. campanelliformis* Singer, Colombia, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Apioperdon (Kreisel & D. Krüger) Vizzini 2017, Lycoperdaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *A. pyriforme* (Schaeff.) Vizzini, sequence data available, see Vizzini and Ercole 2017 (phylogeny, taxonomy).

Apiotrichum Stautz 1931, Trichosporonaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, 21 species, types pecies *A. porosum* Stautz,

yeast, on wood, soil, human skin, widespread, cultures and sequence data available, see Liu et al. 2015b (phylogeny), James et al. 2016 (new spp.), Takashima et al. 2018 (taxonomy and phylogeny).

Aplopsora Mains 1921, Chaconiaceae, Pucciniales, Pucciniomycetes, six species, type species *A. nyssae* Mains, biotrophic on Cornaceae, Fabaceae, Nyssaceae, Vochysiaceae, Urticaceae, terrestrial, North America, South America (Brazil), Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Aporophallus Möller 1895, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *A. subtilis* Möller, terrestrial, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Apra J.F. Hennen & F.O. Freire 1979, Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *A. bispora* J.F. Hennen & F.O. Freire, biotrophic on Fabaceae, terrestrial, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Aquascypha D.A. Reid 1965, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. hydrophora* (Berk.) D.A. Reid, stipitate stereoid basidioma, wood-rotting, Central and South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Arachnion Schwein. 1822, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, 13 species, type species *A. album* Schwein., subtropical, see Kirk et al. 2013 (genus accepted), sequence data available, see Miller et al. 2011 (fungus identification), new spp. see see Trierveiler-Pereira et al. 2018 (Brazil).

Araeocoryne Corner 1950, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, one species, type species *A. elegans* Corner, wood-decaying, Malaysia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Arambarria Rajchenb. & Pildain 2015, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *A. cognata* (Speg.) Rajchenb. & Pildain, type species on dead branches and stems of *Lomatia hirsuta* (Proteaceae) and *Diostea juncea* (Verbenaceae), basidioma poroid, wood-rotting, white rot, sequence data available, see Rajchenberg et al. 2015 (phylogeny, poroid Hymenochaetaceae, Patagonia, Argentina), Pildain et al. 2017 (pathogen, canker rot of *Eucalyptus* in Uruguay, stem-rot of *Vitis vinifera* in Argentina and Chile).

Arcispora Marvanová & Bärl. 1998, *incertae sedis*, *incertae sedis*, Basidiomycota, sexual morph unknown, one species, type species *A. bisagittaria* Marvanová & Bärl., aquatic, Canada, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Seifert et al. 2011 (genera of Hyphomycetes).

Arcticomyces Savile 1959, Exobasidiaceae, Exobasidiales, Exobasidiomycetes, one species, tyepe species *A. warmingii* (Rostr.) Savile, plant parasite on *Saxifraga* spp. (Saxifragaceae), Europe, cultures unavailable, sequence data available, see Begerow et al. 2002, 2014 (taxonomy), Wang et al. 2015c (phylogeny).

Armillaria (Fr.) Staude 1857, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, 39 species, type species *A. mellea* (Vahl) P. Kumm, worldwide, parasitic, saprobic, honey fungus, wood pathogen (*A. ostoyae* (Romagn.) Herink), edible (*A. mellea* (Vahl) P. Kumm.), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), Pildain et al. 2010 (Argentina), Kirk et al. 2013 (genus accepted), Koch et al. 2017 (biogeography, taxonomy), sequence data available, see Ross-Davis et al. 2012 (phylogeny, North American), Klopfenstein et al. 2017 (phylogeny, Northern Hemisphere), new spp. see Lima et al. 2008 (Brazil), Brazee et al. 2012a (North America), Hood and Ramsfield 2016 (New Zealand), Elías-Román et al. 2018 (Mexico), Park et al. 2018 (Korea).

Aroramyces Castellano & Verbeken 2000, Hysterangiaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, c. five species, type species *A. gelatinosporus* (Cribb) Castellano, hypogeous, basidioma gasteroid, only known from Zimbabwe, Mexico and Queensland, Australia, ectomycorrhizal with angiosperms and gymnosperms, sequence data available, see Hosaka et al. 2008 (phylogeny), Guevara-Guerrero et al. 2016 (Mexico).

Arrasia Bernicchia, Gorjón & Nakasone 2011, *incertae sedis*, *incertae sedis*, Basidiomycota, asexual morph unknown, one species, type species *A. rostrata* Bernicchia, Gorjón & Nakasone, Italy, sequence data unavailable, see Bernicchia et al. 2011 (taxonomy).

Arrhenia Fr. 1849, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 36 species, type species *A. auriscalpium* (Fr.) Fr., temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Larsson 2007a (phylogeny), Lodge et al. 2014

(phylogeny, monograph, Hygrophoraceae), new spp. see Desjardin and Perry 2017 (São Tomé and Príncipe, Africa).

Arthrodochium R.F. Castañeda & W.B. Kendr. 1990, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *A. candidum* R.F. Castañeda & W.B. Kendr., Cuba, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Seifert et al. 2011 (genera of Hyphomycetes).

Arthromyces T.J. Baroni & Lodge 2007, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *A. claviformis* T.J. Baroni & Lodge, America, sequence data available, see Baroni et al. 2007 (taxonomy), Bellanger et al. 2015 (phylogeny).

Arthrosporella Singer 1970 (= *Nothoclavulina* Singer 1970 *fide* Index Fungorum 2019, Art. 59.1), *incertae sedis*, Agaricales, Agaricomycetes, asexual morph was previously known in *Nothoclavulina* Singer 1970, one species, type species *A. ditopa* (Singer) Singer, America, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Seifert et al. 2011 (genera of Hyphomycetes).

Arthuria H.S. Jacks. 1931, Phakopsoraceae, Pucciniales, Pucciniomycetes, six species, type species *A. catenulata* H.S. Jacks. & Holw., biotrophic on Apocynaceae, Euphorbiaceae, Phyllanthaceae, terrestrial, Brazil, Columbia, India, Mexico, see Kirk et al. 2013 (genus accepted), sequence data available, see Zuluaga et al. 2011 (phylogeny, Uredinales, Colombian Andean region).

Arthuriomyces Cummins & Y. Hirats. 1983, Phragmidiaceae, Pucciniales, Pucciniomycetes, asexual morph unknown, three species, type species *A. peckianus* (Howe) Cummins & Y. Hirats., north America, Russia, China, Japan, on *Rubus*, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Artomyces Jülich 1982, Auriscalpiaceae, Russulales, Agaricomycetes, asexual morph unknown, 17 species, type species *A. pyxidatus* (Pers.) Jülich, wood-rotting, worldwide, sequence data available, new sp. see Kneal and Smith 2015 (Chile).

Arualis Katz 1980, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *A. carolinensis* Katz, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Aseroë Labill 1800, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, two species, type species *A. rubra* Labill, terrestrial, widespread, see Kirk et

al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny), Trierveiler-Pereira et al. 2014a (phylogeny, morphology).

Asproinocybe R. Heim 1970, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *A. lactifera* R. Heim, tropical Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Aspropaxillus Kühner & Maire 1934, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *A. giganteus* (Sowerby) Kühner & Maire (current name: *Leucopaxillus giganteus* (Sowerby) Singer), sequence data available, see Vizzini et al. 2012b (new combinations, phylogeny).

Asterocyphella W.B. Cooke 1961, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *A. floccosa* W.B. Cook, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Asterodon Pat. 1894, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *A. ferruginosus* Pat., widespread (North temperate), basidioma resupinate, smooth hymenophore, wood-rotting, white rot, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny).

Asterophora Ditmar 1809, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph *Ugola* Adans. 1763, three species, type species *A. lycoperdoides* (Bull.) Ditmar, temperate, fungal parasitic, see Kirk et al. 2013 (genus accepted), mycoparasite, sequence data available, see Hofstetter et al. 2014 (phylogeny, Lyophyllaceae).

Asterostroma Massee 1889, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, 19 species, type species *A. apalum* (Berk. & Broome) Massee, worldwide, basidioma resupinate, smooth hymenophore, wood-rotting, white rot, sequence data available, see Suhara 2010 (taxonomy), new spp. see De 2009 (India).

Astraeus Morgan 1889, Diplocystidiaceae, Boletales, Agaricomycetes, asexual morph unknown, eleven species, type species *A. hygrometricus* (Pers.) Morgan, worldwide, earthstar, some species medicinal use (*A. hygrometricus* (Pers.) Morgan), see Dai and Yang 2008 (medicinal mushrooms, China), Lai et al. 2012 (compounds), see Kirk et al. 2013 (genus accepted), sequence data available, see Fangfuk et al. 2010 (Japan), Phosri et al. 2013 (phylogeny), new spp. see Phosri et al. 2013, 2014 (USA, Greece, Thailand), Ryoo et al. 2017 (Korea, Japan).

Atelocauda Arthur & Cummins 1933, Pileolariaceae, Pucciniales, Pucciniomycetes, three species, type species *A. incrustans* Arthur & Cummins, biotrophic on Fabaceae, terrestrial, Asia (China, Japan), Australia, Brazil, Hawaii, Panama, gall rust, see Nelson 2009 (on *Acacia koa*, *A. digitate* (G. Winter) Cummins & Y. Hirats.), see Kirk et al. 2013 (genus accepted), sequence data available, see Yepes and Alves de Carvalho 2014 (new species, discussion).

Athelia Pers. 1822 (= *Fibularhizoctonia* G.C. Adams & Kropp 1996 *fide* Adams and Kropp 1996), Atheliaceae, Atheliales, Agaricomycetes, asexual morph was previously known in *Fibularhizoctonia* (current name: *Athelia* Pers. 1822), 32 species, type species *A. epiphylla* Pers., widespread, see Zmitrovich 2008 (species manual), Kirk et al. 2013 (genus accepted), some species are facultative parasites of plants (including crops) and of lichens, see Esslinger 2016 (checklist), sequence data available, see Lawrey et al. 2007 (phylogeny), Binder et al. 2010 (phylogeny), Xu et al. 2010 (phylogeny).

Athelicium K.H. Larss. & Hjortstam 1986, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, two species, type species *A. stridii* K.H. Larss. & Hjortstam, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Athelidium Oberw. 1965, Stephanosporaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *A. aurantiacum* (M.P. Christ.) Oberw., see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson 2007b (classification, corticioid fungi), new spp. see Yurchenko and Kotiranta 2007 (Belarus and Finland), Zmitrovich 2008 (species manual).

Athelocystis Hjortstam & Ryvarden 2010, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, one species, type species *A. capitata* Hjortstam & Ryvarden, Brazil, sequence data unavailable, see Hjortstam and Ryvarden 2010b (new spp.).

Atheloderma Parmasto 1968, Rickenellaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, two species, type species *A. mirabile* Parmasto, wood-decaying, Europe, Asia, see Zmitrovich 2008 (species manual), Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2006 (phylogeny, hymenochaetoid clade).

Athelopsis Oberw. ex Parmasto 1968, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, 14 species, type species *A. glaucina* (Bourdot & Galzin) Oberw. ex Parmasto, widespread, see Zmitrovich 2008 (species manual), Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (phylogeny), new spp. see Hjortstam et al. 2009 (Western Australia), Singh et al. 2010c (India).

Atheniella Redhead, Moncalvo, Vilgalys, Desjardin & B.A. Perry 2012, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *A. adonis* (Bull.) Redhead, Moncalvo, Vilgalys, Desjardin & B.A. Perry, worldwide, saprophytic, sequence data unavailable, see Redhead 2012 (taxonomy), new spp. see Lehmann and Lüderitz 2018 (Germany).

Atractidochium Oono, Urbina & Aime 2018, Phleogenaceae, Atractiellales, Atractiellomycetes, sporodochial asexual state, sexual morph unkown, one species, type species *A. hillariae* Oono, Urbina & Aime, abundant hyphal endophytes of *Pinus taeda* needles, nature of association with host unknown, North Carolina (USA), sequence data available, see Aime et al. 2018b (integrative taxonomy).

Atractiella Sacc. 1886, Phleogenaceae, Atractiellales, Atractiellomycetes, seven species, type species *A. brunaudiana* Sacc., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Oberwinkler et al. 2006 (phylogeny, Atractiellales), new spp. see Bonito et al. 2017 (USA, integrative taxonomy, ecology).

Atractocolax R. Kirschner, R. Bauer & Oberw. 1999, *incertae sedis*, *incertae sedis*, Microbotryomycetes, asexual morph unknown, one species, type species *A. pulvinatus* R. Kirschner, R. Bauer & Oberw., Europe, associated with bark beetles, see Kirk et al. 2013 (genus accepted), sequence data unavailable, see Kirk et al. 2008.

Atractogloea Oberw. & Bandoni 1982, Atractogloeaceae, Atractiellales, Atractiellomycetes, sexual morph unknown, one species, type species *A. stillata* Oberw. & Bandoni, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Atractosporocybe P. Alvarado, G. Moreno & Vizzini 2015, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *A. inornat*a (Sowerby) P. Alvarado, G. Moreno & Vizzini, from the Mediterranean basin to Northern Europe and North America, in either broadleaf or conifer forests, sequence data available, see Alvarado et al. 2015 (taxonomy), new spp. see Gulden and Larsson 2016 (Svalbard, Scandinavia).

Atraporiella Ryvarden 2007, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *A. neotropica* Ryvarden, Belize, sequence data available, see Miettinen and Rajchenberg 2012 (phylogeny), new spp. see Wu et al. 2017c (China).

Atroporus Ryvarden 1973, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *A. diabolicus* (Berk.) Ryvarden., wood-rotting, neotropics, sequence data available, see Palacio et al. 2017 (genus accepted, taxonomy, phylogeny).

Aurantiopileus Ginns, D.L. Lindner & T.J. Baroni 2010, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *A. mayaensis* Ginns, D.L. Lindner & T.J. Baroni, hymenophore poroid, wood-rotting, white rot, widespread (Asia, America), sequence data available, see Ginns et al. 2010 (monograph, new combinations), see Justo et al. 2017 (phylogeny, Polyporales).

Aurantiosporium M. Piepenbr., Vánky & Oberw. 1996, Ustilentylomataceae, Microbotryales, Microbotryomycetes, four species, type species *A. subnitens* (J. Schröt. & Henn.) M. Piepenbr., Vánky & Oberw., worldwide, on Cyperaceae, see Kirk et al. 2013 (genus accepted), sequence data available, see Begerow et al. 1997 (phylogeny).

Aurantiporus Murrill 1905, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, six species (needs revision since genus shown to be polyphyletic, see Papp and Dima 2018), type species *A. pilotae* (Schwein.) Murrill, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), Papp and Dima 2018 (new genus, new combination, phylogeny, type study), new sp. see Niemelä et al. 2012 (morphology, Europe).

Aureoboletus Pouzar 1957, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, 33 species, type species *A. gentilis* (Quél.) Pouzar, stipitate-pileate, worldwide, biogeography study see Wrzosek et al. 2017 (*A. projectellus*, biogeography, Europe), some species edible (*A. thibetanus* (Pat.) Hongo & Nagas.), see Dai et al. 2010b (edible mushrooms, China), see Kirk et al. 2013 (genus accepted), sequence data available, see Klofac 2010 (monograph), Nuhn et al. 2013 (phylogeny, Boletineae), Halling et al. 2015 (phylogeny, new combination), Wu et al. 2016f (monograph, new combination, new spp., China), new spp. see Shi and Liu 2013 (China), Zhang et al.

2014a (Guangxi, China), Zeng et al. 2015 (China), Zhang et al. 2015a, b (Hunan, Guangdong, China), Wu et al. 2016e (new combination, new spp., China), Zhang et al. 2017b (Tibet, China).

Auricularia Bull. 1789, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, c. 21 species, type species *A. mesenterica* (Dicks.) Pers., widespread , some species edible [*A. auricula-judae* (Bull.) Quél.], see Dai et al. 2010b (edible mushrooms, China), some medicinal use (*A. auricula* (L. ex Hook.) Underw.), see Dai and Yang 2008 (medicinal mushrooms, China), see Kirk et al. 2013 (genus accepted), sequence data available, see Looney et al. 2013 (Southeastern USA, monograph), Malysheva and Bulakh 2014 (Russia, monograph), Wu et al. 2014a (phylogeny), new spp. see Kumari et al. 2013a (North India), Looney 2013 (southeastern USA), Wu et al. 2014a, 2015d, e (USA, China, Brazil), Bandara et al. 2015a, 2017 (Southeastern Asia).

Auriculariopsis Maire 1902, Schizophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *A. ampla* (Lév.) Maire (current name: *Schizophyllum amplum* (Lév.) Nakasone), worldwide, wood decaying, sequence data available, see Binder et al. 2005 (phylogeny), new combination see Ryvarden 2010 (America).

Auriculoscypha D.A. Reid & Manim. 1985, Septobasidiaceae, Septobasidiales, Pucciniomycetes, sexual morph unknown, one species, type species *A. anacardiicola* D.A. Reid & Manim., India, medicinal use, see Puthusseri et al. 2010 (antioxidant and anti-inflammatory properties), see Kirk et al. 2013 (genus accepted), sequence data available, see Kumar et al. 2007 (phylogeny).

Aurificaria D.A. Reid 1963, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, two species, type species *A. indica* (Massee) D.A. Reid, wood-rotting, basidioma pileate to stipitate, poroid hymenophore, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Wagner and Fischer 2002 (phylogeny).

Auriporia Ryvarden 1973, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *A. aurea* (Peck) Ryvarden, basidimes resupinate, poroid hymenophore, wood-rotting, brown rot, widespread (north temperate), see Kirk et al. 2013 (genus accepted), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales).

Auriscalpium Gray 1821, Auriscalpiaceae, Russulales, Agaricomycetes, asexual morph unknown, eight species, type species *A. vulgare* Gray, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Kim et al. 2015 (mushroom flora of Korea).

Auritella Matheny & Bougher 2006, Inocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, eight species, type species *A. dolichocystis* Matheny, Trappe & Bougher ex Matheny & Bougher, Australia, India, ectomycorrhizal, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny and Bougher 2006 (monograph), new spp. see Matheny et al. 2012 (India), Matheny et al. 2017b (Cameroon, worldwide key), Matheny and Bougher 2017 (Australia).

Austeria Miettinen 2016, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. citrea* (Berk.) Miettinen, pileate basidioma, poroid hymenophore, wood-rotting, white rot, sequence data available, see Miettinen and Ryvarden 2016 (new genus, new combination, morphology).

Australicium Hjortstam & Ryvarden 2002, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *A. singulare* (G. Cunn.) Hjortstam & Ryvarden, corticioid basidioma, wood-rotting, white rot, widespread (Australia, New Zealand, Venezuela), sequence data unavailable, see Kirk et al. 2008.

Australohydnum Jülich 1978, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *A. griseofuscescens* (Reichardt) Jülich, basidioma resupinate, hymenophore hydnoid, wood-rotting, widespread (Australia, Europe), see Tura et al. 2011 (new record, Israel), Kirk et al. 2013 (genus accepted), sequence data unavailable, see Saitta et al. 2014 (morphology, new record, Italy, *A. dregeanum* (Berk.) Hjortstam & Ryvarden).

Australopilus Halling & N.A. Fechner 2012, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *A. palumanus* (Wolfe & Bougher) Halling & N.A. Fechner, stipitate-pileate, Australia, sequence data available, see Halling et al. 2012b (monograph).

Australoporus P.K. Buchanan & Ryvarden 1988, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. tasmanicus*

(Berk.) P.K. Buchanan & Ryvarden, poroid hymenophore, wood-rotting, white rot, Australia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Australovuilleminia Ghobad-Nejhad & Hallenb. 2010, Vuilleminiaceae, Corticiales, Agaricomycetes, asexual morph unknown, one species, type species *A. coccinea* Ghobad-Nejhad & Hallenb., saprotroph, wood-rotting, on dead attached twigs and branches of *Nothofagus* in New Zealand, sequence data available, see Ghobad-Nejhad et al. 2010 (phylogeny, *Vuilleminia*, Corticiales).

Austrobasidium Palfner 2006, Exobasidiaceae, Exobasidiales, Exobasidiomycetes, one species, type species *A. pehueldeni* Palfner, plant parasite (stem) on *Hydrangea* spp. (Hydrangeaceae), Chile, cultures unavailable, sequence data unavailable, see Begerow et al. 2014.

Austroboletus (Corner) Wolfe 1980, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 36 species, type species *A. dictyotus* (Boedijn) Wolfe, stipitate-pileate, worldwide, some species edible (*A. gracilis* (Peck) Wolfe), see Dai et al. 2010b (edible mushrooms, China), see Fulgenzi et al. 2010 (new record, Guyana), Kirk et al. 2013 (genus accepted), sequence data available, see Drehmel et al. 2008 (phylogeny, boletes), new spp. see da Vasco-Palacios et al. 2014 (Colombian Amazonia), Das and Dentinger 2015 (India), Fechner et al. 2017 (Australia).

Austroclitocybe Raithelh. 1972, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *A. veronicae* Raithelh., temperate America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Austrogaster Singer 1962, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, four species, type species *A. marthae* Singer, South America (temperate), New Zealand, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Austrogautieria E.L. Stewart & Trappe 1985, Gallaceaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, seven species, type species *A. macrospora* E.L. Stewart & Trappe, Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2008 (biogeography, Hysterangiales), Truong et al. 2017b (DNA-barcoding).

Austrolentinus Ryvarden 1991, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *A. tenebrosus* (Corner) Ryvarden,

hymenophore lamellate, wood-rotting, Australia, Solomon Islands, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Austroomphaliaster Garrido 1988, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *A. nahuelbutensi*s Garrido, temperate America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Austropaxillus Bresinsky & Jarosch 1999, Serpulaceae, Boletales, Agaricomycetes, asexual morph unknown, nine species, type species *A. statuum* (Speg.) Bresinsky & Jarosch, ectomycorrhizal, widespread (southern temperate), see Kirk et al. 2013 (genus accepted), sequence data available, see Skrede et al. 2011 (evolution, phylogeny).

Austropuccinia Beenken 2017, Sphaerophragmiaceae, Pucciniales, Pucciniomycetes, one species, type species *A. psidii* (G. Winter) Beenken (asexual morph *Uredo psidii* J.A. Simpson, K. Thomas & Grgur.), biotrophic on Myrtaceae, terrestrial, Australia, Brazil, China, USA, Hawaii, Japan, Mexico, New Caledonia, New Zealand, South Africa, South America, sequence data available, see Tan et al. 2014 (phylogeny), Machado et al. 2015 (epitypification), Beenken 2017 (distribution, morphology, phylogeny). Several authors (e.g., Sandhu et al. 2016) assume that the myrtle rust is a species complex, future research will show how many species exist in the genus.

Baeodromus Arthur 1905, Pucciniosiraceae, Pucciniales, Pucciniomycetes, six species, type species *B. holwayi* Arthur, biotrophic on Asteraceae, Ranunculaceae, Urticaceae, terrestrial, China, Central America, North America, South America, Russia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Baeospora Singer 1938, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, 13 species, type species *B. myosura* (Fr.) Singer, North temperate, tropical, snowbank agaric, saprobic, see Hutchison et al. 2012 (morphology, new spp.), Kirk et al. 2013 (genus accepted), sequence data available, see Walther et al. 2005 (phylogeny, conidiogenesis modes).

Ballistosporomyces Nakase, G. Okada & Sugiy. 1989, Chionosphaeraceae, Agaricostilbales, Agaricostilbomycetes, sexual morph unknown, four species, type species *B. xanthus* Nakase, G. Okada & Sugiy., yeast, Japan, see Kirk et al. 2013 (genus accepted), Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see

Wang et al. 2015e (phylogenetic classification of yeasts, Pucciniomycotina), new spp. see Han et al. 2016b (China).

Baltazaria Leal-Dutra, Dentinger & G.W. Griff. 2018, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, four species, type species *B. galactina* (Fr.) Leal-Dutra, Dentinger & G.W. Griff., corticioid, wood-rotting, worldwide, sequence data available, see Leal-Dutra et al. 2018 (taxonomy and phylogeny).

Bambusiomyces Vánky 2011, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species *B. shiraianus* (Henn.) Vánky, plant parasite on woody bamboos (Bambuseae, Poaceae), South East Asia, cultures unavailable, sequence data unavailable, see Vánky 2011 (taxonomy), McTaggart et al. 2012a (taxonomy).

Bandonia A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Tetragoniomycetaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, one species, type species *B. marina* (Uden & Zobell) A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, aquatic, worldwide, sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Bankera Coker & Beers ex Pouzar 1955, Bankeraceae, Thelephorales, Agaricomycetes, asexual morph unknown, eight species, type species *B. fuligineoalba* (J.C. Schmidt) Coker & Beers ex Pouzar, worldwide, on soil, basidioma stipitate, hymenophore hydnoid, see Kirk et al. 2013 (genus accepted), sequence data available.

Bannoa Hamam. 2002, Erythrobasidiaceae, Erythrobasidiales, Cystobasidiomycetes, sexual and asexual morphs known, four species, type species *B. hahajimensis* Hamam., Thanh & Nakase, yeast, isolated from plant material, Japan, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Wang et al. 2015e (emended, phylogeny).

Bannozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Chrysozymaceae, *incertae sedis*, Microbotryomycetes, sexual morph unknown, two species, type species *B. yamatoana* (Nakase, M. Suzuki & M. Itoh) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, psychrophilic, Arctic, Japan, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Baorangia G. Wu & Zhu L. Yang 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, four species, type species *B. pseudocalopus* (Hongo) G. Wu &

Zhu L. Yang, ectomycorrhizal, stipitate-pileate, China, Japan, North America, sequence data available, see Wu et al. 2016e (taxonomy).

Barcheria T. Lebel 2004, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *B. willisiana* T. Lebel, Australia, sequence data available, see Lebel et al. 2004 (monograph).

Bartheletia G. Arnaud ex Scheuer, R. Bauer, M. Lutz, Stabenth., Melnik & Grube 2008, *incertae sedis*, *incertae sedis*, Basidiomycota, one species, type species *B. paradoxa* G. Arnaud ex Scheuer, R. Bauer, M. Lutz, Stabenth., Melnik & Grube, Austria, Denmark, France, Germany, Russia, Sweden, The Netherlands, United Kingdom, Korea, Japan, living on ginkgo, see Kirschner and Okuda 2013 (new record, Japan), sequence data available, see Scheuer et al. 2008 (monograph).

Basidioascus Matsush. 2003, Geminibasidiaceae, Geminibasidiales, Wallemiomycetes, asexual morph unknown, three species, type species *B. undulatus* Matsush., Australia,

sequence data available, see Nguyen et al. 2013a (phylogeny, new sp.), Nasr et al. 2014b (new sp., Iran).

Basidiodendron Rick 1938, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, c. 15 species, type species *B. luteogriseum* Rick, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Sotome et al. 2014 (Asian species, poroid Auriculariales, phylogeny).

Basidiopycnis Oberw., R. Kirschner, R. Bauer, Begerow & Arenal 2006, Hoehnelomycetaceae, Atractiellales, Atractiellomycetes, synonyms *Basidiopycnides albertensis* J. Reid, Eyjólfsd. & Georg Hausner 2008, asexual morph known, one species, type species *B. hyaline* Oberw., R. Kirschner, R. Bauer, Begerow & Arenal, presumably mycophilic but nature of association unknown, in bark beetle galleries in dead wood of conifers, Europe and North America, see Oberwinkler et al. 2006 (integrated taxonomy), Kischner and Oberwinkler 2009 (integrated taxonomy), sequence data available, see Aime et al. 2018c (phylogeny).

Basidioradulum Nobles 1967, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *B. radula* (Fr.) Nobles, basidioma resupinate, hymenophore raduloid or hydnoid, wood-rotting, Europe,

North America, see Kirk et al. 2013 (genus accepted), sequence data available, see Weiß and Oberwinkler 2001 (phylogeny).

Battarrea Pers. 1801, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *B. phalloides* (Dicks.) Pers., worldwide, terrestrial, saprobic, see Kirk et al. 2013 (genus accepted), sequence data available, see Martín and Johannesson 2000 (phylogeny, Europe), Martín et al. 2013b (phylogeny), Ivančević et al. 2016 (taxonomy, worldwide review).

Battarreoides T. Herrera 1953, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *B. potosinus* T. Herrera (current name: *B. diguetii* (Pat. & Har.) R. Heim & T. Herrera), America (deserts), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Bauerago Vánky 1999, Microbotryaceae, Microbotryales, Microbotryomycetes, nine species, type species *B. abstrusa* (Malençon) Vánky, worldwide, biotrophic in seeds of Commelinaceae, Cyperaceae, Juncaceae, see Kirk et al. 2013 (genus accepted), Denchev and Denchev 2018 (taxonomic re-examination, Africa), sequence data available, see Kemler et al. 2006, 2009 (phylogeny, Microbotryaceae, non-caryophyllaceous plant-parasitic species, *Microbotryum*).

Beenakia D.A. Reid 1956, Clavariadelphaceae, Gomphales, Agaricomycetes, asexual morph unknown, seven species, type species *B. dacostae* D.A. Reid, wood-decaying, widespread (tropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Giachini et al. 2010 (phylogeny, Gomphales).

Bensingtonia Ingold 1986, Kondoacea, Agaricostilbales, Agaricostilbomycetes, sexual morph unknown, five species, type species *B. ciliata* Ingold, yeast, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Wang et al. 2015e (taxonomy and phylogeny).

Biatoropsis Räsänen 1934, *incertae sedis*, Tremellales, Tremellomycetes, asexual morph unknown, four species, type species *B. usnearum* Räsänen, lichenicolous, worldwide, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Bibulocystis J. Walker, Beilharz, Pascoe & Priest 2006, Raveneliaceae, Pucciniales, Pucciniomycetes, three species, type species *B. pulcherrima* J. Walker,

Beilharz, Pascoe & Priest, Australia, New Caledonia, sequence data unavailable, new sp. see Walker and Shivas 2009 (morphology, Australia).

Binderoboletus T.W. Henkel & M.E. Sm. 2016, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *B. segoi* T.W. Henkel & Husbands, stipitate-pileate, presumably ectomycorrhizal, South America, DNA sequence data available, see Henkel et al. 2016 (taxonomy).

Bjerkandera P. Karst. 1879, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *B. adusta* (Willd.) P. Karst., basidioma pilate, hymenophore poroid, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Jung et al. 2014 (sequence validation), Westphalen et al. 2015 (new sp., new combination, phylogeny, Central and South America), Ryvarden 2016b (new sp., morphology, tropical America), Zmitrovich et al. 2016 (Russia, intraspecies polymorphism).

Blasiphalia Redhead 2007, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *B. pseudogrisella* (A.H. Sm.) Redhead, USA, sequence data unavailable, see Kirk et al. 2008.

Blastospora Dietel 1908 (= *Pelastoma*), Mikronegeriaceae, Pucciniales, Pucciniomycetes, five species, type species *B. smilacis* Dietel, asexual morphs *Caeoma* Link 1809, *Pelastoma* M. Salazar, A.A. Carvalho & J.F. Hennen 2012, biotrophic on Apocynaceae, Betulaceae, Smilacaceae, terrestrial, Central and South America, Japan, see Yepes and de Carvalho 2012 (new combination, asexual morph), Kirk et al. 2013 (genus accepted), sequence data available, see Aime 2006 (phylogeny, family-level, Uredinales).

Blastosporella T.J. Baroni & Franco-Mol. 2007, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *B. zonata* T.J. Baroni & Franco-Mol., Colombia, sequence data available, see Baroni et al. 2007 (taxonomy).

Blumenavia Möller 1895, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, three species, type species *B. rhacodes* Möller, terrestrial, south America; Africa, see Kirk et al. 2013 (genus accepted), sequence data available, see Degreef et al. 2013 (morphology), Trierveiler-Pereira et al. 2014a (phylogeny, morphology).

Bogbodia Redhead 2013, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *B. uda* (Pers.) Redhead, worldwide, sequence data unavailable, see Redhead 2013a (taxonomy).

Boidinella Nakasone 2011, *incertae sedis*, Cantharellales, Agaricomycetes, asexual morph unknown, two species, type species *B. globulispora* (Boidin & Lanq.) Nakasone, wood-decaying, Europe, sequence data unavailable, see Nakasone 2011 (taxonomy, morphology).

Boidinia Stalpers & Hjortstam 1982, Russulaceae, Russulales, Agaricomycetes, asexual morph unknown, eleven species, type species *B. furfuracea* (Bres.) Stalpers & Hjortstam, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny), new spp. see Adamčík et al. 2015 (China).

Bolbitius Fr. 1838, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 70 species, type species *B. titubans* (Bull.) Fr., worldwide, saprobic, dung fungi, see Kirk et al. 2013 (genus accepted), sequence data available, see Amandeep et al. 2013 (India), Malysheva et al. 2015a (taxonomic revision, Russia), new spp. see Hausknecht et al. 2008 (Italy), Dähncke et al. 2010 (Spain), Crous et al. 2015a (new sp., phylogeny).

Boletellus Murrill 1909, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *B. ananas* (M.A. Curtis) Murrill, stipitate-pileate, ectomycorrhizal, worldwide (mostly subtropical to tropical), some species edible see Boa 2004, see Kirk et al. 2013 (genus accepted), DNA sequence data available, see Halling and Ortiz-Santana 2009 (revision of sect. *Ixocephali*), Halling et al. 2015 (phylogeny, new spp. and combinations), new spp. see Fulgenzi et al. 2008 (Guyana), Mayor et al. 2008 (Guyana), Sato and Hattori 2015 (Japan), Wu et al. 2016f (China), Parihar et al. 2018a (India).

Boletinellus Murrill 1909, Boletinellaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *B. merulioides* (Schwein.) Murrill, North America, Japan, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2006 (Agaricales, phylogeny).

Boletochaete Singer 1944, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, five species, type species *B. spinifera* (Pat. & C.F. Baker) Singer, stipitate-

pileate, ectomycorrhizal, Souteast Asia, see Kirk et al. 2013 (genus accepted), sequence data unavailable, see Horak 2011 (new combinations).

Boletopsis Fayod 1889, Bankeraceae, Thelephorales, Agaricomycetes, asexual morph unknown, ten species, type species *B. leucomelaena* (Pers.) Fayod, worldwide, terrestrial, some species edible [*B. grisea* (Peck) Bondartsev & Singer], see Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Watling and Milne 2008 (European, North American), new spp. see Cooper and Leonard 2012 (Southern Hemisphere).

Boletus L. 1753, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 350 species, type species *B. edulis* Bull., terrestrial, ectomycorrhizal, some stipitate-pileate, others are sequestrate, porcini mushrooms, some species edible, King bolete (*B. edulis* Bull.), see Drehmel et al. 2008 (phylogeny, biodiversity, boletes), Sarikurkcu et al. 2008 (antioxidant activity), Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Beugelsdijk et al. 2008 (Europe, phylogeny, *Boletus* section *Boletus*), Dentinger et al. 2010 (*Boletus* section *Boletus*, monograph), Nuhn et al. 2013 (phylogeny, Boletaceae), Cui et al. 2016 (Porcini mushrooms, *Boletus* sect. *Boletus*, China), new spp. see Arora 2008 (California, USA), Korhonen et al. 2009 (Fennoscandia), Ortiz-Santana et al. 2009a, b (North America, Gulf Coast, Northern Florida), Takahashi et al. 2011 (Japan), Blanco-Dios and Marques 2013 (coastal dunes of Northwest Spain), Gelardi et al. 2013a (China), Nuhn et al. 2013 (New Zealand), Takahashi et al. 2013 (Japan), Arora and Frank 2014a (USA), Halling et al. 2014 (Thailand, Australia), Li et al. 2014a (China), Šutara et al. 2014 (Czech Republic), Zeng et al. 2014 (China), Chakraborty et al. 2015 (India), Das and Dentinger 2015 (India), Cui et al. 2016 (China), Terashima et al. 2016 (Japan), Chakraborty et al. 2017b (India).

Bondarcevomyces Parmasto 1999, Tapinellaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *B. taxi* (Bondartsev) Parmasto, Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (phylogeny).

Bondarzewia Singer 1940, Bondarzewiaceae, Russulales, Agaricomycetes, asexual morph unknown, 14 species, type species *B. montana* (Quél.) Singer, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Chen et

al. 2016e (phylogeny), Song et al. 2016c (phylogeny, biogeography), new spp. see Dai et al. 2010a (China), Das et al. 2015a (India).

Boninogaster Kobayasi 1937, *incertae sedis*, Geastrales, Agaricomycetes, asexual morph unknown, one species, type species *B. phalloides* Kobayasi, Bonin islands, Japan, see Kirk et al. 2013 (genus accepted), sequence data available.

Bonomyces Vizzini 2014, Pseudoclitocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *B. sinopicus* (Fr.) Vizzini, worldwide, agaricoid, see Vizzini 2014b (taxonomy), sequence data available, see Alvarado et al. 2018a, b (phylogeny).

Boreostereum Parmasto 1968, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, four species, type species *B. radiatum* (Peck) Parmasto, widespread (north temperate), brown rot, wood-rotting, see Kirk et al. 2013 (genus accepted), Chen et al. 2016a (novel natural compounds), sequence data available, see Garcia-Sandoval et al. 2011 (phylogeny).

Borofutus Hosen & Zhu L. Yang 2012, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *B. dhakanus* Hosen & Zhu L. Yang, stipitate-pileate, presumably ectomycorrhizal, Asia (tropical), sequence data available, see Hosen et al. 2013 (morphology, taxonomy, phylogeny), Vadthanarat et al. 2018 (phylogeny, Thailand).

Bothia Halling, T.J. Baroni & Manfr. Binder 2007, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *B. castanella* (Peck) Halling, T.J. Baroni & Manfr. Binder, stipitate-pileate, ectomycorrhizal, North America, Asia, sequence data available, new spp. see Zeng et al. 2015 (China).

Botryobasidium Donk 1931 (= *Haplotrichum* Link *fide* Rossman et al. 2016), Botryobasidiaceae, Cantharellales, Agaricomycetes, asexual morph described as *Haplotrichum* spp., c. 58 species, type species *B. subcoronatum* (Höhn. & Litsch.) Donk, saprotrophic, widespread, see Kirk et al. 2013 (genus accepted), McLaughlin and Spatafora 2014 (overview of genus), Rossman et al. 2016 (although *Haplotrichum* is the older name, *Botryobasidium* is proposed for protection due to its size and popularity), sequence data available, see Brazee et al. 2014 (ecology), Rosenthal et al. 2017 (ecology, corticioid fungi in North American pinaceous forests), new spp. see Bernicchia et al. 2010 (Italy), Buyck et al. 2017 (Africa).

Botryoconis Syd. & P. Syd. 1906, Cryptobasidiaceae, Exobasidiales, Exobasidiomycetes, two species, type species *B. saccardoi* Syd. & P. Syd., plant parasites (leaves, stem, fruits) on Lauraceae, Central and South America, cultures unavailable, see Kirk et al. 2013 (genus accepted), sequence data unavailable, see Begerow et al. 2002, Begerow et al. 2014 (taxonomy).

Botryodontia (Hjortstam & Ryvarden) Hjortstam 1987, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, six species, type species *B. cirrata* (Hjortstam & Ryvarden) Hjortstam, wood-decaying, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Sell et al. 2014 (*B. millavensis* and *Oxyporus philadelphi* are conspecific).

Botryorhiza Whetzel & Olive 1917, Chaconiaceae, Pucciniales, Pucciniomycetes, one species, type species *B. hippocrateae* Whetzel & Olive, biotrophic on Hippocrateaceae, terrestrial, Brazil, Puerto Rico, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Bourdotia (Bres.) Bres. & Torrend 1913, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *B. galzinii* (Bres.) Trotter, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Sotome et al. 2014 (Asian species, poroid Auriculariales, phylogeny).

Bourdotiella Duhem & Schultheis 2011, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *B. complicata* Duhem & Schultheis, corticioid basidioma, wood-rotting, France, sequence data unavailable, see Bernard and Schultheis 2011 (new genus, new species, morphology).

Bourdotigloea Aime 2018, Phleogenaceae, Atractiellales, Atractiellomycetes, asexual morph unknown, c. nine species, type species *B. vestita* (Bourdot & Galzin) Aime, presumably saprobic, on decaying wood, decaying herbaceous material and old fungi, Europe and North America, sequence data available, see Aime et al. 2018c (taxonomy, phylogeny), Spirin et al. 2018c (phylogeny, new spp.).

Bovista Pers. 1794, Lycoperdaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 58 species, type species *B. plumbea* Pers., two subgenera *Globaria* and *Bovista*, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Jeppson 2008 (phylogeny, Europe), Larsson et al. 2009a (phylogeny, Europe), new spp. see Trierveiler-Pereira et al. 2010 (Brazil), Yousaf et al. 2013

(Pakistan), Jeppson et al. 2016 (Hungary), Rebriev et al 2017 (Russia), Trierveiler-Pereira et al. 2018 (Brazil).

Brachybasidium Gäum. 1922, Brachybasidiaceae, Exobasidiales, Exobasidiomycetes, asexual morph unknown, one species, type species *B. pinangae* (Racib.) Gäum., plant parasites (leaves) on *Pinang*a spp. (Arecaceae), West Java, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2002, Begerow et al. 2014 (taxonomy).

Brauniella Rick ex Singer 1955, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *B. alba* (Rick) Rick ex Singer, America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Bresadolia Speg. 1883, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *B. paradoxa* Speg., on dead wood, white rot, tropical to warm-temperate, sequence data available, see Motato-Vásquez et al. 2018 (genus accepted, phylogeny, taxonomy).

Brevicellicium K.H. Larss. & Hjortstam 1978, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, 13 species, type species *B. exile* (H.S. Jacks.) K.H. Larss. & Hjortstam, wood-decaying, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Sjökvist et al. 2012 (evolution), Telleria et al. 2013a (phylogeny).

Brevicellopsis Hjortstam & Ryvarden 2008, *incertae sedis*, *incertae sedis*, Basidiomycota, asexual morph unknown, one species, type species *B. allantospora* (Hjortstam & Ryvarden) Hjortstam & Ryvarden, worldwide, sequence data unavailable, see Hjortstam and Ryvarden 2008b (taxonomy).

Bridgeoporus T.J. Volk, Burds. & Ammirati 1996, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, two species, type species *B. nobilissimus* (W.B. Cooke) T.J. Volk, Burds. & Ammirati, USA, basidioma pileate, hymenophore poroid, wood-rotting, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Wu et al. 2017a (China).

Broomeia Berk. 1844, Broomeiaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *B. congregata* Berk., Americas, Asia, sequence data unavailable, see Lugo et al. 2012 (morphology, new record, Argentina), Kirk et al. 2013 (genus accepted).

Brunneocorticium Sheng H. Wu 2007, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *B. pyriforme* Sheng H. Wu, China, sequence data available, see Wu et al. 2007 (taxonomy).

Brunneoporus Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *B. malicola* (Berk. & M.A. Curtis) Audet, wood-rotting, sequence data available, see Audet 2017b (taxonomy).

Bryoperdon Vizzini 2017, Lycoperdaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *B. acuminatum* (Bosc) Vizzini, sequence data available, see Vizzini and Ercole 2017 (phylogeny, taxonomy).

Buchwaldoboletus Pilát 1969, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, eleven species, type species *B. lignicola* (Kallenb.) Pilát, stipitate-pileate, lignicolous and mycoparasitic see Nuhn et al. 2013, worldwide, see Ortiz-Santana and Both 2011 (review with new combinations), Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Blanco-Dios and Marques 2013 (Europe).

Buckleyzyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Buckleyzymaceae, Buckleyzymales, Cystobasidiomycetes, sexual morph unknown, five species, type species *B. aurantiaca* (Saito) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Buglossoporus Kotl. & Pouzar 1966, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, nine species, type species *B. quercinus* (Schrad.) Kotl. & Pouzar, hymenophore poroid, wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Han et al. 2016a (new sp., phylogeny, China).

Bulbilla Diederich, Flakus & Etayo 2014 [= *Adamflakia* Diederich & Lawrey nom. inval. et nom. illeg. superfl.], *incertae sedis*, Cantharellales, Agaricomycetes, only asexual morph known (bulbil-forming), one species, type species *B. applanata* Diederich, Flakus & Etayo [= *Adamflakia applanata* (Diederich, Flakus & Etayo) Diederich & Lawrey, nom. inval.], sequence data available, see Diederich et al. 2014 (new sp., phylogeny).

The new name *Adamflakia* was introduced by Lawrey et al. (2016) for *Bulbilla* because these authors believed that the latter generic name was not validly published following Art. 20.2 (ICN), stating that it “coincides with a Latin technical term in use in morphology”. As a consequence, the names *Adamflakia* and *A. applanata* (as “*A. applanata* Diederich & Lawrey”) were recently accepted in the world-wide checklist of lichenicolous fungi (Diederich et al. 2018a). However, *Bulbilla* was actually validly published because it is not a morphological term. In the case of the term "bulbil" there is no corresponding "bulbilla" in use for this morphological structure in Latin. The Latin term would be "bulbillus" and thus only the exact spelling "*Bulbillus*" is not allowed following Art. 20.2. A similar case exists for the genus *Spinulum* in lycopods. The Latin term would be "spinula", but because the generic name ends with “-um”, and not “-a”, the fern community considers it as valid (PPG I 2016, p. 570; see also discussion on http://www.fernsoftheworld.com/2014/01/02/spinulum-annotinum/) and Art. 20.2 does not to apply here too. In addition, the genus *Adamflakia* was invalidly published (Art. 40.1 (Melbourne)) because the type of *Adamflakia* should have been cited as *A. applanata* (not *B. applanata*). As a result of the genus not being validly published, the species *Adamflakia applanata* is invalid too because it was published in an invalidly published genus (Art. 35.1). Because *Bulbilla* was validly published, *Adamflakia* is both invalid (because it wasn't validly published) and illegitimate (because it was a superfluous renaming since *Bulbilla* was available, valid and legitimate), and *A. applanata* is invalid (since the genus was invalid, the species cannot be validly combined).

Bulbillomyces Jülich 1974, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph *Aegerita* Pers. 1794, one species, type species *B. farinosus* (Bres.) Jülich, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson 2007b (phylogeny, *Hyphoderma*), Justo et al. 2017 (phylogeny, Polyporales).

Bullera Derx 1930, Bulleraceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, four species, type species *B. alba* (W.F. Hanna) Derx, yeast, possibly mycoparasite, plant material, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, Liu et al. 2015b (taxonomy and phylogeny).

Bulleribasidium J.P. Samp., M. Weiss & R. Bauer 2002, Bulleribasidiaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, eleven species, type

species *B. oberjochense* J.P. Samp., Gadanho, M. Weiss & R. Bauer, yeast, possibly mycoparasite, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Burgella Diederich & Lawrey 2007, Hydnaceae, Cantharellales, Agaricomycetes, only asexual morph known (bulbil-forming), two species, type species *B. flavoparmeliae* Diederich & Lawrey, North and South America, sequence data available, see Diederich et al. 2014 (new spp., phylogeny).

Burgellopsis Diederich & Lawrey 2014, Hydnaceae, Cantharellales, Agaricomycetes, only asexual morph known (bulbil-forming), one species, type species *B. nivea* Diederich & Lawrey, Scotland, sequence data available, see Diederich et al. 2014 (new spp., phylogeny), Lawrey et al. 2016 (phylogeny).

Burgoa Goid. 1937, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph known (bulbil-forming), nine species, type species *B. verzuoliana* Goid., propagules bulbils, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Diederich and Lawrey 2007 (new sp.), Kiyuna et al. 2015 (Japan, ecology).

Burrillia Setch. 1891, Doassansiaceae, Doassansiales, Exobasidiomycetes, four species, type species *B. pustulata* Setch., plant parasites on monocots (Alismataceae, Pontederiaceae), South and East Asia, North America, India, cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Butlerelfia Weresub & Illman 1980, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, one species, type species *B. eustacei* Weresub & Illman, Canada, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Vu et al. 2019 (DNA barcodes).

Butyrea Miettinen 2016, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *B. luteoalba* (P. Karst.) Miettinen, resupinate basidioma, poroid hymenophore, wood-rotting, widespread (northern Europe, Asia), sequence data available, see Miettinen et al. 2012 (phylogeny), Miettinen and Ryvarden 2016 (new genus, new combinations, phylogeny), Zmitrovich et al. 2018a (taxonomy).

Butyriboletus Arora & J.L. Frank 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 25 species, type species *B. appendiculatus* (Schaeff.) D. Arora & J.L. Frank, stipitate-pileate, ectomycorrhizal, worldwide, some species edible, see Boa 2004 (wild edible fungi), sequence data available, see Arora and Frank 2014b

(phylogeny, new spp. and combinations), new spp. see Liang et al. 2016 (China), Wu et al. 2016f (China), new combinations see Zhao et al. 2015d.

Byssocorticium Bondartsev & Singer 1944, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, eleven species, type species *B. atrovirens* (Fr.) Bondartsev & Singer, ectomycorrhizal, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Palmer et al. 2008 (ectomycorrhizal), Zmitrovich 2008 (species manual), Bahram et al. 2012 (ectomycorrhizal fungal diversity), Pickles et al. 2012 (ecology), Gao et al. 2013a (ecology), Miyamoto et al. 2014 (ectomycorrhizal fungus), new spp. see Kotiranta et al. 2011 (Finland), Dhingra 2014 (diversity, Himalaya and adjoining areas).

Byssomerulius Parmasto 1967, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, eight species, type species *B. corium* (Pers.) Parmasto, basidioma merulioid, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny, corticioid homobasidiomycetes), Jang et al. 2016 (Korea), new combination see Tura et al. 2011 (morphology, Israel), Justo et al. 2017 (Phylogeny, Polyporales).

Byssoporia M.J. Larsen & Zak 1978, Albatrellaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *B. terrestris* (DC.) M.J. Larsen & Zak, mycorrhizal, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson 2007a (corticioid fungi, phylogeny).

Cabalodontia Piątek 2004, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *C. queletii* (Bourdot & Galzin) Piątek, resupinate basidioma, varied hymenophore (ceraceous to subgelatinous, odontoid, tuberculate, smooth), wood-rotting, widespread (Northern Hemisphere), sequence data available, see Rosenthal et al. 2017 (ecology, corticioid fungi in North American pinaceous forests).

Caeoma Link 1809 (= *Hypodermium* Link 1815), *incertae sedis*, Pucciniales, Pucciniomycetes, asexual morph particularly of *Arthuria* H.S. Jacks., *Chrysocelis* Lagerh. & Dietel, *Gymnoconia* Lagerh., *Melampsora* Castagne, *Polioma* Arthur, c. 50 species, type species *C. berberidis* (Pers.) Har. (current name: *Puccinia graminis* Pers.), biotrophic on various families, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Aime et al. 2018a (phylogeny, evolution with

host, Pucciniales), new spp. see Yepes and Céspedes 2008, Afshan et al. 2012 (morphology, Pakistan), Savchenko et al. 2014 (morphology, rust fungi, Israel).

Caeruleomyces Stalpers 2000, *incertae sedis*, Hymenochaetales, Agaricomycetes, sexual morph Hymenochaetales, one species, type species *C. verae* Stalpers, wood-decaying, sequence data unavailable, see Kirk et al. 2008.

Caetea Salazar-Yepes & A.A. Carvalho 2012, *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *C. itatiaiaensis* Salazar-Yepes & A.A. Carvalho, biotrophic on Fabaceae (*Piptadenia*), terrestrial, Brazil, see Yepes and Carvalho 2012 (taxonomy).

Calbovista Morse ex M.T. Seidl 1995, Lycoperdaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. subsculpta* Morse ex M.T. Seidl, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Calcipostia B.K. Cui, L.L. Shen & Y.C. Dai 2019, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *C. guttulata* (Sacc.) B.K. Cui, L.L. Shen & Y.C. Dai, China, Europe, USA, wood-rotting, sequence data available, see Shen et al. 2019 (taxonomy, phylogeny).

Calidion Syd. & P. Syd. 1919 [1918], Uncolaceae, Pucciniales, Pucciniomycetes, four species, type species *C. lindsaeae* (Henn.) Syd. & P. Syd., biotrophic on Bombacaceae, Polypodiaceae, terrestrial, Brazil, Colombia, Asia (China, India, Sri Lanka), see Kirk et al. 2013 (genus accepted), sequence data unavailable, new spp. see Yepes and Céspedes 2008, Silva et al. 2009 (new combination, new host record, Brazil).

Callistodermatium Singer 1981, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. violascens* Singer, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Callistosporium Singer 1944, Biannulariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 14 species, type species *C. palmarum* (Murrill) Singer, saprobic, wood-decaying or on soil, worldwide, see Antonín et al. 2009 (Czech, ecology), Kirk et al. 2013 (genus accepted), sequence data available, see Hofstetter et al. 2014 (phylogeny, Lyophyllaceae), Saba and Khalid 2014 (Pakistan), Sánchez-García et al. 2014, 2017 (phylogeny, evolution), new spp. see Desjardin and Hemmes 2011 (Hawaii), Desjardin and Perry 2017 (São Tomé and Príncipe, West Africa).

Caloboletus Vizzini 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, 14 species, type species *C. calopus* (Pers.) Vizzini, stipitate-pileate, ectomycorrhizal, worldwide, see Vizzini 2014b, sequence data available, see Zhao et al. 2014d (phylogeny and new spp., Asia).

Calocera (Fr.) Fr. 1828, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, asexual morph unknown, 18 species, type species *C. viscosa* (Pers.) Fr., wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Nagy et al. 2015 (genome, evolution), new spp. see Wu et al. 2011b (China), Shirouzu et al. 2013a (Amazonia).

Calocybe Kühner ex Donk 1962, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 46 species, type species *C. gambos*a (Fr.) Donk, worldwide, some species edible (*C. indica* Purkay. & A. Chandra), see Alam et al. 2008 (nutritional analysis), Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Bellanger et al. 2015 (phylogeny), new spp. see Floriani and Vizzini 2016 (Italy), Corriol et al. 2017 (France), Li et al. 2017a (China).

Calocybella Vizzini, Consiglio & Setti 2015, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *C. pudica* (Bon & Contu) Vizzini, Consiglio & Setti, Italy, France, Spain, India, Dominican Republic, sequence data available, see Vizzini et al. 2015a (monograph), new spp. see Latha et al. 2016b (India), Vizzini et al. 2017 (Dominican Republic).

Calostoma Desv. 1809, Calostomataceae, Boletales, Agaricomycetes, asexual morph unknown, 16 species, type species *C. cinnabarinum* Desv., ectomycorrhizal, widespread, see Wilson et al. 2012a (ecology), some species edible, yemitas (*C. cinnabarina* Desv.), see Bautista-Nava and Moreno-Fuentes 2009 (*C. cinnabarina*), some species medicinal use (*C. japonica* Henn.), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Wilson 2009 (Sclerodermatineae, ecology, evolution), Wilson et al. 2012a (phylogeny, Sclerodermatineae), Trierveiler-Pereira et al. 2013 (Costa Rica, monograph), new spp. see Deng and Wu 2014 (South China).

Calvarula Zeller 1939, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *C. excavata* Zeller, terrestrial, America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Calvatia Fr. 1849 (= *Langermannia* Rostk. 1839), Lycoperdaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 43 species, type species *C. craniiformis* (Schwein.) Fr., two subgenera: *Calvatia* Fr. and *Langermannia* (Rostk.) Jeppson & E. Larss., see Larsson and Jeppson 2008, worldwide, terrestrial, saprobic, some species edible (*C. lilacina* (Mont. & Berk.) Henn.), see Coetze and van Wyk 2009 (ethnomycology), Dai et al. 2010b (Chinese edible mushrooms), Wu et al. 2011a (compounds), Coetzee and Van Wyk 2012 (nomenclatural notes), Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Jeppson 2008 (North Europe, phylogeny), Bates et al. 2009 (key, phylogeny), new sp. see Suárez et al. 2009 (Brazil), Alves and Cortez 2013a (Brazil), Rebriev 2013 (Vietnam), Alfredo et al. 2014a (Brazil), Gunasekaran et al. 2018 (India, new sp., distribution data).

Calvatiopsis Hollós 1929, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. bovistoides* Hollós, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Calyptella Quél. 1886, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, 20 species, type species *C. capula* (Holmsk.) Quél., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes).

Camarophyllopsis Herink 1958, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 26 species, type species *C. schulzeri* (Bres.) Herink, worldwide, biotrophic, saprobic, see Kirk et al. 2013 (genus accepted), sequence data available, see Birkebak et al. 2013, 2016 (ecology, Clavariaceae, phylogeny, taxonomy).

Campanella Henn. 1895, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 39 species, type species *C. buettneri* Henn., pleurotoid habit with vein or ridge-like anastomosing lamellae, worldwide, see Bougher 2007 (Western Australia), Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Vinnere et al. 2005 (phylogeny, pathogen), Desjardin et al. 2017 (type study), new spp. see Farook and Manimohan 2014 (India), Desjardin and Perry 2017 (São Tomé and Príncipe, Africa).

Campanophyllum Cifuentes & R.H. Petersen 2003, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. proboscideum* (Fr.) Cifuentes & R.H. Petersen, America, sequence data available, see Cifuentes et al. 2003 (taxonomy).

Campanulospora Salazar-Yepes, Pardo-Card. & Buriticá 2007, Phragmidiaceae, Pucciniales, Pucciniomycetes, one species, type species *C. rubi* Salazar-Yepes, Pardo-Card. & Buriticá, anamorph of *Gerwasia*, biotrophic on Rosaceae (*Rubus*), terrestrial, Ecuador, sequence data unavailable.

Camptobasidium Marvanová & Suberkr. 1990 (= *Crucella* Marvanová & Suberkr. 1990 *fide* Art. 59.1), Camptobasidiaceae, Kriegeriales, Microbotryomycetes, sexual morph unknown, one species, type species *C. hydrophilum* Marvanová & Suberkr., USA, yeast, aquatic, see Kirk et al. 2013 (genus accepted), cultures and sequence data available, see Sampaio et al. 2003 (phylogeny), Wang et al. 2015e (phylogeny).

Campylomyces Nakasone 2004, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, two species, type species *C. tabacinus* (Cooke) Nakasone, Australia, Morocco, sequence data unavailable, see Kirk et al. 2008.

Canasta A.A. Carvalho & J.F. Hennen 2010, Uropyxidaceae, Pucciniales, Pucciniomycetes, three species, type species *C. cruscula* A.A. Carvalho & J.F. Hennen, biotrophic on Bignoniaceae, terrestrial, warmer areas of Central and South America, asexual stage of *Prospodium*, see de Carvalho Jr and Hennen 2010 (taxonomy).

Candelabrochaete Boidin 1970, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, twelve species, type species *C. africana* Boidin, corticioid basidioma, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Floudas and Hibbett 2015 (phylogeny), Justo et al. 2017 (phylogeny, Polyporales), new spp. see Duhem and Buyck 2011a (morphology, New Caledonia).

Cantharellopsis Kuyper 1986, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *C. prescotii* (Weinm.) Kuyper, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Larsson et al. 2006 (phylogeny, Hymenochaetales).

Cantharellula Singer 1936, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. umbonata* (J.F. Gmel.) Singer, worldwide (temperate), see Kirk et al. 2013 (genus accepted), sequence data available,

see Osmundson et al. 2013 (DNA barcode), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae).

Cantharellus Adans.ex Fr. 1821, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, c. 300 species estimated, see Buyck et al. 2014, Buyck 2016, type species *C. cibarius* Fr., six subgenera: *Afrocantharellus* Eyssart. & Buyck, *Cantharellus* Adans. ex Fr., *Cinnabarinus* Buyck & V. Hofst., *Parvocantharellus* Eyssart. & Buyck, *Pseudocantharellus* Eyssart. & Buyck, *Rubrinus* Eyssart. & Buyck, (the 7th subgenus has been suggested for neotropical species, i.e. *C. guyanensis* Mont. (see Buyck et al. 2016), c. 15 sections, ectomycorrhizal, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), multiple commercially important edible species, see Buyck 1994 (Africa), Pilz et al. 2003, Buyck 2008 (Madagascar), Arora and Dunham 2008 (North America), Shao et al. 2011, sequence data available, see Moncalvo et al. 2006 (cantharelloid clade), Buyck et al. 2013 (phylogeny, Africa), Buyck et al. 2014 (world multigene phylogeny), Buyck et al. 2015 (phylogeny, Madagascar), De Kesel et al. 2016 (multigene phylogeny, new section, Africa); Olariaga et al. 2015c (phylogeny, Europe), Buyck et al. 2016c (phylogeny, America), epitypifications and new species, for Asia, see Eyssartier et al. 2009, Kumari et al. 2011, 2013c, Tian et al. 2012, Das et al. 2015c, Suhara and Kurogi 2015, Shao et al. 2014, 2016a, b, Antonín et al. 2017a; for Africa, see Tibuhwa et al. 2008, De Kesel and Buyck 2011, Buyck 2012a, b, 2014, Buyck et al. 2016a, b, c, d, e, f, g, 2017, 2018, 2019; for Madagascar, see Ariyawansa et al. 2015, Buyck et al. 2015, for Europe, see Olariaga et al. 2015c; for North America, see Buyck and Hofstetter 2011, Buyck et al. 2010b, 2011, 2016d, e, Thorn et al. 2017; for South America, see Wartchow et al. 2012a, b, Pinheiro and Warchow 2013, Henkel et al. 2014b, Nascimento et al. 2014; for New Caledonia, see Buyck 2014, Buyck et al. 2016d.

Cantharocybe H.E. Bigelow & A.H. Sm. 1973, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *C. gruberi* (A.H. Sm.) H.E. Bigelow & A.H. Sm., on soil, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Ovrebo et al. 2011 (phylogeny, morphology, Belize), Kumar and Manimohan 2013 (new combination, phylogeny), Hosen et al. 2016b (phylogeny, Bangladesh), new combination see Kumar and Manimohan 2013 (India).

Capillosclerotium Prameela & Deeba 2013, Corticiaceae, Corticiales, Agaricomycetes, sexual morph unknown, one species, type species *C. indicum* Prameela & Deeba, causing the stem rot of cluster bean, India, sequence data available, see Devi et al. 2013 (phylogeny).

Capitulocladosporium L.Y. Sun, X. Sun & L.D. Guo 2017, *incertae sedis*, *incertae sedis*, Ustilaginomycetes, one species, type species *C. clinodiplosidis* L.Y. Sun, X. Sun & L.D. Guo, China, host midge (genus *Clinodiplosis*), cultures available, sequence data available, see Sun et al. 2018 (taxonomy).

Carcinomyces Oberw. & Bandoni 1982, Carcinomycetaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, three species, type species *C. effibulatus* (Ginns & Sunhede) Oberw. & Bandoni, yeast, mycoparasite, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Caripia Kuntze 1898, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. montagnei* (Berk.) Kuntze, America, see Ginns 2011a (USA, morphology), Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Mata et al. 2006 (phylogeny).

Carlosrosaea A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Trimorphomycetaceae, Tremellales, Tremellomycetes, sexual morph unknown, three species, type species *C. vrieseae* (M.F. Landell, L.R. Brandão, S.V. Safar, F.C. Gomes, C.R. Félix, A.R. Santos, D.M. Pagani, J.P. Ramos, L. Broetto, T. Mott, M.H. Vainstein, P. Valente & C.A. Rosa) A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, Europe, Brazil, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny), new spp. see Felix et al. 2017 (Brazil).

Carolinigaster M.E. Sm. & S. Cruz 2018, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *C. bonitoi* M.E. Sm. & S. Cruz, basidioma hypogeous, ectomycorrhizal, USA, sequence data available, see Crous et al. 2018a (taxonomy).

Castellanea T.W. Henkel & M.E. Sm. 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *C. pakaraimophila* T.W. Henkel & M.E. Sm., sequestrate, ectomycorrhizal, South America, sequence data available, see Smith et al. 2015 (phylogeny, taxonomy).

Castoreum Cooke & Massee 1887, Mesophelliaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, three species, type species *C. radicatum* Cooke & Massee, Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Truong et al. 2017b (DNA-barcoding).

Catathelasma Lovejoy 1910, Biannulariaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *C. evanescens* Lovejoy, North temperate, see Zhang et al. 2009 (biochemical analysis), Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Dentinger et al. 2011 (DNA barcode), Sánchez-García et al. 2017 (phylogeny, new family).

Catatrama Franco-Mol. 1991, Amanitaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. costaricensis* Franco-Mol., India, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Yang et al. 2018b (phylogeny).

Catilla Pat. 1915, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. pandani* (Pat.) Pat., Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Caudicicola Miettinen, M. Kulju & Kotir. 2017, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *C. gracilis* Miettinen, M. Kulju & Kotir., resupinate basidioma, poroid hymenophore, wood-rotting, Finland, on stumps and roots of *Picea abies* and *Pinus sylvestris*, sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), Kotiranta et al. 2017 (new genus, new sp., morphology).

Caulorhiza Lennox 1979, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *C. umbonata* (Peck) Lennox, USA, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny).

Celatogloea P. Roberts 2005, *incertae sedis*, *incertae sedis*, Basidiomycota, asexual morph unknown, one species, type species *C. simplicibasidium* (Lindsey & Gilb.) P. Roberts, USA, sequence data unavailable, see Kirk et al. 2008.

Cellypha Donk 1959, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *C. goldbachii* (Weinm.) Donk, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cenangiomyces Dyko & B. Sutton 1979, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *C. luteus* Dyko & B. Sutton, British Isles, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Centrolepidosporium R.G. Shivas & Vánky 2007, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species *C. sclerodermum* R.G. Shivas & Vánky, plant parasite on *Centrolepis exserta* (Centrolepidaceae), Australia, cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Cephaloscypha Agerer 1975, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. mairei* (Pilát) Agerer, saprophytic, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Ceraceomyces Jülich 1972, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, 16 species, type species *C. tessulatus* (Cooke) Jülich, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Dhingra and Singh 2008b (India), Zmitrovich 2008 (species manual), Chikowski et al. 2017 (Atlantic Rain Forest, Brazil).

Ceraceopsis Hjortstam & Ryvarden 2007, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *C. verruculosa* Hjortstam & Ryvarden, Venezuela, sequence data unavailable, see Hjortstam et al. 2007 (taxonomy).

Ceraceopsora Kakish., T. Sato & S. Sato 1984, Chaconiaceae, Pucciniales, Pucciniomycetes, one species, type species *C. elaeagni* Kakish., T. Sato & S. Sato, biotrophic on Elaeagnaceae, (Ranunculaceae alternate host), terrestrial, Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Ceraceosorus B.K. Bakshi 1976, Ceraceosoraceae, Ceraceosorales, Exobasidiomycetes, three species, type species *C. bombacis* (B.K. Bakshi) B.K. Bakshi, plant parasites (leaves) on *Bombax* spp. (Malvaceae), India, West Africa, Guam, saprobic yeast states on plants, cultures available, see Kirk et al. 2013 (genus accepted), sequence data available, see Wang et al. 2015c, Kijpornyongpan and Aime 2016, Piątek

et al. 2016, Kijpornyongpan et al. 2018 (smut pathogenic ancestry of the fungal clade Ustilaginomycotina, genome).

Cerarioporia F. Wu, L.W. Zhou & Jing Si 2016, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *C. cystidiata* F. Wu, L.W. Zhou & J. Si, wood-rotting, China, sequence data available, see Wu et al. 2016c (taxonomy, China).

Ceratellopsis Konrad & Maubl. 1937, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, nine species, type species *C. queletii* (Pat.) Konrad & Maubl., wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Ceratobasidium D.P. Rogers 1935, Ceratobasidiaceae, Cantharellales, Agaricomycetes, asexual morph *Ceratorhiza*, c. 19 species, type species *C. calosporum* D.P. Rogers, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Samuels et al. 2012 (Southeast Asia, Melanesia, taxonomy), Oberwinkler et al. 2013a (only recognized one species in the genus, transferring the others to *Rhizoctonia*), Zhou et al. 2017 (China, pathogenic), new spp. see Diederich et al. 2014 (Europe).

Ceratocoma Buriticá & J.F. Hennen 1991, Pucciniosiraceae, Pucciniales, Pucciniomycetes, one species, type species *C. jacksoniae* (Henn. ex McAlpine) Buriticá & J.F. Hennen, biotrophic on Fabaceae, terrestrial, Australia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Ceratoporia Ryvarden & de Meijer 2002, Ceratobasidiaceae, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *C. perplexa* Ryvarden & de Meijer, saprobic, Brazil, sequence data unavailable, see Kirk et al. 2008.

Ceratorhiza R.T. Moore 1987, Ceratobasidiaceae, Cantharellales, Agaricomycetes, asexual *Ceratobasidium/ Rhizoctonia*, seven species, type species *C. goodyerae-repentis* (Costantin & L.M. Dufour) R.T. Moore, pathogenetic, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Hu et al. 2010 (pathogenicity), Amirmijani et al. 2012 (Iran), Oberwinkler et al. 2013a (considered as a synonym of *Rhizoctonia*).

Ceratosebacina P. Roberts 1993, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, three species, type species *C. longispora* (Hauerslev) P.

Roberts, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Weiß and Oberwinkler 2001 (phylogeny).

Cercopemyces T.J. Baroni, Kropp & V.S. Evenson 2014, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *C. crocodilinus* T.J. Baroni, Kropp & V.S. Evenson, USA, sequence data available, see Baroni et al. 2014 (phylogeny, taxonomy).

Cericium Hjortstam 1995, Cystostereaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. luteoincrustatum* (Hjortstam & Ryvarden) Hjortstam, south America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cerinomyces G.W. Martin 1949, Cerinomycetaceae, Dacrymycetales, Dacrymycetes, asexual morph unknown, 13 species, type species *C. pallidus* G.W. Martin, wood-decaying, widespread (temperate), see Kirk et al. 2013 (genus accepted), sequence data available, see Shirouzu et al. 2013b (phylogeny, several species with clamp connections and mainly 0–1-septate basidiospores are in Cerinomycetaceae clade), new combination see Malysheva 2009.

Cerinosterus R.T. Moore 1987, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, sexual morph *Femsjonia* Fr., one species, type species *C. luteoalbus* (de Hoog) R.T. Moore, wood-decaying, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Lim et al. 2005 (fungal diversity).

Cerioporus Quél. 1886, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 15 species, type species *C. squamosus* (Huds.) Quél., polyporoid basidiomas, wood-rotting, white rot, cosmopolitan, see Zmitrovich and Kovalenko 2016 (genus re-establishing, phylogeny), Zmitrovich et al. 2017 [*C. rangiferinus* (Bolton) Zmitr. et al. re-habilitation, phylogeny].

Ceriporia Donk 1933, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *C. viridans* (Berk. & Broome) Donk, basidioma resupinate, hymenophore poroid, wood-rotting, white rot, cosmopolitan, see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen et al. 2012 (phylogeny), new spp. see Læssøe and Ryvarden 2010a (morphology, Ecuador), Mata and Ryvarden 2010 (morphology, Costa Rica), Jia and Cui 2011 (morphology, China), Gomes-Silva et al. 2012b (morphology, Brazil), Jia et al. 2014 (phylogeny, China), Ryvarden 2014

(morphology, tropical America), Soares et al. 2015 (morphology, Brazil, Neotropics), Miettinen et al. 2016a (phylogeny, France, Indonesia, Russia, USA), Spirin et al. 2016b (phylogeny, *C. purpura* group, Europe, North America), Yuan et al. 2017c (phylogeny, tropical China), Ryvarden 2018a (morphology, Seychelles), new combinations see Ryvarden 2015c (morphology), Ryvarden et al. 2017 (morphology), needs revision since genus shown to be polyphyletic, see Jia et al. 2014, Miettinen et al. 2016a.

Ceriporiopsis Domański 1963, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 40 species (needs revision since genus shown to be polyphyletic, see Zhao and Cui 2014, Justo et al. 2017), type species *C. gilvescens* (Bres.) Domański, resupinate basidioma, poroid hymenophore, wood-rotting, white rot, cosmopolitan, see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen and Rajchenberg 2012 (phylogeny), new spp. see Læssøe and Ryvarden 2010b (morphology, Ecuador), Mata and Ryvarden 2010b (morphology, Costa Rica), Vlasák et al. 2012 (phylogeny, USA), Cui 2013b (morphology, China), Zhao and Cui 2014 (phylogeny, China), Zhao et al. 2015c (phylogeny, China), Gomes-Silva et al. 2016 (morphology, Brazil), Ryvarden 2016b (morphology, tropical America), Spirin and Ryvarden 2016 (morphology, Mexico), Ryvarden 2016b, 2018 (morphology, Namibia, Burundi, Ethiopia, Mozambique), Zhao and Wu 2017 (phylogeny, China), new combination see Ryvarden 2015c (morphology, type study, India).

Ceropsora B.K. Bakshi & Suj. Singh 1960, Coleosporiaceae, Pucciniales, Pucciniomycetes, one species, type species *C. piceae* (Barclay) B.K. Bakshi & Suj. Singh, biotrophic on Pinaceae, terrestrial, India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cerotelium Arthur 1906 (= *Catenulopsora* Mundk. 1943), Phakopsoraceae, Pucciniales, Pucciniomycetes, 27 species, type species *C. canavaliae* Arthur, biotrophic on Aristolochiaceae, Fabaceae, Moraceae, Papaveraceae, Urticaceae, terrestrial, circumglobal in tropics and subtropics, fig rust (*C. fici* (Castagne) Arthur), cotton rust (*C. desmium* (Berk. & Broome) Arthur), see Kirk et al. 2013 (genus accepted), Latinovic et al. 2015 (pathogen, Montenegro), sequence data available, new spp. see Yepes and de Carvalho 2009, Mohanan 2010.

Cerradoa J.F. Hennen & Y. Ono 1978, *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *C. palmaea* J.F. Hennen & Y. Ono (current

name: *Edythea palmaea* (J.F. Hennen & Y. Ono) Cummins & Y. Hirats.), sequence data unavailable.

Cerrena Gray 1821, Cerrenaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *C. cinerea* (Pers.) Gray (current name: *C. unicolor* (Bull.) Murrill), hymenophore poroid to daedaloid or irpicoid, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Zmitrovich and Malysheva 2013 (phylogeny), Justo et al. 2017 (phylogeny, Polyporales), new sp. see Lee and Lim 2010 (phylogeny, South Korea), new combinations see Yuan 2014 (phylogeny).

Chaconia Juel 1897, Chaconiaceae, Pucciniales (= *Bitzea* Mains 1939, = *Desmotelium* Syd. 1937), Pucciniomycetes, twelve species, type species *C. alutacea* Juel, biotrophic on Bignoniaceae, Clusiaceae, Euphorbiaceae, Fabaceae, Heliconiaceae, Mimosaceae, Moraceae, Oleaceae, terrestrial, India, South America (Brazil, French Guiana, Paraguay, Venezuela), Thailand, West Africa, sequence data unavailable, see Berndt 2008a (*C. hennenii* Berndt, holomorph species for *Uredo maclurae* and *Uredo celtidis*), Kirk et al. 2013 (genus accepted), new spp. see Berndt and Beenken 2013 (notes, key).

Chaetocalathus Singer 1943, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *C. craterellus* (Durieu & Lév.) Singer, saprophytic, worldwide, see Takahashi and Degawa 2011 (Japan), Antonín and Noordeloos 2010 (Europe), Antonín 2012 (morphology, tropical Africa), Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes), Kerekes and Desjardin 2009 (monograph, *Crinipellis*, *Moniliophthora*, Southeast Asia).

Chaetodermella Rauschert 1988, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, one species, type species *C. luna* (Romell ex D.P. Rogers & H.S. Jacks.) Rauschert, Europe, see Kirk et al. 2013 (genus accepted), sequence data available see Sjökvist et al. 2012 (phylogeny).

Chaetospermum Sacc. 1892, Sebacinaceae, Sebacinales, Agaricomycetes, asexual known, four species, type species *C. tubercularioides* Sacc., worldwide, see Roberts 2011 (‘*E. rolleyi*, morphology), Kirk et al. 2013 (genus accepted), sequence data

available, see Riess et al. 2014 (phylogeny), Oberwinkler et al. 2014 (taxonomy, phylogeny, Sebacinales).

Chaetotyphula Corner 1950, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *C. hyalina* (Jungh.) Corner, tropical, see Kirk et al. 2013 (genus accepted), sequence data available, see Dentinger and McLaughlin 2006 (phylogeny).

Chalciporus Bataille 1908 (= *Rubinoboletus* Pilát & Dermek 1969), Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 30 species, type species *C. piperatus* (Bull.) Bataille, stipitate-pileate, parasitic? (at least the type species is mycoparasitic see Nuhn et al. 2013), worldwide, some species edible (*C. rubritubifer* (Kauffman) Singer) see Bessette et al. 2017 (Eastern North America), see Kirk et al. 2013 (genus accepted), sequence data available, new species see Degreef and De Kesel 2008 (Cameroon), Wu et al. 2016f (China), Zhang et al. 2017c (China).

Chamaemyces Battarra ex Earle 1909, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. alphitophyllus* (Berk. & M.A. Curtis) Earle, agaricoid, saprotrophic, North temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Vellinga 2004 (phylogeny), Walther et al. 2005 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Saar et al. 2009 (phylogeny).

Chamonixia Rolland 1899, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, eight species, type species *C. caespitosa* Rolland, sequestrate, worldwide, see Mleczko et al. 2009 (new record, central Europe), Kirk et al. 2013 (genus accepted), sequence data available, see Binder and Hibbett 2006 (phylogeny, Boletales), Orihara et al. 2016a (new record, Japan).

Chardoniella F. Kern 1939, Pucciniosiraceae, Pucciniales, Pucciniomycetes, four species, type species *C. gynoxidis* F. Kern, biotrophic on Asteraceae, terrestrial, South America (Bolivia, Colombia, Ecuador, Peru), see Kirk et al. 2013 (genus accepted), sequence data available, see Zuluaga et al. 2011 (Colombian Andean region, Uredinales).

Cheimonophyllum Singer 1955, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *C. candidissimum* (Berk. & M.A.

Curtis) Singer, worldwide, see Blanco-Dios 2014b (morphology, keys), Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006 (phylogeny).

Chernovia A.M. Yurkov & Begerow 2016, *incertae sedis*, *incertae sedis*, Wallemiomycetes, sexual morph unknown, one species, type species *C. houtui* J. Federici, A.M. Yurkov & D. Begerow, yeast, soil, Germany, sequence and cultures available, see Yurkov et al. 2016 (new spp., Germany).

Chionosphaera D.E. Cox 1976 (= *Fibulostilbum* Seifert & Oberw. 1992), Chionosphaeraceae, Agaricostilbales, Agaricostilbomycetes, yeast stage known for *C. apobasidialis* and *C. cuniculicola*, six species, type species *C. apobasidialis* D.E. Cox, presumably mycophilic on ascomycetes but nature of the association is unclear, on bark of deciduous wood, in beetle galleries in dead wood, on lichens, on ascocarps of *Phylacia poculiformis*, Europe and North America, cultures and sequence data available, see Kurtzman et al. 2011 (taxonomy), Wang et al. 2015e(phylogeny).

Chiua Y.C. Li & Zhu L. Yang 2016, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, four species, type species *C. virens* (W.F. Chiu) Yan C. Li & Zhu L. Yang, stipitate-pileate, China, sequence data available, see Wu et al. 2016f (taxonomy, China).

Chlamydopus Speg. 1898, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. clavatus* Speg. (current name: *C. meyenianus* (Klotzsch) Lloyd), desert areas, see Kirk et al. 2013 (genus accepted), sequence data available, see Martín et al. 2000 (phylogeny).

Chlorogaster Læssøe & Jalink 2004, Sclerodermataceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *C. dipterocarpi* Læssøe & Jalink, Sabah, sequence data unavailable, see Kirk et al. 2008.

Chlorolepiota Sathe & S.D. Deshp. 1979, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *C. mahabaleshwarensis* Sathe & S.D. Deshp., India, see Kirk et al. 2013 (genus accepted), Kumari et al. 2013c (morphology, India), sequence data available, see Atri et al. 2014 (new spp., India).

Chlorophyllum Massee 1898, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, 19 species, type species *C. esculentum* Massee, agaricoid, sequestrate, worldwide, see Ge and Yang 2006 (China, key), Kirk et al. 2013 (genus accepted),

sequence data available, see Vellinga 2006 (United Kingdom, key), Crous et al. 2015a, b (morphology, phylogeny), Ge et al 2018 (phylogeny, new spp., key).

Chondrogaster Maire 1926, Mesophelliaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, two species, type species *C. pachysporus* Maire, Mauritania Brazil, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Lupatini et al. 2008 (mycorrhizal morphotyping and molecular characterization), Hosaka et al. 2008 (phylogeography).

Chondrostereum Pouzar 1959, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *C. purpureum* (Pers.) Pouzar, worldwide, wood decaying (*C. purpureum* (Pers.) Pouzar), see Lygis et al. 2004 (pathogen), Vartiamäki 2009 (silvicide use), Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny, corticioid homobasidiomycetes).

Chromocyphella De Toni & Levi 1888, Chromocyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *C. crouanii* Pat. & Doass., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Petersen et al. 2010 (phylogeny, Crepidotaceae), Moreno et al. 2017 (new spp., phylogeny).

Chromosera Redhead, Ammirati & Norvell 1995, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *C. cyanophylla* (Fr.) Redhead, Ammirati & Norvell, three subgenera: *Chromosera* Redhead, Ammirati & Norvell 1995, *Oreocybe (Boertm.)* Vizzini, Lodge & Padamsee 2013, *Subomphalia* Vizzini, Lodge & Padamsee 2013, worldwide, see Kirk et al. 2013 (genus accepted), Holec et al. 2015 (Europe), sequence data available, see Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae).

Chroogomphus (Singer) O.K. Mill. 1964, Gomphidiaceae, Boletales, Agaricomycetes, asexual morph unknown, 23 species, type species *C. rutilus* (Schaeff.) O.K. Mill., ectomycorrhizal, widespread (north temperate), some species edible (*C. confusus* Yan C. Li et Zhu L. Yang), see Dai et al. 2010b (edible mushrooms, China), some medicinal use (*C. rutilus* (Schaeff.: Fr.) O.K. Miller), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), Feng et al. 2014 (compounds), sequence data available, see Li et al. 2009b (phylogeny, new spp.),

Martín et al. 2016 (phylogeny), Scambler et al. 2018 (monograph, new sp., typification, Europe).

Chrysella Syd. 1926, Pucciniaceae, Pucciniales, Pucciniomycetes, one species, type species *C. mikaniae* Syd., biotrophic on Asteraceae, terrestrial, Central America (Costa Rica), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Chrysocelis Lagerh. & Dietel, in Mayor 1914, (= *Stomatisora* J.M. Yen 1971), Mikronegeriaceae, Pucciniales, Pucciniomycetes, five species, type species *C. lupini* Lagerh. & Dietel, biotrophic on Acanthaceae, Cucurbitaceae, Fabaceae, Polygonaceae, Zingiberaceae, terrestrial, Central America (Costa Rica), South America (Colombia, Ecuador), India, Japan, Philippines, see Kirk et al. 2013 (genus accepted), sequence data available, see Zuluaga et al. 2011 (Colombian Andean region, Uredinales).

Chrysoconia McCabe & G.A. Escobar 1979, Coniophoraceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *C. orthospora* McCabe & G.A. Escobar, Réunion, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Chrysocyclus Syd. 1925 (= *Holwayella* H.S. Jacks. 1926), Pucciniaceae, Pucciniales, Pucciniomycetes, three species, type species *C. cestri* (Dietel & Henn.) Syd., biotrophic on Asteraceae, Solanaceae, terrestrial, Central and South America, see Kirk et al. 2013 (genus accepted), sequence data available, see Zuluaga et al. 2011 (Colombian Andean region, Uredinales).

Chrysomphalina Clémençon 1982, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *C. chrysophylla* (Fr.) Clémençon, saprotrophic, white rot, see Kirk et al. 2013 (genus accepted), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae), sequence data available, see Matheny and Bougher 2006 (phylogeny), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae).

Chrysomyxa Unger 1840 (=*Barclayella* Dietel 1890, = *Coleosporium* subgen. *Melampsoropsis* J. Schröt., in Cohn 1879, = *Melampsoropsis* (J. Schröt.) Sacc. 1888, = *Melampsoropsis* (J. Schröt.) Arthur 1906, = *Stilbechrysomyxa* M.M. Chen 1984, ? = *Hiratsukaia* Hara 1948), Coleosporiaceae, Pucciniales, Pucciniomycetes, 38 species, type species *C. abietis* (Wallr.) Unger, biotrophic on Aquifoliaceae, Ericaceae, Pinaceae (alternate host), terrestrial, worldwide, cause witches' brooms and needle and cone

diseases mainly on *Picea*, see Kirk et al. 2013 (genus accepted), sequence data available, see Kaitera et al. 2010 (phylogeny, Finland), Feau et al. 2011 (phylogeny, DNA barcoding), new spp. see Cao et al. 2016 (China).

Chrysopsora Lagerh. 1891 [1892], Pucciniaceae, Pucciniales, Pucciniomycetes, one species, type species *C. gynoxidis* Lagerh. 1891 [1892] (current name: *Psora testacea* Hoffm.), biotrophic on Asteraceae (*Gynoxys*), terrestrial, Ecuador, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Chrysozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Chrysozymaceae, *incertae sedis*, Microbotryomycetes, sexual morph unknown, two species, type species *C. griseoflava* (Nakase & M. Suzuki) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, on plant, Asia (China, Japan), sequence data available, see Wang et al. 2015e (taxonomy).

Cibaomyces Zhu L. Yang, Y.J. Hao & J. Qin 2014, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. glutinis* Zhu L. Yang, Y.J. Hao & J. Qin, East Asia, Europe, sequence data available, see Hao et al. 2014 (monograph), Moreau et al. 2015b (Europe).

Cilicia Fr. 1825, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, two species, type species *C. aeruginosa* Fr., Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cinereomyces Jülich 1982, Gelatoporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *C. lindbladii* (Berk.) Jülich, basidiomas resupinate, hymenophore poroid, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen and Rajchenberg 2012 (phylogeny), Miettinen 2012 (new combination, morphology), Justo et al. 2017 (phylogeny, Polyporales).

Cinereomycetella Zmitr. 2018, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, monotypic, one species, type species *C. overholtsii* (Pilát) Zmitr., resupinate basidioma, poroid hymenophore, wood-rotting, white rot, see Zmitrovich 2018a (taxonomy).

Cintractia Cornu 1883, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, 13 species, type species *C. axicola* (Berk.) Cornu, plant parasites (floral axis, ovaries) on Cyperaceae (not *Carex* spp.), widespread in tropics and subtropics, cultures available,

see Kirk et al. 2013 (genus accepted), sequence data available, see Piepenbring et al. 1999, Begerow et al. 2014, Wang et al. 2015c (phylogeny).

Cintractiella Boedijn 1937, Cintractiellaceae, Ustilaginales, Ustilaginomycetes, two species, type species *C. lamii* Boedijn, plant parasites (galls, witches' brooms) on Cyperaceae (genera *Hypolytrum*, *Diplasia*), South America, Indonesia, cultures unavailable, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Begerow et al. 2014 (taxonomy).

Cionothrix Arthur 1907, Pucciniosiraceae, Pucciniales, Pucciniomycetes, five species, type species *C. praelonga* (G. Winter) Arthur, biotrophic on Asteraceae, terrestrial, tropical Central and South America, Cuba, see Kirk et al. 2013 (genus accepted), sequence data unavailable, see Berndt 2017 (new spp., morphology, emendation).

Circulocolumella S. Ito & S. Imai 1957, Hysterangiaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, one species, type species *C. hahashimensis* (S. Ito & S. Imai) S. Ito & S. Imai, Bonin island, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Citripora Miettinen 2016, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *C. bannaensis* Miettinen, basidioma resupinate to piletate, hymenophore poroid, wood-rotting, white rot, widespread (Uganda, China), sequence data unavailable, see Miettinen and Ryvarden 2016 (taxonomy, China), Justo et al. 2017 (taxonomy, Polyporales), Zmitrovich 2018a (taxonomy).

Clarkeinda Kuntze 1891, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *C. pedilia* (Berk. & Broome) Kuntze, South Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Vellinga et al. 2011 (phylogeny), Li et al. 2016b (morphology, phylogeny).

Classicula R. Bauer, Begerow, Oberw. & Marvanová 2003, Classiculaceae, Classiculales, Classiculomycetes, recommended for protection over *Naiadella* Marvanová & Bandoni 1987 see Aime et al. 2018a, asexual morph described as *Naiadella fluitans*, two species, type species *C. fluitans* R. Bauer, Begerow, Oberw. & Marvanová, (self)mycoparasitic, in aquatic habitats associated with leaf litter, submerged plants, worldwide, see Aime et al. 2018b (nomenclature), cultues and

sequence data available, see Aime et al. 2006 (phylogeny), Bauer et al. 2006 (phylogeny), Aime et al. 2014 (phylogeny), new spp. see Qiao et al. 2018 (China).

Clathrogaster Petri 1900, Hysterangiaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, two species, type species *C. vulvarius* Petri, Borneo, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Clathrus P. Micheli ex L. 1753, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *C. ruber* P. Micheli ex Pers., terrestrial, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Giachini et al. 2010 (phylogeny), Trierveiler-Pereira et al. 2014a (phylogeny), new spp. see Fazolino et al. 2010 (Brazil), Lécuru et al. 2013 (Caribbean), Pietras et al. 2016 (Poland).

Claustula K.M. Curtis 1926, Claustulaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *C. fischeri* K.M. Curtis, terrestrial, New Zealand, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny).

Clavaria Vaill. ex L. 1753, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 32 species, type species *C. fragilis* Holmsk., worldwide, saprobic, mycorrhizal, some species edible (*C. vermicularis* Sw.), see Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Kautmanová et al. 2012b (Europe, phylogeny), Birkebak et al. 2013, 2016 (Clavariaceae, phylogeny, new genus), Olariaga et al. 2015b (phylogeny), new spp., see Furtado et al. 2016 (Brazil, new records).

Clavariachaete Corner 1950, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, two species, type species *C. rubiginosa* (Berk. & M.A. Curtis ex Cooke) Corner, South America (tropical, Brazil and Venezuela), basidioma coralloid (like-*Ramaria*), sequence data unavailable, see Parmasto et al. 2010 (morphology), Kirk et al. 2013 (genus accepted).

Clavariadelphus Donk 1933, Clavariadelphaceae, Gomphales, Agaricomycetes, asexual morph unknown, 20 species, type species *C. pistillaris* (L.) Donk, widespread (temperate), see Kirk et al. 2013 (genus accepted), sequence data available, see Durall et al. 2006, new spp. see Hanif et al. 2014 (Himalaya, Pakistan).

Clavicorona Doty 1947, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *C. taxophila* (Thom) Doty, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Birkebak et al. 2013 (phylogeny).

Clavogaster Henn. 1896, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. novozelandicus* Henn., New Zealand, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Clavomphalia E. Horak 1987, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. yunnanensis* E. Horak, China, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Clavulicium Boidin 1957, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, five species, type species *C. pilatii* (Boidin) Boidin, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Sjökvist et al. 2014 (new order), Wang et al. 2017c (Northern China, ecology), new spp. see Singh et al. 2012 (India).

Clavulina J. Schröt. 1888, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, c. 75 species, type species *C. cristata* (Holmsk.) J. Schröt., some species edible (*C. cinerea* (Bull.) J. Schröt.), see Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Smith et al. 2011 (ectomycorrhizal fungal diversity), new spp. see Henkel et al. 2011 (Guiana Shield), Uehling et al. 2012a, b (Guiana Shield), Felipe 2012 (Brazil), He et al. 2016 (southwestern China), Tibpromma et al. 2017 (notes).

Clavulinopsis Overeem 1923, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 34 species, type species *C. sulcata* Overeem, worldwide, terrestrial, see Kirk et al. 2013 (genus accepted), Olariaga and Salcedo 2013 (new combination), sequence data available, see Birkebak et al. 2013, 2016 (Clavariaceae, phylogeny, new genus), new spp. see Hyde et al. 2016 (Brazil).

Cleistocybe Ammirati, A.D. Parker & Matheny 2007, Pseudoclitocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *C. vernalis* Ammirati, A.D. Parker & Matheny, basidioma clitocyboid, western North America, sequence data available, see Ammirati et al. 2007 (monograph), new spp. see Wu et al. 2018b (China).

Cleptomyces Arthur 1918, Pucciniaceae, Pucciniales, Pucciniomycetes, one species, type species *C. lagerheimianus* (Dietel) Arthur 1918, biotrophic on Verbenaceae, terrestrial, South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Climacocystis Kotl. & Pouzar 1958, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *C. borealis* (Fr.) Kotl. & Pouzar, basidioma pileate, hymenophore poroid, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Song et al. 2014a (new sp., phylogeny, China), Justo et al. 2017 (phylogeny, Polyporales), Zmitrovich 2018a (taxonomy).

Climacodon P. Karst. 1881, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *C. septentrionalis* (Fr.) P. Karst., basidioma pileate, hymenophore hydnoid, wood-rotting, white rot, some species tree pathogen, see Koski-Kotiranta and Niemelä 1988 (distribution, North Europe, *C. septentrionalis*), widespread, some species edible, see Dai et al. 2010 (edible mushrooms, China, *C. septentrionalis*), Kirk et al. 2013 (genus accepted), Jia et al. 2015 (*C. septentrionalis*, antioxidant activity, compounds), sequence data available, see Yuan and Cao 2016 (hydnaceous fungi, China), Moreno et al. 2017b (phylogeny, type study), Justo et al. 2017 (phylogeny, Polyporales).

Clinoconidium Pat. 1898, Cryptobasidiaceae, Exobasidiales, Exobasidiomycetes, six species, type species *C. farinosum* Pat. ex Sacc., plant parasites (leaves, fruits) on Lauraceae, Central and South America, East Asia, Canary Islands, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2002, 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny), Jiang and Kirschner 2016 (taxonomy, phylogeny), Kakishima et al. 2017 b, c (morphology, new name).

Clintamra Cordas & Durán 1977, Clintamraceae, Ustilaginales, Ustilaginomycetes, one species, type species *C. nolinae* (G.P. Clinton) Cordas & Durán, plant parasite (leaves, flowers) on *Nolina microcarpa* (Asparagaceae), Mexico, USA, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Clitocella Kluting, T.J. Baroni & Bergemann 2014, Entolomataceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *C. popinalis* (Fr.)

Kluting, T.J. Baroni & Bergemann, on soil or rotten wood, worldwide, sequence data available, see Kluting 2013 (taxonomy), Vizzini et al. 2016d (new combination, phylogeny), dos Santos Silva-Filho et al. 2018 (new sp., new combination, Brazil).

Clitocybe (Fr.) Staude 1857, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. 300 species, type species *C. nebularis* (Batsch) P. Kumm., worldwide, some species edible (*C. robusta* Peck), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Walther et al. 2005 (conidiogenesis study), Osmundson et al. 2013 (DNA barcode), Alvarado et al. 2015 (phylogeny), new spp. see Seok et al. 2009 (Korea, doubtful generic assignment), Cooper 2014b (New Zealand), Musumeci and Contu 2014a (France), Specht 2014 (Germany), Specht et al. 2014 (Germany), Musumeci and Contu 2015 (France), Lüderitz et al. 2016 (Germany).

Clitocybula (Singer) Singer ex Métrod 1952, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, 25 species, type species *C. lacerata* (Scop.) Métrod, worldwide, lignicolous, wood-rotting, see Barrasa et al. 2006 (brown-rot, Spain), see Kirk et al. 2013 (genus accepted), sequence data available, see Malysheva et al. 2011, Antonín et al. 2019 (new combination, phylogeny), new spp. see Latha et al. 2015b (India, phylogeny), Dutta et al. 2018 (India, phylogeny).

Clitolyophyllum E. Sesli, Vizzini & Contu 2016, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. akcaabatense* E. Sesli, Vizzini & Contu, Turkey, on the bark of *Picea orientalis*, sequence data available, see Sesli et al. 2016 (taxonomy).

Clitopaxillus G. Moreno, Vizzini, Consiglio & P. Alvarado 2018, Pseudoclitocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. alexandri* (Gillet) G. Moreno, Vizzini, Consiglio & P. Alvarado, sequence data available, see Alvarado et al. 2018b (genus accepted, phylogeny).

Clitopilopsis Maire 1937, Entolomataceae, Agaricales, Agaricomycetes, asexual morph unknown, two speceis, type species *C. hirneola* (Fr.) Kühner, known only in the northern hemisphere, saprobes, sequence data available, see Kluting et al. 2014 (phylogeny, new combination).

Clitopilus (Fr. ex Rabenh.) P. Kumm. 1871, Entolomataceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 140 species, type species *C. prunulus*

(Scop.) P. Kumm., saprophytic, worldwide, some species edible (*C. prunulus* (Scop.) P. Kumm.), see Hall et al. 2003 (edible mushrooms), Horak 2008 (New Zealand, monograph), Dai et al. 2010b (Chinese edible mushrooms), Noordeloos and Gates 2012b (Tasmania, Australia, morphology, monograph), Kirk et al. 2013 (genus accepted), sequence data available, see Co-David et al. 2009 (new combination, phylogeny), Cooper 2014b (phylogeny), Kluting et al. 2014 (phylogeny), Morgado et al. 2016 (phylogeny, new sp.), new spp. see Roux et al. 2010 (France), Vizzini et al. 2011e (Switzerland), Crous et al. 2012 (Australia), Blanco-Dios 2013a (Spain), Deng et al. 2013a, b (China), Jatuwong et al. 2017 (Thailand), Wang et al. 2017a (China), Raj and Manimohan 2018 (India, taxonomy).

Coccidiodictyon Oberw. 1989, Septobasidiaceae, Septobasidiales, Pucciniomycetes, one species, type species *C. inconspicuum* Oberw., Spain, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Coccobotrys Boud. & Pat. 1900, *incertae sedis*, Agaricales, Agaricomycetes, sexual morph *Leucoagaricus* Locq. ex Singer 1948, two species, type species *C. xylophilus* (Fr.) Boud. & Pat., Europe, Chile, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Colacogloea Oberw. & Bandoni 1991, Colacogloeaceaea, *incertae sedis*, Microbotryomycetes, sexual and asexual morphs known, 13 species, type species *C. peniophorae* Oberw. & Bandoni, yeast, gelatinous basidiocarps, mycoparasite, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Kirk et al. 2013 (genus accepted), Wang et al. 2015e (emendation, re-classification), Yurkov et al. 2016 (new spp.).

Colacosiphon R. Kirschner, R. Bauer & Oberw. 2001, Cryptomycocolacaceae, Cryptomycocolacales, Cryptomycocolacomycetes, presumably anamorphic (the authors indicated that the interpretation of the sporogenous cells is ambiguous), one species, type species *C. filiformis* R. Kirschner, R. Bauer & Oberw., mycoparasitic on ascomycetes, in barkbeetles in coniferous wood, Germany, see Kirschner et al. 2001 (morphology), sequence data available, see Aime et al. 2006 (phylogeny), Bauer et al. 2006 (phylogeny), Aime et al. 2014 (phylogeny).

Coleopuccinia Pat. 1889 (= *Coleoma* Clem. 1909), *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *C. sinensis* Pat., biotrophic on Rosaceae,

terrestrial, China, see Kirk et al. 2013 (genus accepted), sequence data available, see Cao et al. 2018 (not the synonym of *Gymnosporangium*).

Coleopucciniella Hara ex Hirats. 1937 (= *Coleopucciniella* Hara 1936), Pucciniaceae, Pucciniales, Pucciniomycetes, two species, type species *C. simplex* (Dietel) Hara ex Hirats., biotrophic on Rosaceae, terrestrial, China, Japan, see Cummins and Hiratsuka 2003 (synonym of *Gymnosporangium*), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Coleosporium Lév. 1847 (= *Erannium* Bonord. 1860, = *Stichopsora* Dietel 1899 [1900], = *Synomyces* Arthur 1924), Coleosporiaceae, Pucciniales, Pucciniomycetes**,** c. 125 species, lectotype species *C. campanulae* (F. Strauss) Tul., biotrophic on numerous hosts including Asteraceae, Campanulaceae, Orobanchaceae, Ranunculaceae, Pinaceae (alternate hosts), terrestrial, Asia, Central America, North America South America, Europe, New Zealand, see Baiswar et al. 2008 (*C. plumeriae* on *Plumeria alb*a, India), Holcomb and Aime 2010 (*C. plumeriae* on *Plumeria* spp., Louisiana, Malaysia), Wang et al. 2011 (rust disease, China, Vietnam), Su et al. 2012 (disease outbreak), Helfer 2013 (description of *C. tussilaginis* formae speciales, Europe), Kirk et al. 2013 (genus accepted), sequence data available, see Chappell 2010 (Coevolution, *Ipomoea-Coleosporium*), Dixon et al. 2010 (phylogeny, rust fungi on sugarcane), Chappell and Rausher 2011 (genetics, *C. ipomoeae*), see Back et al. 2014 (*C. asterum* on *Solidago virgaurea* var. *gigantea*, Ulleung-do), Beenken et al. 2017 (phylogeny), new spp. see You et al. 2010 (China).

Collybia (Fr.) Staude 1857, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *C. tuberosa* (Bull.) P. Kumm., Australia, most of the species transferred to *Gymnopus* and *Rhodocollybia*, see Kirk et al. 2013 (genus accepted), sequence data available, see Hughes et al. 2001 (phylogeny), Walther et al. 2005 (conidiogenesis Agaricales), Antonín and Noordeloos 2010 (Europe), Dentinger et al. 2011 (DNA barcode).

Colospora Miettinen & Spirin 2015, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *C. andalasii* Miettinen & Spirin, basidioma corticioid, resupinate, hymenophore spiny, wood-rotting, white rot, widespread, sequence data available, see Ariyawansa et al. 2015 (taxonomy, phylogeny, Indonesia).

Coltricia Gray 1821, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 40 species, type species *C. perennis* (L.) Murrill, basidioma stipitate, hymenophore poroid, ectomycorrhizal, soil and wood-rotting, see Tedersoo et al. 2007 (ectomycorrhizas of *Coltricia*, Seychelles), Kirk et al. 2013 (genus accepted), widespread, sequence data available, new spp. see Baltazar et al. 2010 (Brazil), Dai 2010b, 2012b (China), Baltazar and Silveira 2012 (India), Dai and Li 2012 (type study, South East Asia), Decock 2013 (São Tomé), Zhou and Tedersoo 2013 (Australia), Bian et al. 2016a (China), Bian and Dai 2017 (China).

Coltriciella Murrill 1904, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 13 species, type species *C. dependens* (Berk. & M.A. Curtis) Murrill, basidioma resupinate to stipitate, soil and wood-rotting, ectomycorrhizal, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Dai et al. 2011, 2014a (China), Valenzuela et al. 2011 (Mexico), Dai 2012b (China), Bian and Dai 2017 (China).

Columnodontia Jülich 1979, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *C. resupinata* Jülich, basidioma resupinate, hymenophore hydnoid, wood-rotting, Southeast Asia, Australasia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Colus Cavalier & Séchier 1835, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, four species, type species *C. hirudinosus* Cavalier & Séchier, terrestrial, saprobic, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Harrower et al. 2011 (phylogeny).

Conchomyces Overeem 1927, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. verrucisporus* Overeem, Indonesia, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny).

Confertextum Priyanka & Dhingra 2014, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *C. macrosporum* Priyanka & Dhingra, Australia, sequence data unavailable, see Dhingra 2014 (taxonomy).

Conferticium Hallenb. 1980, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, four species, type species *C. insidiosum* (Bourdot & Galzin) Hallenb.,

worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Vu et al. 2019 (DNA barcodes).

Conidiosporomyces Vánky 1992, Tilletiaceae, Tilletiales, Exobasidiomycetes, three species, type species *C. ayresii* (Berk.) Vánky & R. Bauer, plant parasites (ovaries) on genera *Megathyrsus*, *Panicum* and *Setaria* (Poaceae), widespread in tropics and subtropics, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Wang et al. 2015c, Jiang and Kirschner 2016.

Coniferiporia L.W. Zhou & Y.C. Dai 2016, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, three species, type species *C. qilianensis* (L.W. Zhou & Y.C. Dai) L.W. Zhou & Y.C. Dai, wood-rotting, forest pathogen, sequence data available, see Zhou et al. 2016d (taxonomy, phylogeny).

Coniodictyum Har. & Pat., 1909, Cryptobasidiaceae, Exobasidiales, Exobasidiomycetes, one species, plant parasite (leaves, branches, fruits) on *Zyzyphus mucronatum* (Rhamnaceae), Southern Africa, cultures available, sequence data available, see Begerow et al. 2002, Maier et al. 2006, Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Coniolepiota Vellinga 2011, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. spongodes* (Berk. & Broome) Vellinga, agaricoid, south east Asia, terrestrial, saprotrophic, sequence data available, see Vellinga et al. 2011 (genus introduced), Hosen and Yang 2013 (Bangladesh, China).

Coniophora DC. 1815, Coniophoraceae, Boletales, Agaricomycetes, asexual morph unknown, 20 species, type species *C. membranacea* DC., saprobic, widespread, some species pathogenic (brown-rot fungus *C. puteana* (Schumach.) P. Karst.), see Irbe et al. 2011 (pathogen), Kirk et al. 2013 (genus accepted), sequence data available, see Skrede et al. 2012 (cryptic species, genome), Rhoden et al. 2013 (ecology).

Coniophoropsis Hjortstam & Ryvarden 1986, Coniophoraceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *C. obscura* Hjortstam & Ryvarden, Argentina, Vietnam, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhao et al. 2018b (new spp., Vietnam, phylogeny).

Connopus R.H. Petersen 2010, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. acervatus* K.W. Hughes, Mather

& R.H. Petersen, on wood, Europe, North America, basidioma collybioid or mycenoid, sequence data available, see Hughes et al. 2010 (taxonomy).

Conocybe Fayod 1889, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 221 species, type species *C. tenera* (Schaeff.) Fayod, saprotrophic, dung fungi, worldwide, see Kirk et al. 2013 (genus accepted), Amandeep et al. 2015a (India), sequence data available, see Hallen et al. 2003 (phylogeny, toxicity), Hausknecht et al. 2009 (monograph, morphology, Europe), Tóth et al. 2013 (phylogeny), Wang and Tzean 2015 (China, phylogeny), new spp. see Gubitz 2008 (Germany), Hausknecht et al. 2009 (temperate Asia), Tkalčec et al. 2009 (Croatia), Hausknecht and Krisai-Greilhuber 2010b (Austria), Hausknecht et al. 2011 (Norway), Watling et al. 2011 (Turkey), Malysheva 2012, 2013, 2017 (Russia), Liu and Bau 2018 (China).

Conohypha Jülich 1975, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *C. albocremea* (Höhn. & Litsch.) Jülich, basidioma resupinate, wood-rotting, Europe, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Contumyces Redhead, Moncalvo, Vilgalys & Lutzoni 2002, Rickenellaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, three species, type species *C. rosellus* (M.M. Moser) Redhead, Moncalvo, Vilgalys & Lutzoni, Europe, sequence data available, see Lutzoni et al. 2002 (phylogeny), Antonín and Noordeloos 2004 (Europe).

Coprinellus P. Karst. 1879, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph *Hormographiella* Guarro & Gené, 70 species, type species *C. deliquescens* (Bull.) P. Karst., saprobic, worldwide, ink caps, some species cause white rot (*C. disseminatus* (Pers.) J.E. Lange), can be pathogenic for human (*Hormographiella aspergillata* Guarro, Gené & De Vroey), or mycorrhizal (Yagame et al. 2013, phylogeny, symbiotic ability), see Uljé 2005 (morphology, monograph, *Coprinus s. l.*), Singh et al. 2009 (biochemical), Schafer 2010 (key to sections), Nagy et al. 2010b (phylogeny, evolution, Psathyrellaceae), Nagy et al. 2011 (phylogeny, evolution, Psathyrellaceae), Kirk et al. 2013 (genus accepted), sequence data available, see Nagy et al. 2012a, b (phylogeny, morphology, evolution, new spp.), Örstadius et al. 2015 (phylogeny, Psathyrellaceae, new sp.), new spp. see Házi et al. 2010 (Sweden), Gomes and Wartchow 2014, 2018 (Brazil), Huang and Bau 2018 (China), Hussain et al. 2018b (Pakistan).

Coprinopsis P. Karst. 1881, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph *Rhacophyllus* Berk. & Broome 1871 (see Redhead et al. 2000), c. 150 species, type species *C. friesii* (Quél.) P. Karst., sapbrobic, worldwide, ink caps, see Uljé 2005 (morphology, monograph, *Coprinus s. l.*), Schafer 2010 (key to sections), Kirk et al. 2013 (genus accepted), sequence data available, see Nagy et al. 2010b, 2011 (phylogeny, evolution, Psathyrellaceae), Stajich et al. 2010 (genome), Örstadius et al. 2015 (phylogeny, Psathyrellaceae, new sp.), new spp. see Fukiharu et al. 2011, 2013, 2014, 2015 (New Zealand, China, Japan), Raut et al. 2011 (Canada), Nagy et al. 2013 (Hungary, phylogeny), Desjardin and Perry 2016 (Republic of São Tomé and Príncipe), Crous et al. 2017a (Spain), Gierczyk et al. 2017 (Poland), Tibpromma et al. 2017 (Croatia), Crous et al. 2018b (Croatia), Hyde et al. 2019 (Libya).

Coprinus Pers. 1797, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 17 species, type species *C. comatus* (O.F. Müll.) Pers., saprobic, worldwide, ink caps, some species edible (*C. comatus* (O.F. Müll.) Pers.), see Hall et al. 2003 (edible mushrooms), Kirk et al. 2013 (genus accepted), sequence data available, see Ko et al. 2001 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), new spp. see Crous et al. 2016a (Spain, phylogeny), Phookamsak et al. 2019 (Saudi Arabia, phylogeny).

Cora Fr. 1825, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, 189 species, type species *C. pavonia* (Sw.) Fr. see Lücking et al. 2013 (nomenclatural discussion), Kirk et al. 2013 (genus accepted), lichen-forming, Neotropic, Asia, see Lücking et al. 2017 (new species, phylogeny, sequence data, worldwide).

Coralloderma D.A. Reid 1965, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *C. acroleucum* (Pat.) D.A. Reid, wood-rotting, Asia, Australia, sequence data unavailable, see Welden 2010 (new combination, morphology, Neotropics), Kirk et al. 2013 (genus accepted).

Corallofungus Kobayasi 1983, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, two species, type species *C. hatakeyamanus* Kobayasi, Japan, in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Corella Vain. 1890, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. brasiliensis* Vainio, lichen-forming, Neotropic, see Lücking et al. 2013 (key for species), Kirk et al. 2013 (genus accepted), sequence data available, see Lücking et al. 2017 (phylogeny).

Corbulopsora Cummins 1940, Pucciniaceae, Pucciniales, Pucciniomycetes**,** three species, type species *C. clemensiae* Cummins, biotrophic on Asteraceae, terrestrial, India, New Guinea, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Corditubera Henn. 1897, *incertae sedis*, Boletales, Agaricomycetes, asexual morph unknown, five species, type species *C. staudtii* Henn., Africa (tropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Smith and Schmull 2011 (tropical Asia, tropical truffles, review).

Cordochaete Sanyal, Samita, Dhingra & Avneet P. Singh 2013, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *C. cystidiata* S.K. Sanyal, Samita, Dhingra & Avneet P. Singh, corticioid basidioma, wood-rotting, India, sequence data unavailable, see Sanyal et al. 2013 (India, morphology).

Coriolopsis Murrill 1905, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 19 species, type species *C. occidentalis* (Klotzsch) Murrill, worldwide, sequence data available, see Nogueira-Melo et al. 2012 (Brazil), Hattori and Sotome 2013 (new combinations), Cui et al. 2019 (taxonomy, phylogeny).

Corneriella Sánchez-García 2014, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *C. bambusarum* (Desjardin & Hemmes) Sánchez-García, Hawaii, Malaysia, India, sequence data available, see Sánchez-García et al. 2014 (monograph, phylogeny), new spp. see Raj et al. 2015 (India).

Corneroboletus N.K. Zeng & Zhu L. Yang 2012, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *C. indecorus* (Massee) N.K. Zeng & Zhu L. Yang, stipitate-pileate, southeastern Asian, sequence data available, see Zeng et al. 2012 (monograph), Included in *Hemileccinum* by Wu et al. 2016f.

Corneromyces Ginns 1976, *incertae sedis*, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *C. kinabalui* Ginns, Sabah, saprobes, terrestrial, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Corneroporus T. Hatt. 2001, Bankeraceae, Thelephorales, Agaricomycetes, asexual morph unknown, one species, type species *C. subcitrinus* (Corner) T. Hatt., Asia, on soil, sequence data unavailable, see Kirk et al. 2008.

Coronicium J. Erikss. & Ryvarden 1975, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *C. gemmiferum* (Bourdot & Galzin) J. Erikss. & Ryvarden, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny, corticioid homobasidiomycetes).

Corticirama Pilát 1957, Corticiaceae, Corticiales, Agaricomycetes, asexual morph unknown, two species, type species *C. petrakii* Pilát, saprobes, clavarioid, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Corticium Pers. 1794, Corticiaceae, Corticiales, Agaricomycetes, asexual morph unknown, 25 species, type species *C. roseum* Pers., wood-rotting, widespread, *C. silviae* is lichenicolous on *Thamnolia*, see Kirk et al. 2013 (genus accepted), Diederich et al. 2018b (lichenicolous), sequence data available, see Vu et al. 2019 (DNA barcodes).

Corticomyces A.I. Romero & S.E. López 1989, *incertae sedis*, *incertae sedis*, Agaricomycetes, sexual morph Agaricomyces, one species, type species *C. xenasmatoides* A.I. Romero & S.E. López, Argentina, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cortinarius (Pers.) Gray 1821, Cortinariaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 2250 species, type species *C. violaceus* (L.) Gray, seven subgenera: *Cortinarius* (Pers.) Gray, *Dermocybe* (Fr.) Trog, *Leprocybe* MM Moser., *Myxacium* (Fr.) Trog, *Phlegmacium* (Fr.) Trog, *Sericeocybe* Rob. Henry, *Telamonia* (Fr.) Wünsche, ectomycorrhizal, terrestrial, worldwide, some species poisonous (*C. gentilis* (Fr.) Fr., *C. orellanus* Fr. and *C. speciosissimus* Kühner & Romagn), see Michelot and Tebbett 1990, Kirk et al. 2013 (genus accepted), sequence data available, see Ortega et al. 2008 (section: *Calochroi*, Europe), Garnica et al. 2009 (section: *Calochroi*, phylogeny), Niskanen et al. 2009, 2011 (section: *Brunnei*, section: *Armillati*, Europe), Suárez-Santiago et al. 2009 (section: *Hydrocybe*, Europe), Garnica et al. 2011 (section:

Calochroi, phylogeny), Harrower et al. 2011 (Canada), Niskanen et al. 2013a (section: *Bovini*), Liimatainen et al. 2014 (subgenus: *Phlegmacium*), Stensrud et al. 2014 (North European), Cripps et al. 2015 (subgenus *Phlegmacium*, western North America), Harrower et al. 2015 (section: *Cortinarius*, phylogeny), new spp. see Gasparini and Soop 2008 (Oceania), Niskanen et al. 2012, 2013a, b (Europe, North America), Bojantchew 2013 (USA), Stefani et al. 2014 (subgenus: *Dermocybe*, Australia), Fernández-Brime et al. 2014 (subgenus: *Phlegmacium*, Europe), Brandrud et al. 2015 (Norway), Liimatainen et al. 2015 (section: *Disjungendi*, cryptic species), Dima et al. 2016 (northern Europe).

Costatisporus T.W. Henkel & M.E. Sm. 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *C. cyanescens* T.W. Henkel & M.E. Sm., sequestrate, Guyana, sequence data available, see Smith et al. 2015 (taxonomy).

Cotylidia P. Karst. 1881, Rickenellaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, ten species, type species *C. undulata* (Fr.) P. Karst., basidioma stipitate, confluent, hymenophore smooth, soil and wood-rotting, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Sjökvist et al. 2012 (phylogeny).

Crassisporium Matheny, P.-A. Moreau & Vizzini 2014, Crassisporiaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *C. funariophilum* (M.M. Moser) Matheny, P.-A. Moreau & Vizzini, worldwide, sequence data available, see Matheny et al. 2015 (taxonomy), Vizzini et al. 2019 (phylogeny and taxonomy).

Craterellus Pers. 1825, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, c. 80 species, type species *C. cornucopioides* (L.) Pers., no infrageneric subdivision proposed, see Hembrom et al. 2016, ectomycorrhizal, terrestrial, worldwide, commercially important edible species, see Boa 2004, Kirk et al. 2013 (genus accepted), sequence data available, see Dahlman et al. 2000 (genus delimitation), Wilson et al. 2012, Henkel et al. 2014 (Guyana), new spp. see Kumari et al. 2009, Olariaga et al. 2009 (typification *Pseudocraterellus*), Buyck et al. 2010 (USA, new recombinations), Henkel et al. 2014 (Guyana), Sa et al. 2014 (Brazil), Das et al. 2017c (India), Hembrom et al. 2017a (India, synonymy *Pterygellus*).

Crepidotus (Fr.) Staude 1857, Crepidotaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 200 species, type species *C. mollis* (Schaeff.) Staude, worldwide, basidioma pileate, hymenophore lamellate, saprotrophic, mostly wood-rotting, only some species on soil, one species biotrophic on fruitbodies of *Craterellus lutescens* (Fr.) Fr., see Kirk et al. 2013 (genus accepted), sequence data available, see Petersen et al. 2010 (phylogeny), new spp. see Bandala et al. 2008a, b (Mexico, Spain), Consiglio et al. 2008 (monograph, Europe, new sp.), Hausknecht and Krisai-Greilhuber 2009 (Austria, monograph, morphology), Capelari 2011 (Brazil), Kasuya and Kobayashi 2011 (Japan, type studies, morphology), Yang and Bau 2014 (China), Desjardin and Perry 2016 (São Tomé and Príncipe, Africa), Ge et al. 2017 (China), Guzmán-Dávalos et al. 2017 (India, Thailand, phylogeny, morphology), Horak 2018 (monograph, New Zealand, new sp.), Kumar et al. 2018a, b (India, phylogeny).

Cribbea A.H. Sm. & D.A. Reid 1962, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *C. gloriosa* (D.A. Reid) A.H. Sm. & D.A. Reid, worldwide, basidiomas sequestrate, see Kirk et al. 2013 (genus accepted), sequence data available, see Lebel and Catcheside 2009 (phylogeny, Australia).

Crinipellis Pat. 1889, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 65 species, type species *C. stipitaria* (Fr.) Pat., saprophytic and parasitic, worldwide, see Takahashi 2011 (Japan), Antonín 2012 (tropical Africa, monograph), Bandala et al. 2012b (Mexico), Kirk et al. 2013 (genus accepted), sequence data available, see Kerekes and Desjardin 2009 (monograph, Southeast Asia), Antonín and Noordeloos 2010 (Europe), Antonín et al. 2014b (Korea, phylogeny), new spp. see Antonín and De Kesel 2012 (Benin), Antonín et al. 2015a (Italy), Xia et al. 2015 (China), Crous et al. 2016b (India).

Cristinia Parmasto 1968, Stephanosporaceae, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *C. helvetica* (Pers.) Parmasto, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (phylogeny, Agaricomycetidae), Lebel et al. 2015 (biodiversity of *Stephanospora*).

Crocinoboletus N.K. Zeng, Zhu L. Yang & G. Wu 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *C. rufoaureus*

(Massee) N.K. Zeng, Zhu L. Yang & G. Wu, stipitate-pileate, Japan, subtropical and tropical China, Singapore, Malaysia, possibly Indonesia, Papua New Guinea and Australia, see Zeng et al. 2014 (morphology study), sequence data available, see Wu et al. 2014b (phylongeny).

Cronartium Fr. 1815, Cronartiaceae, Pucciniales, Pucciniomycetes, 34 species, type species *C. asclepiadeum* (Willd.) Fr., biotrophic on Asclepiadaceae, Pinanceae (alternate host), causal agent of fusiform rust disease in pines, see Zhang et al. 2010c (blister rust, China), Kaitera et al. 2012 (alternate host ranges), terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Anderson et al. 2010 (Genome size, *C. quercuum* f. sp. *fusiforme*), Samils et al. 2011 (new genetic markers, *Cronartium flaccidum*, *Peridermium pini*), Liu and Hambleton 2013 (transcriptome analysis, *Pinus monticola*, host resistance, *C. ribicola*).

Crossopsora Syd. & P. Syd. 1919 [1918], Phakopsoraceae, Pucciniales, Pucciniomycetes, 16 species, type species *C. ziziphi* (Syd., P. Syd. & E.J. Butler) Syd. & P. Syd., biotrophic on Apocynaceae, Asclepiadaceae, Asteraceae, Bixaceae, Fabaceae, Lamiaceae, Moraceae, Piperaceae, Rhamnaceae, Solanaceae, terrestrial, circumglobal in tropics, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Crucibulum Tul. & C. Tul. 1844, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *C. vulgare* Tul. & C. Tul., worldwide, bird's nests fungi, saprotrophic, see Kirk et al. 2013 (genus accepted), sequence data available, see da Vu et al. 2019 (DNA barcodes).

Cruciger R. Kirschner & Oberw. 1999, *incertae sedis*, *incertae sedis*, Agaricomycetes, sexual morph unknown, one species, type species *C. lignatilis* R. Kirschner & Oberw., Germany, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Crucispora E. Horak 1971, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, *C. naucorioides* E. Horak, New Zealand, Asia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cruentomycena R.H. Petersen, Kovalenko & O.V. Morozova 2008, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *C. viscidocruenta* (Cleland) R.H. Petersen & Kovalenko, Austrialia, Europe, America, on fallen twigs and associated leaf fragments, basidioma mycenoid, sequence data

available, see Petersen et al. 2008 (monograph), new spp. see Takahashi et al. 2016 (Japan).

Crustoderma Parmasto 1968, Sparassidaceae, Polyporales, Agaricomycetes, asexual morph unknown, 16 species, type species *C. dryinum* (Berk. & M.A. Curtis) Parmasto, basidioma resupinate, hymenophore smooth, wood-rotting, causal agent of brown rot [*C. dryinum* (Berk. & M.A. Curtis) Parmasto], widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Ortiz-Santana et al. 2013 (phylogeny, antrodia clade), Justo et al. 2017 (phylogeny, Polyporales).

Crustodontia Hjortstam & Ryvarden 2005, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *C. chrysocreas* (Berk. & M.A. Curtis) Hjortstam & Ryvarden, basidioma resupinate, hymenophore smooth, tuberculate or odontioid, wood-rotting, widespread, sequence data available, see Binder et al. 2013 (phylogeny, Polyporales), Justo et al. 2017 (phylogeny, Polyporales).

Crustomyces Jülich 1978, Cystostereaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *C. subabruptus* (Bourdot & Galzin) Jülich, basidioma resupinate, wood-rotting, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Rosenthal et al. 2017 (ecology, corticioid fungi in North American pinaceous forests).

Cryptococcus Vuill. 1901 (= *Filobasidiella* Kwon-Chung 1976), Cryptococcaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, tewlve species, type species *C. neoformans* (San Felice) Vuill., yeast, pathogenic to mammals, pathogen in humans, widespread, see Kurtzman et al. 2011 (taxonomy), Hagen et al. 2017 (nomenclature review), cultures and sequence data available, see Kurtzman et al. 2011 (taxonomy), Hagen et al. 2015 (taxonomy), Liu et al. 2015b (emendation, taxonomy and phylogeny), Passer et al. 2019 (new species, genomic analyses).

Cryptomarasmius T.S. Jenkinson & Desjardin 2014 (= *Marasmius* sect. *Hygrometrici* Kühner *fide* Jenkinson et al. 2014), Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, 15 species, type species *Marasmius hygrometricus* (V. Brig.) Sacc. (current name *Cryptomarasmius corbariensis* (Roum.) T.S. Jenkinson & Desjardin), worldwide, sequence data available, see Antonín and

Noordeloos 2010 (Europe, as *Marasmius* sect. *Hygrometrici*), Jenkinson et al. 2014 (taxonomy).

Cryptomphalina R. Heim 1966, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *C. sulcata* R. Heim, wood-rotting, Thailand, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cryptomycocolax Oberw. & R. Bauer 1990, Cryptomycocolacaceae, Cryptomycocolacales, Cryptomycocolacomycetes, yeast stage observed from budding meiospores, one species, type species, *C. abnormis* Oberw. & R. Bauer, mycoparasitic on ascomycetes, Costa Rica, sequence data available, see Bauer et al. 2006 (phylogeny), Aime et al. 2014 (phylogeny).

Cryptoporus (Peck) Shear 1902, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *C. volvatus* (Peck) Shear, basidioma piletae, hymenophore poroid with volva-like structure, wood-rotting, white rot, widespread (Asia and North America), see Kirk et al. 2013 (genus accepted), sequence data available, see Binder and Hibbett 2002 (phylogeny).

Cryptotrichosporon Okoli & Boekhout 2007, Tetragoniomycetaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, five species, type species *C. anacardii* Okoli & Boekhout, yeast, worldwide, cultures and sequence data available, see Kurtzman et al. 2011 (taxonomy), Liu et al. 2015a (taxonomy and phylogeny), Pontes et al. 2017, Kaewwichian et al. 2018 (new spp.).

Cumminsiella Arthur 1933, Pucciniaceae, Pucciniales, Pucciniomycetes, eight species, type species *C. sanguinea* (Peck) Arthur, biotrophic on Berberidaceae (*Berberis*, *Mahonia*), terrestrial, North and South America (*C. mirabilissima* introduced to other areas), Mahoni rust [*C. mirabilissima* (Peck) Nannf.], see Ruske and Dörfelt 2010 (history of the *Mahonia* rust), Kirk et al. 2013 (genus accepted), sequence data available, see Van Der Merwe et al. 2008 (phylogeny, *Puccinia*/*Uromyces* rust).

Cumminsina Petr. 1955, Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *C. clavispora* Petr., biotrophic on Tiliaceae (*Grewia*), terrestrial, Angola, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cunninghammyces Stalpers 1985, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. umbonatus* (G. Cunn.) Stalpers,

New Zealand, Réunion, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cuphophyllus (Donk) Bon 1985, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 25 species, type species *C. pratensis* (Fr.) Bon, four sections: section *Fornicati*, section *Adonidum*, section *Cuphophyllus*, section *Virginei*, Waxcaps, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Dentinger et al. 2011 (DNA barcode), Osmundson et al. 2013 (DNA barcode), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae), new spp. see Crous et al. 2017b (Ecuador, South America).

Cupreoboletus Simonini, Gelardi & Vizzini 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *C. poikilochromus* (Pöder, Cetto & Zuccherelli) Simonini, Gelardi & Vizzini, in warm regions bordering the Mediterranean basin, associated with members of Fagaceae (*Quercus*), sequence data available, see Gelardi et al. 2015a (taxonomy).

Curvibasidium Samp. & Golubev 2004, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual and asexual morphs unknown, three species, type species *C. cygneicollum* J.P. Samp., yeast, worldwide, cultures and sequence data available, see Sampaio et al. 2004 (description), Kurtzman et al. 2011 (taxonomy), Wang et al. 2015e (taxonomy and phylogeny), new spp. see Bourret et al. 2012 (on wine grapes, Washington state).

Cutaneotrichosporon X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Trichosporonaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, 15 species, type species *C. cutaneum* (Beurm., Gougerot & Vaucher bis) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, on wood, human skin, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny), Takashima et al. 2018 (taxonomy and phylogeny).

Cyanoboletus Gelardi, Vizzini & Simonini 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, seven species, type species *C. pulverulentus* (Opat.) Gelardi, Vizzini & Simonini, stipitate-pileate, ectomycorrhizal, Europe, Asia, North America, some species edible (*C. pulverulentus* edible), see Bessette et al. 2017, sequence data available, see Wu et al. 2016e (phylogeny, new combination and new spp., Asia), new spp. see Li et al. 2016b (Asia).

Cyanodontia Hjortstam 1987, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *C. spathulata* Hjortstam, resupinate basidioma, hydnoid hymenophore, wood-rotting, East Africa (Tanzania), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cyanosporus McGinty 1909, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *C. caesius* (Schrad.) McGinty, wood-rotting, sequence data unavailable, see Kirk et al. 2008.

Cystidiopostia B.K. Cui, L.L. Shen & Y.C. Dai 2019, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *C. hibernica* (Berk. & Broome) B.K. Cui, L.L. Shen & Y.C. Dai, Europe, China, wood-rotting, sequence data available, see Shen et al. 2019 (taxonomy, phylogeny).

Cyanotrama Ghobad-Nejhad & Y.C. Dai 2010, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *C. rimosa* Ghobad-Nejhad & Y.C. Dai, growth on conifers, especially *Juniperus*, sequence data available, new spp. see Ghobad-Nejhad and Dai 2010 (Asia).

Cyathus Haller 1768, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. 59 species, type species *C. striatus* (Huds.) Willd., worldwide, saprotrophic, terrestrial, wood-rotting, bird's nest fungi, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhao et al. 2007 (phylogeny), new spp. see Trierveiler-Pereira et al. 2009 (Brazil), da Cruz and Baseia 2014 (Brazil), da Cruz 2014 (Brazil), Poinar 2014 (fossil), Das et al. 2015b (India), Martin et al. 2015 (Cape Verde Archipelago), Crous et al. 2016b (Spain), Hyde et al. 2016 (Thailand), Sharma 2016 (India), da Silva et al. 2016 (phylogeny), Crous et al. 2017a, b (Brazil), Góis et al. 2018 (Costa Rica).

Cyclocybe Velen. 1939, Tubariaceae, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *C. erebia* (Fr.) Vizzini & Matheny, worldwide, sequence data available, see Vizzini et al. 2014c (new combination).

Cylindrobasidium Jülich 1974, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *C. evolvens* (Fr.) Jülich, worldwide, wood decaying, see Kirk et al. 2013 (genus accepted), sequence available, see Floudas et al. 2015 (genome), new spp. see Dhingra 2014 (Himalaya).

Cylindrosporus L.W. Zhou 2015, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *C. flavidus* L.W. Zhou, basidioma pilete-sessile, hymenophore poroid, wood-rotting, white rot, sequence data available, see Zhou 2015b (gen. et comb. nov., segregated from *Onnia*).

Cymatella Pat. 1899, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *C. minima* Pat., Antilles, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cymatellopsis Parmasto 1985, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. ilmiana* Parmasto, East Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cymatoderma Jungh. 1840, Panaceae, Polyporales, Agaricomycetes, asexual morph unknown, eleven species, type species *C. elegans* Jungh., basidioma stipitate, hymenophore venous, wood-rotting, widespread (pantropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Sjökvist et al. 2012 (phylogeny, stipitate stereoid fungi), Miettinen et al. 2012 (phylogeny, polypores), genus in need of revision.

Cynema Maas Geest. & E. Horak 1995, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. alutacea* Maas Geest. & E. Horak, Papua New Guinea, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cyphella Fr. 1822, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. digitalis* (Alb. & Schwein.) Fr., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2005 (phylogeny).

Cyphellocalathus Agerer 1981, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. cecropiae* (Singer) Agerer, Bolivia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cyphellostereum D.A. Reid 1965, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, nine species, type species *C. pusiolum* (Berk. & M.A. Curtis) D.A. Reid [current name: *Cotylidia pusiola* (Berk. & M.A. Curtis) A.L. Welden], lichenized, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Dal-Forno 2015 (basidiolichen), new spp. see Ryvarden 2010 (America), Yánez et

al. 2012 (Galapagos), Lücking et al. 2013, Lücking and Timdal 2016 (new combination, tropical Africa, Indian Ocean), Dal Forno et al. 2017 (Galapagos).

Cyphobasidium Millanes, Diederich & Wedin 2016, *incertae sedis*, Erythrobasidiales, Cystobasidiomycetes, asexual morph unknown, two species, type species *C. hypogymniicola* (Diederich & Ahti) Millanes, Diederich & Wedin, lichenicolous (growing on *Hypogymnia* and *Usnea*), gall-inducing, sequence data available, see Millanes et al. 2016 (new genus, Cystobasidiomycetes).

Cyptotrama Singer 1960, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, 16 species, type species *C. macrobasidia* Singer, four sections, sect. *Cyptotrama*, sect. *Depauperata*, sect. *Xerulina* and sect. *Aporpotrama*, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Qin and Yang 2016 (monograph, Asia), new spp. see Moreau et al. 2015b (Spain).

Cyrenella Goch. 1981, *incertae sedis*, Erythrobasidiales, Cystobasidiomycetes, sexual morph unknown, dikaryotic with teliospores, one species, type species *C. elegans* Goch., aquatic, on submerged fungus, yeast, USA, see Kurtzman et al. 2011 (taxonomy), Kirk et al. 2013 (genus accepted), cultures and sequence data available, see Wang et al. 2015d, e (phylogenetic classification of yeasts, Pucciniomycotina).

Cystidiodontia Hjortstam 1983, Cystostereaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *C. artocreas* (Berk. & M.A. Curtis ex Cooke) Hjortstam, worldwide, see Kirk et al. 2013 (genus accepted), sequence data availale, see Larsson et al. 2007b (phylogeny, corticioid fungi).

Cystoagaricus Singer 1947, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *C. strobilomyces* (Murrill) Singer, subtropical America, see Kirk et al. 2013 (genus accepted), sequence data available, see Örstadius et al. 2015 (phylogeny, new combination).

Cystobasidiopsis R. Bauer, B. Metzler, Begerow & Oberw. 2009, Chionosphaeraceae, Agaricostilbales, Agaricostilbomycetes, sexual and asexual morphs known, three species, type species *C. nirenbergiae* R. Bauer, B. Metzler, Begerow & Oberw., plant material, soil, worldwide, cultures and sequence data available, see Bauer et al. 2009 (integrative taxonomy), Wang et al. 2015d, e (emended, phylogeny).

Cystobasidium (Lagerh.) Neuhoff 1924, Cystobasidiaceae, Cystobasidiales, Cystobasidiomycetes, sexual and asexual morphs known, c. 20 species, type species *C.*

lasioboli (Lagerh.) Neuhoff [current name: *C. fimetarium* (Schumach.) P. Roberts], yeast, lichenicolous, worldwide, see Kurtzman et al. 2011 (taxonomy), Kirk et al. 2013 (genus accepted), cultures and sequence data available, see Sampaio and Oberwinkler 2011 (taxonomy), new spp. see Wang et al. 2015d, e (taxonomy and phylogeny), Yurkov et al. 2015 (emendation, taxonomy, phylogeny, new spp.), Tsuji et al. 2017 (East Ongul Island, East Antarctica), Chang et al. 2018 (China), Turchetti et al. 2018 (Arctic region), Fotedar et al. 2019b (Arabian Gulf).

Cystoderma Fayod 1889, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. 36 species, type species *C. amianthinum* (Scop.) Fayod, worldwide, saprotrophic, see Kirk et al. 2013 (genus accepted), sequence data available, see Saar et al. 2009 (phylogeny), Saar 2012 (monograph), new spp. see Blanco-Dios 2014a (Spain).

Cystodermella Harmaja 2002, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, 16 species, type species *C. granulosa* (Batsch) Harmaja, worldwide, saprotrophic, basidioma collybioid, sequence data available, see Saar et al. 2009, 2012, 2016 (phylogeny, taxonomy, type study).

Cystofilobasidium Oberw. & Bandoni 1983, Cystofilobasidiaceae, Cystofilobasidiales, Tremellomycetes, sexual and asexual morphs known, eight species, type species *C. bisporidii* (Fell, I.L. Hunter & Tallman) Oberw. & Bandoni, yeast, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny), Pontes et al. 2016 (new spp., Mediterranean forest).

Cystogloea P. Roberts 2006, *incertae sedis*, *incertae sedis*, Basidiomycota, asexual morph unknown, one species, type species C. oelandica P. Roberts, Sweden, basidioma auricularioid, sequence data unavailable, see Kirk et al. 2008.

Cystogomphus Singer 1942, Gomphidiaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *C. humblotii* Singer, France (introduced), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Cystolepiota Singer 1952(= *Pulverolepiota* Bon 1993), Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. twelve species, type species *C. constricta* Singer, three sections: sect. *Cystolepiota* Singer, sect. *Pulverolepiota* (M. Bon) Vellinga, sect. *Pseudoamyloideae* Singer and Clémençon, worldwide, saprotrophic, see Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (agarics,

phylogeny, basidiospore ultrastructure), Osmundson et al. 2013 (DNA barcode), new spp. see Kumar and Manimohan 2009b (India), Paraíso et al. 2016 (Europe), Xu et al. 2016b (China).

Cystomyces Syd. 1926, Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *C. costaricensis* Syd., biotrophic on Fabaceae, terrestrial, Costa Rica, sequence data unavailable, see Cannon 2009 (description), Kirk et al. 2013 (genus accepted).

Cystopsora E.J. Butler 1910, Pucciniaceae, Pucciniales, Pucciniomycetes, sexual morph unknown, two species, type species *C. oleae* E.J. Butler [current name: *Zaghouania oleae* (E.J. Butler) Cummins], India, Indonesia, biotrophic on *Antidesma*, see Kirk et al. 2013 (genus accepted), sequence data available, see McTaggart et al. 2016a (evolution, host jumps, rust fungi diversity, Pucciniales).

Cystostereum Pouzar 1959, Cystostereaceae, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *C. murrayi* (Berk. & M.A. Curtis) Pouzar, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2007b (phylogeny, corticioid fungi).

Cytidia Quél. 1888, Vuilleminiaceae, Corticiales, Agaricomycetes, asexual morph unknown, five species, type species *C. salicina* (Fr.) Burt, wood-rotting, widespread (North Temperate), see Kirk et al. 2013 (genus accepted), sequence data available, see Ghobad-Nejhad et al. 2010 (phylogeny).

Cytidiella Pouzar 1954, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *C. albomellea* (Bondartsev) Parmasto, resupinate, wood-rotting, white rot, widespread, sequence data available, see Justo et al. 2017 (phylogeny), Zmitrovich 2018a (taxonomy).

Cyttarophyllopsis R. Heim 1968, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *C. cordispora* R. Heim, India, basidioma gasteroid, sequence data unavailable, see Kirk et al. 2008.

Dacrymyces Nees 1816, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, asexual morph unknown, c. 50 species, type species *D. stillatus* Nees, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Shirouzu et al. 2007, new spp. see Shirouzu et al. 2009, 2013b (Japan, New Zealand).

Dacryobolus Fr. 1849, Dacryobolaceae, Polyporales, Agaricomycetes, asexual morph unkonwn, seven species, type species *D. sudans* (Alb. & Schwein.) Fr., basidioma membranaceous to coriaceous, hymenophore smooth, odontioid or tuberculate, wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data avaiable, see Binder et al. 2005 (phylogeny), Larsson et al. 2007a (phylogeny, corticioid fungi), Justo et al. 2017 (phylogeny, Polyporales), new spp. see Yuan et al. 2016a (phylogeny, China).

Dacryonaema Nannf. 1947, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, asexual morph unknown, one species, type species *D. rufum* (Fr.) Nannf., wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dacryopinax G.W. Martin 1948, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, asexual morph unknown, 24 species, type species *D. elegans* (Berk. & M.A. Curtis) G.W. Martin, wood-decaying, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Floudas et al. 2012 (genome), new spp. see Shirouzu et.al. 2009 (Japan), McLaughlin et al. 2016 (Costa Rica).

Dacryoscyphus R. Kirschner & Zhu L. Yang 2005, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, one species, type species *D. chrysochilus* R. Kirschner & Zhu L. Yang, wood-decaying, China, sequence data available, see Kirschner and Yang 2005 (taxonomy).

Dactylosporina (Clémençon) Dörfelt 1985, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *D. steffenii* (Rick) Dörfelt, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Qin et al. 2014a (phylogeny), new spp. see Ushijima et al. 2015 (Japan).

Daedalea Pers. 1801, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, twelve species, type species *D. quercina* (L.) Pers., basidioma pileate, hymenophore poroid to daedaleoid, wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2013 (phylogeny, Polyporales), Nagy et al. 2015 (genome, *D. quercina*), new spp. see Lindner et al. 2011 (phylogeny, Belize), Drechsler-Santos et al. 2012a (morphology, Brazil), Li and Cui 2013a (phylogeny, China), Han et al. 2015, 2016a (phylogeny, North and Central America, China).

Daedaleopsis J. Schröt. 1888, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *D. confragosa* (Bolton) J. Schröt., basidioma pileate, hymenophore poroid to lamellate, wood-rotting, white rot, widespread (Northern Hemisphere), see Kirk et al. 2013 (genus accepted), sequence data available, see Zmitrovich and Malysheva 2013 (new combination, phylogeny), Koukol et al. 2014 (phylogeny), Li et al. 2016c (new sp., phylogeny, tropical China).

Dasturella Mundk. & Khesw. 1943, Phakopsoraceae, Pucciniales, Pucciniomycetes, three species, type species *D. divina* (Syd.) Mundk. & Khesw. [current name: *Kweilingia divina* (Syd.) Buriticá], biotrophic on Poaceae, Rubiaceae (alternate host), Sapindaceae, terrestrial, see Kirk et al. 2013 (genus accepted), Mishra et al. 2015 (species on bamboo, India), sequence data available, see Wingßeld al. 2004 (phylogeny).

Dasyspora Berk. & M.A. Curtis 1854 [1853] (= *Sartvellia* Berk. 1857, nom. illeg.), Uropyxidaceae, Pucciniales, Pucciniomycetes, 13 species, type species *D. foveolata* Berk. & M.A. Curtis [current name: *D. gregaria* (Kunze) Henn.], asexual morph aecidium-like, biotrophic on Annonaceae, terrestrial, Central America, northern South America, see Kirk et al. 2013 (genus accepted), sequence data available, see Beenken et al. 2012 (monograph, new spp.), Beenken and Wood 2015 (description, key, morphology, phylogeny).

Datronia Donk 1966, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, nine species, type species *D. mollis* (Sommerf.) Donk, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Li et al. 2014b (phylogeny), new spp. see Ryvarden 2014 (morphology, tropical America), Kaur et al. 2015b (morphology, India), new combinations see Hattori and Sotome 2013 (morphology, type study, Malaysia), Ryvarden 2015d (morphology, Neotropics).

Datroniella B.K. Cui, Hai J. Li & Y.C. Dai 2014, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, six species, type species *D. scutellata* (Schwein.) B.K. Cui, Hai J. Li & Y.C. Dai, poroid hymenophore, wood-rotting, white rot, widespread, sequence data available, see Li et al. 2014b (taxonomy, new combination, phylogeny, China), de Lira et al. 2016 (new sp., phylogeny, Brazil).

Decapitatus Redhead & Seifert 2000, Mycenaceae, Agaricales, Agaricomycetes, sexual morph *Mycena* (Pers.) Roussel 1806, one species, type species *D. flavidus* (Cooke) Redhead & Seifert, sequence data unavailable, see Kirk et al. 2008.

Deconica (W.G. Sm.) P. Karst. 1879, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 44 species, type species *D. montana* (Pers. : Fr.) P.D. Orton, worldwide, sequence data available, see Noordeloos 2009 (new combinations), Noordeloos 2011 (Europe, monograph), Guzmán et al. 2012 (Thailand, new combination), Ramírez-Cruz et al. 2012, 2013 (new combinations, type studies, new combinations, phylogeny), da Silva et al. 2013b, 2014, 2016 (Brazil, new combination, taxonomy, culthure studies), Matheny et al. 2015 (phylogeny).

Deflexula Corner 1950, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. eleven species, type species *D. fascicularis* (Bres. & Pat.) Corner, worldwide, sequence data available, see Munkacsi et al. 2004 (coevolution, coral mushrooms), Dentinger et al. 2009 (ant-fungus mutualism).

Deigloria Agerer 1980, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *D. pulchella* Agerer, neotropics, cupulate basidiomas, on fern or stems of herbs, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Delentaria Corner 1970, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, one species, type species *D. decurva* Corner, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Delicatula Fayod 1889, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. three species, type species *D. integrella* (Pers.) Fayod, temperate, see Kirk et al. 2013 (genus accepted), Antonín 2003 (revision of species described by J. Velenovský; 42 species), Antonín and Noordeloos 2004 (Europe), sequence data available, see Saar et al. 2009 (phylogeny), Kim et al. 2015 (Korea).

Dendrocollybia R.H. Petersen & Redhead 2001, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph *Tilachlidiopsis* Keissl. 1924, one species, type species *D. racemosa* (Pers.) R.H. Petersen & Redhead, Australia, mycosaprobic, sequence data available, see Hughes et al. 2001, Machnicki et al. 2006 (growth on *Russula crassotunicata* Singer), Antonín and Noordeloos 2010 (Europe).

Dendrocorticium M.J. Larsen & Gilb. 1974, Punctulariaceae, Corticiales, Agaricomycetes, asexual morph unknown, nine species, type species *D. polygonioides* (P. Karst.) M.J. Larsen & Gilb., wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Ghobad-Nejhad et al. 2010, Ghobad-Nejhad and Duhem 2014 (phylogeny).

Dendrogloeon Spirin & Miettinen 2015, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *D. helenae* Spirin, Ryvarden & Miettinen, sequence data available, see Spirin et al. 2015a (St. Helena).

Dendrominia Ghobad-Nejhad & Duhem 2013, Dendrominiaceae, Corticiales, Agaricomycetes, asexual morph unknown, four species, type species *D. maculata* (H.S. Jacks. & P.A. Lemke) Ghobad-Nejhad & Duhem, wood-rotting, North America and Europe, sequence data available, new spp. see Ghobad-Nejhad and Duhem 2014 (France), Nakasone (North American), Ariyawansa et al. 2015 (phylogeny).

Dendrophlebia Dhingra & Priyanka 2011, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unkonwn, one species, type species *D. crassispora* Dhingra & Priyanka, corticioid basidioma, wood-rotting, India, sequence data unavailable, see Dhingra and Priyanka 2011 (new genus, new sp., morphology).

Dendrophora (Parmasto) Chamuris 1987, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, three species, type species *D. versiformis* (Berk. & M.A. Curtis) Chamuris, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Hestmark et al. 2011 (evolutionary radiation).

Dendrosporomyces Nawawi, J. Webster & R.A. Davey 1977, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *D. prolifer* Nawawi, J. Webster & R.A. Davey, Malaysia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dendrothele Höhn. & Litsch. 1907, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, 58 species, type species *D. papillosa* Höhn. & Litsch., wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Hjortstam et al. 2009 (Australia), Nakasone 2009 (North America), Pouzar and Kotlaba 2010 (Czech), Gorjón et al. 2011 (Argentina), Nakasone and Burdsall 2011 (New Zealand), Rodrigues and Guerrero 2013 (Brazil).

Dennisiomyces Singer 1955, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *D. glabrescentipes* Singer, South America, see Kirk et al. 2013 (genus accepted), sequence data available, see Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae), Sánchez-García et al. 2014 (phylogeny).

Dentipellicula Y.C. Dai & L.W. Zhou 2013, Hericiaceae, Russulales, Agaricomycetes, asexual morph unknown, three species, type species *D. taiwaniana* (Sheng H. Wu) Y.C. Dai & L.W. Zhou, South Africa, China, sequence data available, see Zhou and Dai 2013a (wood-rotting hydnoid species in Russulales), new spp. see Chen et al. 2015b (China).

Dentipellis Donk 1962, Hericiaceae, Russulales, Agaricomycetes, asexual morph unknown, seven species, type species *D. fragilis* (Pers.) Donk, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhou and Dai 2013a (wood-inhabiting hydnoid species in Russulales), new spp. see Shen and Wang 2017 (China).

Dentipellopsis Y.C. Dai & L.W. Zhou 2013, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *D. dacrydicola* Y.C. Dai & L.W. Zhou, sequence data available, see Zhou and Dai 2013a (wood-inhabiting hydnoid species in Russulales).

Dentiporus Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *D. albidoides* (A. David & Dequatre) Audet, wood-rotting, sequence data available, see Audet 2017a (new genus).

Dentipratulum Domański 1965, Auriscalpiaceae, Russulales, Agaricomycetes, asexual morph unknown, three species, type species *D. bialoviesense* Domański, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny, russuloid basidiomycetes), new spp. see Karasiński and Piątek 2017 (morphology).

Dentocorticium (Parmasto) M.J. Larsen & Gilb. 1974, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *D. ussuricum* (Parmasto) M.J. Larsen & Gilb., varied hymenophore surface (odontoid, tuberculate, spinose, poroid, daedaleoid), wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Floudas and

Hibbett 2015 (phylogeny, *Phanerochaete*), Liu et al. 2018a (new combinations, phylogeny, type study).

Dermatosorus Sawada ex L. Ling 1949, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, six species, type species *D. eleocharidis* Sawada ex L. Ling, plant parasites (ovaries) on Cyperaceae, Africa, South America, East Asia, South Asia, Australia, cultures unavailable, see Kirk et al. 2013 (genus accepted), sequence data available, see Wang et al. 2015c (phylogeny).

Dermoloma J.E. Lange ex Herink 1958, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 25 species, type species *D. cuneifolium* (Fr.) Singer, worldwide, saprotophic, see Kirk et al. 2013 (genus accepted), sequence data available, see Kropp 2008 (phylogeny, Belize), Sánchez-García and Matheny 2017 (evolution, phylogeny), new spp. see Contu et al. 2008 (Italy, monograph, morphology), Raj et al. 2014b (India).

Derxomyces F.Y. Bai & Q.M. Wang 2008, Bulleribasidiaceae, Tremellales, Tremellomycetes, sexual morph unknown, 24 species, type species *D. mrakii* (Hamam. & Nakase) F.Y. Bai & Q.M. Wang, yeast, worldwide, cultures and sequence data available, see Wang and Bai 2008, Liu et al. 2015b (taxonomy and phylogeny).

Desarmillaria (Herink) R. A. Koch & Aime 2017, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unkown, two species, type species *D. tabescens* (Scop.) R.A. Koch & Aime, saprotrophic to parasitic, known only from the northern hemisphere, sequence data available, see Koch et al. 2017 (evolution, taxonomy, phylogeny).

Descolea Singer 1952 (= *Descomyces* Bougher & Castellano 1993; = *Timgrovea* G. Cunn.), Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 15 species, type species *D. antarctica* Singer, worldwide, ectomycorrhizal, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny and Bougher 2006 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Tóth et al. 2013 (phylogeny, Bolbitiaceae), Kuhar et al. 2017 (phylogeny, sequestrate taxa), new spp. see Khan et al. 2017 (Pakistan).

Desmella Syd. & P. Syd. (1919) [1918], *incertae sedis*, Pucciniales, Pucciniomycetes, four species, type species *D. aneimiae* Syd. & P. Syd., biotrophic on Nephrolepidaceae, Polypodiaceae, Schizaeaceae, terrestrial, Australia, Brazil, see Kirk

et al. 2013 (genus accepted), sequence data available, see McTaggart et al. 2014 (first record of fern rust in Australia, phylogeny).

Desmellopsis J.M. Yen 1969, *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *D. aframomicola* J.M. Yen, biotrophic on Zingiberaceae (*Aframomum*), terrestrial, Africa (Gabon), see Cummins and Hiratsuka 2003 (treated as a synonym of *Puccinia*), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Desmosorus Ritschel, Oberw. & Berndt 2005, *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *D. oncidii* Ritschel, Oberw. & Berndt, biotrophic on Orchidaceae, terrestrial, Central and South America, Europe (introduced), sequence data unavailable, see Kirk et al. 2008.

Destuntzia Fogel & Trappe 1985, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, five species, type species *D. rubra* (Harkn.) Fogel & Trappe, N. America, see Kirk et al. 2013 (genus accepted), sequence data available.

Deviodontia (Parmasto) Hjortstam & Ryvarden 2009, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *D. pilaecystidiata* (S. Lundell) Hjortstam & Ryvarden, wood-rotting, sequence data unavailable, see Hjortstam et al. 2009 (taxonomy).

Dextrinocystidium Sheng H. Wu 1996, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *D. sacratum* (G. Cunn.) Sheng H. Wu, New Zealand, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dextrinocystis Gilb. & M. Blackw. 1988, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, two species, type species *D. capitata* (D.P. Rogers & Boquiren) Gilb. & M. Blackw., wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dextrinodontia Hjortstam & Ryvarden 1980, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, one species, type species *D. molliuscula* Hjortstam & Ryvarden, wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dextrinoporus H.S. Yuan 2018, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *D. aquaticus* H.S. Yuan, tyromycetoid basidioma, wood-rotting, white rot, see Yuan and Qin 2018 (taxonomy).

Diabole Arthur 1922, Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *D. cubensis* (Arthur & J.R. Johnst.) Arthur, biotrophic on Fabaceae, terrestrial, Central America (Cuba, Brazil, El Salvador, Mexico), used as biological control agent [*D. cubensis* (Arthur & J.R. Johnst.) Arthur], see Burrows et al. 2012 (classical biological control agent, Australia), Kirk et al. 2013 (genus accepted), sequence data unavailable.

Diabolidium Berndt 1995, Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *D. calliandrae* Berndt, biotrophic on Fabaceae (*Calliandra*), terrestrial, South America (Venezuela), sequence data unavailable, see Cummins and Hiratsuka 2003 (treated as a synonym of *Allotelium*), Kirk et al. 2013 (genus accepted).

Diacanthodes Singer 1945, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph *Bornetina* L. Mangin & Viala 1903, three species, type species *D. philippinensis* (Pat.) Singer [current name: *D. novoguineensis* (Henn.) O. Fidalgo], poroid hymenophore, terrestrial, widespread (pantropical), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Diaphanopellis P.E. Crane 2005, Coleosporiaceae, Pucciniales, Pucciniomycetes, two species, type species *D. forrestii* P.E. Crane, biotrophic on Ericaceae (*Rhododendron*), terrestrial, China, India, Nepal, sequence data available, see Cao et al. 2017b (new spp., phylogeny).

Dicellomyces L.S. Olive 1945, Brachybasidiaceae, Exobasidiales, Exobasidiomycetes, four species, type species *D. gloeosporus* L.S. Olive, plant parasites (leaves) on Cyperaceae and Poaceae, India, Namibia, cultures unavailable, see Kirk et al. 2013 (genus accepted), sequence data available, see Begerow et al. 2002, Wang et al. 2015c (phylogeny).

Dichantharellus Corner 1966, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *D. malayanus* Corner, Malaysia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dicheirinia Arthur 1907, Raveneliaceae, Pucciniales, Pucciniomycetes, 14 species, type species *D. binata* (Berk.) Arthur, biotrophic on Fabaceae, terrestrial, Central and South America, Canary Islands, Madeira, Mauritius, New Caledonia, see de Carvalho and Hennen 2008, Beenken and Berndt 2010 (new species, new combination), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dichochaete Parmasto 2001, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, two species, type species *D. setosa* (Sw.) Parmasto, wood-rotting, widespread, sequence data unavailable, see Kirk et al. 2008.

Dichomitus D.A. Reid 1965, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, 13 species, type species *D. squalens* (P. Karst.) D.A. Reid, poroid hymenophore, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Li and Cui 2013b (phylogeny), Floudas et al. 2012 (genome, *D. squalens*), new spp. see Ainsworth and Ryvarden 2008 (morphology, Europe), Læssøe and Ryvarden 2010a (morphology, Ecuador), Gomes-Silva et al. 2012b (morphology, Brazil), Ryvarden 2012d (morphology, Costa Rica), Li and Cui 2013c (morphology, China), Yuan 2013b (morphology, China, monograph).

Dichopleuropus D.A. Reid 1965, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *D. spathulatus* D.A. Reid, Malaysia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dichostereum Pilát 1926, Peniophoraceae, Russulales, Agaricomycetes, asexual morph, eleven species, type species *D. durum* (Bourdot & Galzin) Pilát, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dictyocephalos Underw. ex V.S. White 1901, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *D. attenuatus* (Peck) Long & Plunkett, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Martin et al. 2000 (phylogeny).

Dictyonema C. Agardh ex Kunth 1822, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, 28 species, type species *D. excentricum* C. Agardh [current name *D. thelephora* (Spreng.) Zahlbr.], worldwide, lichenized, see Kirk et al. 2013 (genus accepted), sequence data available, see Lawrey et al. 2009 (phylogeny), Dal-Forno et al. 2013 (phylogeny), Lücking et al. 2013, 2016 (key, classification), new spp. see Schmull et al. 2014 (Ecuadorian Amazon region).

Dictyotremella Kobayasi 1971, *incertae sedis*, Tremellales, Tremellomycetes, asexual morph unknown, one species, type species *D. novoguineensis* Kobayasi, wood-decaying, Oceania, see Kirk et al. 2013 (genus accepted), sequence data unavailable

Didymopsora Dietel 1899, Pucciniosiraceae, Pucciniales, Pucciniomycetes, six species, type species *D. solani-argentei* (Henn.) Dietel, biotrophic on Asteraceae, Melastomataceae, Solanaceae, Tiliaceae, terrestrial, South America, Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Didymopsorella Thirum. 1950 (= *Gymnopuccinia* K. Ramakr. 1951), Uropyxidaceae, Pucciniales, Pucciniomycetes, two species, type species *D. toddaliae* (Petch) Thirum., biotrophic on Rutaceae (*Toddalia*), terrestrial, Africa, India, Sri Lanka, China, Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dietelia Henn. 1897 (= *Endophylloides* Whetzel & Olive 1917; = *Jacksonia* J.C. Lindq. 1970; = *Jacksoniella* J.C. Lindq. 1972; = *Jacksoniella* Kamat & Sathe 1972; = *Thirumalachariella* Sathe 1975 [1974]), Pucciniosiraceae, Pucciniales, Pucciniomycetes, 13 species, type species *D. verruciformis* (Henn.) Henn., biotrophic on Asteraceae, Balsaminaceae, Euphorbiaceae, Malvaceae, terrestrial, south and central America, Africa (South Africa, Uganda), see Cummins and Hiratsuka 2003 (*D. codiaei* introduced to Europe), see Berndt and Wood 2012 (new combination), Kirk et al. 2013 (genus accepted), sequence data available, see Aime 2006 (phylogeny), Van der Merwe et al. 2007 (phylogeny).

Digitatispora Doguet 1962, Niaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *D. marina* Doguet, marine fungi, Europe, North America, see Kirk et al. 2013 (genus accepted), sequence data available, see Rämä et al. 2014 (marine fungi, Norway, morphology).

Dimennazyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Naemateliaceae, Tremellales, Tremellomycetes, sexual morph unknown, one species, type species *D. cisti-albidi* (Á. Fonseca, J. Inácio & Spenc.-Mart.) A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, plant material, Europe, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Diorchidiella J.C. Lindq. 1957, Raveneliaceae, Pucciniales, Pucciniomycetes, two species, type species *D. australis* (Speg.) J.C. Lindq., biotrophic on Fabaceae (*Mimosa*), terrestrial, South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Diorchidium Kalchbr. 1882 (= *Diphragmium* Boedijn (1960) [1959]), Raveneliaceae, Pucciniales, Pucciniomycetes, 20 species, type species *D. woodii*

Kalchbr. & Cooke, biotrophic on Annonaceae, Fabaceae, Poaceae, Rubiaceae, terrestrial, Africa, South America, Sri Lanka, Pakistan, China, Japan, Indonesia, see Kirk et al. 2013 (genus accepted), sequence data available, see Beenken and Wood 2015 (phylogeny, new genera on Annonaceae, Pucciniales).

Dioszegia Zsolt 1957, Bulleribasidiaceae, Tremellales, Tremellomycetes, sexual morph unknown, 18 species, type species *D. hungarica* Zsolt, yeast, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny), Yurkov et al. 2016 (phylogeny), Trochine et al. 2017 (new spp.).

Diplocystis Berk. & M.A. Curtis 1868, Diplocystidiaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *D. wrightii* Berk. & M.A. Curtis, West Indies, see Kirk et al. 2013 (genus accepted), sequence data available, see Phosri et al. 2014 (Thailand, phylogeny).

Diplomitoporus Domański 1970, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, c. 25 species, type species *D. flavescens* (Bres.) Domański, poroid hymenophore, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen and Larsson 2011 (phylogeny), Zmitrovich and Malysheva 2013 (phylogeny), new spp. see Hjortstam and Ryvarden 2009a (morphology, Seychelles), Ryvarden and Iturriaga 2011 (morphology, Venezuela), Baltazar et al. 2014a (morphology, Brazil), Ryvarden 2018b (morphology, Ethiopia, Kenya, Uganda, Zimbabwe), new combinations see Ryvarden 2012c, 2015c (morphology, type study, Tanzania).

Dipyxis Cummins & J.W. Baxter 1967, Uropyxidaceae, Pucciniales, Pucciniomycetes, two species, type species *D. mexicana* Cummins & J.W. Baxter, biotrophic on Bignoniaceae, terrestrial, Central and South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Dirkmeia F.Y. Bai, Q.M. Wang, Begerow & Boekhout 2015, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species *D. churashimaensis* (T. Morita, Y. Ogura, M. Takash., N. Hirose, Fukuoka, Imura, Y. Kondo & Kitamoto) F.Y. Bai, Q.M. Wang, Begerow & Boekhout, known only from saprobic yeast morph, plant material, Japan, cultures available, sequence data available, see Wang et al. 2015c (taxonomy, phylogeny).

Disciseda Czern. 1845, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, 15 species, type species *D. collabescens* Czern., worldwide, basidioma gasteroid, see Kirk et al. 2013 (genus accepted), see da Silva and Baseia 2014 (morphology, Brazil), sequence data available, see Larsson and Jeppson 2008 (phylogeny, north Europe), Bates et al. 2009 (phylogeny, key).

Disporotrichum Stalpers 1984, *incertae sedis*, Agaricales, Agaricomycetes, one species, type species *D. dimorphosporum* (Arx) Stalpers, Netherlands, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Ditangium P. Karst. 1867, Sebacinaceae, Sebacinales, Agaricomycetes, sexual morph unknown, three species, type species *D. insigne* P. Karst., North and South America, Russia, Europe, saprobic, on rotten wood, sequence data available, see Malysheva et al. 2019 (taxonomy, phylogeny, genus accepted against *Craterocolla*).

Ditiola Fr. 1822, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, asexual morph unknown, c. ten species, type species *D. radicata* (Alb. & Schwein.) Fr., wood-rotting, see Kirk et al. 2013 (genus accepted), sequence data available, see Shirouzu et al. 2013a (phylogeny, Dacrymycetes).

Doassansia Cornu 1883, Doassansiaceae, Doassansiales, Exobasidiomycetes, twelve species, plant parasites (leaves, stems, petioles) of dicots and monocots, widespread, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Wang et al. 2015c (phylogeny).

Doassansiopsis (Setch.) Dietel 1897, Doassansiopsidaceae, Urocystidales, Ustilaginomycetes, 14 species, plant parasites (leaves, ovaries, petioles, stems) on Alismataceae, Limnocharitaceae, Menianthaceae, Nymphaceae, Potamogetonaceae, widespread, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (phylogeny).

Doassinga Vánky, R. Bauer & Begerow 1998, Doassansiaceae, Doassansiales, Exobasidiomycetes, one species, type species *D. callitrichis* (Liro) Vánky, R. Bauer & Begerow, plant parasitic on *Callitriche* spp. (Callitrichaceae), Europe, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy).

Donkia Pilát 1937, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *D. pulcherrima* (Berk. & M.A. Curtis) Pilát,

hydnoid hymenophore, wood-rotting, widespread, sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), Moreno et al. 2017b (phylogeny, type study), Papp et al. 2017a (phylogeny, Central Europe), Zmitrovich 2018a (taxonomy).

Donkioporia Kotl. & Pouzar 1973, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *D. expansa* (Desm.) Kotl. & Pouzar, poroid hymenophore, wood-rotting, white rot, widespread (North America and Europe), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Vlasák et al. 2010 (new combination, phylogeny, Central Europe), Garcia-Sandoval et al. 2011 (phylogeny).

Donkioporiella L.W. Zhou 2016, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *D. mellea* L.W. Zhou, wood-rotting, China, sequence data available, see Qin et al. 2016 (taxonomy, China).

Drepanoconis J. Schröt. & Henn. 1896, Cryptobasidiaceae, Exobasidiales, Exobasidiomycetes, three species, type species *D. brasiliensis* J. Schröt. & Henn., species plant parasitic (leaves, fruits) on Lauraceae, Central and South America, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2002, 2014, Wang et al. 2015c (taxonomy, phylogeny).

Ductifera Lloyd 1917, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, c. eleven species, type species *D. millei* Lloyd, widespread, sequence data available, see Weiß and Oberwinkler 2001 (phylogeny, Auriculariales).

Duportella Pat. 1915, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, 13 species, type species *D. velutina* Pat., worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Spirin and Kout 2015 (new spp. North East Asia, morphology).

Durianella Desjardin, A.W. Wilson & Manfr. Binder 2008, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *D. echinulata* (Corner & Hawker) Desjardin, A.W. Wilson & Manfr. Binder, gastroid, known only from Malaysia, sequence data available, see Desjardin et al. 2008b (taxonomy, phylogeny).

Earliella Murrill 1905, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *E. scabrosa* (Pers.) Gilb. & Ryvarden, basidioma effused-reflexed to resupinate, poroid hymenophore, wood-rotting, white rot,

widespread (tropical), see Kirk et al. 2013 (genus accepted), medicinal use, see Zmitrovich 2018b (mini-review), sequence data available, see Justo and Hibbett 2011 (phylogeny).

Eballistra R. Bauer, Begerow, A. Nagler & Oberw. 2001, Eballistraceae, Georgefischeriales, Exobasidiomycetes, four species, type species *E. oryzae* (Syd. & P. Syd.) R. Bauer, Begerow, A. Nagler & Oberw., plant parasites (leaves, stems) on Poaceae, widespread in Southern Hemisphere, cultures unavailable, sequence data available, see Bauer et al. 2001b, Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Echinochaete D.A. Reid 1963, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *E. megalopora* (Bres.) D.A. Reid [current name: *E. brachypora* (Mont.) Ryvarden], basidioma laterally stipitate, with short stipite, hymenophore poroid, element setoids with lateral spines, wood-rotting, white rot, widespread (tropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Sotome et al. 2009 (new sp., phylogeny, Asia, Japan).

Echinoderma (Locq. ex Bon) Bon 1991, Agaricaceae, Agaricales, Agaricomycetes, asexual morph not known, c. 15 species, type species *E. asperum* (Pers.) Bon, worldwide, sequence data available, see Vu et al. 2019 (DNA barcodes), in need of revision.

Echinodontiellum S.H. He & Nakasone 2017, Echinodontiaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *E. japonicum* (Imazeki) S.H. He & Nakasone, wood-rotting, causing a white rot on living *Quercus* in Japan and China, sequence data available, see Liu et al. 2017e (taxonomy).

Echinodontium Ellis & Everh. 1900, Echinodontiaceae, Russulales, Agaricomycetes, asexual morph unknown, four species, type species *E. tinctorium* (Ellis & Everh.) Ellis & Everh., America, Japan, Europe, basidioma ungulate to effuse-refflexed, hymenophore dentate to daedaleoid or poroid, white rot, see Kirk et al. 2013 (genus accepted), sequence data available, see Liu et al. 2017e (phylogeny).

Echinophallus Henn. 1898, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *E. lauterbachii* (Henn.) Henn., terrestrial, East Indies, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Echinoporia Ryvarden 1980, Schizoporaceae, Hymenochaetales, Agaricomycetes, anamorph *Echinodia*, three species, type species *E. hydnophora* (Berk. & Broome) Ryvarden, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data unavailable, see Motato-Vasquez 2015 (new records, geographic distribution), new spp. see Coelho 2008 (Brazil).

Edythea H.S. Jacks. 1931, *incertae sedis*, Pucciniales, Pucciniomycetes, five species, type species *E. quitensis* (Lagerh.) H.S. Jacks. & Holw., biotrophic on Arecaceae, Berberidaceae, terrestrial, South America, see Kirk et al. 2013 (genus accepted), sequence data available, see Ordoñez and Barnes 2017 (*E. quitensis*, Ecuador).

Effuseotrichosporon A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Trichosporonaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, one species, type species *E. vanderwaltii* (Motaung, Albertyn, Kock, C.F. Lee, S.O. Suh, M. Blackw. & C.H. Pohl) A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, soil, South Africa, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Efibula Sheng H. Wu 1990, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, 18 species, type species *E. tropica* Sheng H. Wu, resupinate corticioid basidioma, wood-rotting, white rot, widespread, sequence data available, see Floudas and Hibbett 2015 (new spp., phylogeny, *Phanerochaete s. l*, USA).

Efibulella Zmitr. 2018, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *E. deflectens* (P. Karst.) Zmitr., grandinioid basidioma, wood-rotting, white rot, see Zmitrovich 2018a (taxonomy).

Efibulobasidium K. Wells 1975, Sebacinaceae, Sebacinales, Agaricomycetes, asexual morph known, one species, type species *E. albescens* (Sacc. & Malbr.) K. Wells, worldwide, saprobic, sequence data available, see Oberwinkler et al. 2014 (taxonomy, phylogeny, Sebacinales), Kirschner et al. 2017 (*Chaetospermum camelliae* with *Efibulobasidium* teleomorph from Panama).

Eichleriella Bres. 1903, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, c. 14 species, type species *E. incarnata* Bres., widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Malysheva and Spirin 2017 (phylogeny, new spp.).

Elaphocephala Pouzar 1983, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, one species, type species *E. iocularis* Pouzar, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Elaphroporia Z.Q. Wu & C.L. Zhao 2018, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *E. ailaoshanensis* Z.Q. Wu & C.L. Zhao, China, sequence data unavailable, see Wu et al. 2018d (genus accepted, China).

Elateraecium Thirum., F. Kern & B.V. Patil 1966 (=*Hiratsukamyces* Thirum., F. Kern & B.V. Patil 1975 *fide* Art. 59.1), *incertae sedis*, Pucciniales, Pucciniomycetes, sexual morph previously known in *Hiratsukamyces* Thirum., F. Kern & B.V. Patil 1975, three species, type species *E. salaciicola* Thirum., F. Kern & B.V. Patil, India, south Africa, sequence data unavailable, see Kirk et al. 2008.

Ellula Nag Raj 1980, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *E. guaduae* (Viégas) Nag Raj, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Elmerina Bres. 1912, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, seven species, type species *E. cladophora* (Berk.) Bres., widespread (esp. tropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Brazee et al. 2012b (phylogeny, ecology), Sotome et al. 2014 (Asian species, poroid Auriculariales, phylogeny), new spp. see Zhou and Dai 2013b (China, phylogeny), Wu et al. 2015a (central China).

Emmia Zmitr., Spirin & Malysheva 2006, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *E. latemarginata* (Durieu & Mont.) Zmitr., Spirin & Malysheva, poroid hymenophore, wood-rotting, white rot (*E. latemarginata* (Durieu & Mont.) Zmitr., Spirin & Malysheva), see El-Gharabawy et al. 2016 (wood decay, Polyporales), widespread, sequence data available, see Zmitrovich and Malysheva 2014 (phylogeny), Miettinen et al. 2016b (phylogeny, Phanerochaetaceae), Wu et al. 2017a (new combination, China), Zmitrovich 2018a (taxonomy).

Endoclathrus B. Liu, Yin H. Liu & Z.J. Gu 2000, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *E. panzhihuaensis* B. Liu, Yin H. Liu & Z.J. Gu, terrestrial, China, sequence data unavailable.

Endocronartium Y. Hirats. 1969, Cronartiaceae, Pucciniales, Pucciniomycetes, two species, type species *E. harknessii* (J.P. Moore) Y. Hirats., biotrophic on Pinaceae (*Pinus*), terrestrial, North America, Japan, see Kirk et al. 2013 (genus accepted), sequence data available, see Jitjak and Sanoamuang 2017 (phylogeny).

Endogonopsis R. Heim 1966, Diplocystidiaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *E. sacramentarium* R. Heim, Asia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Endolepiotula Singer 1963, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *E. ruizlealii* Singer, Argentina, basidioma gasteroid, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Endopandanicola Tibpromma & K.D. Hyde 2018, Polyporaceae, Polyporales, Agaricomycetes, asexual morph known, one species, type species *E. thailandica* Tibpromma & K.D. Hyde, Thailand, sequence data available, see Tibpromma et al. 2018 (taxonomy).

Endoperplexa P. Roberts 1993, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, six species, type species *E. dartmorica* P. Roberts, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Roberts 2008a, b (British Virgin Islands, Belize).

Endophallus M. Zang & R.H. Petersen 1989, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *E. yunnanensis* M. Zang & R.H. Petersen, terrestrial, China, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Endophyllum Lév. 1826 [1825], Pucciniaceae, Pucciniales, Pucciniomycetes, 43 species, type species *E. persoonii* Lév, biotrophic on various families including Asteraceae, Convolvulaceae, Crassulaceae, Euphorbiceae, Malvaceae, terrestrial, circumglobal especially in tropics, see Kirk et al. 2013 (genus accepted), sequence data available, see Crous 2005 (South Africa), new spp. see Berndt and Wood 2012 (new combination).

Endoraecium Hodges & D.E. Gardner 1984, Raveneliaceae, Pucciniales, Pucciniomycetes, 22 species, type species *E. acaciae* Hodges & D.E. Gardner, biotrophic on *Acacia* (Fabaceae), terrestrial, Australia, South-East Asia (China), Hawaii, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Berndt

2011 (new combination), McTaggart et al. 2015 (key to Australian species, molecular phylogeny).

Entocybe T.J. Baroni, V. Hofst. & Largent 2011, Entolomataceae, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *E. trachyospora* (Largent) Largent, T.J. Baroni & V. Hofstetter, worldwide, sequence data available, see Baroni et al. 2011 (phylogeny), new spp. see Baroni and Lamoureux 2013 (Canada), Bergemann et al. 2013 (new combination).

Entoloma Fr. ex P. Kumm. 1871, Entolomataceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 1800 species, type species *E. sinuatum* (Bull.) P. Kumm., worldwide, mostly saprotrophic, minority of species mycorrhizal or weakly parasitic see Tedersoo et al. 2010, some species edible (*E. lividoalbum* (Kühner & Romagn.) Kubička), see Kirk et al. 2013 (genus accepted), Horak 2008 (New Zealand, monograph), Noordeloos 2008 (North America, type studies, morphology), Noordeloos and Gates 2012 (Tasmania, Australia, morphology, monograph), Maity et al. 2014, 2015 (compounds), Dovana et al. 2016 (*E. ochreoprunuloides*, Italy), Mešić et al. 2016 (new names, new combinations), sequence data available, see Co-David et al. 2009 (phylogeny), Baroni and Matheny 2011 (phylogeny), Baroni et al. 2011 (phylogeny), Kinoshita et al. 2012 (sequestrate species, phylogeny), He et al. 2013a, b (China, phylogeny, type study), Morgado et al. 2013 (phylogeny), Vila et al. 2013 (phylogeny, morphology), Morozova et al. 2014a (phylogeny), Kokkonen 2015 (phylogeny), Kondo et al. 2017 (*E. rhodopolium*-related species, Japan, PCR-RFLP), new spp. see Largent et al. 2008 (Guyana, South America), Noordeloos and Polemis 2008 (Greece), Contu et al. 2009 (Italy), Eyssartier and Noordeloos 2009 (France), Gates et al. 2009 (Tasmania), Horak and Cheype 2009 (French Guiana, South America), Li and Li 2009 (China), Li et al. 2009a (China), Noordeloos and Hausknecht 2009 (Austria), Vila and Caballero 2009 (Spain), Aime et al. 2010 (Australia, as *Calliderma, Paraeccilia* and *Trichopilus*), Blanco-Dios 2010 (Spain), Eyssartier et al. 2010 (New Caledonia), Henkel et al. 2010b (Guyana, South America, as *Alboleptonia*), Jordal and Noordeloos 2010 (Norway), Noordeloos and Morozova 2010 (Russia), Noordeloos et al. 2010, 2017 (Netherlands, Norway), Van Waveren and Llistosella 2010 (Spain), Eyssartier et al. 2011b (New Caledonia), He et al. 2011b (China), Largent et al. 2011a, b, 2013 a, b, 2015, 2016 (Australia, as *Claudopus*, as *Pouzarella*, as *Leptonia*, as *Inocephalus*), Senthilarasu et al.

2010a (India), Takahashi 2011 (Japan, as *Clitopilus*), Wölfel and Hampe 2011 (Germany), Blanco-Dios 2012 (Spain), Caballero et al. 2012 (Spain), He et al. 2012 (China), Morozova et al. 2012 (Vietnam), Pradeep et al. 2012b (India), Raj and Manimohan 2012, 2017 (India), Wölfel et al. 2012 (Germany), Blanco-Dios 2013 (Spain), Coimbra et al. 2013a (Brazil), Illice and Todeschini 2013 (Italy), Qi et al. 2013 (China), Ribes and Vila 2013 (Spain), Vila et al. 2013 (Spain), Wang and Bau 2013 (China), Battistin et al. 2014 (China), Eyssartier and Buyck 2014 (Madagascar), Henkel et al. 2014a (Guyana, South America, as *Nolanea*), Morozova et al. 2014a (Russia), Raj et al. 2014b (India), Weholt et al. 2014 (Norway), Ariyawansa et al. 2015 (Italy), Catcheside et al. 2015 (Australia), Crous et al. 2015a, 2016b, 2017b, 2018a (Vietnam, China, Russia, Ecuador), Deng et al. 2015b (China), He et al. 2015a,b,c (China), Karstedt and Capelari 2015 (Brazil), Raj and Manimohan 2016 (India), Blanco-Dios 2016 (Spain), Largent and Bergemann 2016 (USA, as *Pouzarella*), Lüderitz et al. 2016 (Germany), Montañez et al. 2016 (Mexico), Noordeloos and Hausknecht 2016 (Seychelles, La Réunion, Mauritius), Pradeep et al. 2016a (India), Vidal et al. 2016 (Spain), Blanco-Dios 2017 (Spain, new names and combinations), Ediriweera et al. 2017 (China), He et al. 2017c (China), Karstedt and Capelari 2017 (Brazil), Tibpromma et al. 2017 (India), Ainsworth et al. 2018 (UK), Morozova et al. 2018 (Russia, Vietnam).

Entomocorticium H.S. Whitney, Bandoni & Oberw. 1987, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *E. dendroctoni* H.S. Whitney, Canada, see Kirk et al. 2013 (genus accepted), sequence data available, see Sakayaroj et al. 2010 (phylogeny, Thailand).

Entyloma de Bary 1874, Entylomataceae, Entylomatales, Exobasidiomycetes, asexual morph unknown, 163 species, type species *E. microsporum* J. Schröt., plant parasites on dicots, widespread, saprobic yeast states, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2002, Begerow et al. 2014, Boekhout et al. 2006, Wang et al. 2015c (phylogeny).

Entylomaster Vánky & R.G. Shivas 2006, Doassansiaceae, Doassansiales, Exobasidiomycetes, two species, type species *E. typhonii* Vánky & R.G. Shivas, plant parasites on Araceae, Europe, Australia, cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Eocronartium G.F. Atk. 1902, Eocronartiaceae, Platygloeales, Pucciniomycetes, one species, type species *E. typhuloides* G.F. Atk. [current name: *E. muscicola* (Pers.) Fitzp.], biotrophic on *Musci*, Europe, North America, see Kirk et al. 2013 (genus accepted), sequence data available, cultures available, see Henk and Vilgalys 2007 (insect symbiosis origin, phylogeny).

Eonema Redhead, Lücking & Lawrey 2009, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *E. pyriforme* (M.P. Christ.) Redhead, Lücking & Lawrey, sequence data available, see Lawrey et al. 2009 (phylogeny, taxonomy).

Epicnaphus Singer 1960, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *E. phalaropus* Singer, saprophytic, South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Episphaeria Donk 1962, Crepidotaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *E. fraxinicola* (Berk. & Broome) Donk, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Epithele (Pat.) Pat. 1900, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, 17 species, type species *E. typhae* (Pers.) Pat., resupinate basidioma, odontioid hymenophore (formed by sterile hyphal pegs), wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), Zmitrovich 2018a (taxonomy), new spp. see Wang et al. 2010a (morphology, China, Vietnam), Nakasone 2013 (new combination, morphology, Belize, Reunion, Trinidad and Tobago, Venezuela).

Epithelopsis Jülich 1976, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *E. fulva* (G. Cunn.) Jülich, resupinate basidioma, odontioid hymenophore (formed by sterile hyphal pegs), wood-rotting, widespread (Australia, India, New Zealand), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Erastia Niemelä & Kinnunen 2005, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *E. salmonicolor* (Berk. & M.A. Curtis) Niemelä & Kinnunen, poroid hymenophore, wood-rotting, widespread (Asia, Europe, USA and Cuba), sequence data unavailable, see Kirk et al. 2008, Zmitrovich 2018a (taxonomy).

Eriocaulago Vánky 2005, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, two species, type species *E. eriocauli* (Massee) Vánky, species parasite (ovaries) on plant Eriocaulaceae, Angola, India, Madagascar, Thailand, USA, cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Eriocortex Vánky & R.G. Shivas 2013, *incertae sedis*, *incertae sedis*, Ustilaginomycetes, aexual morph unknown, one species, type species *E. eriocauli* R.G. Shivas, Vánky, M.D. Barrett & M. Lutz, Australia, plant parasites (ovaries) on Eriocaulaceae, Australia, cultures unavailable, sequence data available, see Vánky et al. 2013, Nasr et al. 2014a (taxonomy).

Eriocybe Vellinga 2011, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *E. chionea* Vellinga, agaricoid, saprotrophic, Thailand, sequence data available, see Vellinga et al. 2011 (genus introduced).

Eriomoeszia Vánky 2005, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species *E. eriocauli* (G.P. Clinton) Vánky, plant parasite (ovaries) on *Eriocaulon* spp. (Eriocaulaceae), India, USA, cultures unavailable, sequence data available, see Begerow et al. 2014, Nasr et al. 2014a (taxonomy).

Eriosporium Vánky 2005, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, two species, plant parasites (ovaries) on Eriocaulaceae, Angola, cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Erratomyces M. Piepenbr. & R. Bauer 1997, Erratomycetaceae, Tilletiales, Exobasidiomycetes, five species, type species *E. patelii* (Pavgi & Thirum.) M. Piepenbr. & R. Bauer, plant parasites (leaves) on Fabaceae, Africa, South America, North America, India, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (phylogeny).

Ertzia B.P. Hodk. & Lücking 2014, Lepidostromataceae, Lepidostromatales, Agaricomycetes, asexual morph unknown, one species, type species *E. akagerae* (Eb. Fisch., Ertz, Killmann & Sérus.) B.P. Hodk. & Lücking, tropical Africa, lichenized, sequence data available, see Hodkinson et al. 2014 (monograph), Liu et al. 2017a (phylogeny).

Erythricium J. Erikss. & Hjortstam 1970 (= *Marchandiobasidium* Diederich & Schultheis 2003), Corticiaceae, Corticiales, Agaricomycetes, asexual morph known (bulbils, *Marchandiobasidium* Diederich & Schultheis *fide* Hawksworth and Henrici

2015), six species, type species *E. laetum* (P. Karst.) J. Erikss. & Hjortstam, wood-rotting and lichenicolous, widespread, see Diederich et al. 2003 (taxonomy of asexual morph), Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Ghobad-Nejhad and Hallenberg 2011 (Iran), Hawksworth and Henrici 2015 (new combination).

Erythrobasidium Hamam., Sugiy. & Komag. 1988, Erythrobasidiaceae, Erythrobasidiales, Cystobasidiomycetes, sexual and asexual morphs known, three species, *E. hasegawianum* Hamam., Sugiy. & Komag., yeast, plant material, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Wang et al. 2015d, e (taxonomy, phylogeny).

Erythromyces Hjortstam & Ryvarden 1990, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *E. crocicreas* (Berk. & Broome) Hjortstam & Ryvarden, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Yuan and Wan 2012 (phylogeny).

Erythrophylloporus Ming Zhang & T.H. Li 2018, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *E. cinnabarinus* Ming Zhang & T.H. Li, China, terrestrial, stipitate-pileate, presumably ectomycorrhizal, sequence data available, see Zhang and Li 2018 (taxonomy, phylogeny).

Esalque J.F. Hennen, Figueiredo & A.A. Carvalho 2000, Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *E. holwayi* (H.S. Jacks.) J.F. Hennen, Figueiredo & A.A. Carvalho, biotrophic on *Caesalpinia* (Fabaceae), terrestrial, Brazil, sequence data unavailable, see Kirk et al. 2008.

Exidia Fr. 1822, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, c. 26 species, type species *E. glandulosa* (Bull.) Fr., widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Sotome et al. 2014 (Asian species, poroid Auriculariales, phylogeny), new spp. see Roberts 2009 (British Isles).

Exidiopsis (Bref.) Möller 1895, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, c. 30 species, type species *E. effusa* Bref., widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Sotome et al. 2014 (Asian species, poroid Auriculariales, phylogeny), Malysheva and Spirin 2017 (phylogeny).

Exobasidium Woronin 1867, Exobasidiaceae, Exobasidiales, Exobasidiomycetes, type species *E. vaccinii* (Fuckel) Woronin, 51 species, plant parasites (leaves, stems) on Ericales, widespread in Europe, South America, East Asia, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2002, 2014, Wang et al. 2015c (phylogeny).

Exoteliospora R. Bauer, Oberw. & Vánky 1999, Melanotaeniaceae, Ustilaginales, Ustilaginomycetes, one species, type species *E. osmundae* (Peck) R. Bauer, Oberw. & Vánky, plant parasite (leaves) on *Osmunda* (Osmundaceae), North America, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Faerberia Pouzar 1981, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *F. carbonaria* (Alb. & Schwein.) Pouzar, cantharelloid basidioma, terrestrial (post-fire), Europe, North America, see Kirk et al. 2013 (genus accepted), sequence data available, see Thorn et al. 2000 (phylogeny, Pleurotaceae).

Farysia Racib. 1909, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, (= *Elateromyces* Bubák, Arch. Prírodov. Výzk. 1912; = *Farysizyma* A. Fonseca 2008), 23 species, type species *F. javanica* Racib., plant parasites (flowers) on genera *Carex* and *Uncinia* (Cyperaceae), Africa, East Asia, South Asia, Australia, saprobic yeast states on plants, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Inácio et al. 2008, Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Farysporium Vánky 1999, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, asexual morph unknown, one species, type species *F. endotrichum* (Berk.) Vánky, plant parasite (flowers) on *Gahnia* spp. (Cyperaceae), Australasia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Favillea Fr. 1849, Sclerodermataceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *F. argillacea* Fr., Australia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Favolaschia (Pat.) Pat. 1892, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 54 species, type species *F. gaillardii* (Pat.) Pat., tropics and subtropics, see Vizzini et al. 2009 (species distribution), Kirk et al. 2013 (genus

accepted), Chepkirui et al. 2016 (compounds), sequence data available, see Gillen et al. 2013 (Ecuador, Panama, key), Capelari et al. 2014 (Brazil, phylogeny), new spp. see Takahashi 2011 (Japan), Magnago et al. 2013a (Brazil), Pérez-Ramírez et al. 2014 (Mexico).

Favolus P. Beauv. 1805, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *F. daedaleus* (Link) Fr. [current name: *F. brasiliensis* (Fr.) Fr.], poroid hymenophore, wood-rotting, white rot, widespread (mainly in tropics), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), some species edible (*F. brasiliensis*), see Sanuma et al. 2016 (edible mushrooms, Brazil), sequence data available, see Sotome et al. 2013 (phylogeny, emendation of genus, key), Dai et al. 2014b (phylogeny, China), Zhou et al. 2016b (phylogeny, China), Papp and Dima 2017 (phylogeny, Central Europe), new spp. see Tibpromma et al. 2017 (phylogeny, Korea), Zhou and Cui 2017 (phylogeny, China).

Fayodia Kühner 1930, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. ten species, type species *F. bisphaerigera* (J.E. Lange) Singer, North temperate, see Kirk et al. 2013 (genus accepted), Antonín 2004 (type studies), Antonín and Noordeloos 2004 (European taxa), sequence data available, see Moncalvo et al. 2002 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure).

Fellomyces Y. Yamada & Banno 1984, Cuniculitremaceae, Tremellales, Tremellomycetes, sexual morph unknown, four species, type species *F. polyborus* (D.B. Scott & Van der Walt) Y. Yamada & I. Banno, yeast, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy, phylogeny).

Fellozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Chrysozymaceae, *incertae sedis*, Microbotryomycetes, sexual morph unknown, one species, type species *F. inositophila* (Nakase & M. Suzuki) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, plant material, Japan, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Femsjonia Fr. 1849, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, asexual morph unknown, seven species, type species *F. luteoalba* Fr. [current name: *Ditiola peziziformis* (Lév.) D.A. Reid], wood-rotting, sequence data available, new spp. see Shirouzu et al. 2017 (Japan), Tibpromma et al. 2017 (China).

Fereydounia S. Nasr, M.R. Soudi, H.D.T. Nguyen, M. Lutz & Piątek 2014, Fereydouniaceae, Urocystidales, Ustilaginomycetes, one species, known only from saprobic states, plant material, cultures available, sequence data available, see Nasr et al. 2014a (description), Wang et al. 2015c (taxonomy, phylogeny).

Fevansia Trappe & Castellano 2000, Rhizopogonaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *F. aurantiaca* Trappe & Castellano, ectomycorrhizal, North America, sequence data available.

Fibricium J. Erikss. 1958, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, five species, type species *F. greschikii* (Bres.) J. Erikss., wood-rotting, see Kirk et al. 2013 (genus accepted), sequence data available, see Wu et al. 2007 (phylogeny).

Fibrodontia Parmasto 1968, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, six species, type species *F. gossypina* Parmasto, wood-rotting, sequence data available, new sp. and new comb. see Yurchenko and Wu 2014c (China), Baltazar et al. 2016 (taxonomy).

Fibroporia Parmasto 1968, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, c. ten species, type species *F. vaillantii* (DC.) Parmasto, basidioma resupinate, hymenophore poroid, wood-rotting, brown rot, widespread, sequence data available, see Chen et al. 2017d (new spp., phylogeny, China), new spp. see Bernicchia et al. 2012 (new combination, phylogeny, *Antrodia s. l*, Czech Republic), Chen et al. 2015e (phylogeny, China).

Fibulobasidium Bandoni 1979, Sirobasidiaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, three species, type species *F. inconspicuum* Bandoni, yeast, insect, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Fibulochlamys A.I. Romero & Cabral 1989, *incertae sedis*, Agaricales, Agaricomycetes, two species, type species *F. ferruginosa* A.I. Romero & Cabral, Argentina, Chile, see Kirk et al. 2013 (genus accepted), sequence data available, see Madrid et al. 2010 (new sp.).

Fibulocoela Nag Raj 1978, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *F. indica* Nag Raj, India, Cuba, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Fibulosebacea K. Wells & Raitv. 1987, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *F. strigosa* (Bourdot & Galzin) K. Wells & Raitv., Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Fibulotaeniella Marvanová & Bärl. 1988, *incertae sedis*, *incertae sedis*, Agaricomycetes, hyphomycetous, one species, type species *F. canadensis* Marvanová & Bärl., Canada, sequence data unavailable, see Kirk et al. 2008.

Filobasidium L.S. Olive 1968, Filobasidiaceae, Filobasidiales, Tremellomycetes, sexual and asexual morphs known, nine species, type species *F. floriforme* L.S. Olive, yeast, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (emendation, taxonomy and phylogeny).

Fissolimbus E. Horak 1979, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *F. fallaciosus* E. Horak, Papua New Guinea, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Fistulina Bull. 1791, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph *Confistulina* Stalpers, nine species, type species *F. hepatica* (Schaeff.) With., worldwide, basidioma pileate-stipitate, hymenophore tubular, with separate tubes, wood decaying, brown rot, beefsteak fungus, some species edible (*F. hepatica* (Schaeff.) With.), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes), Matheny et al. 2006 (phylogeny), Garnica et al. 2007a (agarics, phylogeny, basidiospore ultrastructure), Floudas et al. 2015 (genome), new spp, see Song et al. 2015 (China).

Fistulinella Henn. 1901, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 25 species, type species *F. staudtii* Henn., stipitate-pileate, presumably ectomycorrhizal, pantropical and South temperate zone of Australia, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Fulgenzi et al. 2010 (Guyana), Magnago et al. 2017a (Brazil), new combinations see Horak et al. 2011, genus in need of revision.

Flabellimycena Redhead 1984, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *F. flava* (Singer) Redhead, South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Flabellophora G. Cunn. 1965, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, 18 species, type species *F. superposita* (Berk.) G. Cunn., poroid hymenophore, wood-rotting, widespread (pantropical), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Flagelloscypha Donk 1951, Niaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 25 species, type species *F. minutissima* (Burt) Donk, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes).

Flamingomyces R. Bauer, M. Lutz, Piątek, Vánky & Oberw. 2007, Urocystidaceae, Urocystidales, Ustilaginomycetes, one species, type species *F. ruppiae* (Feldmann) R. Bauer, M. Lutz, Piątek, Vánky & Oberw., plant parasite (leaves, rhizome) on *Ruppia maritima* (Ruppiaceae), Europe, cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy).

Flaminia Sacc. & P. Syd. 1902, *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *F. amylospora* (Rehm) Sacc. & P. Syd., on *Xanthoxylon*, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Flammeopellis Y.C. Dai, B.K. Cui & C.L. Zhao 2014, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *F. bambusicola* Y.C. Dai, B.K. Cui & C.L. Zhao, China, poroid hymenophore, bambusicolous, white rot, sequence data available, see Zhao et al. 2014b (taxonomy, phylogeny, China).

Flammula (Fr.) P. Kumm. 1871, Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. ten species, type species *F. flavida* (Fr.) P. Kumm., see Redhead 2013b (nomenclature), sequence data available, see Moncalvo et al. 2002 (phylogeny), Matheny et al. 2006 (phylogeny)

Flammulaster Earle 1909, Tubariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 20 species, type species *F. carpophilus* (Fr.) Earle ex Vellinga, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Gulden et al. 2005 (phylogeny), Matheny 2005 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Matheny et al. 2015 (phylogeny, clustering into Tubariaceae), Horak 2018 (monograph, New Zealand).

Flammulina P. Karst. 1891, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, 14 species, type species *F. velutipes* (Curtis) Singer, worldwide, some species edible, enokitake (*F. velutipes* (Curtis) Singer), see Hall et al. 2003 (edible mushrooms), Smiderle et al. 2008 (nutritional values), Yang et al. 2012a (compounds), Kirk et al. 2013 (genus accepted), sequence data available, see Matheny and Bougher 2006 (phylogeny), new spp. see Ge et al. 2008b, 2015a (China, phylogeny).

Flavidoporia Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *F. pulvinascens* (Pilát) Audet, wood-rotting, see Audet 2017d (taxonomy), sequence data available, see Ortiz-Santana et al. 2013 (antrodia clade of Polyporales, phylogeny), Spirin et al. 2016b (phylogeny, *Antrodia s. s.*).

Flaviporus Murrill 1905, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, 14 species, type species *F. brownii* (Humb.) Donk, poroid hymenophore, wood-rotting, widespread (tropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen et al. 2012 (phylogeny), see Wu et al. 2017a (new combination, phylogeny).

Flavodon Ryvarden 1973, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *F. flavus* (Klotzsch) Ryvarden, varied hymenophore (poroid, hydnoid to irpicoid), wood-rotting, white rot, mycosymbiont of ambrosia beetles, see Kasson et al. 2016 (symbiosys, *F. ambrosius* D.R. Simmons, You Li, C.C. Bateman & J. Hulcr), sequence data available, see Miettinen et al. 2012 (phylogeny), see Simmons et al. 2016 (new sp., phylogeny, USA), Wu et al. 2017a (new combination, phylogeny).

Floccularia Pouzar 1957, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *F. luteovirens* (Alb. & Schwein.) Pouzar, worldwide, some species edible (*F. luteovirens* (Alb. & Schwein.) Pouzar), see Dai et al. 2010b (Chinese edible mushrooms), Li et al. 2010b (nutritional components), Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny).

Floromyces Vánky, M. Lutz & R. Bauer 2008, Floromycetaceae, Urocystidales, Ustilaginomycetes, one species, type species *F. anemarrhenae* (C.H. Chow & Chi C. Chang) Vánky, M. Lutz & R. Bauer, plant parasite (flowers) on *Anemarrhena*

asphodeloides (Asparagaceae), China, cultures unavailable, sequence data available, see Begerow et al. 2014, Nasr et al. 2014a (taxonomy).

Fomes (Fr.) Fr. 1849, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *F. fomentarius* (L.) Fr., perennial basidioma, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), medicinal use, see Grienke et al. 2014, Gáper et al. 2016 (review, *F. fomentarius*), ethnomycological use, see Papp et al. 2017a (Transylvania, Europe, *F. fomentarius*), sequence data available, see Judova et al. 2012 (phylogeny, Europe), McCormick et al. 2013 (phylogeny, culture study, USA).

Fomitella Murrill 1905, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *F. supina* (Sw.) Murrill, poroid hymenophore, wood-rotting, white rot, widespread (tropical, subtropical), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), see Hattori and Sotome 2013 (new combination, morphology, type study, Malaysia).

Fomitiporella Murrill 1907, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 13 species, type species *Poria umbrinella* Bres., basidioma resupinate, hymenophore poroid, wood-decaying, white rot, widespread, sequence data available, new spp. see Zhou 2014c (genus accepted), Ji et al. 2017c, 2018 (species diversity, phylogeny, China).

Fomitiporia Murrill 1907, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 46 species, type species *F. langloisii* Murrill, basidioma resupinate to pileate, hymenophore poroid, wood-rotting, white rot, widespread, *F. ellipsoidea* has the largest fruiting body among the fungi, see Dai and Cui 2011, possibly medicinal use, see Liu et al. 2017b (antioxidant, HIV protease inhibiting and HIV integrase inhibiting activities), inclusion of some pathogenic wood-decaying species (*F. capensis* M. Fisch., M. Cloete, L. Mostert & F. Halleen, *F. hartigii* (Allesch. & Schnabl) Fiasson & Niemelä), see Kirk et al. 2013 (genus accepted), Cloete et al. 2014 (associated with esca on grapevine in South Africa), sequence data available, new spp. see Amalfi et al. 2010 (Africa), Vlasák et al. 2011 (USA, new combinations, Pileate *Fomitiporia* species), Amalfi et al. 2012 (Southern USA and Northern Mexico), Raymundo et al. 2012 (México), Zhou and Xue 2012 (China), Amalfi and Decock 2013,

2014 (South America), Cloete et al. 2014 (South Africa), de Campos Santana 2014 (Brazil), Chen and Cui 2017 (China), Liu et al. 2018b (China).

Fomitopsis P. Karst. 1881, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *F. pinicola* (Sw.) P. Karst., poroid hymenophore, wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), some species medicinal use, see Grienke et al. 2014, Pleszczyńska et al. 2017 (review, *F. betulina*, *F. pinicola*), sequence data available, see Han et al. 2016a (phylogeny, morphology), Floudas et al. 2012 (genome, *F. pinicola*), Hong et al. 2017 (genome, *F. palustris* (Berk. & M.A. Curtis) Gilb. & Ryvarden), new spp. Zhou and Wei 2012 (phylogeny, China), Li et al. 2013b (phylogeny, China), Han et al. 2014 (phylogeny, China), Tibpromma et al. 2017 (phylogeny, Brazil), new combination, see Hattori and Sotome 2013 (morphology, type study, Indonesia).

Fonsecazyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Bulleraceae, Tremellales, Tremellomycetes, sexual morph unknown, three species, type species *F. mujuensis* (K.S. Shin & Y.H. Park) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Foraminispora Robledo, Costa-Rezende & Drechsler-Santos 2017, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *F. rugosa* (Berk.) Costa-Rezende, Drechsler-Santos & Robledo, poroid hymenophore, terrestrial or wood-rotting, tropical (South America), sequence data available, see Costa-Rezende et al. 2017 (taxonomy, *Amauroderma* s. *l.*, new combination, phylogeny).

Fragifomes B.K. Cui, M.L. Han & Y.C. Dai 2016, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *F. niveomarginatus* (L.W. Zhou & Y.L. Wei) B.K. Cui, M.L. Han & Y.C. Dai, poroid hymenophore, wood-rotting, brown rot, China, sequence data available, see Zhou and Wei 2012 (*Fomitopsis niveomarginata*, phylogeny, China), Han et al. 2016a (new genus, new combination, phylogeny, morphology).

Fragiliporia Y.C. Dai, B.K. Cui & C.L. Zhao 2015, Fragiliporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *F. fragilis* Y.C. Dai, B.K. Cui & C.L. Zhao, resupinate basidioma, poroid hymenophore, wood-rotting, white

rot, China, sequence data available, see Zhao et al. 2015a (new family, new genus, new sp., phylogeny, China).

Frantisekia Spirin & Zmitr. 2007, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *F. fissiliformis* (Pilát) Spirin & Zmitr., poroid hymenophore, wood-rotting, white rot, widespread (Northern Hemisphere), see Zmitrovich 2018a (taxonomy), sequence data available, see Miettinen et al. 2012 (phylogeny, *F. mentschulensis*), new sp. see Yuan 2014 (phylogeny, *Antrodiella*, China).

Franzpetrakia Thirum. & Pavgi 1957, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, three species, type species *F. microstegii* Thirum. & Pavgi, plant parasite (flowers) on Poaceae, East Asia, South Asia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy).

Fulvifomes Murrill 1914, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 33 species, type species *F. robiniae* (Murrill) Murrill, basidioma pileate to ungulate, hymenophore poroid, wood-rotting, white rot, widespread, sequence data available, see Salvador-Montoya et al. 2018 (delimitation of *F. robiniae*, new sp.), new spp. see Baltazar and Gibertoni 2010 (new combinations), Dai 2010b (China), Zhou and Zhang 2012 (Cambodia), Zhou 2014b (China), Hattori et al. 2014 (Thailand), Zhou 2015b (Thailand), Ji et al. 2017b (America).

Fulvisporium Vánky 1997, Ustilentylomataceae, Microbotryales, Microbotryomycetes, asexual morph unknown, one species, type species *F. restifaciens* (D.E. Shaw) Vánky, on Poaceae, Australia, see Kirk et al. 2013 (genus accepted), sequence data available.

Funalia Pat. 1900, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. ten species, type species *F. mons-veneris* (Jungh.) Pat., poroid hymenophore, wood-rotting, white rot, widespread, industrial use, see Daâssi et al. 2014 (biodegradation, *F. gallica* (Fr.) Bondartsev & Singer), Zmitrovich et al. 2018c (*F. trogii* (Berk.) Bondartsev & Singer, mini-review), sequence data available, see, Li et al. 2016c (new sp., phylogeny, China), new combinations, see Dai and Yuan 2010 (type study, morphology, China), Zmitrovich and Malysheva 2013 (phylogeny, morphology).

Furtadoa Costa-Rezende, Robledo & Drechsler-Santos 2017, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *F. biseptata* Costa-Rezende, Drechsler-Santos & Reck, poroid hymenophore, terrestrial or wood-rotting, growing on the ground or on decayed angiosperm wood, white rot, tropical (South America), sequence data available, see Costa-Rezende et al. 2017 (taxonomy, phylogeny).

Fuscoporia Murrill 1907, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 62 species, type species *F. ferruginosa* (Schrad.) Murrill, basidioma resupinate to pileate, hymenophore poroid, wood-rotting, white rot, see Pires et al. 2015 (Brazilian Atlantic Rainforest), sequence data available, see Baltazar and Gibertoni 2010 (new combination), Raymundo et al. 2012, 2013a, b (morphology, new species, new combinations taxonomy, Sonoran desert, Mexico).

Fuscopostia B.K. Cui, L.L. Shen & Y.C. Dai 2019, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *F. fragilis* (Fr.) B.K. Cui, L.L. Shen & Y.C. Dai, worldwide, wood-rotting, sequence data available, see Shen et al. 2019 (taxonomy, phylogeny).

Galerella Earle 1909, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, eight species, type species *G. plicatella* (Peck) Singer, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Tóth et al. 2013 (phylogeny), new spp. see Tkalčec et al. 2011 (tropical Africa, morphology), Bandala and Montoya 2015 (Mexico, morphology).

Galerina Earle 1909, Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 250 species, type species *G. vittiformis* (Fr.) Singer, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Osmundson et al. 2013 (DNA barcode), Jang et al. 2015b (phylogeny), Riley et al. 2014 (genome), new spp. see Latha et al. 2015a (India).

Galeropsis Velen. 1930, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, nine species, type species *G. desertorum* Velen. & Dvořák, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Tóth et al. 2013 (phylogeny, Bolbitiaceae).

Gallacea Lloyd 1905, Gallaceaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, six species, type species *G. scleroderma* (Cooke) Lloyd, Australia,

New Zealand, see Kirk et al. 2013 (genus accepted), sequence data available, see Giachini et al. 2010 (phylogeny).

Gallowaya Arthur 1906, Coleosporiaceae, Pucciniales, Pucciniomycetes, three species, type species *G. pini* Arthur (current name: *G. pinicola* Arthur), pycniospores and teliiospores microcyclic, North America, Siberia, *G. crowellii* on *Pinus*, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Galzinia Bourdot 1922, Corticiaceae, Corticiales, Agaricomycetes, asexual morph unknown, nine species, type species *G. pedicellata* Bourdot, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data from type not available, but from *G. incrustans* available, see Hibbett and Binder 2002 (evolution), Sjökvist et al. 2012 (evolution).

Gambleola Massee 1898, Pucciniosiraceae, Pucciniales, Pucciniomycetes, sexual morph unknown, one species, type species *G. cornuta* Massee, on *Berberis*, India, Nepal, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gamundia Raithelh. 1979, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. seven species, type species *G. pseudoclusilis* (Joss. & Konrad) Raithelh., Europe, South America, see Antonín and Noordeloos 2004 (European taxa), Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Musumeci et al. 2010 (new sp., France).

Ganoderma P. Karst. 1881, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 180 species, type species *G. lucidum* (Curtis) P. Karst., basidioma pileate, poroid hymenophore, wood-rotting, white rot, see Kirk et al. 2013 (genus accepted), some species pathogen of horticultural plants or pulpwood plantations, see Wasser et al. 2006 (*G. lucidum*-complex), Mercière et al. 2015 (oil palm, basal stem rot disease, *G. boninense* Pat.), Page et al. 2018 (fungal mating systems, *G. philippii*, *G. mastoporum* and *G. australe*, Indonesia), Papp 2019 (review, taxonomy, global diversity), cosmopolitan, several species medicinal use, see Baby et al. 2015 (review, metabolites, biological activities), Lindequist et al. 2015 (review, *G. pfeifferi*, Europe), Richter et al. 2015 (review, chemotaxonomy), Hapuarachchi et al. 2017 (review, medicinal properties, clinical evidence), Papp et al. 2017b (review, *G. lucidum* complex, nomenclature, phylogeny), sequence data available, see Chen et al. 2012b (genome, *G. lingzhi* Sheng H. Wu, Y. Cao & Y.C. Dai, as *G. lucidum*, see Papp et al. 2017), Zhou et

al. 2015 (phylogeny, *G. lucidum* complex, northern hemisphere), Kües et al. 2015 (review, genomics, *Ganoderma* spp.), Jargalmaa et al. 2017 (Korean *Ganoderma* and database sequence validation), new spp. see Torres-Torres et al. 2008 (morphology, Mexico), Douanla-Meli and Langer 2009c (phylogeny, Cameroon), Welti and Courtecuisse 2010 (morphology, Martinique), Kinge and Mih 2011 (phylogeny, Cameroon), Cao et al. 2012 (phylogeny, China), Cao and Yuan 2013 (phylogeny, China), Crous et al. 2014b, 2015b, 2016a, 2017a, b (phylogeny, South Africa, Ecuador, Ghana, India), Coetzee et al. 2015 (phylogeny, South Africa), Li et al. 2015c (phylogeny, China), Xing et al. 2016, 2018 (phylogeny, South Africa, China), Hapuarachchi et al. 2018a, b, 2019 (phylogeny, China, Laos), Tchoumi et al. 2018 (phylogeny, South Africa), new combination, see Papp 2016 (nomenclature, East Asia).

Gasterella Zeller & L.B. Walker 1935, Gasterellaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *G. luteophila* Zeller & L.B. Walker, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gasterellopsis Routien 1940, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. silvicola* Routien, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gasteroagaricoides D.A. Reid 1986, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. ralstoniae* D.A. Reid, Australia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gastroboletus Lohwag 1926, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, 14 species, type species *G. boedijnii* Lohwag, sequestrate, ectomycorrhizal, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Dentinger et al. 2010 (section *Boletus*, phylogeny), new spp. see Wang et al. 2014 (morphology, China).

Gastroleccinum Thiers 1989, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *G. scabrosum* (Mazzer & A.H. Sm.) Thiers, sequestrate, North America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gastropila Homrich & J.E. Wright 1973, Lycoperdaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *G. fragilis* (Lév.) Homrich & J.E. Wright, worldwide, sequence data unavailable, see Cortez et al. 2012

(Brazil, key), Rebriev and Assyov 2012 (Europe, Asia), Kirk et al. 2013 (genus accepted).

Gastrosporium Mattir. 1903, Gastrosporiaceae, Phallales, Agaricomycetes, asexual morph unknown, two species, type species *G. simplex* Mattir., ectomycorrhizal, widespread, see Kirk et al. 2013 (genus accepted), Tomaszewska et al. 2015 (ecology), sequence data available, see Trierveiler-Pereira et al. 2014a (phylogeny).

Gautieria Vittad. 1831, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, 37 species, type species *G. morchelliformis* Vittad., terrestrial and ectomycorrhizal, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Bau and Liu 2013 (China).

Geasteroides Long 1917, Geastraceae, Geastrales, Agaricomycetes, asexual morph unknown, one species, type species *G. texensis* Long, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Geastrum Pers. 1794, Geastraceae, Geastrales, Agaricomycetes, asexual morph unknown, c. 130 species, type species *G. pectinatum* Pers., widespread, earthstars, terrestrial, 14 sections, sect. *Campestria* J.C.Zamora, sect. *Corollina* J.C.Zamora, sect. *Elegantia* J.C.Zamora, sect. *Exareolata* De Toni, sect. *Fimbriata* De Toni, sect. *Fornicata* De Toni, sect. *Geastrum* Pers., sect. *Hariotia* J.C.Zamora, sect. *Hieronymia* J.C.Zamora, sect. *Myceliostroma* (Henn.) P.Ponce de León, sect. *Papillata* De Toni, sect. *Pseudolimbata* J.C.Zamora, sect. *Schmidelia* J.C.Zamora, sect. *Trichaster* (Czern.) P. Ponce de León, see Kirk et al. 2013 (genus accepted), Zamora et al. 2014b (systematics, *Geastrum*), some species medicinal use (*G. fimbriatum* Fr.), see Dai and Yang 2008 (medicinal mushrooms, China), sequence data available, see Zamora et al. 2014b, 2015 (section *Schmidelia*, *Geastrum*), new spp. see Hemmes and Desjardin 2011 (Hawaii), da Silva et al. 2013a (Brazil), Kuhar et al. 2013 (Argentina), Sousa et al. 2015 (Brazil), Zamora et al. 2015 (Australia), Crous et al. 2016b, 2017b, 2018c.

Geesterania Westphalen, Tomšovský & Rajchenb. 2018, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *G. carneola* (Bres.) Westphalen & Rajchenb, resupinate porioid basidioma, wood-rotting, white rot, see Westphalen et al. 2018 (taxonomy).

Gelacantha V. Malysheva & Spirin 2019, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *G. pura* V.

Malysheva & Spirin, Europe (Russian Caucasus), saprobic, on fallen log of *Abies*, sequence data available, see Spirin et al. 2019b (taxonomy, phylogeny).

Gelatoporia Niemelä 1985, Gelatoporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *G. subvermispora* (Pilát) Niemelä, resupinate basidioma, poroid hymenophore, wood-rotting, white rot, widespread (north temperate), see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen and Rajchenberg 2012 (phylogeny), Fernandez-Fueyo et al. 2012 (genome, as *Ceriporiopsis subvermispora*).

Gelidatrema A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Phaeotremellaceae, Tremellales, Tremellomycetes, sexual morph unknown, one species, type species *G. spencermartinsiae* (C. García, Brizzio, Boekhout, Theelen, Libkind & van Broock) A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, Europe, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Geliporus Yuan Yuan, Jia J. Chen & S.H. He 2017, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *G. exilisporus* (Y.C. Dai & Niemelä) Yuan Yuan, Jia J. Chen & S.H. He, wood-rotting, white rot, sequence data available, see Yuan et al. 2017b (Phanerochaetaceae, taxonomy, China).

Gelopellis Zeller 1939, Claustulaceae, Phallales, Agaricomycetes, asexual morph unknown, six species, type species *G. macrospora* Zeller, South America, Japan, Sustralia, see Kirk et al. 2013 (genus accepted), sequence data avaialble, see Hosaka et al. 2006 (phylogeny, gomphoid-phalloid fungi).

Geminago Vánky & R. Bauer 1996, Geminaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species *G. nonveilleri* (Zambett. & Foko) Vánky & R. Bauer, plant parasite (flowers) on *Triplochiton scleroxylon* (Malvaceae), Africa, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Geminibasidium H.D.T. Nguyen, N.L. Nick. & Seifert 2013, Geminibasidiaceae, Geminibasidiales, Wallemiomycetes, asexual morph unknown, two species, type species, *G. donsium* H.D.T. Nguyen, N.L. Nickerson & Seifert, Canada, sequence data available, see Nguyen et al. 2013a (taxonomy).

Genolevuria X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Bulleraceae, Tremellales, Tremellomycetes, sexual morph unknown, four species, type species *G. amylolytica* (Á. Fonseca, J. Inácio & Spenc.-Mart.) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, worldwide, yeast, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Georgefischeria Thirum. & Naras. 1963, Georgefischeriaceae, Georgefischeriales, Exobasidiomycetes, four species, type species *G. riveae* Thirum. & Naras., plant parasites (leaves, stems) on Convolvulaceae, India, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Bauer et al. 2001b, Begerow et al. 2014 (taxonomy).

Geotrichopsis Tzean & Estey 1991, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *G. mycoparasitica* Tzean & Estey, Canada, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gerhardtia Bon 1994, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. seven species, type species *G. incarnatobrunnea* (Ew. Gerhardt) Bon, sequence data available, see Mešić and Tkalčec 2009 (morphology, type study), Vizzini et al. 2015a (new emendation), Matheny et al. 2017a (new combination), new spp. see Cooper 2014b (New Zealand), Li et al. 2017b (China).

Gerronema Singer 1951, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, 58 species, type species *G. melanomphax* Singer, lignicolous, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Antonín et al. 2008 (Korea), new spp. see Cooper 2014b (New Zealand), Latha et al. 2018b (India).

Gerwasia Racib. 1909, Phragmidiaceae, Pucciniales, Pucciniomycetes, (= *Mainsia* H.S. Jacks. 1931), 19 species, type species *G. rubi* Racib., asexual morphs *Campanulospora* Salazar-Yepes, Pardo-Card. & Buriticá, *Morispora* Salazar-Yepes, Pardo-Card. & Buriticá, *Scutelliformis* Salazar-Yepes, Pardo-Card. & Buriticá, biotrophic on Rosaceae (*Rubus*, *Rosa*) terrestrial, Central and South America, Asia, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see McTaggart et al. 2016a (Evolution, phylogeny).

Giacomia Vizzini & Contu 2012, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. mirabilis* (Bres.) Vizzini & Contu, worldwide, sequence data available, see Vizzini et al. 2012b (new genus).

Gilbertsonia Parmasto 2001, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *G. angulopora* (M.J. Larsen & Lombard) Parmasto, resupinate basidioma, poroid hymenophore, wood-rotting, brown rot, USA, sequence data available, see Ortiz-Santana et al. 2013 (phylogeny, antrodia clade).

Ginnsia Sheng H. Wu & Hallenb. 2010, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *G. viticola* (Schwein.) Sheng H.Wu & Hallenb., wood-rotting, widespread, sequence data available, see Wu et al. 2010a (new combination, *Phanerochaete*).

Giulia Tassi 1904, Corticiaceae, Corticiales, Agaricomycetes, sexual morph unknown, one species, type species *G. tenuis* (Sacc.) Tassi ex Sacc. & D. Sacc., Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Rungjindamai et al. 2008 (phylogeny).

Gjaerumia R. Bauer, M. Lutz & Oberw. 2005, Gjaerumiaceae, Georgefischeriales, Exobasidiomycetes, three species, type species *G. ossifragi* (Rostr.) R. Bauer, M. Lutz & Oberw., plant parasite (leaves) on Asparagaceae, Melanthiaceae, Xanthorrhoeaceae, Denmark, Italy, Kazakhstan, saprobic yeast states, cultures available, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Glabrocyphella W.B. Cooke 1961, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, twelve species, type species *G. palmarum* (Berk. & M.A. Curtis) W.B. Cooke, saprophytic, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Glaciozyma Turchetti, Connell, Thomas-Hall & Boekhout 2011, Camptobasidiaceae, Kriegeriales, Microbotryomycetes, sexual and asexual morphs known, four species, type species *G. antarctica* (Fell, Statzell, I.L. Hunter & Phaff) Turchetti, Connell, Thomas-Hall & Boekhout, yeast, psychrophilic, worldwide, cultures and sequence data available, see Turchetti et al. 2011 (genus introduced, taxonomy), Wang et al. 2015e (taxonomy and phylogeny).

Gliophorus Herink 1958, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 17 species, type species *G. psittacinus* (Schaeff.) Herink, worldwide, waxcap mushrooms, sequence data available, see Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae), new spp. see Ainsworth et al. 2013 (Britain).

Globifomes Murrill 1904, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *G. graveolens* (Schwein.) Murrill, basidioma consist of overlapping stipe-less caps, poroid hymenophore, wood-inhabiting, white rot, North America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Globosomyces Jülich 1980, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *G. aggregatus* Jülich, basidioma aggregate, Borneo, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Globuliciopsis Hjortstam & Ryvarden 2004, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *G. fuegiana* Hjortstam & Ryvarden, basidioma resupinate, corticioid, wood-rotting, Central and South America, sequence data unavailable, see Kirk et al. 2008.

Globulicium Hjortstam 1973, Rickenellaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *G. hiemale* (Laurila) Hjortstam, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2006 (phylogeny), Larsson 2007b (phylogeny).

Globulisebacina Oberw., Garnica & K. Riess 2014, Sebacinaceae, Sebacinales, Agaricomycetes, asexual morph unknown, two species, type species *G. rolleyi* (L.S. Olive) Oberw., Garnica & K. Riess, sequence data avaiable, see Oberwinkler et al. 2014 (phylogeny), new spp. see Kirschner et al. 2017 (China).

Gloeoasterostroma Rick 1938, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *G. sordidum* Rick, sequence data unavailable, see Kirk et al. 2008.

Gloeocantharellus Singer 1945, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, twelve species, type species *G. purpurascens* (Hesler) Singer, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Deng and Li 2008 (China, morphology), Linhares et al. 2016 (Brazil), Wartchow et al. 2017 (Brazil, morphology), new combinations see Giachini and Castellano 2011 (taxonomic classification for species in *Gomphus s. l.*).

Gloeocorticium Hjortstam & Ryvarden 1986, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. cinerascens* Hjortstam & Ryvarden, Argentina, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gloeocystidiellum Donk 1931, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, eight species, type species *G. porosum* (Berk. & M.A. Curtis) Donk, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Gorjón and Hallenberg 2013 (taxonomy), new spp. see Telleria et al. 2012b (Spain).

Gloeocystidiopsis Jülich 1982, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *G. flammea* (Boidin) Jülich, resupinate, sequence data available, see Larsson and Larsson 2003 (phylogeny, taxonomy).

Gloeodontia Boidin 1966, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, eight species, type species *G. discolor* (Berk. & M.A. Curtis) Boidin, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhou and Dai 2013a (taxonomy, phylogeny, hydnoid Russulales), new spp. see Telleria et al. 2008b (Spain).

Gloeohypochnicium (Parmasto) Hjortstam 1987, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *G. analogum* (Bourdot & Galzin) Hjortstam, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Fukami et al. 2010 (biodiversity).

Gloeomucro R.H. Petersen 1980, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, ten species, type species *G. nodosus* (Linder) R.H. Petersen, widespread, genus in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gloeomyces Sheng H. Wu 1996, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, three species, type species *G. graminicola* Sheng H. Wu, China, Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gloeopeniophorella Rick 1934, Russulaceae, Russulales, Agaricomycetes, asexual morph unknown, six species, type species *G. rubroflava* Rick, sequence data available, see Larsson and Larsson 2003 (phylogeny, russuloid basidiomycetes).

Gloeophyllum P. Karst. 1882, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, 13 species, type species *G. sepiarium* (Wulfen) P. Karst.,

basidioma resupinate to pilete, hymenophore poroid to lamellate, wood-rotting, brown rot, widespread, sequence data available, see Garcia-Sandoval et al. 2011 (phylogeny), Floudas et al. 2012 (phylogeny).

Gloeoporellus Zmitr. 2018, Incrustoporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, monotypic, one species, type species *G. merulinus* (Berk.) Zmitr., resupinate porioid basidioma, wood-rotting, white rot, see Zmitrovich 2018a (taxonomy).

Gloeoporus Mont. 1842, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, 13 species, type species *G. conchoides* Mont. [current name: *G. thelephoroides* (Hook.) G. Cunn.], poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, new spp. see Mata and Ryvarden 2010 (morphology, Costa Rica), Yuan et al. 2016b (phylogeny, tropical China), Jung et al. 2018 (phylogeny, Uganda, Korea).

Gloeosoma Bres. 1920, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *G. vitellinum* (Lév.) Bres., cupulate, sequence data available, see Wu et al. 2001 (phylogeny).

Gloeostereum S. Ito & S. Imai 1933, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. incarnatum* S. Ito & S. Imai, Japan, Korea, see Kirk et al. 2013 (genus accepted), sequence data available, see Jang et al. 2015a (Korea), Jang et al. 2016 (Korea).

Gloeosynnema Seifert & G. Okada 1988, *incertae sedis*, *incertae sedis*, Agaricomycetes, two species, type species *G. ochroleucum* (Penz. & Sacc.) Seifert & G. Okada, Indonesia, Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gloiocephala Massee 1892, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *G. epiphylla* Massee, worldwide, saprotrophic, see Antonín and Noordeloos 2010 (Europe, monograph), Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2006 (phylogeny), new spp. see Tkalčec and Mešić 2008 (Croatia), Adamčík et al. 2015 (China).

Gloiodon P. Karst. 1879, Bondarzewiaceae, Russulales, Agaricomycetes, asexual morph unknown, three species, type species *G. strigosus* (Sw.) P. Karst., Europe, see

Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny, russuloid basidiomycetes).

Gloiothele Bres. 1920, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, c. twelve species, type species *G. lamellosa* (Henn.) Bres., see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny, russuloid basidiomycetes).

Gloioxanthomyces Lodge, Vizzini, Ercole & Boertm. 2013, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *G. vitellinus* (Fr.) Lodge, Vizzini, Ercole & Boertm., North America, Newfoundland, Europe, sequence data available, see Lodge et al. 2014 (phylogeny, taxonomy).

Glomerogloea Doweld 2013, Platygloeaceae, Platygloeales, Pucciniomycetes, one species, type species *G. empetri* (D.M. Hend.) Doweld, sequence data unavailable.

Glomerulomyces A.I. Romero & S.E. López 1989, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *G. fibulosus* A.I. Romero & S.E. López, Argentina, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Glomopsis D.M. Hend. 1961, Platygloeaceae, Platygloeales, Pucciniomycetes, two species, type species *G. corni* (Peck) D.M. Hend., USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Glutinoagger Sivan. & Watling 1980, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *G. fibulatus* Sivan. & Watling, Seychelles, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Glyptoderma R. Heim & Perr.-Bertr. 1971, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. coelatum* (Pat. ex R. Heim) R. Heim & Perr.-Bertr., tropical America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Goffeauzyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Filobasidiaceae, Filobasidiales, Tremellomycetes, sexual morph unknown, six species, type species *G. gastrica* (Reiersöl & di Menna) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, acid environments, soils, psychrophilic, widespread, cultures and sequence data available, cultures are available, see Liu et al. 2015b (taxonomy, phylogeny).

Golubevia Q.M. Wang, F.Y. Bai, Begerow & Boekhout 2015, Golubeviaceae, Golubeviales, Exobasidiomycetes, one species, type species *G. pallescens* (Gokhale) Q.M. Wang, F.Y. Bai, Begerow & Boekhout, known only from saprobic states, cultures available, sequence data available, see Begerow et al. 2000, Wang et al. 2015c (taxonomy, phylogeny).

Gomphidius Fr. 1836, Gomphidiaceae, Boletales, Agaricomycetes, asexual morph unknown, ten species, type species *G. glutinosus* (Schaeff.) Fr., widespread, some species edible (*G. glutinosus* (Schaeff.) Fr.), see Dai et al. 2010b (edible mushrooms, China), some medicinal use (*G. rutilus* (Schaeff.) S. Lundell), see Gao et al. 2013b (medicinal study), Kirk et al. 2013 (genus accepted), sequence data available, see Li et al. 2009b (phylogeny), Yu 2015 (ecology), Větrovský et al. 2016 (phylogeny), Pérez-Izquierdo et al. 2017 (phylogeny), new spp. see Qi et al. 2017 (Northeast China).

Gomphogaster O.K. Mill. 1973, Gomphidiaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *G. leucosarx* (A.H. Sm. & Singer) O.K. Mill., USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gomphus Pers. 1797, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, seven species, type species *G. clavatus* (Pers.) Gray, widespread, few species are mycorrhizal, see Giachini and Castellano 2011 (taxonomic classification for species in *Gomphus s. l.*), some species edible (*G. clavatus* (Pers.) Gray), see Dai et al. 2010b (edible mushrooms, China), Makropoulou et al. 2012 (antioxidant and cytotoxic activity), Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Villegas et al. 2010 (Mexico), Petersen et al. 2014b (North America).

Goplana Racib. 1900, Chaconiaceae, Pucciniales, Pucciniomycetes, 13 species, type species *G. micheliae* Racib., biotrophic on Asteraceae, Dioscoreaceae, Euphorbiaceae, Grossulariaceae, Lauraceae, Magnoliaceae, Meliosmaceae, Rubiaceae, Vitaceae, terrestrial, worldwide, see Hernández and Cline 2010 (replaced *Goplana dioscoreae* Cummins, nom. illeg. with *Goplana dioscoreae-alatae*), Kirk et al. 2013 (genus accepted), sequence data unavailable.

Gramincola Velen. 1947, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. gracilis* Velen., sequence data unavailable, see Kirk et al. 2008.

Grammatus H.S. Yuan & Decock 2018, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, two species, type species *G. labyrinthinus* H.S. Yuan & Decock, wood-inhabiting, southern, tropical China, basidiomas resupinate, subporoid hymenophore, sequence data available, see Yuan et al. 2018 (phylogeny, taxonomy, China).

Grammothele Berk. & M.A. Curtis 1868, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *G. lineata* Berk. & M.A. Curtis, resupinate basidioma, poroid hymenophore, wood-rotting, some species known as endophytes, widespread (tropical), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), medicinal use, see Das et al. 2017a (compound, paclitaxel, *G. lineata*), sequence data available, see Zhou and Dai 2012a (phylogeny), Das et al. 2017a (draft genome, *G. lineata*), new spp. see Zhou and Dai 2012 (phylogeny, China), Karasiński 2015 (morphology, Bolivia), Ryvarden 2015a (morphology, Brazil, USA, Venezuela), Wu et al. 2016d (phylogeny, China), new combination, see Li and Cui 2013b (phylogeny).

Grammothelopsis Jülich 1982, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *G. macrospora* (Ryvarden) Jülich, poroid hymenophore, wood-rotting, widespread (Africa, South America, China), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data avaiable, see Li and Cui 2013b (phylogeny, *Megasporoporia*), new spp. see Dai et al. 2011 (China), Zhao and Cui 2012a (China, morphology).

Granulobasidium Jülich 1979, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. vellereum* (Ellis & Cragin) Jülich, North America, wood-decaying, see Kirk et al. 2013 (genus accepted), Nord et al. 2013, 2014 (compounds), sequence data available, see Larsson 2007b (phylogeny).

Graphiola Poit. 1824, Graphiolaceae, Exobasidiales, Exobasidiomycetes, twelve species, type species *G. phoenicis* (Moug. ex Fr.) Poit., plant parasites (leaves) on Arecaceae, widespread in tropics and subtropics, cultures available, see Kirk et al. 2013 (genus accepted), sequence data available, see Begerow et al. 2002, 2014, Wang et al. 2015c (phylogeny), new spp. see Nasr et al. 2018.

Grifola Gray 1821, Grifolaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *G. frondosa* (Dicks.) Gray, compound basidioma,

poroid hymenophore, terrestrial or wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), some species edible, see Montoya et al. 2012b (cultivation, *G. frondosa*), some species medicinal use (*G. frondosa*, *G. gargal* Singer, *G. sordulenta* (Mont.) Singer), see Zhuang and Wasser 2004 (*G. frondosa*, review), Postemsky and Curvetto 2016 (*Grifola* spp., Argentina), sequence data available, see Binder et al. 2013 (phylogeny, Polyporales), Justo et al. 2017 (phylogeny, Polyporales).

Griseoporia Ginns 1984, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, two species, type species *G. carbonaria* (Berk. & M.A. Curtis) Ginns, sequence data available, new spp. see He et al. 2014 (phylogeny, taxonomy, genus accepted).

Guepinia Fr. 1825, *incertae sedis* Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *G. helvelloides* (DC.) Fr., terricolous, probably saprotrophic, sequence data available, Mattock 2006 (United Kingdom).

Guepiniopsis Pat. 1883, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, asexual morph unknown, eight species, type species *G. tortus* Pat., wood-decaying, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Weiß et al. 2001, new spp. see Delivorias et al. 2012 (Greece).

Gummiglobus Trappe, Castellano & Amar. 1996, Mesophelliaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, two species, type species *G. joyceae* Trappe, Castellano & Amar, Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny, gomphoid-phalloid fungi).

Gummivena Trappe & Bougher 2002, Mesophelliaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, one species, type species *G. potorooi* Trappe & Bougher, Australia, sequence data unavailable, see Kirk et al. 2008.

Guyanagarika Sánchez-García, T.W. Henkel & Aime 2016, Biannulariaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *G. aurantia* Sánchez-García, T.W. Henkel & Aime, associate with species of the ectomycorrhizal (ECM) tree genus *Dicymbe* (Fabaceae subfam. Caesalpinioideae), Pakaraima Mountains of Guyana in the central Guiana Shield, sequence data available, see Sánchez-García et al. 2016 (monograph, new genus).

Guyanagaster T.W. Henkel, M.E. Sm. & Aime 2010, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *G. necrorhizus* T.W. Henkel, Aime & M.E. Sm., Guyana, basidioma sequestrate, wood-decaying, sequence data available, see Henkel et al. 2010a (monograph), Moreau et al. 2015b (phylogeny), Koch et al. 2017 (phylogeny, biogeography).

Guyanaporus T.W. Henkel & M.E. Sm. 2016, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *G. albipodus* T.W. Henkel & Husbands, stipitate-pileate, presumably ectomycorrhizal, South America, sequence data available, see Henkel et al. 2016 (taxonomy).

Gymnoconia Lagerh. 1894 (= *Arthuriomyces* Cummins & Y. Hirats. 1983, = *Kunkelia* Arthur 1917), Phragmidiaceae, Pucciniales, Pucciniomycetes, four species, type species *G. interstitialis* (Schltdl.) Lagerh., biotrophic on Rosaceae, terrestrial, North America, Europe, Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see McLaughlin et al. 2017 (phylogeny).

Gymnoderma Humb. 1793, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, one species, type species *G. sinuatum* Humb., Europe, wood-rotting, see Kirk et al. 2013 (genus accepted), sequence data available.

Gymnogaster J.W. Cribb 1956, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *G. boletoides* J.W. Cribb, Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Halling et al. 2012b (*Boletus*, phylogeny), Wu et al. 2016f (*Boletus*, phylogeny, China).

Gymnoglossum Massee 1891, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. stipitatum* Massee, Australia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gymnopanella Sand.-Leiva, J.V. McDonald & Thorn 2016, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *G. nothofagi* P. Sandoval-Leiva, J.V. McDonald & Thorn, Chilean Nothofagus forest, lignicolous, saprotrophic, sequence data available, see Sandoval-Leiva et al. 2016 (new genus, gymnopoid fungi, Omphalotaceae, Chile).

Gymnopaxillus E. Horak 1966, Serpulaceae, Boletales, Agaricomycetes, asexual morph unknown, four species, type species *G. morchelliformis* E. Horak, South

America (temperate), Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Truong et al. 2017b (DNA-barcoding).

Gymnopilus P. Karst. 1879, Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 200 species, type species *G. liquiritiae* (Pers.) P. Karst., worldwide, Lee et al. 2008a (compounds), Kirk et al. 2013 (genus accepted), sequence data available, see Guzmán-Dávalos et al. 2008 (phylogeny), Holec et al. 2016 (Europe), new spp. see Guzmán-Dávalos et al. 2009 (phylogeny), Silva-Junior and Wartchow 2015 (Brazil).

Gymnopus (Pers.) Roussel (1806), Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 325 species, type species *G. fusipes* (Bull.) Gray, worldwide, mostly saprotrophic, some species parasitic (*G. fusipes*), some species edible (*G. nubicola* Halling), see Mata and Ovrebo 2009 (Costa Rica, Panama), Antonín and Noordeloos 2010 (Europe, monograph), Thongbai et al. 2013 (antimicrobial and cytotoxic activity), Tkalčec and Mešić 2013 (type studies, new combinations), Kirk et al. 2013 (genus accepted), Gamboa-Trujillo et al. 2014 (using of *G. nubicola* as food), Dutta et al. 2015c (phylogeny, morphology, India), Ványolós et al. 2016 (compounds), sequence data available, see Wilson and Desjardin 2005 (phylogeny), Antonín and Noordeloos 2010 (Europe), Noordeloos and Gates 2012b (key, Europe), Antonín et al. 2013, 2014a (Europe, Korea), new spp. see Antonín and Legon 2008 (England), Mešić et al. 2011 (China), Cooper and Leonard 2013 (New Zealand), Petersen et al. 2014b, c (North America), Coimbra et al. 2015 (Brazil), Vizzini et al. 2015c (Turkey), Deng et al. 2016 (China), Petersen and Hughes 2016 (phylogeny, new section), Desjardin and Perry 2017 (Republic of São Tomé and Príncipe, Africa), Ryoo et al 2016 (Republic of Korea), Terashima et al. 2016 (Japan), César et al. 2018 (Mexico), new combinations see Desjardin and Perry 2017 (West Africa).

Gymnosporangium R. Hedw. ex DC. 1805 (=*Ceratitium* Rabenh. 1851 = *Ceratitium* Ces. 1879, = *Ciglides* Chevall. 1826, = *Gymnotelium* Syd. 1921, = *Podisoma* Link 1809), Pucciniaceae, Pucciniales, Pucciniomycetes, 64 species, type species *G. fuscum* DC. [current name: *G. sabinae* (Dicks.) G. Winter 1884], asexual morph *Roestelia* pro parte, biotrophic on Cupressaceae, Rosaceae (alternate hosts), Hydrangeaceae, Myricaceae, terrestrial, north temperate areas including Asia, Europe, North America, see Kirk et al. 2013 (genus accepted), sequence data available, new spp.

see Yun et al. 2009 (lectotype specimens, molecular analysis, key to species in Korea), Cao et al 2016, 2017a (phylogeny, China), Shen et al. 2018c (phylogeny, China).

Gyrodon Opat. 1836, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, ten species, type species *G. sistotremoides* Opat., widespread, some species edible (*G. lividus* (Bull.) Fr.), see Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Kennedy et al. 2011 (ecology), Osmundson et al. 2013 (DNA barcoding), Roy et al. 2013 (ecology), Wu et al. 2014b (phylogeny).

Gyrodontium Pat. 1900, Coniophoraceae, Boletales, Agaricomycetes, asexual morph unknown, three species, type species *G. henningsii* (Bres.) Pat., widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (phylogeny), Carlier et al. 2004 (phylogeny, Etiopia), Valenzuela et al. 2013b (new records, Mexico).

Gyroflexus Raithelh. 1981, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *G. brevibasidiatus* (Singer) Raithelh., wood-rotting, widespread, sequence data available, see Kirk et al. 2013 (genus accepted), Larsson et al. 2006 (phylogeny, taxonomy).

Gyrophanopsis Jülich 1979, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *G. zealandica* (G. Cunn.) Jülich, corticioid basidioma, wood-rotting, widespread, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Gyroporus Quél. 1886, Gyroporaceae, Boletales, Agaricomycetes, asexual morph unknown, 24 species, type species *G. cyanescens* (Bull.) Quél., poroid, ectomycorrhizal, widespread, some species edible (*G. cyanescens* (Bull.) Quél.), see Dai et al. 2010b (edible mushrooms, China), some medicinal use (*G. castaneus* (Bull.: Fr.) Quél), see Dai and Yang 2008 (medicinal mushrooms, China), Davoodian and Halling 2013 (taxonomy), Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Das et al. 2017b (Indian Himalaya), Davoodian 2018 (monograph, phylogeny).

Haasiella Kotl. & Pouzar 1966, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *H. splendidissima* Kotl. & Pouzar, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Vizzini et al.

2012c (monograph, phylogeny), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae).

Haddowia Steyaert 1972, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *H. longipes* (Lév.) Steyaert, stipitate basidioma, poroid hymenophore, terrestrial or wood-rotting, white rot, widespread (pantropical), see Kirk et al. 2013 (genus accepted), sequence data unavailable, see Costa-Rezende et al. 2017 (phylogeny, systematics).

Haglerozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Trichosporonaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, one species, type species *H. chiarellii* (Pagnocca, Legaspe, A. Rodrigues & Ruivo) A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, insect, Brazil, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Hallenbergia Dhingra & Priyanka 2011, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *H. singularis* Dhingra & Priyanka, basidioma corticioid, Bhutan, sequence data unavailable, see Dhingra 2012b (monograph).

Hallingea Castellano 1996, Gallaceaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, three species, type species *H. purpurea* (Zeller & C.W. Dodge) Castellano, America, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006, 2008 (phylogeny, phylogeography).

Haloaleurodiscus N. Maek., Suhara & K. Kinjo 2005, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *H. mangrovei* N. Maek., Suhara & K. Kinjo, wood-decaying, Asia, sequence data available, see Maekawa et al. 2005 (phylogeny).

Halobasidium Z. Guo, Y.R. Wang, Q.C. Hou, W.C. Li, H.J. Zhao, Z.H. Sun & Z.D. Zhang 2019, Cystobasidiaceae, Cystobasidiales, Cystobasidiomycetes, sexual morph unknown, one species, type species *H. xiangyangense* Z. Guo, Y.R. Wang, Q.C. Hou, W.C. Li, H.J. Zhao, Z.H. Sun & Z.D. Zhang, yeast, salty sause, China, sequence data available, see Guo et al. 2019 (taxonomy).

Halocyphina Kohlm. & E. Kohlm. 1965, Niaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *H. villosa* Kohlm. & E. Kohlm.,

USA, marine, see Kirk et al. 2013 (genus accepted), sequence data available, see Yamaguchi et al. 2009 (phylogeny).

Hamamotoa Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Chrysozymaceae, *incertae sedis*, Microbotryomycetes, sexual morph unknown, four species, type species *H. singularis* (Phaff & Carmo Souza) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, worldwide, yeast, cultures and sequence data available, see Wang et al. 2015e (phylogeny), new spp. see Yurkov et al. 2016.

Hamaspora Körn. 1877 (= *Hamasporella* Höhn. 1912), Phragmidiaceae, Pucciniales, Pucciniomycetes, 15 species, type species *H. longissima* (Thüm.) Körn., biotrophic on *Rubus* (Rosaceae), terrestrial, Africa, Asia, Australasia, see Kirk et al. 2013 (genus accepted), sequence data available, see McTaggart et al. 2016a (phylogeny, evolution).

Hannaella F.Y. Bai & Q.M. Wang 2008, Bulleribasidiaceae, Tremellales, Tremellomycetes, sexual morph unknown, eleven species, type species *H. sinensis* (M.X. Li) F.Y. Bai & Q.M. Wang, worldwide, yeast, cultures and sequence data available, see Wang and Bai 2008 (taxonomy and phylogeny), Liu et al. 2015b (taxonomy and phylogeny).

Hapalophragmium Syd. & P. Syd. 1901, (= *Hapalophragmiopsis* Thirum. 1950; = *Triactella* Syd. 1921), Raveneliaceae, Pucciniales, Pucciniomycetes, 18 species, type species *H. derridis* Syd. & P. Syd., biotrophic on Fabaceae, terrestrial, Africa, Asia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Hapalopilus P. Karst. 1881, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, eleven species, type species *H. nidulans* (Fr.) P. Karst. [current name: *H. rutilans* (Pers.) Murrill], poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), some species poisonous, see Villa et al. 2013 (polyporic acid, report, *H. rutilans*), sequence data available, see Ryvarden and Melo 2014 (new combination, morphology), Miettinen et al. 2016a (new sp., new combinations, phylogeny, morphology).

Haploporus Bondartsev & Singer 1944, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, 13 species, type species *H. odorus* (Sommerf.) Bondartsev & Singer, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), ethnomycological use, see Blanchette

1997 (North America, *H. odorus*), sequence data available, see Shen et al. 2016 (new spp., phylogeny, monograph, China).

Harmajaea Dima, P. Alvarado & Kekki 2018, Pseudoclitocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *H. harperi* (Murrill) Dima & P. Alvarado, North America and North Europe, on thick forest litter, saprotrophic, sequence data available, see Alvarado et al. 2018b (taxonomy).

Harrya Halling, Nuhn & Osmundson 2012, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, six species, type species *H. chromapes* (Frost) Halling, Nuhn, Osmundson & Manfr. Binder, stipitate-pileate, North America, China, sequence data available, see Halling et al. 2012b (monograph), new spp. see Wu et al. 2016f (China).

Hasegawazyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, Erythrobasidiales, Cystobasidiomycetes, sexual morph unknown, one species, type species *H. lactosa* (Hasegawa) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, cultures and sequence data available, see Wang et al. 2015e (taxonomy and phylogeny).

Hastodontia (Parmasto) Hjortstam & Ryvarden 2009, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, two species, type species *H. halonata* (J. Erikss. & Hjortstam) Hjortstam & Ryvarden, wood-rotting, sequence data available, see Hjortstam and Ryvarden 2009c, Riebesehl and Langer 2017 (*Hyphodontia s.l.*, phylogeny), Yurchenko et al. 2017.

Hauerslevia P. Roberts 1998, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *H. pulverulenta* (Hauerslev) P. Roberts, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Hebeloma (Fr.) P. Kumm. 1871, Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 190 species, type species *H. fastibile* (Pers.) P. Kumm., worldwide, poison pie (*H. crustuliniforme* (Bull.) Quél.), see Hall et al. 2003 (poisonous mushrooms), ectomycorrhizal, see Eberhardt et al. 2009 (species associated with Cistus), Kirk et al. 2013 (genus accepted), sequence data available, Eberhardt et al. 2013, 2015a, b, 2016 (Europe, section *Theobromina*, section *Denudata*), Rees et al. 2013 (phylogeny), Grilli et al. 2016 (Europe, sections *Sinapizantia* and *Velutipes*), new spp. see Eberhardt and Beker 2010 (Europe), Beker et al. 2016 (Europe), Moreno et al. 2017a (Europe).

Heimiomyces Singer 1942, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. seven species, type species *H. rheicolor* (Berk.) Singer [current name: *Xeromphalina tenuipes* (Schwein.) A.H. Sm.], sequence data available, see Moncalvo et al. 2002 (phylogeny), Cooper 2014c (new combination).

Heimioporus E. Horak 2004, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, 14 species, type species *H. retisporus* (Pat. & C.F. Baker) E. Horak, stipitate-pileate, sequence data available, phylogeny and new spp. see Halling et al. 2015 (Australia).

Heinemannomyces Watling 1999, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *H. splendidissima* Watling, Peninsular Malaysia, see Kirk et al. 2013 (genus accepted), sequence data available, see Vellinga et al. 2011 (phylogeny), Zhao et al. 2016f (phylogeny).

Helicobasidium Pat. 1885, Helicobasidiaceae, Helicobasidiales, Pucciniomycetes, c. six species, type species *H. purpureum* (Tul.) Pat. 1885, worldwide, pathogenic, see Soni and Verma 2010 (root rot, India), Hong et al. 2011 (violet root rot, Korea), Kirk et al. 2013 (genus accepted), sequence data available, see Lutz et al. 2004 (phylogeny).

Heitmania X.Z. Liu, F.Y. Bai, M. Groenew. & T. Boekhout 2018, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, three species, type species *H. litseae* X.Z. Liu, F.Y. Bai, M. Groenew. & T. Boekhout, three species, yeast, plant material, China, cultures and sequence data available, see Liu et al. 2017f (description, phylogeny).

Helicogloea Pat. 1892, Phleogenaceae, Atractiellales, Atractiellomycetes, asexual morph known, 25 species, type species *H. lagerheimii* Pat., presumable saprobic, on decaying plant remnants, on (decaying) fungi, worldwide, sequence data available, see Bauer et al. 2006 (phylogeny), see Aime et al. 2018c (phylogeny, taxonomy), new spp. see Schoutteten et al. 2018 (Belgium), Spirin et al. 2018c (phylogeny, taxonomy).

Helicomyxa R. Kirschner & Chee J. Chen 2004, Hyaloriaceae, Auriculariales, Agaricomycetes, asexual morph, one species, type species *H. everhartioides* R. Kirschner & Chee J. Chen, China, wood-rotting, sequence data available, see Kirschner and Chen 2004 (taxonomy, phylogeny).

Heliocybe Redhead & Ginns 1985, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexaul morph unknown, one species, type species *H. sulcata* (Berk.)

Redhead & Ginns, brown rot, wood-rotting, sequence data available, see Garcia-Sandoval et al. 2011 (phylogeny, Gloeophyllales, brown rot Agaricomycotina), new spp. see Zhang et al. 2018 (China).

Heliogaster Orihara & K. Iwase 2010, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *H. columellifer* (Kobayasi) Orihara & K. Iwase, sequestrate, ectomycorrhizal, Asia, sequence data available, see Orihara et al. 2010 (taxonomy).

Helvellosebacina Oberw., Garnica & K. Riess 2014, Sebacinaceae, Sebacinales, Agaricomycetes, asexual morph unknown, two species, type species *H. helvelloides* (Schwein.) Oberw., Garnica & K. Riess, worldwide, ectomycorrhizal, sequence data available, see Oberwinkler et al. 2014 (new combination, phylogeny).

Hemigaster Juel 1895, Hemigasteraceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *H. candidus* Juel, Sweden, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Hemileccinum Šutara 2008, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, five species, type species *H. impolitum* (Fr.) Šutara, stipitate-pileate, ectomycorrhizal, Europe, North America, Asia, sequence data available, see Halling et al. 2015 (new combination), Wu et al. 2016f (phylogeny, new combination and new sp., Asia).

Hemileia Berk. & Broome 1869 (=*Hemileiopsis* Racib. 1900, = *Wardia* J.F. Hennen & M.M. Hennen, in Cummins & Hiratsuka 2003 [nom. inval.]), *incertae sedis*, Pucciniales, Pucciniomycetes, asexual morph previously known in *Wardia* J.F. Hennen & M.M. Hennen, c. 55 species, type species *H. vastatrix* Berk. & Broome, biotrophic on Apocynaceae, Lamiaceae, Oleaceae, Phyllanthaceae, Rubiaceae, terrestrial, circumglobal in tropics, especially Africa and Asia, see Mohan 2010 (new species), Kirk et al. 2013 (genus accepted), Judith and Rossman 2014 (new combinations based on one fungus, one name concept), sequence data available, see Carvalho et al. 2011 (genetic diversity, coffee rust).

Hemimycena Singer 1938, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 60 species, type species *H. lactea* (Pers.) Singer, worldwide, see Antonín and Noordeloos 2004 (Europe), Læssøe and Elborne 2012 (key), Malysheva and Morozova 2009 (European Russia, notes), Kirk et al. 2013 (genus accepted),

sequence data available, see Moncalvo et al. 2002 (phylogeny), Walther et al. 2005 (phylogeny), Matheny et al. 2006 (phylogeny), Osmundson et al. 2013 (DNA barcode), new spp. see Niveiro et al. 2014a (Atlantic Forest), Lehmann and Lüderitz 2018 (Germany).

Hemistropharia Jacobsson & E. Larss. 2007, Tubariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *H. albocrenulata* (Peck) Jacobsson & E. Larss., sequence data available, see Jacobsson and Larsson 2007 (phylogeny, taxonomy).

Hennenia Buriticá 1995, *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *H. ditelia* Buriticá, biotrophic on Annonaceae (*Annona*), terrestrial, Colombia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Henningsia Möller 1895, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *H. brasiliensis* (Speg.) Speg., merulioid to poroid hymenophore, wood-rotting, widespread (Neotropical), see Kirk et al. 2013 (genus accepted), sequence data unavailable, new spp. see Gibertoni and Ryvarden 2014 (morphology).

Henningsomyces Kuntze 1898, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. 21 species, type species *H. candidus* (Pers.) Kuntze, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes), Wei and Qin 2009 (cyphelloid fungi, China).

Hericium Pers. 1794, Hericiaceae, Russulales, Agaricomycetes, asexual morph unknown, c. 23 species, type species *H. coralloides* (Scop.) Pers., wood-decaying, worldwide, some species edible (*H. alpestre* Pers.), some species of medicinal use (*H. coralloides* (Scop.: Fr.) Pers.), see Dai and Yang 2008 (medicinal mushrooms, China), Mori et al. 2008b (natural products), Dai et al. 2010b (edible mushrooms, China), Khan et al. 2013 (*H. erinaceus* (Bull.) Pers.), Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003, Park et al. 2004, Miller et al. 2006 (phylogeny), new spp. see Das et al. 2011, 2013b (Sikkim Himalaya, India), Hallenberg et al. 2013 (southern South America).

Herpobasidium Lind 1908, Eocronartiaceae, Platygloeales, Pucciniomycetes, six species, type species *H. filicinum* (Rostr.) Lind, worldwide, sequence data availabnle, see Maier et al. 2003 (phylogeny), Kirk et al. 2013 (genus accepted).

Hermanssonia Zmitr. 2018, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, monotypic, one species, type species *H. centrifuga* (P. Karst.) Zmitr., phlebioid basidioma, wood-rotting, white rot, see Zmitrovich 2018a (taxonomy).

Heteroacanthella Oberw. 1990 (= *Acanthellorhiza* P. Roberts 1999 *fide* Art. 59.1), Hydnaceae, Cantharellales, Agaricomycetes, asexual morph previously known in *Acanthellorhiza* P. Roberts 1999, three species, type species *H. variabilis* Oberw. & Langer, China, USA, British Isles, lichenicolous basidiomycete (*H. ellipsospora*), see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Zamora and Pérez-Ortega 2014 (Spain).

Heterobasidion Bref. 1888, Bondarzewiaceae, Russulales, Agaricomycetes, asexual morph unknown, 15 species, type species *H. annosum* (Fr.) Bref., worldwide, wood-decaying, some species cause root rot, see Vainio et al. 2011 (host diversity), Garbelotto and Gonthier 2013 (pathogenic), Kirk et al. 2013 (genus accepted), sequence data available, see Dalman et al. 2010 (evolutionary history, *H. annosum s. l.*), Olson et al. 2012 (genome), Chen et al. 2015d (monograph), new spp. see Dai and Korhonen 2009 (derived from the *H. insulare* complex), Tokuda et al. 2009 (East Asia), Otrosina and Garbelotto 2010 (North America), Chen et al. 2014 (eastern Himalayas).

Heterocephalacria Berthier 1980, Filobasidiaceae, Filobasidiales, Tremellomycetes, sexual and asexual morph known, eight species, type species *H. solida* Berthier, yeast, mycoparasite, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Heterochaete Pat. 1892, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *H. andina* Pat. & Lagerh., widespread (esp. tropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Sotome et al. 2014 (Asian species, poroid Auriculariales, phylogeny), Bandara et al. 2017 (Thailand, phylogeny).

Heterodoassansia Vánky 1993, Doassansiaceae, Doassansiales, Exobasidiomycetes, eight species, type species *H. morotiana* (Zundel) Vánky, plant parasites (leaves, petioles and stems) on various aquatic or paludal mono- and dicots,

widespread, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Heteromycophaga P. Roberts 1997, *incertae sedis*, *incertae sedis*, Tremellomycetes, sexual morph unknown, two species, type species *H. glandulosae* P. Roberts, Great Britain, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Heteroradulum Lloyd ex Spirin & Malysheva 2017, Auriculariaceae, Auriculariales, Agaricomycetes, asexul morph unknown, seven species, type species *H. kmetii* (Bres.) Spirin & Malysheva, wood-rotting, on dry branches and logs of deciduous trees, sequence data available, see Malysheva and Spirin 2017 (stereoid fungi, Auriculariales, phylogeny).

Heterorepetobasidium Chee J. Chen & Oberw. 2002, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, two species, type species *H. subglobosum* Chee J. Chen & Oberw., China, sequence data unavailable, see Kirk et al. 2008.

Heteroscypha Oberw. & Agerer 1979, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *H. applanata* (P.H.B. Talbot) Oberw. & Agerer, S. Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Heterotextus Lloyd 1922, Dacrymycetaceae, Dacrymycetales, Dacrymycetes, asexual morph unknown, six species, type species *H. flavus* Lloyd, wood-decaying, sequence data available, see Shirouzu et al. 2017 (phylogeny).

Heterotolyposporium Vánky 1997, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, two species, type species *H. lepidospermatis* Vánky, plant parasites (various plant parts) on genera *Lepidosperma* (Cyperaceae) and Juncus (Juncaceae), Southern Africa, Australasia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Nasr et al. 2014a (taxonomy).

Hexagonia Fr. 1835, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, 17 species, type species *H. hirta* (P. Beauv.) Fr., poroid hymenophore, wood-rotting, white rot, widespread (esp. tropical), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), new sp. see Härkönen et al. 2015 (morphology, Zambia).

Hiatulopsis Singer & Grinling 1967, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *H. amara* (Beeli) Singer & Grinling, Brazil, Congo, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Hirticlavula J.H. Petersen & Læssøe 2014, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *H. elegans* J.H. Petersen & Læssøe, Denmark, Norway, clavarioid, sequence data available, see Petersen et al. 2014a (taxonomy).

Hispidaedalea Y.C. Dai & S.H. He 2014, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, one species, type species *H. imponens* (Ces.) Y.C. Dai & S.H. He, wood-decaying, China, sequence data available, see He et al. 2014 (taxonomy, phylogeny).

Hispidocalyptella E. Horak & Desjardin 1994, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *H. australis* E. Horak & Desjardin, saprophytic, Australia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Hobsonia Berk. ex Massee 1891, Phleogenaceae, Atractiellales, Atractiellomycetes, possibly synonym of *Helicogloea*, only known as hyphomecetous asexual morph, sexual morph unknown, two species, type species *H. mirabilis* (Peck) Linder, presumably saprobic, on plant material, wide spread (mainly tropical but recent discoveries in Europe), sequence data available, see Sikaroodi et al. 2001 (phylogeny, lichenicolous fungi), Kirschner 2004 (phylogeny), Aime et al. 2018c (phylogeny).

Hodophilus R. Heim 1958, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 13 species, type species *H. foetens* (W. Phillips) Birkebak & Adamcík, wordwide, sequence data avaialble, new spp., new combination see Birkebak et al. 2016 (Clavariaceae, phylogeny, new genus), Adamčík et al. 2016a, 2017a, b (North America, *Hodophilus* with naphthalene odours, Europe, *H. foetens* complex).

Hoehnelogaster Lohwag 1926, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *H. microsporus* Lohwag, sequence data unavailable, see Kirk et al. 2008.

Hohenbuehelia Schulzer 1866 (= *Nematoctonus* Drechsler 1941), Pleurotaceae, Agaricales, Agaricomycetes, asexual morph was previously known in *Nematoctonus* Drechsler, c. 50 species, type species *H. petaloides* (Bull.) Schulzer, worldwide, some

species edible, mukitake, *H. serotina* (Pers.) Singer [current name *Sarcomyxa serotina* (Pers.) P. Karst.], see Hall et al. 2003 (edible mushrooms), Henrici 2009 (Britain), Kirk et al. 2013 (genus accepted), sequence data available, see Koziak et al. 2007 (phylogeny), new spp. see Liu and Bau 2009 (China).

Holocotylon Lloyd 1906, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *H. brandegeeanum* Lloyd, subtropical America, see Kirk et al. 2013 (genus accepted), sequence data available, see Bates et al. 2009 (phylogeny).

Holtermannia Sacc. & Traverso 1910, Holtermanniaceae, Holtermanniales, Tremellomycetes, sexual and asexual morphs known, eight species, type species *H. pinguis* (Holterm.) Sacc. & Traverso, gelatinous fruiting bodies, yeast, southeast Asia, Brazil, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Wuczkowski et al. 2011 (phylogeny), Kurtzman and Boekhout 2017 (overview).

Holtermanniella Libkind, Wuczk., Turchetti & Boekhout 2011, Holtermanniaceae, Holtermanniales, Tremellomycetes, sexual morph unknown, five species, type species *H. takashimae* Wuczkowski, Passoth, Andersson, Turchetti, Prillinger, Boekhout, yeast, soil, widespread, cultures and sequence data available, see Wuczkowski et al. 2011 (taxonomy), Liu et al. 2015b (phylogeny).

Homophron (Britzelm.) Örstadius & E. Larss. 2015, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *H. spadiceum* (P. Kumm.) Örstadius & E. Larss., in Örstadius, Ryberg & Larsson, worldwide, sequence data available, see Örstadius et al. 2015 (phylogeny, Psathyrellaceae, psathyrelloid species).

Horakiella Castellano & Trappe 1992, Sclerodermataceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *H. clelandii* (Rodway) Castellano & Trappe, Australia, basidiomas sequestrate, see Kirk et al. 2013 (genus accepted), sequence data unavailable, new spp. see Trappe et al. 2010 (Australian outback, African Kalahari).

Hormographiella Guarro & Gené 1992, Psathyrellaceae, Agaricales, Agaricomycetes, sexual morph *Coprinellus* P. Karst. 1879, three species, type species *H. aspergillata* Guarro, Gené & De Vroey, worldwide, some species pathogenic (*H. aspergillata* Guarro, Gené & De Vroey), see Conen et al. 2011 (human pathogen),

Suarez et al. 2011 (human pathogen), sequence data available, see Irinyi et al. 2015 (DNA barcode, human pathogen).

Hormomyces Bonord. 1851, Tremellaceae, Tremellales, Tremellomycetes, sexual morph unknown, six species, type species *H. aurantiacus* Bonord., worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Hornodermoporus Teixeira 1993, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *H. martius* (Berk.) Teixeira, perennial basidioma, poroid hymenophore, wood-rotting, white rot, widespread (pantropical), see Vizzini 2015 (taxonomy), sequence data available, see Zhao and Cui 2013c (phylogeny, *Perenniporia s. l.*), Zhao et al. 2015b (phylogeny, *Abundisporus*).

Hortiboletus Simonini, Vizzini & Gelardi 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, seven species, type species *H. rubellus* (Krombh.) Simonini, Vizzini & Gelardi, stipitate-pileate, ectomycorrhizal, Europe, North America, Asia, sequence data available, see Wu et al. 2016f (phylogeny, new combination and new spp., Asia), new sp. see Das et al. 2016 (Asia).

Hourangia Xue T. Zhu & Zhu L. Yang 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, four species, type species *H. cheoi* (W.F. Chiu) Xue T. Zhu & Zhu L. Yang, China, stipitate-pileate, ectomycorrhizal, Japan, Malaysia, Indonesia, sequence data available, see Wu et al. 2014b (phylogeny), Zhu et al. 2015 (taxonomy, phylogeny).

Humidicutis (Singer) Singer 1959, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, twelve species, type species *H. marginata* (Peck) Singer, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny and Bougher 2006 (phylogeny), Lodge et al. 2014 (phylogeny, taxonomy, Hygrophoraceae), Lavorato et al. 2015 (phylogeny).

Humphreya Steyaert 1972, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *H. lloydii* (Pat. & Har.) Steyaert, stipitate basidioma, poroid hymenophore, terrestrial, white rot, widespread (pantropical), see Kirk et al. 2013 (genus accepted), sequence data unavailable, see Costa-Rezende et al. 2017 (phylogeny, systematics).

Hyalodon Malysheva & Spirin 2018, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, two species, type species *H. piceicola*

(Kühner ex Bourdot) Malysheva & Spirin., East Asia and Europe, wood-rotting, sequence date available, see Malysheva et al. 2018 (taxonomy).

Hyalopsora Magnus 1902, Pucciniastraceae, Pucciniales, Pucciniomycetes, 21 species, type species *H. aspidiotus* (Peck) Magnus, biotrophic on Pinaceae (alternate hosts), Polypodiaceae, terrestrial, see Berndt 2008b (new name), Saba et al. 2012 (new name), sequence data available, see Padamsee and Mckenzie 2014 (phylogeny).

Hyalopycnis Höhn. 1918, Heterogastridiaceae, Heterogastridiales, Microbotryomycetes, asexual morph known, one species, type species *H. pycnidioideum* Oberw. & R. Bauer, mycoparasitic, isolated from other fungi and decaying plant material, distribution north temperate, see Aime et al. 2018b (competing names), sequence data available, see Aime et al. 2006 (phylogeny), Bauer et al. 2006 (phylogeny, simple-septate basidiomycetes), Aime et al. 2014 (phylogeny).

Hyaloria Möller 1895, Hyaloriaceae, Auriculariales, Agaricomycetes, asexual morph unknown, three species, type species *H. pilacre* Möller, wood-decaying, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Weiß and Oberwinkler 2001 (taxonomy and phylogeny).

Hybogaster Singer 1964, Hybogasteraceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *H. giganteus* Singer, terrestrial, Europe, see Kirk et al. 2013 (genus accepted), sequence data unavailable.

Hydnangium Wallr. 1839, Hydnangiaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *H. carneum* Wallr., worldwide, sequence data available, new spp. see Cooper 2014b (New Zealand).

Hydnellum P. Karst. 1879, Bankeraceae, Thelephorales, Agaricomycetes, asexual morph unknown, 39 species, type species *H. suaveolens* (Scop.) P. Karst., worldwide, terrestrial and ectomycorrhizal, see Kirk et al. 2013 (genus accepted), sequence data available, see Baird et al. 2013a (phylogeny).

Hydnochaete Bres. 1896, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *H. badia* Bres., wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Dai and Li 2010 (China), considered as a synonym of *Hymenochaete* Lév in Baltazar et al. 2014b (phylogeny and taxonomy).

Hydnocristella R.H. Petersen 1971, Lentariaceae, Gomphales, Agaricomycetes, asexual morph unknown, two species, type species *H. himantia* (Schwein.) R.H. Petersen, wood-decaying, North Americal, China, see Kirk et al. 2013 (genus accepted), sequence data available, see Jang et al. 2016, new spp. see Chen et al. 2015c (China).

Hydnodon Banker 1913, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, one species, type species *H. thelephorus* (Lév.) Banker, wood-decaying, Europe, sequence data available, see Læssøe et al. 2011 (phylogeny).

Hydnomerulius Jarosch & Besl 2001, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *H. pinastri* (Fr.) Jarosch & Besl, sequence data available, see Binder et al. 2010 (phylogeny), Nuhn et al. 2013 (phylogeny, Boletineae).

Hydnophanerochaete Sheng H. Wu & C.C. Chen 2018, Meruliaceae, Polyporales, Agaricomycetes, one species, type species *H. odontoidea* (Sheng H. Wu) Sheng H. Wu & C.C. Chen, see Chen et al. 2018 (phylogeny, taxonomy).

Hydnophlebia Parmasto 1967, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *H. chrysorhiza* (Torr.) Parmasto, resupinate basidioma, hydnoid hymenophore, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Floudas and Hibbett 2015 (phylogeny, *Phanerochaete*, part of the phlebia clade), Yuan et al. 2017b (phylogeny), new spp. see Telleria et al. 2017 (phylogeny, Macaronesian Islands, monograph).

Hydnopolyporus D.A. Reid 1962, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *H. fimbriatus* (Cooke) D.A. Reid, wood-rotting, white rot, widespread (tropical), edible species (*H. fimbriatus*), see Sanuma et al. 2016 (edible mushrooms, Brazil), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Sjökvist et al. 2012 (phylogeny, stipitate stereoid fungi).

Hydnum L. 1753, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, 49 species, type species *H. repandum* L., ectomycorrhizal, widespread, some species edible (*H. repandum* L.), see Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Feng et al. 2016 (phylogeny), Pérez-Izquierdo et al. 2017 (phylogenetic marker), new spp. see Olariaga et al. 2012

(Iberian Peninsula), Vizzini et al. 2013c (Italy), Yanaga et al. 2015 (Japan), Buyck et al. 2017 (USA), Niskanen et al. 2018 (North America, Europe), Wang et al. 2018e (India).

Hydrophana V. Malysheva & Spirin 2019, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *H. sphaerospora* (Bourdot & Galzin) V. Malysheva & Spirin, Europe (Denmark, France, Norway), saprobic, on fallen logs and twigs of deciduous trees in moist places, sequence data available, see Spirin et al. 2019b (taxonomy, phylogeny).

Hydropus Kühner ex Singer 1948, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 100 species, type species *H. fuliginarius* (Batsch) Singer, worldwide, saprophytic, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006 (phylogeny), Osmundson et al. 2013 (DNA barcode), see Kluthe et al. 2016 (Kenya), Antonín et al. 2019 (phylogeny), new spp. see Gminder 2013 (Germany), Pinheiro et al. 2013 (Brazil)

Hygroaster Singer 1955, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *H. nodulisporus* (Dennis) Singer, tropical America, see Kirk et al. 2013 (genus accepted), sequence data available, see Lodge et al. 2014 (phylogeny, taxonomy, Hygrophoraceae), new spp. see Vrinda et al. 2012 (India).

Hygrocybe (Fr.) P. Kumm. 1871, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 120 species, type species *H. conica* (Schaeff.) P. Kumm., two subgenera, *Hygrocybe* (Fr.) P. Kumm. and *Pseudohygrocybe* Bon, seven sections, worldwide, ectomycorrhizal, waxcap, Vrinda et al. 2009 (India), Ronikier and Borgen 2010 (Poland), Halbwachs et al. 2013 (habitats), Kirk et al. 2013 (genus accepted), sequence data available, see Babos et al. 2011 (phylogeny, taxonomy), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae), new spp. see Læssøe and Boertmann 2008 (Ecuador), Senthilarasu et al. 2010b (India), Wang et al. 2013a, 2015a (China), Vizzini et al. 2015b (Brazil).

Hygrophorocybe Vizzini & Contu 2014, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *H. nivea* (Velen.) Vizzini & Contu, on litter, usually in conifer woods, sequence data unavailable, see Vizzini and Contu 2014.

Hygrophoropsis (J. Schröt.) Maire ex Martin-Sans 1929, Hygrophoropsidaceae, Boletales, Agaricomycetes, asexual morph unknown, 16 species, type species *H.*

aurantiaca (Wulfen) Maire, widespread, some species edible (*H. aurantiaca* (Wulfen) Maire), see Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Holec and Kolařík 2013 (Czech Republic, phylogeny), Garnica et al. 2016 (phylogeny), Větrovský et al. 2016 (ecology), Truong et al. 2017b (diversity).

Hygrophorus Fr. 1836, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 200 species, type species *H. eburneus* (Bull.: Fr.) Fr., three subgenera: *Hygrophorus* [autonym] 1849, *Colorati* (Bataille) E. Larss. 2014, *Camarophylli* Fr. 1849 emend. 2014, nine sections, ectomycorrhizal, worldwide, some species edible (*H. eburneus* (Bull.) Fr.), see Hall et al. 2003 (edible mushrooms), Ouzouni et al. 2009 (compounds), Dai et al. 2010b (Chinese edible mushrooms), Dentinger et al. 2011 (DNA barcode), Kirk et al. 2013 (genus accepted), Zhu et al. 2013 (compounds), sequence data available, see Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae), new spp. see Larsson et al. 2014a (Finland), Endo et al. 2018 (Japan), Huang et al. 2018 (China), Larsson et al. 2018b (North Europe, phylogeny, new species), Pierre-Arthur et al. 2018 (Europe, North America, phylogeny, new sp.), Sesli et al. 2018a (Turkey).

Hymenagaricus Heinem. 1981, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, 20 species, type species *H. hymenopileus* (Heinem.) Heinem., tropical worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006 (phylogeny), Zhao et al. 2010 (phylogeny), new spp. see Ge et al. 2008a (China), Mwanga and Tibuhwa 2014 (Tanzania).

Hymenoboletus Y.C. Li & Zhu L. Yang 2016, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *H. luteopurpureus* Y.C. Li & Zhu L. Yang, stipitate-pileate, China, sequence data available, see Wu et al. 2016f (monograph, boletes).

Hymenochaete Lév. 1846, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 149 species, type species *H. rubiginosa* (Dicks.) Lév., basidioma resupinate, pileate or stipitate, hymenophore smooth, rugose, raduloide to hydnoide, wood-rotting, white rot, see Kirk et al. 2013 (genus accepted), sequence data available, see He and Dai 2012 (taxonomy, phylogeny, China, Hymenochaetaceae), Parmasto 2013, Parmasto et al. 2014 (phylogeny), new spp. see He

and Li 2011 (China), Gomes-Silva et al. 2012a (new combination, key, Amazonia and the Atlantic Forest, Brazil), Pan and Zhou 2016 (Thailand), He et al. 2017b (China), Nie et al. 2017 (on bamboos, east Asia), new spp. Contreras-Pacheco et al. 2018 (morphology, Mexico).

Hymenochaetopsis S.H. He & Jiao Yang 2016 (=*Pseudochaete* T. Wagner & M. Fisch. 2002), Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 16 species, type species *H. tabacina* (Sowerby) S.H. He & Jiao Yang, be proposed to replace *Pseudochaete*, wood-rotting, white rot, sequence data available, see He and Li 2013b (new spp., China, as *Pseudochaete*), Yang et al. 2016b (phylogeny, new spp., China).

Hymenogaster Vittad. 1831, Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 170 species, type species *H. citrinus* Vittad., false truffles, ectomycorrhizal, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Stielow et al. 2011 (monograph).

Hymenogloea Pat. 1900, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *H. riofrioi* (Pat.) Pat., saprophytic, tropical America, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny). Recognized as a synonym of *Marasmius* (Desjardin unpubl. data)

Hymenogramme Mont. & Berk. 1844, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *H. javensis* Mont. & Berk., resupinate basidioma, hymenophore consisting of long anastomosing sterile ridges, wood-rotting, Southeast Asia, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Justo et al. 2017 (phylogeny, Polyporales).

Hymenopellis R.H. Petersen 2010, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *H. radicata* (Relhan) R.H. Petersen, worldwide, sequence data available, see Petersen and Hughes 2010 (taxonomy).

Hymenoporus Tkalčec, Mešić & Chun Y. Deng 2015, Omphalotaceae, Agaricales, Agaricomycetes, aseuxal morph unknown, one species, type species *H. paradoxus* Tkalčec, Mešić & Chun Y. Deng, saprobic, poroid hymenophore adnate to a free collarium, China, sequence data available, see Tkalčec et al. 2015 (monograph).

Hyphoderma Wallr. 1833, Hyphodermataceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 20 species (genus shown to be polyphyletic, see Justo et al. 2017), type species *H. setigerum* (Fr.) Donk, basidioma corticioid, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2013 (phylogeny, Polyporales), new spp. see Dhingra et al. 2009 (morphology, India), Hjortstam et al. 2009 (morphology, corticioid fungi, Kimberley region, Western Australia), Singh et al. 2010b (morphology, India), Dhingra 2012a (morphology, India), Tellería et al. 2012a (new combination, phylogeny, Canary Island), Yurchenko and Wu 2014b, c (morphology, China), Kaur et al. 2015c (morphology, India), new combinations see Nakasone 2008 (type study, *H. crustulinum*), Baltazar et al. 2016 (type study, *H. cinereoalbum*, *H. molliusculum*).

Hyphodermella J. Erikss. & Ryvarden 1976, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *H. corrugata* (Fr.) J. Erikss. & Ryvarden, worldwide, white-rot corticioid fungus, see Kirk et al. 2013 (genus accepted), sequence data available, see Telleria et al. 2010a (morphology, phylogeny, Western Mediterranean area), new spp. see Duhem and Buyck 2011d (morphology, France), Zhao et al. 2017a (phyogeny, China).

Hyphodontia J. Erikss. 1958, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 86 species, type species *H. pallidula* (Bres.) J. Erikss., wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), Yurchenko and Wu 2016 (key), sequence data available, new spp. see Yurchenko and Wu 2014a (China), Riebesehl et al. 2015 (La Réunion), Chen et al. 2016d, 2017a (China), Wang and Chen 2017 (China).

Hyphodontiastra Hjortstam 1999, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *H. virgicola* Hjortstam & Melo, corticioid basidioma, wood-rotting, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Hyphodontiella Å. Strid 1975, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *H. multiseptata* A. Strid, Nordic, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson 2007b (phylogeny).

Hypholoma (Fr.) P. Kumm. 1871, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 45 species, type species *H. fasciculare* (Huds.) P. Kumm.,

saprotroph, worldwide, see Cortez and Silveira 2007 (Brazil), Antonín et al. 2009 (central Europa, new sp.), Kirk et al. 2013 (genus accepted), sequence data available, see Ramírez-Cruz et al. 2013 (phylogeny), Matheny et al. 2015 (phylogeny).

Hyphoradulum Pouzar 1987, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *H. conspicuum* Pouzar [current name *Pseudolagarobasidium conspicuum* (Pouzar) Nakasone], Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Hypochnella J. Schröt. 1888, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, two species, type species *H. violacea* Auersw. ex J. Schröt., Europe, see Kirk et al. 2013 (genus accepted), sequence data unavailable, new spp. see Coelho et al. 2010 (Brazil and Argentina).

Hypochniciellum Hjortstam & Ryvarden 1980, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, one species, type species *H. ovoideum* (Jülich) Hjortstam & Ryvarden, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (phylogeny).

Hypochnicium J. Erikss. 1958, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, c. 30 species (needs revision since genus shown to be polyphyletic, see Justo et al. 2017), type species *H. bombycinum* (Sommerf.) J. Erikss., corticioid basidioma, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), new spp. see Tellería et al. 2010b (re-evaluation, phylogeny, Bioko, Spain), Crous et al. 2013 (phylogeny, Chile), Gorjón and Hallenberg 2013 (morphology, Chile), Jang et al. 2013b (phylogeny, East Asia), Adamčík et al. 2015 (phylogeny, China), new combinations see Gorjón and Greslebin 2012 (type study, morphology, New Zealand).

Hypsizygus Singer 1947, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *H. tessulatus* (Bull.) Singer, worldwide, some species edible, shimeji (*H. marmoreus* (Peck) H. E. Bigelow), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), some medical use, Bunashimeji (*H. marmoreus* (Peck) H.E. Bigelow), see Mori et al. 2008a (medical study), Kirk et al. 2013 (genus accepted), sequence data available, see Wang et al. 2009 (species genetic study), Qiu et al. 2014 (species genetic study), Hofstetter et al. 2014 (phylogeny, Lyophyllaceae), Bellanger et al. 2015 (phylogeny).

Hysterangium Vittad. 1831, Hysterangiaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, c. 54 species, type species *H. clathroides* Vittad., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available see Hosaka et al. 2008 (biogeography), Brock et al. 2009 (DNA barcoding), Giachini et al. 2010 (phylogeny), Osmundson et al. 2013 (DNA barcoding), Smith et al. 2013 (phylogeny), new spp. see Guevara-Guerrero et al. 2008 (Mexico), Elliott et al. 2015 (Australia), Voglmayr and Clémencon 2016 (North America and Europe).

Ileodictyon Tul. & C. Tul. 1844, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, two species, type species *I. cibarium* Tul. & C. Tul, terrestrial, widespread (esp. southern hemisphere), see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny, gomphoid-phalloid fungi), Giachini et al. 2010 (phylogeny Gomphales).

Imleria Vizzini 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, five species, type species *I. badia* (Fr.) Vizzini, stipitate-pileate, ectomycorrhizal, Europe, North America, Asia, *I. badia* widely consumed, see Boa 2004, Bessette et al. 2017 (Eastern North America), sequence data available, see Nuhn et al. 2013, Wu et al. 2014b, 2016f (phylogeny), new spp. and combinations see Zhu et al. 2014 (Asia).

Imperator G. Koller, Assyov, Bellanger, Bertéa, Loizides, G. Marques, P.-A. Moreau, J.A. Muñoz, Oppicelli, Puddu & F. Richard 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, three species, type species *I. torosus* (Fr.) Assyov, Bellanger, Bertéa, Courtec., G. Koller, Loizides, G. Marques, J.A. Muñoz, N. Oppicelli, D. Puddu, F. Rich. & P.-A. Moreau, sequence data avaiblable, see Assyov et al. 2015 (taxonomy).

Incrustocalyptella Agerer 1983, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *I. columbiana* Agerer, Colombia, Papua New Guinea, Hawaiian, USA, Thailand, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Incrustoporia Domański 1963, Incrustoporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *I. stellae* (Pilát) Domański, the generic limit of *Incrustoporia* is not currently settled, poroid hymenophore, wood-

rotting, sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), new combinations see Zmitrovich 2018a (taxonomy).

Indoporus A. Parihar, K. Das, Hembrom & Vizzini 2018, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *I. shoreae* A. Parihar, K. Das, Hembrom & Vizzini, epigeous, ectomycorrhizal with dipterocarps, tropical India, sequence data available, see Parihar et al. 2018b (taxonomy).

Inflatostereum D.A. Reid 1965, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *I. glabrum* (Pat.) D.A. Reid, stipitate stereoid basidioma, smooth hymenophore, wood-rotting, widespread (America, Asia), sequence data unavailable, see Sjökvist et al. 2012 (phylogeny, stipitate stereoid fungi), Kirk et al. 2013 (genus accepted).

Infundibulicybe Harmaja 2003, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, 22 species, type species *I. geotropa* (Bull.) Harmaja, worldwide, some species edible (*I. gibba* (Pers.) Kumm and *I. catinus* (Fr.) Harmaja), see Dai et al. 2010b (Chinese edible mushrooms), sequence data available, new spp. see Vizzini et al. 2011d (Italy), Zhao et al. 2016e (China).

Ingoldiella D.E. Shaw 1972, Hydnaceae, Cantharellales, Agaricomycetes, sexual morph *Sistotrema* Fr. 1821, three species, type species *I. hamata* D.E. Shaw, Australia, some species with antibacterial activity (*I. hamata*), see Sridhar 2012, sequence data unavailable.

Ingoldiomyces Vánky 1996, Tilletiaceae, Tilletiales, Exobasidiomycetes, one species, type species *I. hyalosporus* (Massee) Vánky, plant parasite (leaves) on genera *Nassella*, *Piptochaetium* and *Stipa* (Poaceae), South America, North America, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Inocutis Fiasson & Niemelä 1984, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, nine species, type species *I. rheades* (Pers.) Fiasson & Niemelä, basidioma pielate, hymenophore poroid, wood-rotting, white rot, worldwide, see Ghobad-Nejhad and Kotiranta 2008 (Iran, key), Kirk et al. 2013 (genus accepted), sequence data available, see Brazee 2015 (Northen North America), new spp. see Valenzuela et al. 2013a (México).

Inocybe (Fr.) Fr. 1863, Inocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 1000 species, type species *I. relicina* (Fr.) Quél., ectomycorrhizal, worldwide, see Zhao et al. 2009 (toxic compounds), Lurie et al. 2009 (poisoning case overview), Kirk et al. 2013 (genus accepted), sequence data available, see Ryberg et al. 2008 (DNA barcoding, phylogeny), Larsson et al. 2009b (monograph, section *Rimosae*), Matheny et al. 2009 (biogeography), Cripps et al. 2010 (Rocky Mountains, subgenus *Mallocybe*), Ferrari 2010 (Europe, monograph, morphology, new sp.), Matheny and Bougher 2010 (Australia, type study), Petersen et al. 2010 (Crepidotaceae, phylogeny, taxonomy), Ryberg et al. 2010 (Inocybaceae, evolution, morphology, ecology), Ferrari et al. 2014 (Europe, monograph, morphology, new sp.), Larsson et al. 2014b (phylogeny, morphology, new combination, epitype designation), Horak et al. 2015 (Thailand, Malaysia, monograph), Latha and Manimohan 2017 (India), Ludwig 2017 (Europe, monograph, new spp.), Matheny and Bougher 2017, 2018 (monograph, Australia, new spp., keys), Horak 2018 (monograph, New Zealand, new spp.), new spp. see Marchetti and Franchi 2008 (Italy), Esteve-Raventós and Moreno 2009 (Spain), Jacobsson and Larsson 2009 (Fennoscandia), Kobayashi 2009 (Japan), Kropp and Albee-Scott 2010 (Samoan Archipelago), Kropp et al. 2009 (North America, phylogeny), Kobayashi and Onishi 2010 (Japan), Esteve-Raventós et al. 2011 (Europe), Bidaud et al. 2012 (France), Bougher et al. 2012 (Australia), Kokkonen and Vauras 2012 (phylogeny, Finland), Vauras and Larsson 2012 (Finland, Sweden), Braaten et al. 2013 (Australia, USA), Corriol and Guinberteau 2013 (France), Fan and Bau 2013 (China), Kropp et al. 2013 (USA), Matheny et al. 2013 (USA), Crous et al. 2014a (Spain), Esteve-Raventós 2014 (Spain), Fan and Bau 2014a, b (China), Wartchow et al. 2014 (Brazil), Ariyawansa et al. 2015 (Fennoscandia), Esteve-Raventós et al. 2015 (Southern Europe), Latha and Manimohan 2015 (India), Bizio et al. 2016 (Croatia), Esteve-Raventós et al. 2016 (Spain), Franchi et al. 2016a, b (Italy), Jabeen et al. 2016 (Pakistan), Latha and Manimohan 2016a, b (India), Pradeep et al. 2016b (India), Vauras and Larsson 2016b (Fennoscandia, Estonia), Vauras and Larsson 2016a (Fennoscandia), Bandini et al. 2017 (Germany), Carteret and Reumaux 2017 (France), Crous et al. 2017a (Spain), Farooqi et al. 2017 (Pakistan), La Rosa et al. 2017 (Italy), Larsson et al. 2017, 2018a (Europe), Tibpromma et al. 2017 (India), Bandini et al. 2018 (Europe), Bau and Fan 2018 (China), Bizio and Castellan 2018 (Italy), Esteve-Raventós et al. 2018 (Europe, phylogeny, new

spp.), Matheny and Swenie 2018 (North America, phylogeny, new spp.), Naseer et al. 2018 (Pakistan), Ullah et al. 2018 (Pakistan), Wartchow and Sá 2018 (Brazil).

Inonotopsis Parmasto 1973, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *I. subiculosa* (Peck) Parmasto, wood-rotting, widespread, sequence data available, see Dai 2010b (phylogeny, Hymenochaetaceae, China).

Inonotus P. Karst. 1879, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, c. 120 species, type species *I. hispidus* (Bull.) P. Karst., wood-rotting, widespread, some species can be medicinal use, Chaga mushroom (*I. obliquus*), see Youn et al. 2008, Chen et al. 2010 (anti-tumor activities), Balandaykin and Zmitrovich 2015 (medicinal properties), key see Ghobad-Nejhad and Kotiranta 2008 (Iran), Kirk et al. 2013 (genus accepted), sequence data available, see Tian et al. 2013 (*I. linteus* complex), Zhou et al. 2016e (*I. linteus* complex), new spp. see Baltazar and Gibertoni 2010 (new combination), Cui et al. 2011c (China), Ginns 2011b (North American), Abrahão and Gugliotta 2012 (Brazil), Zhou and Qin 2012a (China), Valenzuela et al. 2013a (morphology, Mexico), Tian et al. 2013 (China), Gomes-Silva et al. 2013 (Brazil), Zhou and Wang 2015 (China), Bian et al. 2016c (China).

Insolibasidium Oberw. & Bandoni 1984, Platygloeaceae, Platygloeales, Pucciniomycetes, one species, North America, Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2007b (DNA sequences).

Intextomyces J. Erikss. & Ryvarden 1976, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, four species, type species *I. contiguus* (P. Karst.) J. Erikss. & Ryvarden, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Intrapes J.F. Hennen & Figueiredo 1979, *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *I. paliformis* J.F. Hennen & Figueiredo, biotrophic on Chrysobalanaceae (*Couepia*), terrestrial, Brazil, sequence data unavailable, see Cummins and Hiratsuka 2003 (question whether or not it is a rust), Kirk et al. 2013 (genus accepted).

Ionosporus O. Khmelnitsky 2019, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *I. longipes* (Massee) O. Khmelnitsky, Davoodian, Raspé, S. Lee & Halling, stipitate-pileate, ectomycorrhizal with

Dipterocarpaceae and Myrtaceae, Malaysia, Singapore, Australia, DNA sequence data available, see Khmelnitsky et al. 2019 (phylogeny, taxonomy).

Irpex Fr. 1825, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. ten species, type species *I. lacteus* (Fr.) Fr., wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), biotechnological application, see Novotný et al. 2000, 2009 (review, biodegradation, *I. lacteus*), García-Torreiro et al. 2016 (bioethanol production, *I. lacteus*), sequence data available, see Miettinen et al. 2016a (phylogeny, Phanerochaetaceae), Yao et al. 2017 (genome, *I. lacteus*, China), new sp. see Lee et al. 2008b (morphology, South Korea).

Irpiciporus Murrill 1905, Cerrenaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *I. mollis* (Berk. & M.A. Curtis) Murrill [current name: *I. pachyodon* (Pers.) Kotl. & Pouzar], irpicoid basidioma, wood-rotting, white rot, widespread, Zmitrovich 2018a (taxonomy), sequence data available, see Floudas and Hibbett 2015 (phylogeny, *Phanerochaete*).

Irpicochaete Rick 1940, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *I. nodulosa* Rick, irpicoid basidioma, wood-rotting, Brazil, sequence data unavailable, see Kirk et al. 2008.

Irpicodon Pouzar 1966, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, one species, type species *I. pendulus* (Alb. & Schwein.) Pouzar, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Niemelä et al. 2007 (phylogeny).

Ischnoderma P. Karst. 1879, Ischodermataceae, Polyporales, Agaricomycetes, asexual morph unknown, ten species, type species *I. resinosum* (Schrad.) P. Karst., poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales).

Itajahya Möller 1895, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, four species, type species *I. galericulata* Möller, worldwide (tropical, subtropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Cabral et al. 2012 (reassessed), Marincowitz et al. 2015 (phylogeny).

Itersonilia Derx 1948, Mrakiaceae, Cystofilobasidiales, Tremellomycetes, sexual reproduction not observed, dikaryotic hyphae occasionally produced, asexual morphs, three species, type species *I. perplexans* Derx, plant parasite, yeast, widespread, see

Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny), Kachalkin et al. 2019 (new spp.).

Jaapia Bres. 1911, Jaapiaceae, Jaapiales, Agaricomycetes, asexual morph unknown, two species, type species *J. argillacea* Bres., wood-saprobic, basidiomas corticioid, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (phylogeny, new orders), Telleria et al. 2015 (monograph).

Jaculispora H.J. Huds. & Ingold 1960, Classiculaceae, Classiculales, Classiculomycetes, sexual morph unknown, one species, type species *J. submersa* H.J. Huds. & Ingold, presumably mycoparasitic, in aquatic habitats, Jamaica, sequence data available, see Aime et al. 2006 (phylogeny), Bauer et al. 2006 (phylogeny, simple-septate basidiomycetes), Aime et al. 2014 (phylogeny).

Jahnoporus Nuss 1980, Daryobolaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type specie *J. hirtus* (Cooke) Nuss, on soil, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Spirin et al. 2015c (phylogeny, new spp.).

Jamesdicksonia Thirum., Pavgi & Payak 1961, Georgefischeriaceae, Georgefischeriales, Exobasidiomycetes, 20 species, type species *J. obesa* (Syd. & P. Syd.) Thirum., Pavgi & Payak, plant parasites (leaves, stems) on Cyperaceae and Poaceae, widespread, saprobic yeast states on plants, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Bauer et al. 2001b, Begerow et al. 2014 (taxonomy).

Jaminaea Sipiczki & Kajdacsi ex T. Kij. & Aime 2017, *incertae sedis*, Microstromatales, Exobasidiomycetes, four species, type species *J. angkorensis* Sipiczki & Kajdacsi ex Kijporn. & Aime, known only from saprobic states, plant material, widespread, cultures available, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (phylogenetic classification of yeasts, Ustilaginomycotina), Kijpornyongpan and Aime 2017 (validation), new spp. see Nasr et al. 2017 (Iran).

Janauaria Singer 1986, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *J. amazonica* Singer, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Japonogaster Kobayasi 1989, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *J. oohashianus* Kobayasi, Japan, a

monstrosity of *Lycoperdon*, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Jianyunia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, Agaricostilbales, Agaricostilbomycetes, sexual morph unknown, one species, type species *J. sakaguchii* (Sugita, M. Takash., Hamam. & Nakase) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, plant material, Japan, cultures and sequence data available, see Wang et al. 2015e (taxonomy and phylogeny).

Jimtrappea T.W. Henkel & M.E. Sm. & Aime 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *C. guyanensis* T.W. Henkel, M.E. Sm. & Aime, sequestrate, ectomycorrhizal, South America, sequence data available, see Smith et al. 2015 (phylogeny, taxonomy).

Joerstadia Gjaerum & Cummins 1982, Phragmidiaceae, Pucciniales, Pucciniomycetes, four species, type species *J. alchemillae* (Bacc.) Gjaerum & Cummins, asexual morph unknown, biotrophic on *Alchemilla* (Rosaceae), terrestrial, East Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Jola Möller 1895, Eocronartiaceae, Platygloeales, Pucciniomycetes, one species, type species *J. hookeriarum* Möller, worldwide, sequence data available, see Henk and Vilgalys 2007 (phylogeny), Kirk et al. 2013 (genus accepted).

Johncouchia S. Hughes & Cavalc. 1983, Septobasidiaceae, Septobasidiales, Pucciniomycetes, one species, type species *J. mangiferae* (Bat.) S. Hughes & Cavalc., worldwide, see Kirk et al. 2013 (genus accepted).

Junghuhnia Corda 1842, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 35 species, type species *J. crustacea* (Jungh.) Ryvarden, poroid hymenophore, wood-rotting, white rot, cosmopolitan, see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen et al. 2012 (phylogeny), new spp. see Yuan and Dai 2008b,c (morphology, China), Ryvarden and Iturriaga 2010 (morphology, Venezuela), Yuan 2011 (morphology, tropical China), Yuan and Dai 2012 (morphology, China), Yuan et al. 2012 (morphology, China), Ryvarden 2018a (morphology, Tanzania), new combinations, see Ryvarden 2014 (morphology, tropical America), Ryvarden 2015d (morphology).

Kalmanozyma Q.M. Wang, F.Y. Bai, Begerow & Boekhout 2015, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, three species, type species *K. brasiliensis* (J.V.C.

Oliveira, T.A. Borges, R.A.C. Santos, L.F.D. Freitas, C.A. Rosa, G.H. Goldman & D.M. Riano-Pachon) Q.M. Wang, F.Y. Bai, Begerow & Boekhout, known only from saprobic states, widespread, cultures available, sequence data available, see Wang et al. 2015c (taxonomy, phylogeny).

Kauffmania Örstadius & E. Larss. 2015, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *K. larga* (Kauffman) Örstadius & E. Larss., Denmark, Finland, Germany, Iceland, Norway, Sweden, North America, sequence data available, see Örstadius et al. 2015 (taxonomy).

Kavinia Pilát 1938, Lentariaceae, Gomphales, Agaricomycetes, asexual morph unknown, four species, type species *K. sajanensis* (Pilát) Pilát, wood-decaying, southern India, Reunion Island in the pacific, Marie Galante Island in the Caribe, America, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogenetic), new spp. see Robledo and Urcelay 2017 (South America).

Kernella Thirum. 1949 (=*Kernia* Thirum. 1946), Pucciniaceae, Pucciniales, Pucciniomycetes, one species (& one variety), type species *K. lauricola* (Thirum.) Thirum., biotrophic on Lauraceae, terrestrial, China, India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Kernkampella Rajendren 1970, Raveneliaceae, Pucciniales, Pucciniomycetes, eight species, type species *K. breyniae-patentis* (Mundk. & Thirum.) Rajendren, biotrophic on Euphorbiaceae, terrestrial, Costa Rica, Nigeria, China, India, Japan, sequence data available, see McTaggart et al. 2015 (phylogeny).

Kimuromyces Dianese, L.T.P. Santos, R.B. Medeiros & Furlan. 1995, Uropyxidaceae, Pucciniales, Pucciniomycetes, one species, type species *K. cerradensis* Dianese, L.T.P. Santos, R.B. Medeiros & Furlan., asexual morph *Calidion*-type, biotrophic on *Astronium* (Anacardiaceae), terrestrial, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Kjeldsenia W. Colgan, Castellano & Bougher 1995, Claustulaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *K. aureispora* W. Colgan, Castellano & Bougher, terrestrial, America, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny gomphoid-phalloid fungi).

Kobayasia S. Imai & A. Kawam. 1958, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *K. nipponica* (Kobayasi) S. Imai & A. Kawam, terrestrial, Japan, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny, gomphoid-phalloid fungi).

Kockovaella Nakase, I. Banno & Y. Yamada 1991, Cuniculitremaceae, Tremellales, Tremellomycetes, sexual morph unknown, 19 species, type species *K. thailandica* Nakase, I. Banno & Y. Yamada, yeast, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Kombocles Castellano, T.W. Henkel & Dentinger 2016, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *K. bakaiana* Castellano, T.W. Henkel & Dentinger, sequestrate, ectomycorrhizal, Africa, sequence data available, see Castellano et al. 2016 (taxonomy).

Kondoa Y. Yamada, Nakagawa & I. Banno 1989, Kondoacea, Agaricostilbales, Agaricostilbomycetes, sexual and asexual morphs known, ten species, type species *K. malvinella* (Fell & I.L. Hunter) Y. Yamada, Nakagawa & I. Banno, yeast, plant material, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Wang et al. 2015d, e (taxonomy and phylogeny), new spp. see Liu et al. 2018d, Fotedar et al. 2019a.

Kordyana Racib. 1900, Brachybasidiaceae, Exobasidiales, Exobasidiomycetes, eight species, type species *K. tradescantiae* (Pat.) Racib., plant parasites (leaves) on Commelinaceae, Southeast Asia, South America, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2002, 2014, Wang et al. 2015c (phylogenetic classification of yeasts, Pucciniomycotina).

Korupella Hjortstam & P. Roberts 2000, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *K. denticulata* P. Roberts & Hjortstam, Cameroon, sequence data unavailable, see Kirk et al. 2008.

Krasilnikovozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Mrakiaceae, Cystofilobasidiales, Tremellomycetes, sexual and asexual morphs known, three species, type species *K. huempii* (C. Ramírez & A. E. González) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy, phylogney), Kachalkin et al. 2019 (new spp.).

Kriegeria Bres. 1891 (= *Xenogloea* Syd. & P. Syd. 1919, = *Zymoxenogloea* D.J. McLaughlin & Doublés 1992), Kriegeriaceae, Kriegeriales, Microbotryomycetes, sexual and asexual morphs known, one species, type species *K. eriophori* Bres., yeast, plant parasite (Cyperaceae), worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Toome et al. 2013, Wang et al. 2015e (taxonomy and phylogeny).

Krieglsteinera Pouzar 1987, Heterogastridiaceae, Heterogastridiales, Microbotryomycetes, one species, type species *K. lasiosphaeriae* Pouzar, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Kryptastrina Oberw. 1990, *incertae sedis*, *incertae sedis*, Pucciniomycotina, asexual morph unknown, one species, type species *K. inclusa* Oberw., Colombia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Kuehneola Magnus 1898 (= *Spirechina* Arthur 1907), Phragmidiaceae, Pucciniales, Pucciniomycetes, 22 species, type species *K. albida* (J.G. Kühn) Magnus, asexual morph, biotrophic on Anacardiaceae, Celastraceae, Malvaceae, Rosaceae, Verbenaceae, Vitaceae, terrestrial, widespread, new spp. see Ono 2013a, 2015a.

Kuntzeomyces Henn. ex Sacc. & P. Syd. 1899, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, two species, type species *K. ustilaginoideus* (Henn.) Sacc., parasite (flowers) on *Rhynchospora* spp. (Cyperaceae), South America, cultures unavailable, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Begerow et al. 2014 (taxonomy).

Kurtia Karasiński 2014, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, three species, type species *K. argillacea* (Bres.) Karasiński, ericoid mycorrhizal fungus, temperate, boreal forests of Europe, Asia and Northern America, sequence data available, see Kolařík and Vohník 2018 (phylogeny, monograph).

Kurtzmanomyces Y. Yamada, Itoh, H. Kawas., I. Banno & Nakase 1989, Chionosphaeraceae, Agaricostilbales, Agaricostilbomycetes, sexual morph unknown, four species, type species *K. nectairei* (Rodr. Mir.) Y. Yamada, Itoh, H. Kawas., I. Banno & Nakase, yeast, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Wang et al. 2015d, e (taxonomy and phylogeny).

Kusaghiporia J. Hussein, S. Tibell & Tibuhwa 2018, Laetiporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *K. usambarensis* J. Hussein, S. Tibell & Tibuhwa, wood-rotting, brown rot, Tanzania, sequence data available, see Hussein et al. 2018 (phylogeny, taxonomy).

Kweilingia Teng 1940 (= *Dasturella* Mundk. & Khesw. 1943, *Tunicopsora* Suj. Singh & P.C. Pandey 1971), Phakopsoraceae, Pucciniales, Pucciniomycetes, four species, type species *K. bambusae* (Teng) Teng, asexual morph, biotrophic on Poaceae, Costaceae, terrestrial, circumglobal in tropics, sequence data available, see Aime et al. 2018a (evolution, phylogeny).

Kwoniella Statzell-Tallman & Fell 2008, Cryptococcaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, 14 species, type species *K. mangroviensis* Statzell-Tallman, Belloch & Fell, yeast, plant material, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (emendation, taxonomy and phylogeny), Kachalkin et al. 2019 (phylogeny and new spp.)

Laccaria Berk. & Broome 1883, Hydnangiaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 85 species, type species *L. laccata* (Scop.) Cooke, worldwide, ectomycorrhizal, some species edible (*L. amethystina* Cooke), see Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), Melgar et al. 2014 (edible mushrooms), Sheedy et al. 2015 (population genetic structure), sequence data available, see Martin et al. 2008 (genome), Sheedy et al. 2013 (Australia, phylogeny), Wilson et al. 2017 (evolution), new spp. see Wilson et al. 2013 (China), Popa et al. 2014, 2016 (China, Panama), Montoya et al. 2015 (Mexico), Luo et al. 2016 (China), Cho et al. 2018 (South Korea).

Laccariopsis Vizzini 2013, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. mediterraneus* (Pacioni & Lalli) Vizzini, worldwide, terrestrial, gregarious, sequence data available, see Vizzini et al. 2013a (taxonomy).

Laccocephalum McAlpine & Tepper 1895, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *L. basilapidoides* McAlpine & Tepper, stipitate basidioma, poroid hymenophore, terrestrial, brown rot, sclerotium-forming, some species edible, medicinal use, see Zhou et al. 2010

(anthelmintic activity, *L. mylittae* (Cooke & Massee) Núñez & Ryvarden), Australia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Lachnella Fr. 1836, Niaceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *L. alboviolascens* (Alb. & Schwein.) Fr., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes), Matheny et al. 2006 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure).

Lachnocladium Lév. 1846, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *L. brasiliense* (Lév.) Pat., worldwide, wood-decaying, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny).

Lacrymaria Pat. 1887, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph unknown, 14 species, type species *L. lacrymabunda* (Bull.) Pat., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Walther et al. 2005 (phylogeny), Matheny et al. 2006 (phylogeny), Larsson and Örstadius 2008 (phylogeny), Padamsee et al. 2008 (phylogeny), Nagy et al. 2009, 2010b (phylogeny), Dentinger et al. 2011 (DNA barcode).

Lactarius Pers. 1797, Russulaceae, Russulales, Agaricomycetes, asexual morph unknown, agaricoid to secotioid-gasteroid, c. 450 species accepted, c. 1000 species estimated, conserved type species *L. torminosus* (Schaeff.) Pers., three large subgenera, ectomycorrhizal, worldwide but with main distribution in boreal and temperate regions, some poisonous, also some commercially important edible species (Wang 2000; Wang and Liu 2002; Wang et al. 2015h), sequence data available, see Eberhardt and Verbeken 2004, Nuytinck and Verbeken 2007, Nuytinck et al. 2007, Geml et al. 2009, He et al. 2011a, Stubbe and Verbeken 2012, Verbeken et al. 2014, Wisitrassameewong et al. 2016, Vidal et al. 2019 (phylogeny), new spp. see Montoya et al. 2012a (Neotropics), Stubbe et al. 2012b (Australia), Verbeken et al. 2014 (Asia), Nuytinck and Ammirati 2014 (North America), Lee et al. 2015 (South Korea), Liu et al. 2015a (Asia), Wisitrassameewong et al. 2014a, b 2015, 2016 (Asia), Wang et al. 2015h (Asia), Wang 2016, 2017, 2018 (Asia), Buyck et al. 2017 (Asia), Das et al. 2017c (Asia), Nuytinck et al. 2017 (North America), Shi et al. 2018 (Asia), Wang et al. 2018c, e (Asia), Lee et al. 2019 (Asia), Uniyal et. al. 2018 (Asia), Paloi and Acharya 2019 (Asia), other literature

see Heilmann-Clausen et al. 1998 (Europe), Basso 1999 (Europe), Verbeken et al. 2018 (Europe), Buyck et al. 2008a (phylogeny), Geml et al. 2009 (Alaska, boreal and arctic spp.), Buyck et al. 2010 (nomenclature), Verbeken and Walleyn 2010 (Africa, monograph), Nuytinck et al. 2010 (Europe and North America), Verbeken et al. 2010 (Australasia), Li et al. 2011 (Asia), Rochet et al. 2011 (Europe), Geml et al. 2012 (Arctic, phylogeny, biogeography), Stubbe and Verbeken 2012 (taxonomy), Garay-Serrano et al. 2012 (Neotropics), Verbeken and Nuytinck 2013 (taxonomy), Lee et al. 2018 (Asia, new records), Looney et al. 2018 (genomes), Li et al. 2019c (mitochondrial genomes).

Lactifluus (Pers.) Roussel 1806 (= *Pleurogala* Redhead & Norvell 1993), Russulaceae, Russulales, Agaricomycetes, asexual morph unknown, 207 species accepted, 530 species estimated, type species *L. volemus* (Fr.:Fr.) Kuntze, four subgenera, 19 sections (De Crop et al. 2017), agaricoid, some pleurotoid, ectomycorrhizal with angiosperms and gymnosperms, worldwide (main distribution in the tropics), some species edible, commercially important edible species see Boa 2004, Lincoff 2010, Sharp 2011, 2014, Njouonkou et al. 2016, sequence data available, see Buyck et al. 2008, De Crop et al. 2017 (multigene phylogenies), new spp. see Van de Putte et al. 2009 (Afrotropics), Van de Putte et al. 2010 (Aisa), Wang et al. 2012, 2015 (Asia), De Crop et al. 2012, 2016 (Afrotropics), Miller et al. 2012 (America), Van de Putte et al. 2012 (Asia), Stubbe et al. 2012a (Asia), Morozova et al. 2013 (Asia), Sá et al. 2013, Sá and Wartchow 2013 (America), Wartchow et al. 2013 (Neotropics), Maba et al. 2014, 2015a, b (West Africa), Verbeken et al. 2014 (Asia), Latha et al. 2016c (Asia), Li et al. 2016b (Asia), Uniyal et al. 2016 (Asia),Van de Putte et al. 2016 (Western Palearctic), Zhang et al. 2016 (Asia), Delgat et al. 2017 (Afrotropics), Song et al. 2017, 2018d (Asia), Das et al. 2017d (Asia), Hyde et al. 2017b (Asia), Crous et al. 2017b (Neotropics), De Lange et al. 2018 (Afrotropics), De Crop et al. 2018 (Asia, pleurotoid), Liu et al. 2018 (Asia), De Crop et al. 2019 (Afrotropics), Dierickx et al. 2019 (Asia and Australasia), Phookamsak et al. 2019 (Asia), other literature see Buyck et al. 2010 (nomenclature), Verbeken and Walleyn 2010 (Afrotropics, monograph), Verbeken et al. 2011, 2012 (recombinations), Stubbe et al. 2012a (recombinations), Verbeken and Nuytinck 2013 (taxonomy), De Crop et al. 2014 (phylogeny), Lee et al. 2018 (Asia, new records).

Lactocollybia Singer 1939, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, 20 species, type species *L. lacrimosa* (R. Heim) Singer, Saprobic, worldwide, see Kirk et al. (genus accepted), sequence data available, new spp. see Hosen et al. 2016a (China).

Laeticutis Audet 2010, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *L. cristata* (Schaeff.) Audet, wood-decaying, Europe, sequence data available, see Audet 2010 (taxonomy).

Laetifomes T. Hatt. 2001, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *L. flammans* (Corner) T. Hatt., perennial basidioma, poroid hymenophore, wood-rotting, Solomon Islands, sequence data unavailable, see Kirk et al. 2008.

Laetiporus Murrill 1904, Laetiporaceae, Polyporales, Agaricomycetes, asexual morph unknown, 15 species, type species *L. speciosus* Battarra ex Murrill [current name: *L. sulphureus* (Bull.) Murrill], poroid hymenophore, wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), some species edible, medicinal use, see Grienke et al. 2014 (review, *L. sulphureus*), sequence data available, see Nagy et al. 2015 (genome, *L. sulphureus*), Song and Cui 2017 (phylogeny, historical biogeography), new spp. see Tomsovský and Jankovský 2008 (phylogeny, Europe), Ota et al. 2009 (phylogeny, Japan), Banik et al. 2012 (phylogeny, Caribean basin), Song et al. 2014b (phylogeny, China), Pires et al. 2016 (phylogeny, Brazil), Song et al. 2018b (phylogeny, China).

Laetisaria Burds. 1979, (= *Limonomyces* Stalpers & Loer. 1982), Corticiaceae, Corticiales, Agaricomycetes, asexual morph known (bulbil-forming), seven species, type species *L. fuciformis* (Berk.) Burds., grass parasite, lichenicolous, or lignicolous, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Diederich et al. 2011 (Luxembourg), Diederich et al. 2018a (phylogeny).

Lagarobasidium Jülich 1974, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, five species, type species *L. pruinosum* (Bres.) Jülich, wood-rotting and lichenicolous, Europe, sequence data available, new spp. see Dueñas et al. 2009 (Azores Islands).

Lamelloclavaria Birkebak & Adamčík 2016, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. petersenii*

Adamčík & Birkebak, Finland, sequence data available, see Birkebak et al. 2016 (Clavariaceae, phylogeny, taxonomy).

Lamelloporus Ryvarden 1987, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *L. americanus* Ryvarden, hymenophore concentrically lamellate, wood-rotting, neotropical, see Salvador-Montoya et al. 2012 (morphology, distribution, new record, Peru), Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Miettinen et al. 2012 (phylogeny).

Langdonia McTaggart & R.G. Shivas 2012, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, eight species, type species *L. fraseriana* (Syd.) McTaggart & R.G. Shivas, parasite (ovaries) on *Aristida* and *Stipagrostis* (Poaceae), Australia, Bolivia, Thailand, saprobic yeast states on plants, cultures available, sequence data available, see Wang et al. 2015c (taxonomy, phylogeny).

Lanmaoa G. Wu, Zhu L. Yang & Halling 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, seven species, type species *L. asiatica* G. Wu & Zhu L. Yang, stipitate-pileate, ectomycorrhizal, North America, Asia, Central America, some species edible (*L. asiatica* G. Wu & Zhu L. Yang), sequence data available, see Wu et al. 2016 e, f (new genus, Boletaceae, phylogeny), new sp. see Chai et al. 2018 (China).

Laricifomes Kotl. & Pouzar 1957, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *L. officinalis* (Vill.) Kotl. & Pouzar, perennial basidioma, poroid hymenophore, wood-rotting, brown rot, widespread (North America, Eurasia), ethnomycological use, see Blanchette et al. 1992 (spirit figures, North America), medicinal use, see Grienke et al. 2014 (review), sequence data available, see Han et al. 2016a (phylogeny, *Fomitopsis s. l.*).

Larssoniporia Y.C. Dai, Jia J. Chen & B.K. Cui 2015, Echinodontiaceae, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *L. tropicalis* (Cooke) Y.C. Dai, Jia J. Chen & B.K. Cui, wood-decaying, Asia, sequence data available, see Chen et al. 2016b (phylogeny).

Laternea Turpin 1822, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, two species, type species *L. triscapa* Turpin, America, see Kirk et al. 2013

(genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny, gomphoid-phalloid fungi).

Laurilia Pouzar 1959, Bondarzewiaceae, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *L. sulcata* (Burt) Pouzar, wood-decaying, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny).

Lauriliella Nakasone & S.H. He 2017, Bondarzewiaceae, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *L. taxodii* (Lentz & H.H. McKay) S.H. He & Nakasone, wood-rotting, associated with white stringy rot to brown powdery rot in pockets, often associated with living trees of Cupressaceae, sequence data available, see Liu et al. 2017e (phylogeny, *Echinodontium*).

Laurobasidium Jülich 1982, Laurobasidiaceae, Exobasidiales, Exobasidiomycetes, two species, plant parasites (stem, trunk) on *Laurus* and *Cinnamomum* (Lauraceae), Canary Islands, Madeira and Thailand, cultures unavailable, see Kirk et al. 2013 (genus accepted), sequence data available, see Begerow et al. 2002, 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny), Kakishima et al. 2017a (new combination), Somrithipol et al. 2018 (phylogeny, new family).

Lawreymyces Lücking & Moncada 2017, Corticiaceae, Corticiales, Agaricomycetes, asexual morph unknown, seven species, type species *L. palicei* Lücking & Moncada, lichenicolous, occurring on lichens of the family Verrucariaceae, known specifically from the genera *Agonimia* and *Normandina*, sequence data available, see Lücking and Moncada 2017 (taxonomy, voucherless fungi, phylogeny).

Lawrynomyces Karasiński 2013, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *L. capitatus* (J. Eriksson & Å. Strid) Karasiński, is introduced to accommodate *Hyphoderma capitatum*, wood-rotting, growing on decayed coniferous wood, Europe, see Karsiński 2013 (taxonomy), sequence data unavailable.

Laxitextum Lentz 1956, Hericiaceae, Russulales, Agaricomycetes, asexual morph unknown, three species, type species *L. bicolor* (Pers.) Lentz, wood-decaying, worldwide, see Kirk et al. 2013 (genus accepted), Mudalungu et al. 2016 (natural products), sequence data available, see Larsson and Hallenberg 2001 (*Gloeocystidiellum*

porosum-clavuligerum complex), Larsson et al. 2004 (phylogeny, corticioid homobasidiomycetes).

Lecanocybe Desjardin & E. Horak 1999, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. lateralis* Desjardin & E. Horak, on senescent leaves of yellow ginger or banana, Java, Hawaii, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Leccinellum Bresinsky & Manfr. Binder 2003, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, 17 species, type species *L. nigrescens* (Singer) Bresinsky & Manfr. Binder, stipitate-pileate, ectomycorrhizal, worldwide (north temperate, except Australia), sequence data available, see Nuhn et al. 2013 (phylogeny, Boletineae), new spp. see Kuo et al. 2013 (North America), Li et al. 2016a (China), Wu et al. 2016f (China).

Leccinum Gray 1821, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 130 species, type species *L. aurantiacum* (Bull.) Gray, stipitate-pileate, ectomycorrhizal, worldwide, some species edible, see Boa 2004 (edible mushrooms), Kirk et al. 2013 (genus accepted), Bessette et al. 2017 (Eastern North America), sequence data available, new spp. see Li et al. 2016b (India), new combinations see Horak 2011.

Leifiporia Y.C. Dai, F. Wu & C.L. Zhao 2016, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *L. rhizomorpha* Y.C. Dai, F. Wu & C.L. Zhao, wood-rotting, sequence data available, see Zhao et al. 2016a (new genus, new species, new combinations), Zmitrovich 2018a (taxonomy).

Lentaria Corner 1950, Lentariaceae, Gomphales, Agaricomycetes, asexual morph unknown, 19 species, type species *L. surculus* (Berk.) Corner, lignicolous, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007, new spp. see Liu et al. 2017d (China, monograph, key).

Lentinellus P. Karst. 1879, Auriscalpiaceae, Russulales, Agaricomycetes, asexual morph unknown, c. 30 species, type species *L. cochleatus* (Pers.) P. Karst., wood-decaying, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny), new spp. see Liu et al. 2011a, b (Chinese records).

Lentinula Earle 1909, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, eight species, type species *L. boryana* (Berk. & Mont.) Pegler, worldwide, wood-decaying, some species edible, shiitake mushroom (*L. edodes* (Berk.) Pegler), see Dai et al. 2010b (Chinese edible mushrooms), Zmitrovich 2010, Zmitrovich and Kovalenko 2016 (medicinal, phylogeny), Sanuma et al. 2016 (edible mushrooms, Brazil), Kirk et al. 2013 (genus accepted), sequence data available, see Capelari et al. 2010a (Brazil), Grand et al. 2011 (phylogeny), Avin et al. 2012 (phylogeny, edible mushrooms), Sharma et al. 2015 (India, monograph), Chen et al. 2016f (genome), Xiang et al. 2016 (China, population genetic diversity), Yang et al. 2017a (mitochondrial genome).

Lentinus Fr. 1825, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, 55 species, type species *L. crinitus* (L.) Fr., stipitate basidioma, lamellate or poroid hymenophore, wood-rotting, white rot, widespread (esp. subtropical), some species edible (*L. cyathiformis* (Schaeff.) Bres.), see Dai et al. 2010b (edible mushrooms, China), Sanuma et al. 2016 (edible mushrooms, Brazil), some species medicinal use (*L. lepideus* (Fr.) Fr.), see Dai and Yang 2008 (medicinal mushrooms, China), Bisen et al. 2010 (pharmacological activities), Kirk et al. 2013 (genus accepted), sequence data available, see Krüger et al. 2008 (‘*Polyporellus’* group, phylogeny), Grand et al. 2011 (phylogeny), Seelan et al. 2015 (phylogeny), Sharma et al. 2015 (India, phylogeny), Zmitrovich and Kovalenko 2016 (phylogeny), new spp. see Zmitrovich 2010 (new combination), Karunarathna et al. 2012 (Thailand), Senthilarasu et al. 2013b (India), Njouonkou et al. 2013 (Africa), new combinations, see Zmitrovich 2010 (nomenclature), Zmitrovich and Kovalenko 2016 (phylogeny).

Lentoporia Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *L. carbonica* (Overh.) Audet, wood-rotting, sequence data available, see Ortiz-Santana et al. 2013 (phylogeny).

Lenzitopsis Malençon & Bertault 1963, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, two species, type species *L. oxycedri* Malençon & Bertault, worldwide, wood decaying, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhou and Kõljalg 2013 (phylogeny, new sp.).

Lepidomyces Jülich, 1979, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *L. subcalceus* (Litsch.) Jülich, sequence data unavailable, see Larsson 2007b (taxonomy).

Lepidostroma Mägd. & S. Winkl. 1967, Lepidostromataceae, Lepidostromatales, Agaricomycetes, asexual morph unknown, four species, type species *L. terricolens* Mägd. & S. Winkl. [current name: *L. calocerum* (G.W.Martin) Oberw.], tropics of Africa and the Americas, lichenized, see Kirk et al. 2013 (genus accepted), sequence data available, see Hodkinson et al. 2012, 2014 (new order, new spp., phylogeny), Liu et al. 2017a (phylogeny).

Lepiota (Pers.) Gray 1821 (=*Amogaster* Castellano 1995 *fide* Ge and Smith 2013; =*Cryptolepiota* Kropp & Trappe 2012; =*Cribrospora* Pacioni & P. Fantini 2000 *fide* Vidal et al. 2015), Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 450 species, type species *L. clypeolaria* (Bull.) P. Kumm., agaricoid, sequestrate, worldwide, terrestrial and saprotrophic, see Kirk et al. 2013 (genus accepted), sequence data available, Liang et al. 2009 (*L. cristata*), Sysouphanthong et al. 2011, 2012, 2013a (East Asia), Lebel and Vellinga 2013 (Australia, sequestrate taxa), Vidal et al. 2015 (Europe, sequestrate taxa), Liang 2016 (China, phylogeny), new spp. see Arun Kumar and Manimohan 2009b (India), Vellinga 2010a (USA), Liang and Yang 2011 (China), Vidal et al. 2011 (Europe, sequestrate spp.), Liang et al. 2012 (China), Liang and Yang 2013 (China), Kumari et al. 2013c (India), Vizzini et al. 2014 (Italy), Caballero et al. 2015 (Spain), Justo et al. 2015a (Dominican Republic), Qasim et al. 2015a, 2016 (Pakistan).

Lepista (Fr.) W.G. Sm. 1870, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *L. panaeola* (Fr.) P. Karst., worldwide, some species edible, wood blewit (*L. nuda* (Bull.) Cooke), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), sequence data available, see Stott et al. 2005 (phylogeny), Alvarado et al. 2015 (phylogeny), Thongbai et al. 2017b (Thailand, cultivation).

Lepistella T.J. Baroni & Ovrebo 2007, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. ocula* T.J. Baroni & Ovrebo, Costa Rica, sequence data unavailable, see Ovrebo and Baroni 2007 (taxonomy).

Leptocorticium Hjortstam & Ryvarden 2002, *incertae sedis*, Corticiales, Agaricomycetes, asexual morph unknown, eight species, type species *L. cyatheae* (S. Ito & S. Imai) Hjortstam & Ryvarden, sequence data available for *L. tenellum* only, new spp. see Gorjón and Saitta 2014 (Italy), Sanyal and Dhingra 2015 (India), Li et al. 2016b (sequence data).

Leptoporus Quél. 1886, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *L. mollis* (Pers.) Quél., basidioma resupinate to pileate, hymenophore poroid, wood-rotting, brown rot, widespread (north temperate), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales).

Leptosporomyces Jülich 1972, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, 15 species, type species *L. galzinii* (Bourdot) Jülich, widespread (north temperate), see Zmitrovich 2008 (species manual), Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (phylogeny).

Leratiomyces Bresinsky & Manfr. Binder ex Bridge, Spooner, Beever & D.C. Park 2008, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 13 species, type species *L. similis* (Pat. ex Sacc. & Trotter) Bresinsky & Manfr. Binder ex Redhead & McNeill, sequence data available, see Bridge et al. 2008 (new combination, monograph), Borovička et al. 2015 (phylogeny).

Leucoagaricus Locq. ex Singer 1948 (= *Sericeomyces* Heinem. 1978), Agaricaceae, Agaricales, Agaricomycetes, asexual morph *Attamyces* Kreisel 1972, c. 135 species, type species *L. rubrotinctus* (Peck) Singer, agaricoid, terrestrial and saprotrophic, worldwide, see Kirk et al. 2013 (genus accepted), Cabrera 2015 (Brazil), sequence data available, Vellinga 2010b (California, USA, section *Piloselli*), new spp. see Arun Kumar and Manimohan 2009a (India), Liang et al. 2010 (China), Muñoz et al. 2012 (Spain), Malysheva et al. 2013 (Russia), Yuan et al. 2014 (South China), Ge et al. 2015b (Asia), Justo et al. 2015b (Dominican Republic), Qasim et al. 2015b (Pakistan), Yu et al. 2016 (China), Dovana et al. 2017 (Italy), Hussain et al. 2018 (Pakistan), new combinations, see Ruiz and Molinari-Novoa 2016 (anamorphic Agaricaceae, nomenclature), Yang and Ge 2017 (China), Hussain et al. 2018b (Pakistan), Sysouphanthong et al 2018 (Laos)

Leucocalocybe X.D. Yu & Y.J. Yao 2011, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. mongolica* X.D. Yu & Y.J. Yao, China, Mongolia, saprotrophic, edible, sequence data available, see Yu et al. 2011 (taxonomy).

Leucocintractia M. Piepenbr., Begerow & Oberw. 1999, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, four species, type species *L. scleriae* (DC.) M. Piepenbr., Begerow & Oberw., plant parasites (pedunculi of inflorescence, internodes) of *Rhynchospora* (Cyperaceae), Africa, North America, South America, South Asia, West Indies, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Piepenbring et al. 1999, Begerow et al. 2014, Wang et al. 2015c (phylogeny).

Leucocoprinus Pat. 1888, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *L. cepistipes* (Sowerby) Pat., worldwide, terrestrial, saprotrophic, see Birkebak 2010 (USA), Kirk et al. 2013 (genus accepted), sequence data available, see Arun Kumar and Manimohan 2009a (India), Vellinga et al. 2011 (phylogeny).

Leucocortinarius (J.E. Lange) Singer 1945, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. bulbiger* (Alb. & Schwein.) Singer, ectomycorrhizal, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure).

Leucocybe Vizzini, P. Alvarado, G. Moreno & Consiglio 2015, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, tree species, type species *L. candicans* (Pers.) Vizzini, P. Alvarado, G. Moreno & Consiglio, Europe, North America, sequence data available, see Alvarado et al. 2015 (taxonomy), Das et al. 2017d (new combination).

Leucogaster R. Hesse 1882, Albatrellaceae, Russulales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *L. liosporus* R. Hesse, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Osmundson et al. 2013 (DNA barcoding).

Leucogyrophana Pouzar 1958, Hygrophoropsidaceae, Boletales, Agaricomycetes, asexual morph unknown, 13 species, type species *L. mollusca* (Fr.) Pouzar, widespread,

see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson 2007a (phylogeny, corticioid fungi), Binder et al. 2010 (phylogeny).

Leucoinocybe Singer ex Antonín, Borovička, Holec & Kolařík 2019, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *L. lenta* (Maire) Antonín, Borovička, Holec & Kolařík, Europe, sequence data available, see Antonín et al. 2019 (taxonomy, phylogeny).

Leucopaxillus Boursier 1925, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 16 species, type species *L. paradoxus* (Costantin & L.M. Dufour) Boursier, temperate, subtropical, some species edible, giant clitocybe (*L. giganteus* (Sowerby) Singer), see Hall et al. 2003 (edible mushrooms), Ren et al. 2008 (medical use), Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), sequence data available, see Vizzini et al. 2012b (phylogeny), Osmundson et al. 2013 (DNA barcode), Sánchez-García et al. 2014 (phylogeny), Sánchez-García and Matheny 2017 (evolution), new spp., see Buda et al. 2012 (Sicilia).

Leucophellinus Bondartsev & Singer 1944, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *L. irpicoides* (Bondartsev ex Pilát) Bondartsev & Singer, wood-rotting, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Wu et al. 2017a (phylogeny).

Leucophleps Harkn. 1899, Albatrellaceae, Russulales, Agaricomycetes, asexual morph unknown, three species, type species *L. magnata* Harkn., terrestrial, North America, see Kirk et al. 2013 (genus accepted), sequence data available, see Albee-Scott 2007 (phylogeny).

Leucopholiota (Romagn.) O.K. Mill., T.J. Volk & Bessette 1996, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *L. decorosa* (Peck) O.K. Mill., T.J. Volk & Bessette, USA, see Kirk et al. 2013 (genus accepted), sequence data available see Vellinga 2004 (phylogeny), Harmaja 2013 (new combination, synonymization of *Amylolepiota* Harmaja).

Leucosporidium Fell, Statzell, I.L. Hunter & Phaff 1970, Leucosporidiaceae, Leucosporidiales, Microbotryomycetes, sexual and asexual morphs known, eleven species, type species *L. scottii* Fell, Statzell, I.L. Hunter & Phaff, yeast, psychrophilic, worldwide, Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Sampaio et al. 2003, Wang et al. 2015e (taxonomy, phylogeny).

Leucotelium Tranzschel 1935, Uropyxidaceae, Pucciniales, Pucciniomycetes, three species, type species *L. cerasi* (Bérenger) Tranzschel, Eurasia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Libkindia Mašínová, A. Pontes, J.P. Samp. & Baldrian 2017, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, one species, type species *L. masarykiana* Mašínová, A. Pontes, J.P. Samp. & Baldrian, yeast, isolated from temperate forest soils, Europe, cultures and sequence data available, see Mašínová et al. 2017 (new genus, new spp.).

Lichenomphalia Redhead, Lutzoni, Moncalvo & Vilgalys 2002, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, 14 species, type species *L. hudsoniana* (H.S. Jenn.) Redhead, Lutzoni, Moncalvo & Vilgalys, arctic-alpine, lichenised, sequence data available, see Geml et al. 2012a (biogeography), new spp. see Barrasa et al. 2009 (new combination), Kantvilas and Jarman 2012 (Tasmania), Sandoval-Leiva et al. 2017 (Chilean Altiplano), Shiryaev et al. 2018 (biogeography).

Licrostroma P.A. Lemke 1964, Peniophoraceae, Russulales, Agaricomycetes, asexual morph known, one species, type species *L. subgiganteum* (Berk.) P.A. Lemke, wood-rotting, sequence data available, see Giraldo et al. 2017 (taxonomy).

Ligiella J.A. Sáenz 1980, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *L. rodrigueziana* J.A. Sáenz, Costa Rica, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Lignomphalia Antonín, Borovička, Holec & Kolařík 2019, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. lignicola* (Lj.N. Vassiljeva) Antonín, Borovička, Holec & Kolařík, Europe, sequence data available, see Antonín et al. 2019 (taxonomy, phylogeny).

Lignomyces R.H. Petersen & Zmitr. 2015, Pleurotaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. vetlinianus* (Domański) R.H. Petersen & Zmitr., Russia, basidioma pleurotoid, sequence data available, see Petersen et al. 2015 (taxonomy, *Resupinatus*-clade).

Lignosus Lloyd ex Torrend 1920, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, eight species, type species *L. sacer* (Afzel. ex Fr.) Torrend, stipitate basidioma, terrestrial, widespread (paleotropical), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), some species medicinal use, see Nallathamby

et al. 2018 (bioactive activities, *L. rhinocerus* (Cooke) Ryvarden), sequence data available, see Cui et al. 2011a (phylogeny, new sp., China), Yap et al. 2014 (genome, *L. rhinocerus*), new spp. see Tan et al. 2013 (phylogeny, Malaysia).

Lilaceophlebia (Parmasto) Spirin & Zmitr. 2004, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *L. livida* (Pers.) Spirin & Zmitr., resupinate phlebioid basidioma, wood-inhabiting, white rot, widespread, sequence data available, see Ghobad-Nejhad and Hallenberg 2012 (phylogeny), Justo et al. 2017 (phylogeny, Polyporales).

Limacella Earle 1909, Amanitaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 15 species, type species *L. delicata* (Fr.) H.V. Sm., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Zhang et al. 2004 (Eastern Asian), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Cui et al. 2018 (phylogeny), new spp. see Kumari et al. 2013c (India).

Limacellopsis Zhu L. Yang, Q. Cai & Y.Y. Cui 2018, Amanitaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *L. guttata* (Pers.)Zhu. L. Yang, Q. Cai & Y.Y. Cui, Europe, China, see Cui et al. 2018 (phylogeny), Yang et al. 2018b (genus accepted).

Limnoperdon G.A. Escobar 1976, Limnoperdaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. incarnatum* G.A. Escobar, USA, Japan, South America, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2006 (phylogeny).

Lindtneria Pilát 1938, Stephanosporaceae, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *L. trachyspora* (Bourdot & Galzin) Pilát, worldwide, sequence data available, new spp. see Liu et al. 2016a (China).

Lipocystis Cummins 1937, Raveneliaceae, Pucciniales, Pucciniomycetes, one species, type species *L. caesalpiniae* (Arthur) Cummins, biotrophic on Oleaceae (*Fraxinus*), terrestrial, Russia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Litschauerella Oberw. 1965, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, three species, type species *L. abietis* (Bourdot & Galzin)

Oberw. ex Jülich, wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Lobulicium K.H. Larss. & Hjortstam 1982, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, one species, type species *L. occultum* K.H. Larss. & Hjortstam, saprobes, terrestrial, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Lopharia Kalchbr. & MacOwan 1881, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *L. lirellosa* Kalchbr. & MacOwan [current name: *L. mirabilis* (Berk. & Broome) Pat.], corticioid or stereoid basidioma, smooth hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), some species can be used as water-cleaning agent, see Wang et al. 2010b (inhibit growth of *Microcystis aeruginosa* in water, *L. spadicea* (Pers.) Boidin), sequence data available, see Binder et al. 2013 (phylogeny, Polyporales), Liu et al. 2018a (new spp., phylogeny, China, monograph).

Loreleia Redhead, Moncalvo, Vilgalys & Lutzoni 2002, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, three species, type species *L. postii* (Fr.) Redhead, Moncalvo, Vilgalys & Lutzoni, Europe, sequence data unavailable, see Kirk et al. 2008.

Loweomyces (Kotl. & Pouzar) Jülich 1982, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, six species, type species *L. fractipes* (Berk. & M.A. Curtis) Jülich, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018 (taxonomy), sequence data available, see Westphalen et al. 2016a (new spp., phylogeny, monograph, Brazil).

Luellia K.H. Larss. & Hjortstam 1974, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, three species, type species *L. recondita* (H.S. Jacks.) K.H. Larss. & Hjortstam, wood-decaying, Europe, see Kirk et al. 2013 (genus accepted), sequence data available.

Lulesia Singer 1970, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *L. densifolia* (Singer) Singer, tropical, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Luteoporia F. Wu, Jia J. Chen & S.H. He 2016, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *L. albomarginata* F. Wu, Jia J. Chen & S.H. He, wood-rotting, causing a white rot, China, sequence data available, see Wu et al. 2016b (taxonomy, China), Zmitrovich 2018a (taxonomy).

Lutypha Khurana, K.S. Thind & Berthier 1977, Typhulaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. sclerotiophila* Khurana, K.S. Thind & Berthier, India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Lycogalopsis E. Fisch. 1886, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. solmsii* E. Fisch., tropical, see Kirk et al. 2013 (genus accepted), sequence data available, see Demoulin et al. 2013 (phylogeny).

Lycoperdon Pers. 1794 (= *Vascellum* F. Šmarda 1958), Lycoperdaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 55 species, type species *L. perlatum* Pers., worldwide, puffball, some species edible, gem-studded puffball (*L. perlatum* Pers.), see Hall et al. 2003 (edible mushrooms), Colak et al. 2009 (compounds), Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Jeppson 2008 (phylogeny), Vellinga et al. 2011 (phylogeny), new spp. see Cortez et al. 2011 (Brazil), Jeppson et al. 2012 (Europe), Kim et al. 2016 (Korea).

Lycoperdopsis Henn. 1900, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. arcyrioides* Henn. & E. Nyman, tropical, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Lyoathelia Hjortstam & Ryvarden 2004, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, one species, type species *L. laxa* (Burt) Hjortstam & Ryvarden, Canada, sequence data unavailable, see Kirk et al. 2008.

Lyophyllopsis Sathe & J.T. Daniel 1981, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *L. keralensis* Sathe & J.T. Daniel, India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Lyophyllum P. Karst. 1881, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 60 species, type species *L. leucophaeatum* (P. Karst.) P. Karst., worldwide, some species edible, honshimeji (*L. shimeji* (Kawam.) Hongo), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), Zhang et al.

2010b (compounds), Kirk et al. 2013 (genus accepted), sequence data available, see Bellanger et al. 2015 (phylogeny), new spp. see Dähncke et al. 2010 (Canary Islands, Spain), Vizzini and Contu 2010 (Canary Islands, Spain), Wang et al. 2013b (China), Cooper 2014b (New Zealand), Lavorato and Contu 2015 (Italy), Sesli et al. 2015 (Turkey).

Lysurus Fr. 1823, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, c. 30 species, type species *L. mokusin* (L.) Fr, terrestrial, widespread (esp. tropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny), new spp. see Gogoi and Parkash 2015 (India), new combination, see Trierveiler-Pereira et al. 2014a.

Macabuna Buriticá & J.F. Hennen 1994, Phakopsoraceae, Pucciniales, Pucciniomycetes, asexual genus, seven species, type species *M. ziziphi* (Pat.) Buriticá & J.F. Hennen, biotrophic on Bignoniaceae, Poaceae, Rhamnaceae, Salicaceae, Vochysiaceae, terrestrial, Brazil, Luxembourg, Sri Lanka, Vietnam, sequence data unavailable, see Cummins and Hiratsuka 2003 (synonym of *Calidion*), Kirk et al. 2013 (genus accepted).

Macalpinomyces Langdon & Full. 1977, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, 41 species, type species *M. eriachnes* (Thüm.) Langdon & Full., plant parasites (ovaries) on Poaceae, widespread in Australia, South Asia, Africa, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (phylogeny).

Maccagnia Mattir. 1922, Hydnangiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. carnica* Mattir., Italy, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Mackintoshia Pacioni & Sharp 2000, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *M. persica* Pacioni & C. Sharp, sequestrate, Africa, sequence data available, see Simth et al. 2015 (phylogeny).

Macrocybe Pegler & Lodge 1998, Biannulariaceae, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *M. titans* (H.E. Bigelow & Kimbr.) Pegler, Lodge & Nakasone, tropics, some species edible (*M. gigantea* (Massee) Pegler & Lodge 1998), see Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), Wiejak et al. 2014 (bioconcentration), Razaq et al. 2016 (Asian, *M.*

gigantea), sequence data available, see Razaq et al. 2016 (Asian, *M. gigantea*), Sánchez-García et al. 2016 (*M. titans* in Biannulariaceae, phylogeny, new family)

Macrocystidia Joss. 1934, Macrocystidiaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *M. cucumis* (Pers.) Joss., saprophytic, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Walther et al. 2005 (phylogeny), Matheny et al. 2006 (phylogeny), Dentinger et al. 2015 (phylogeny).

Macrohyporia I. Johans. & Ryvarden 1979, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *M. dictyopora* (Sacc.) I. Johans. & Ryvarden, resupinate basidioma, poroid hymenophore, wood-rotting, widespread (tropical), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Macrolepiota Singer 1948, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *M. procera* (Scop.) Singer, saprotrophic and terrestrial, agaricoid, sequestrate, worldwide, some species edible, parasol mushroom (*M. procera* (Scop.) Singer), see Hall et al. 2003 (edible mushrooms), Falandysz et al. 2008 (mineral constituents), Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), sequence data available, see Vellinga 2004 (Australia, monograph), Ge et al. 2010 (China, monograph), Barseghyan et al. 2012 (phylogeny, Israel), Lebel and Syme 2012 (Australia, sequestrate species), new spp. see Ge et al. 2012 (China), Perez et al. 2018 (Brazil).

Macrometrula Donk & Singer 1948, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. rubriceps* (Cooke & Massee) Donk & Singer, British Isles, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Macrotyphula R.H. Petersen 1972, Typhulaceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *M. fistulosa* (Holmsk.) R.H. Petersen [current name: *Typhula fistulosa* (Holmsk.) Olariaga], worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny, corticioid homobasidiomycetes), Dentinger and McLaughlin 2006 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), new combinations see Olariaga and Salcedo 2012 (clavarioid fungi).

Macruropyxis Azbukina 1972, Uropyxidaceae, Pucciniales, Pucciniomycetes, two species, type species *M. fraxini* (Kom.) Azbukina, biotrophic on Fabaceae (*Mimosa*), terrestrial, West Indies, see Kirk al. 2013 (genus accepted), sequence data available, see Martin et al. 2017 (phylogeny, new spp., South Africa).

Maireina W.B. Cooke 1961, Niaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 18 species, type species *M. monacha* (Speg.) W.B. Cooke [current name: *Merismodes bresadolae* (Grélet) Singer], worldwide, basidioma cyphelloid, sequence data unavailable, new spp. see Bodensteiner 2007 (key).

Malajczukia Trappe & Castellano 1992, Mesophelliaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, eight species, type species *M. viridigleba* Trappe & Castellano, Australia, New Zealand, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny).

Malassezia Baillon 1889, Malasseziaceae, Malasseziales, Malasseziomycetes, sexual morph unknown, 18wa species, type species *M. furfur* (C.P. Robin) Baill., saprobic, lipophilic, animal skin, some species pathogenic, see Velegraki et al. 2015, widespread, see Kurtzman et al. 2011 (taxonomy), Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2000, Wang et al. 2014, 2015c, Wu et al. 2015f (phylogeny, genome).

Manuripia Singer 1960, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. bifida* Singer, Bolivia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Marasmiellus Murrill 1915, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 260 species, type species *M. juniperinus* Murrill, saprobic, few parasitic on economically important plants (*M. cocophilus* Pegler, on root of *Cocos nucifera* causing bole rot, Pegler 1977), Nemergut et al. 2000 (bioremediation), worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Dutta et al. 2015a (phylogeny), new spp. see Noordeloos and Antonín 2008 (Europe), Kerekes and Desjardin 2009 (monograph, *Crinipellis*, *Moniliophthora*, Southeast Asia), Antonín et al. 2010c (Korea), Antonín and Noordeloos 2010 (Europe), Capelari et al. 2010b (Brazil), Desjardin and Hemmes 2011 (Hawaii), Perez-De-Gregorio et al. 2011 (Mediterranean), Mešić et al. 2012 (Croatia), Retnowati 2012 (Java and Bali), Blanco-

Dios 2015 (Spain), Dutta et al. 2015c (India), Terashima et al. 2016 (Japan), Retnowati 2018 (Java, Bali), Sesli et al. 2018b (Turkey).

Marasmius Fr. 1836, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 600 species, type species *M. rotula* (Scop.) Fr., mostly saprophytic, few parasitic (*M. palmivorus* Sharples, bunch rot of oil palm, postharvest disease of coconut seedlings, on living *Lagerstroemia speciosa* tree, see Pong et al. 2012, Almaliky et al. 2013, Dutta and Acharya 2018), worldwide, some species edible, fairy ring mushroom (*M. oreades* (Bolton) Fr.), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (edible mushrooms), Mešić and Tkalčec 2010 (new names), Gröbe et al. 2011 (compounds), Kirk et al. 2013 (genus accepted), sequence data available, see Puccinelli and Capelari 2009 (Brazil, section *Sicci*), Wannathes 2009 (Northern Thailand, monograph), Antonín and Shin 2010 (Korea, section *Globulares*), Antonín and Noordeloos 2010 (Europe), Noordeloos 2012a (key, Europe), Antonín et al. 2012b, c (Korea, section *Sicci*, section *Hygrometrici*), Antonín 2013 (tropical Africa), Shay et al. 2017 (Madagascar), new spp. see Işıloğlu et al. 2009 (Turkey), Wannathes et al. 2009 (Northern Thailand), Antonín et al. 2010a, b (Korea), Deng and Li 2011 (China), Deng et al. 2011 (China), Papinutti and Lechner 2011 (Argentina), de Oliveira and Capelari 2012 (Brazil), Deng et al. 2012 (China), Yang et al. 2013a (China), de Oliveira et al. 2014 (Brazil), Dutta et al. 2014 (India), Kiyashko et al. 2014 (Russia), Deng at al. 2015a (China), Dutta et al. 2015a (India), Wang and Tzean 2015 (China), Farook and Manimohan 2015 (India), de Oliveira and Capelari 2016 (Brazil), Komura et al. 2016 (central Amazonia), Magnago et al. 2016 (Brazil), Deng et al. 2017 (China), Liang et al. 2017a (China), Shay et al. 2017 (Madagascar), Tibpromma et al. 2017 (India), Niveiro et al. 2018 (Argentina), Sharafudheen and Manimohan 2018 (India), Wang et al. 2018e (India).

Maravalia Arthur 1922, Chaconiaceae, Pucciniales, Pucciniomycetes, (=*Acervulopsora* Thirum. 1945, = *Angusia* G.F. Laundon 1964, = *Argomycetella* Syd. 1922, = *Scopella* Mains 1939, = *Scopellopsis* T.S. Ramakr. & K. Ramakr. 1947), 41 species, type species *M. pallida* Arthur & Thaxt. ex Arthur, biotrophic on Acanthaceae, Apocynaceae, Erythroxylaceae, Euphorbiaceae, Fabaceae, Periplocaceae, Rubiaceae, Sapotaceae, Verbenaceae, Zingiberaceae, terrestrial, circumglobal in tropics and subtropics, see Kirk et al. 2013 (genus accepted), sequence data available, see

McTaggart et al. 2016a (phylogeny), new spp. see McTaggart et al. 2008 (key to species on Fabaceae), de Carvalho Jr and Hennen 2009 (key to species).

Marchandiomyces Diederich & D. Hawksw. 1990, Corticiaceae, Corticiales, Agaricomycetes, sexual morph previously known in *Marchandiomphalina* Diederich, Manfr. Binder & Lawrey 2007, three species, type species *M. corallinus* (Roberge) Diederich & D. Hawksw., lichenicolous, widespread, see Kirk et al. 2013 (genus accepted), sequence data available see Lawrey et al. 2008 (new spp., phylogeny), Diederich et al. 2018a (exclusion of some species).

Marthanella States & Fogel 1999, *incertae sedis*, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *M. nidulosa* States & Fogel, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Masseeëlla Dietel 1895 (= *Kamatomyces* Sathe 1966), *incertae sedis*, Pucciniales, Pucciniomycetes, six species, type species *M. capparis* (Hobson bis ex Cooke) Dietel, biotrophic on Euphorbiaceae, Rhamnaceae, terrestrial, Ethiopia, India, Philippines, see Kirk et al. 2013 (genus accepted), sequence data available, see McTaggart et al. 2016a (phylogeny, evolution).

Matula Massee 1888, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, two species, type specie *M. poroniiforme* (Berk. & Broome) Massee, wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Mayamontana Castellano, Trappe & Lodge 2007, Stephanosporaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type specie *M. coccolobae* Castellano, Trappe & Lodge, wood-decaying, North America, sequence data available, see Lebel et al. 2015 (phylogeny).

Megacollybia Kotl. & Pouzar 1972, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, nine species, type species *M. platyphylla* (Pers.) Kotl. & Pouzar, saprophytic, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Hughes et al. 2007 (monograph), new spp. see Coimbra et al. 2013b (Brazil), Antonín et al. 2019 (phylogeny).

Megalocystidium Jülich 1978, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, seven species, type species *M. leucoxanthum* (Bres.) Jülich, wood-decaying, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny).

Megasporia B.K. Cui, Y.C. Dai & Hai J. Li 2013, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, ten species, type species *M. hexagonoides* (Speg.) B.K. Cui, Y.C. Dai & Hai J. Li, resupinate basidioma, poroid hymenophore, wood-rotting, white rot, widespread (subtropical, tropical), sequence data available, see Li and Cui 2013b (new spp., new combinations, phylogeny, China), Yuan et al. 2017d (new spp. phylogeny, monograph, China).

Megasporoporia Ryvarden & J.E. Wright 1982, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *M. setulosa* (Henn.) Rajchenb., resupinate basidioma, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Li and Cui 2013b (new spp., phylogeny, monograph, China).

Megasporoporiella B.K. Cui, Y.C. Dai & Hai J. Li 2013, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *M. cavernulosa* (Berk.) B.K. Cui, Y.C. Dai & Hai J. Li, resupinate basidioma, poroid hymenophore, wood-rotting, white rot, widespread (temperate region), sequence data available, see Li and Cui 2013b (new spp., new combinations, phylogeny, monograph, China).

Mehtamyces Mundk. & Thirum. 1945, *incertae sedis*, Pucciniales, Pucciniomycetes, one species, type species *M. stereospermi* (Mundk.) Mundk. & Thirum., biotrophic on Bignoniaceae, terrestrial, India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Meiorganum R. Heim 1966, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, three species, type species *M. neocaledonicum* R. Heim, Malaysia, New Caledonia, America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Meira Boekhout, Scorzetti, Gerson & Sztejnb. 2003, Brachybasidiaceae, Exobasidiales, Exobasidiomycetes, four species, type species *M. geulakonigii* Boekhout, Scorzetti, Gerson & Sztejnb., known only from saprobic states, anamorphic genus, widespread, epiphytes and endophytes, biocontrol of citrus mites, see Gerson et al. 2008 (biological control), Kurtzman et al. 2011 (taxonomy), cultures available, sequence data available, see Begerow et al. 2014, Wang et al. 2015c, new spp. see Rush and Aime 2013 (USA), Limtong et al. 2017 (Thailand).

Melampsora Castagne 1843, (= *Chnoopsora* Dietel 1906; = *Mesopsora* Dietel 1922; = *Necium* Arthur 1907; = *Podocystis* Fr. 1849; = *Podosporium* Lév. 1847), Melampsoraceae, Pucciniales, Pucciniomycetes, c. 100 species, type species *M. euphorbiae* (Ficinus & C. Schub.) Castagne, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Damadi et al. 2011 (phylogeny), Toome and Aime 2015 (phylogeny), Zhao et al. 2015e, f (phylogeny), Ali et al. 2016 (phylogeny), Zhao et al. 2017b (*M. epitea* complex, phylogeny).

Melampsorella J. Schröt. 1874, Pucciniastraceae, Pucciniales, Pucciniomycetes, two species, type species *M. caryophyllacearum* (DC.) J. Schröt., biotrophic on Boraginaceae, Caryophyllaceae, Pinaceae (alternate host), terrestrial, Europe, North America, Japan, Korea, Russia, see Kirk et al. 2013 (genus accepted), sequence data available, see Maier et al. 2003 (phylogeny).

Melampsoridium Kleb. 1899, Pucciniastraceae, Pucciniales, Pucciniomycetes, eleven species, type species *M. betulinum* (Pers.) Kleb., biotrophic on Betulaceae, Magnoliaceae, Pinaceae (alternate host), terrestrial, Central and North America, Europe, Asia, New Zealand (introduced), see Kirk et al. 2013 (genus accepted), sequence data available, see Aime et al. 2018a (phylogeny, evolution between host, Pucciniales).

Melaniella R. Bauer, Vánky, Begerow & Oberw. 1999, Melaniellaceae, Doassansiales, Exobasidiomycetes, two species, type species *M. oreophila* (Syd.) R. Bauer, Vánky, Begerow & Oberw., plant parasites (leaves, stems) on Selaginellaceae, Indo-Pacific, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Melanoderma B.K. Cui & Y.C. Dai 2011, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *M. microcarpum* B.K. Cui & Y.C. Dai, poroid hymenophore, wood-rotting, white rot, China, sequence data available, see Cui et al. 2011b (taxonomy, phylogeny, China), Yuan and Kan 2015 (new sp., phylogeny, tropical China).

Melanogaster Corda 1831, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 26 species, type species *M. tuberiformis* Corda, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Moreau et al. 2013 (Europe, taxonomy), Truong et al. 2017b (diversity).

Melanoleuca Pat. 1897, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. 60 species, type species *M. polioleuca* (Fr.) Kühner & Maire, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Vizzini et al. 2012e (Europe), new spp. see Sánchez-García et al. 2013 (Mexico), Antonín et al. 2014b, 2015b 2017b (Hungary, Europe, Korea), Yu et al. 2014 (China), Nawaz et al. 2017 (Pakistan).

Melanomphalia M.P. Christ. 1936, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. nigrescens* M.P. Christ., Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Guzmán-Dávalos et al. 2017 (*M. argipoda* is the basionym of *Crepidotus argipodus*).

Melanophyllum Velen. 1921, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *M. haematospermum* (Bull.) Kreisel, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Vellinga 2003 (phylogeny), Vellinga 2004 (phylogeny), Vellinga et al. 2011 (phylogeny).

Melanopsichium Beck 1894, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, two species, type species *M. austroamericanum* (Speg.) Beck, plant parasites (galls, various parts) on Polygonaceae, widespread, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Melanotaenium de Bary 1874, Melanotaeniaceae, Ustilaginales, Ustilaginomycetes, nine species, type species *M. endogenum* (Unger) de Bary, plant parasite (leaves, roots, stems) on dicots, North America, South America, Northern Africa, Asia, Australasia, Europe, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Melanotus Pat. 1900, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 33 species, type species *M. bambusinus* (Pat.) Pat., most species transferred to *Deconica* (W.G. Sm.) P. Karst., saprotrophic on wood and herbs, sequence data available, see Moncalvo et al. 2002 (phylogeny), recognized as *Deconica* sect. *Melanotus* (Pat.) Noordel., see Noordeloos 2011.

Melanoxa M. Lutz, Vánky & R. Bauer 2013, Urocystidaceae, Urocystidales, Ustilaginomycetes, two species, type species *M. oxalidis* (Dietz & G.W. Fisch.) M. Lutz, Vánky & R. Bauer, plant parasites (vegetative parts) on Oxalidaceae, North America, cultures unavailable, sequence data available, Lutz et al. 2012, Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Melanustilospora Denchev 2003, Urocystidaceae, Urocystidales, Ustilaginomycetes, two species, type species *M. ari* (Cooke) Denchev, plant parasites (leaves) on Araceae, Europe, cultures unavailable, sequence data available, see Begerow et al. 2014, Nasr et al. 2014a (taxonomy).

Melzericium Hauerslev 1975, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, three species, type species *M. udicola* (Bourdot) Hauerslev, widespread, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Melzerodontia Hjortstam & Ryvarden 1980, *incertae sedis*, Corticiales, Agaricomycetes, asexual morph unknown, three species, type species *M. aculeata* Hjortstam & Ryvarden, wood-decaying, Tanzania, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Membranomyces Jülich 1975, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *M. spurius* (Bourdot) Jülich, ectomycorrhizal, Asia, Middle East, Europe, Canada, USA, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2006 (phylogeny, cantharelloid clade), Larsson 2007b (phylogeny, corticioid fungi), Argüelles-Moyao et al. 2017 (ecology).

Mensularia Lázaro Ibiza 1916, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, six species, type species *M. radiata* (Sowerby) Lázaro Ibiza [current name: *Xanthoporia radiata* (Sowerby) Ţura, Zmitr., Wasser, Raats & Nevo], wood-rotting, widespread, sequence data available, new spp. see Zhou 2014a (China), Wu et el. 2015b (China).

Meottomyces Vizzini 2008, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *M. dissimulans* (Berk. & Broome) Vizzini, Northern hemisphere, saprotrophic, sequence data available, see Garnica et al. 2007 (phylogeny), Vizzini 2008 (taxonomy), Halama and Rutkowski 2016 (new record, Poland).

Meredithblackwellia Toome & Aime 2013, Kriegeriaceae, Kriegeriales, Microbotryomycetes, sexual morph unknown, one species, type species *M. eburnea* Toome & Aime, yeast, plant material (fern), South America (Guyana), cultures and sequence data available, see Toome et al. 2013, Wang et al. 2015d, e (taxonomy, phylogeny).

Meripilus P. Karst. 1882, Meripilaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *M. giganteus* (Pers.) P. Karst., basidioma composed of numerous pilei from a short stipe or base, poroid hymenophore, terrestrial or wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales).

Merismodes Earle 1909, Niaceae, Agaricales, Agaricomycetes, asexual morph unknown, 20 species, type species *M. fasciculata* (Schwein.) Donk, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes).

Merulicium J. Erikss. & Ryvarden 1976, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. fusisporum* (Romell) J. Erikss. & Ryvarden, Nordic, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson 2007b (phylogeny).

Meruliophana Duhem & Buyck 2011, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *M. mahorensis* Duhem & Buyck, resupinate meruloid basidioma, wood-rotting, Mayotte (France, Comoro Islands, Indian Ocean), sequence data unavailable, see Duhem and Buyck 2011c (taxonomy, Mayotte).

Meruliopsis Bondartsev 1959, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *M. taxicola* (Pers.) Bondartsev, resupinate basidioma, merulioid or poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2013 (phylogeny, Polyporales), Jung et al. 2018 (phylogeny, new combination, *Gloeoporus s. l.*).

Merulius Fr. 1821, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 150 species, type species *M. tremellosus* Schrad., the generic limit of

Merulius is not currently settled, see Justo et al. 2017 (phylogeny, Polyporales), merulioid basidioma, wood-rotting, white rot, widespread, sequence data available, see Binder et al. 2013 (phylogeny, Polyporales), Zmitrovich 2018a (taxonomy).

Mesophellia Berk. 1857, Mesophelliaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, c. 15 species, type species *M. arenaria* Berk., Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006, 2008 (phylogeny, phylogeography).

Mesophelliopsis Bat. & A.F. Vital 1957, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. pernambucensis* Bat. & A.F. Vital, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Metabourdotia L.S. Olive 1957, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *M. tahitiensis* L.S. Olive, Tahiti, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Metraria (Cooke) Cooke & Massee 1891, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *M. insignis* Sacc., Australia, Nigeria, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Metrodia Raithelh. 1971, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *M. collybioides* Raithelh., Argentina, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Metulocyphella Agerer 1983, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *M. lanceolata* Agerer, saprophytic, South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Metulodontia Parmasto 1968, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *M. nivea* (P. Karst.) Parmasto, wood-rotting, white rot, sequence data available, see Larsson and Larsson 2003 (phylogeny, russuloid basidiomycetes).

Metuloidea G. Cunn. 1965, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *M. tawa* (G. Cunn.) G. Cunn., poroid or hydnoid hymenophore, wood-rotting, white rot, widespread, sequence data available, see Miettinen and Ryvarden 2016 (new combinations, phylogeny, revision, monograph, genus accepted), Zmitrovich 2018a (taxonomy).

Microbotryozyma S.O. Suh, D.A. Maslov, R.E. Molestina & J.J. Zhou 2012, Ustilentylomataceae, Microbotryales, Microbotryomycetes, sexual morph unknown, one species, type species *M. collariae* S.O. Suh, D.A. Maslov, R.E. Molestina & J.J. Zhou, insect, Costa Rica, cultures and sequence data available, see Suh et al. 2012 (taxonomy), Wang et al. 2015d, e (taxonomy and phylogeny).

Microbotryum Lév. 1847, Microbotryaceae, Microbotryales, Microbotryomycetes, c. 100 species, type species *M. violaceum* (Pers.) G. Deml & Oberw., worldwide, pathogenic, see Hood et al. 2010 (pathogenic on Caryophyllaceae), Schäfer et al. 2010 (life cycle on *Silene latifolia*), Badouin et al. 2015 (mating-type chromosomes, *M. lychnidis-dioicae*), sequence data available, see Kemler et al. 2009 (phylogeny), new spp., see He and Guo 2008 (China), Piątek et al. 2012, 2013a (Europe), Ziegler et al. 2018 (Germany).

Microporellus Murrill 1905, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *M. dealbatus* (Berk. & M.A. Curtis) Murrill, stipitate basidioma, poroid hymenophore, wood-rotting, widespread (pantropical), sequence data unavailable, new spp. see Decock 2007 (new combination, morphology, Gabon), Medeiros and Ryvarden 2011 (morphology, south America), Kirk et al. 2013 (genus accepted).

Microporus P. Beauv. 1805, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 13 species, type species *M. perula* P. Beauv. (= *M. xanthopus* (Fr.) Kuntze, *fide* Li et al. 2014c), stipitate basidioma, poroid hymenophore, wood-rotting, widespread (paleotropical), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, new combinations see Hattori and Sotome 2013 (morphology, type study, Malaysia, Singapore).

Micropsalliota Höhn. 1914 (= *Allopsalliota* Nauta & Bas 1999), Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 70 species, type species *M. pseudovolvulata* Höhn., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhao et al. 2010 (Northern Thailand, monograph), Parra et al. 2016 (phylogeny), new spp. see Wei et al. 2015 (China), Chen et al. 2016c (Thailand), Terashima et al. 2016 (Japan).

Microsebacina P. Roberts 1993, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, two species, type species *M. fugacissima* (Bourdot & Galzin) P. Roberts, Tahiti, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Microsporomyces Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Microsporomycetaceae, *incertae sedis*, Cystobasidiomycetes, sexual morph unknown, four species, type species *M. magnisporus* (Nakase, Tsuzuki, F.L. Lee, Sugita, Jindam. & M. Takash.) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015d, e (taxonomy, phylogeny), Bai et al. 2016 (new spp., China).

Microstella K. Ando & Tubaki 1984, *incertae sedis*, *incertae sedis*, Basidiomycota, sexual morph Basidiomycota, one species, type species *M. pluvioriens* K. Ando & Tubaki, Japan, aquatic, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Microstroma Niessl 1861, Microstromataceae, Microstromatales, Exobasidiomycetes, 16 species, type species *M. album* (Desm.) Sacc., plant parasites (leaves) mainly on Fagales, widespread, saprobic yeast states, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2014, Wang et al. 2015c, Kijpornyongpan and Aime 2016.

Mikronegeria Dietel, in Dietel & Neger 1899 [1900], Mikronegeriaceae, Pucciniales, Pucciniomycetes, three species, type species *M. fagi* Dietel & Neger, biotrophic on Araucariaceae, Cupressaceae and Podocarpaceae (alternate hosts), Fagaceae, Onagraceae, terrestrial, South America (Argentina, Chile), New Zealand, see Kirk et al. 2013 (genus accepted), sequence data available, see Padamsee and McKenzie 2017 (phylogeny, new combination, New Zealand).

Milesia F.B. White 1878 [1877-78], Pucciniastraceae, Pucciniales, Pucciniomycetes, c. 20 species, type species *M. polypodii* F.B. White, biotrophic on Polypodiaceae, other families as asexual morph of various rust genera (*Cronartium*, *Hyalopsora*, *Melampsorella*, *Melampsoridium*, *Milesina*, *Naoidemyces*, *Pucciniastrum*, *Thekopsora*, *Uredinopsis*), terrestrial, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Maier et al. 2003 (phylogeny), new spp. see Berndt 2008b (new records), McKenzie 2008, Yepes and Carvalho 2009 (new species as asexual morph of *Phakopsora sennae*), Afshan et al. 2010a.

Milesina Magnus 1909, Pucciniastraceae, Pucciniales, Pucciniomycetes, c. 65 species, type species *M. kriegeriana* (Magnus) Magnus, biotrophic on Pinaceae (alternate host), Polypodiaceae, terrestrial, North, South (Ecuador) and Central America, Europe, southern Africa, Asia, New Zealand, see Berndt 2008 (new names, new records), Kirk et al. 2013 (genus accepted), sequence data available, see McTaggart et al. 2014 (phylogeny, rust on ferns).

Mimema H.S. Jacks. 1931, Uropyxidaceae, Pucciniales, Pucciniomycetes, one species, type species *M. holwayi* H.S. Jacks., biotrophic on Fabaceae (*Mimosa*), terrestrial, South America (Brazil), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Minimedusa Weresub & P.M. LeClair 1971, *incertae sedis*, Cantharellales, Agaricomycetes, three species, type species *M. polyspora* (Hotson) Weresub & P.M. LeClair, see Kirk et al. 2013 (genus accepted), sequence data available, see Lawrey et al. 2007 (lichen-associated homobasidiomycetes, phylogeny).

Minostroscyta Hjortstam & Ryvarden 2001, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *M. discoidalis* Hjortstam & Ryvarden, Colombia, sequence data unavailable, see Kirk et al. 2008.

Mixia C.L. Kramer 1959, Mixiaceae, Mixiales, Mixiomycetes, presumably anamorphic (interpretation of sporogenous cells and spores remains ambiguous), yeast stage known, one species, type species *M. osmundae* (Nishida) C.L. Kramer, intracellular phytoparasite on *Osmunda* and *Osmundastrum* ferns, China, Japan and USA, see Sugiyama and Katumoto 2008 (genus accepted), Kurtzman et al. 2011 (taxonomy), Sugiyama et al. 2018 (review), sequence data available, see Aime et al. 2006 (phylogeny), Bauer et al. 2006 (phylogeny, simple-septate basidiomycetes), Nishida et al. 2011 (genome sequencing), Toome et al. 2014 (genome sequencing), Aime et al. 2014 (phylogeny), Wang et al. 2015d, e (phylogeny, yeast), Sugiyama et al. 2018 (taxonomy, phylogeny).

Miyagia Miyabe ex Syd. & P. Syd. 1913 (=*Peristemma* Syd. 1921), Pucciniaceae, Pucciniales, Pucciniomycetes, three species, type species *M. anaphalidis* Miyabe, biotrophic, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Padamsee and McKenzie 2017 (phylogeny, new combination, New Zealand).

Moesziomyces Vánky 1977, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, seven species, type species *M. bullatus* (J. Schröt.) Vánky, plant parasites (ovaries) on Poaceae, widespread, saprobic yeast states on plants, cultures available, see Kirk et al. 2013 (genus accepted), sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Mollicarpus Ginns 1984, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *M. cognatus* (Berk.) Ginns, pileate basidioma, poroid hymenophore, wood-rotting, southeast Asia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Moniliella Stolk & Dakin 1966, Moniliellaceae, Moniliellales, Moniliellomycetes, 15 species, type species *M. acetoabutans* Stolk & Dakin, known only from saprobic states, osmotolerant, widespread, see Kurtzman et al. 2011 (taxonomy), Kirk et al. 2013 (genus accepted), erythritol-producing, see Lin et al. 2010 (production of erythritol), Kobayashi et al. 2015 (production of erythritol), sequence data availbale, cultures available, see Rosa et al. 2009 (phylogeny, new spp.), new spp see Thanh et al. 2012, 2013, 2018 (Vietnam), Wang et al. 2014, 2015c (phylogeny).

Moniliophthora H.C. Evans, Stalpers, Samson & Benny 1978, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *M. roreri* (Cif.) H.C. Evans, Stalpers, Samson & Benny, worldwide, pathogen causes Witches' broom disease, see Kerekes and Desjardin 2009 (monograph, *Crinipellis*, *Moniliophthora*, southeast Asia), Marelli et al. 2009 (infection biology), Kirk et al. 2013 (genus accepted), sequence data available, see Mondego et al. 2008 (genome), Barbosa et al. 2018 (Genome sequence and effectorome), new spp. see Kropp and Albee-Scott 2012 (Samoan Islands).

Monosporidium Barclay 1888 [1887] (=*Kulkarniella* Gokhale & Patel 1952 [1951]), Phakopsoraceae, Pucciniales, Pucciniomycetes, three species, type species *M. euphorbiae* Barclay ex Sacc. 1891, biotrophic on Euphorbiaceae, Phyllanthaceae, Rubiaceae, terrestrial, India, see Cummins and Hiratsuka 2003 (synonym of *Endophyllum*), sequence data unavailable, Kirk et al. 2013 (genus accepted).

Montagnea Fr. 1836, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *M. arenaria* (DC.) Zeller, secotioid, subtropical try

areas, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny).

Moreaua Liou & H.C. Cheng 1949, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, 39 species, type species *M. kungii* Liou & H.C. Cheng, plant parasite (surface of inner floral organs) on Cyperaceae, widespread (especially Australia), see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Morganella Zeller 1948, Lycoperdaceae, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *M. mexicana* Zeller, worldwide, see Kirk et al. 2013 (genus accepted), Alfredo et al. 2017 (Brazil), sequence data available, gasteroid, see Larsson and Jeppson 2008 (phylogeny), new spp. see Alfredo et al. 2012a (Brazil), Alves and Cortez 2013b (Brazil), Alfredo et al. 2014b (Brazil), Alves et al. 2017 (Brazil).

Morispora Salazar-Yepes, Pardo-Card. & Buriticá 2007, Phragmidiaceae, Pucciniales, Pucciniomycetes, sexual morph *Gerwasia* Racib. 1909, one species, type species *M. tenella* (H.S. Jacks. & Holw.) Salazar-Yepes, Pardo-Card. & Buriticá, biotrophic on Rosaceae (*Rubus*), terrestrial, South America (Ecuador), sequence data unavailable, see Salazar-Yepes et al. 2007 (taxonomy, morphology).

Mrakia Y. Yamada & Komag. 1987, Mrakiaceae, Cystofilobasidiales, Tremellomycetes, sexual and asexual morphs known, twelve species, type species *M. frigida* (Fell, Statzell, I.L. Hunter & Phaff) Y. Yamada & Komag., yeast, psychrophilic, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy, phylogeny), Tsuji et al. 2018, 2019 (new spp.).

Mucidula Pat. 1887, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *M. mucida* (Schrad.) Pat., sequence data available, see Petersen and Hughes 2010 (phylogeny), Schoch et al. 2014 (molecular sequences for reference specimens).

Mucilopilus Wolfe 1979, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *Fistulinella viscida* (McNabb) Singer, stipitate-pileate, presumably ectomycorrhizal, tropical to subtropical, sequence data available, *M. castaneiceps* does not form a monophyletic group with some *Fistulinella* spp., see Wu et al. 2016f (taxonomy, phylogeny).

Mucronella Fr. 1874, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, eight species, type species *M. calva* (Alb. & Schwein.) Fr., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny, corticioid homobasidiomycetes), Dentinger and McLaughlin 2006 (phylogeny, Clavariaceae).

Multiclavula R.H. Petersen 1967, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, 13 species, type species *M. corynoides* (Peck) R.H. Petersen, saprobes, lichenized, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Nelsen et al. 2007 (North America, phylogeny).

Multifurca Buyck & V. Hofst. 2008, Russulaceae, Russulales, Agaricomycetes, asexual morph unknown, ten species, type species *M. ochricompacta* (Bills & O.K. Mill.) Buyck & V. Hofst., two subgenera (subg. *Furcata* for lactarioid species, subg. *Multifurca* for russuloid species), agaricoid, presumed ectomycorrhizal, terrestrial, worldwide (unknown from Africa and South America), amphi-pacific distribution with strong preference for the (sub)tropical zone of the Northern Hemisphere, Wang and Liu 2010 (new record, morphology, China), sequence data available, see Buyck et al. 2008 (phylogeny), Wang et al. 2018d (biogeography, new subgenus), Das et al. 2018 (epitypification), new spp. see Lebel et al. 2013 (Australia).

Mundkurella Thirum. 1944, Urocystidaceae, Urocystidales, Ustilaginomycetes, five species, type species *M. heptapleuri* Thirum., plant parasites (leaves, petioles, stems, leaves) on Araliaceae, North America, Asia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Muribasidiospora Kamat & Rajendren 1968, Exobasidiaceae, Exobasidiales, Exobasidiomycetes, three species, type species *M. indica* Kamat & Rajendren, plant parasites on Anacardiaceae and Ulmaceae, India, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2001, Begerow et al. 2002, 2014, Wang et al. 2015c (taxonomy, phylogeny).

Murinicarpus B.K. Cui & Y.C. Dai 2019, Polyporaceae, Polyporales, Agaricomycetes, asexual morph uknown, two species, type species *M. subadustus* (Z.S. Bi & G.Y. Zheng) B.K. Cui & Y.C. Dai, China, sequence data available, see Cui et al. 2019 (taxonomy, phylogeny).

Muscinupta Redhead, Lücking & Lawrey 2009, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *M. laevis* (Fr.) Redhead, Lücking & Lawrey, see Lawrey et al. 2009 (taxonomy), sequence data available, see Larsson et al. 2006 (phylogeny).

Musumecia Vizzini & Contu 2011, Pseudoclitocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *M. bettlachensis* Vizzini & Contu, France, Italy, China, sequence data available, see Vizzini et al. 2011a (genus introduced), new spp. see Musumeci 2014 (Europe), Li et al. 2016b (China, Italy).

Mutinus Fr. 1849, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, 21 species, type species *M. caninus* (Huds.) Fr, terrestrial, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Giachini et al. 2010 (phylogeny, Gomphales), Degreef et al. 2013 (São Tomé), Trierveiler-Pereira et al. 2014a (Phallales, phylogeny), new spp. see da Silva et al. 2015 (Brazil), Crous et al. 2017b (Brazil).

Mycaureola Maire & Chemin 1922, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. dilseae* Maire & Chemin, marine, pathogen of the red alga, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2006 (evolution, phylogeny).

Mycena (Pers.) Roussel 1806 (= *Decapitatus* Redhead & Seifert 2000 *fide* Art. 59.1), Mycenaceae, Agaricales, Agaricomycetes, asexual morph previously known in *Decapitatus* Redhead & Seifert 2000, c. 600 species, type species *M. galericulata* (Scop.) Gray, saprotrophic, pathogenic, orchid mycorrhizae, worldwide, many species bioluminescent, see Desjardin et al. 2008a (bioluminescent fungus), Kirk et al. 2013 (genus accepted), Robich 2016 (Europe), sequence data available, see Harder et al. 2010 (Northern Europe, section *Calodontes*), Jaeger and Spiteller 2010 (compounds), Harder et al. 2013 (species complex), Park and Lee 2013 (symbiotic, *Gastrodia elata*), new spp. see Robich and Hausknecht 2008 (Austria), Aronsen 2009 (Norway), Boonpratuang 2009 (Thailand), Robich 2009 (Switzerland), Esteve-Raventos and Barrasa 2009 (Spain), Robich and Hausknecht 2009 (Mauritius), Desjardin et al. 2010 (Brazil, Malaysia, Puerto Rico), Aravindakshan and Manimohan 2011, 2012 (India, section *Polyadelphia*), Aronsen and Perry 2012 (Norway), Niveiro et al. 2012 (Argentina),

Zamora and Català 2013 (Spain), Aravindakshan and Manimohan 2013a, b, c, 2014 (new section, section *Galactopoda*, section *Exornatae*, section *Longisetae*), Chew et al. 2014 (Malaysia, bioluminescent taxa), Shih et al. 2014 (China), Seok et al. 2015 (Korea), Perry and Desjardin 2016 (California, USA), Desjardin et al. 2016 (Brazil), Robich 2016 (Europe), Takahashi et al. 2016 (Japan), Miersch and Wilhelm 2017 (France), Wei and Kirschner 2019 (China).

Mycenastrum Desv. 1842, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, 18 species, type species *M. corium* (Guers.) Desv., gasteroid, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Jeppson 2008 (phylogeny), new spp. see Gurgel et al. 2017 (Brazil).

Mycenella (J.E. Lange) Singer 1938, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *M. cyatheae* (Singer) Singer, temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Osmundson et al. 2013 (DNA barcode).

Mycetinis Earle 1909, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, 15 species, type species *M. alliaceus* (Jacq.) Earle ex A.W. Wilson & Desjardin, basidiomas of garlic smelling, saprophytic, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Petersen and Hughes 2017 (taxonomy).

Mycoacia Donk 1931, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 16 species, type species *M. fuscoatra* (Fr.) Donk, resupinate basidioma, hydnoid hymenophore, wood-inhabiting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Moreno et al. 2011 (phylogeny, Meruliaceae), Sjökvist et al. 2012 (phylogeny), new sp. see Yuan and Wan 2013 (morphology, China).

Mycoaciella J. Erikss. & Ryvarden 1978, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *M. bispora* (Stalpers) J. Erikss. & Ryvarden, resupinate basidioma, hydnoid hymenophore, wood-inhabiting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny, corticioid fungi), new combination see Hjortstam and Ryvarden 2009b (morphology).

Mycoalvimia Singer 1981, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. theobromicola* Singer, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accetped).

Mycoamaranthus Castellano, Trappe & Malajczuk 1992, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, three species, type species *M. auriorbis* Castellano, Trappe & Malajczuk, sequestrate, presumably ectomycorrhizal, Australia, Africa, Southeast Asia, some species edible (*M. cambodgensis*), see Lumyong et al. 2003, Kirk et al. 2013 (genus accepted), sequence data available, see Smith et al. 2015 (phylogeny).

Mycocalia J.T. Palmer 1961, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *M. denudata* (Fr. & Nordholm) J.T. Palmer, worldwide, bird's nests fungi, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2015 (taxonomy, dark-spored, phylogeny), new spp. see Crous et al. 2018b (morphology, phylogeny, Brazil).

Mycocryptococcus Pollacci & Nann. 1927, Tremellaceae, Tremellales, Tremellomycetes, asexual morph unknown, one species, type species *M. copellii* Pollacci & Nann., yeast, worldwide, sequence data unavailable, see Kirk et al. 2008.

Mycogloea L.S. Olive 1950, *incertae sedis*, Agaricostilbales, Agaricostilbomycetes, seven species, type species *M. carnosa* L.S. Olive, yeast stage described as *Kurtzmanomyces*, mycoparasitic (mostly on Ascomycota), North America, Japan, Thailand, sequence data available, the genus is most likely polyphyletic, see Bauer et al. 2009 (phylogeny), Wang et al. 2015d, e (phylogeny, yeast).

Mycoleptodonoides Nikol. 1952, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *M. vassiljevae* Nikol., hydnoid hymenophore, wood-rotting, widespread (Asia), see Kirk et al. 2013 (genus accepted), some species edible (*M. aitchisonii* (Berk.) Maas Geest.), see Dai et al. 2010b (edible mushrooms, China), Choi et al. 2016b (compounds), sequence data available, see Justo et al. 2017 (phylogeny, Polyporales), new spp. see Yuan and Dai 2009a (morphology, China), Das et al. 2013b (phylogeny, morphology, India).

Mycolevis A.H. Sm. 1965, Albatrellaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *M. siccigleba* A.H. Sm., terrestrial, North America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Mycopan Redhead, Moncalvo & Vilgalys 2013, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. scabripes* (Murrill) Redhead, Moncalvo & Vilgalys, basidioma mycenoid, sordid, on plant debris, sequence data unavailable, see Redhead 2013a (taxonomy).

Mycorrhaphium Maas Geest. 1962, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, six species, type species *M. adustum* (Schwein.) Maas Geest., hydnoid hymenophore, terrestrial, widespread (USA, Europe, Africa, China), see Kirk et al. 2013 (genus accepted), Tervonen et al. 2015 (redescription of *M. pusillum*), Zmitrovich 2018a (taxonomy), sequence data available, see Miettinen et al. 2012 (phylogeny), Yuan 2014 (phylogeny, *Antrodiella,* China), new sp. see Yuan and Dai 2009b (morphology, China).

Mycorrhaphoides Hembrom, K. Das & Hallenb. 2017, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *M. stalpersii* Hembrom, Nilsson, A. Parihar, K. Das, A. Baghela & S.K. Singh, wood-rotting, India, sequence data available, see Hembrom et al. 2017b (taxonomy, China).

Mycosarcoma Bref. 1912, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, five species, type species *M. maydis*, plant parasite (flowers) on Poaceae, widespread, saprotrophic yeast on plants, cultures available, sequence data available, see McTaggart et al. 2016c (taxonomy).

Mycospongia Velen. 1939, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. juniperi* Velen., sequence data unavailable, see Kirk et al. 2008.

Mycostigma Jülich 1976, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, one species, type species *M. aegeritoides* (Bourdot & Galzin) Jülich, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Mycostilla Spirin & V. Malysheva 2018, *incertae sedis*, Auriculariales, Agaricomycetes, monotypic, type species *M. vermiformis* (Berk. & Broome) Spirin & V. Malysheva (previously *Dacrymyces vermiformis*), temperate European forests, sequence data available, see Spirin et al. 2019a (genus introduced, phylogeny).

Mycosyrinx Beck 1894, Mycosyringaceae, Urocystidales, Ustilaginomycetes, asexual morph unkown, four species, type species *M. cissi* (DC.) Beck, plant parasites (branches) on *Cissus* spp. (Vitaceae), America, Asia, Africa, see Kirk et al. 2013 (genus

accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Nasr et al. 2014a (taxonomy).

Mycothele Jülich 1976, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, one species, type species *M. disciformis* (G. Cunn.) Jülich, New Zealand, sequence data unavailable, see Kirk et al. 2013 (genus accetped).

Mylittopsis Pat. 1895, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *M. langloisii* Pat., USA, Malaysia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Myochromella V. Hofst., Clémençon, Moncalvo & Redhead 2015, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *M. inolens* (Fr.) V. Hofstetter, Clémençon, Moncalvo & Redhead, worldwide, basidioma agarioid, solitary, gregarious or occasionally paired (notcaespitose), sequence data available, see Hofstetter et al. 2014 (phylogeny, Lyophyllaceae), Bellanger et al. 2015 (phylogeny).

Myriococcum Fr. 1823, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *M. praecox* Fr., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Koukol 2016 (phylogeny).

Myriostoma Desv. 1809, Geastraceae, Geastrales, Agaricomycetes, asexual morph unknown, four species, type species *M. anglicum* Desv. [current name: *M. coliforme* (Dicks.) Corda], widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Sousa et al. 2017 (hidden species within *M. coliforme*).

Myriothele Nakasone 2013, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *M. philippiae* (Boidin & Gilles) Nakasone, hydnoid hymenophore, see Nakasone et al. 2013 (morphology), wood-rotting, Réunion, sequence data available, see Wu et al. 2007 (phylogeny), Nakasone 2013 (new genus, new combination, morphology, *Epithele*), Justo et al. 2017 (phylogeny, Polyporales).

Mythicomyces Redhead & A.H. Sm. 1986, Mythicomycetaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *M. corneipes* (Fr.) Redhead & A.H. Sm., North temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006 (phylogeny), Vizzini et al. 2019 (phylogeny).

Myxariellum Spirin & V. Malysheva 2019, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, two species, type species *M. concinnum*

Spirin & V. Malysheva, North America (United States, Washington); on rotten wood of *Thuja*, sequence data available, see Spirin et al. 2019b (taxonomy, phylogeny).

Myxarium Wallr. 1833, Hyaloriaceae, Auriculariales, Agaricomycetes, asexual morph unknown, 14 species, type species *M. nucleatum* Wallr., wood-decaying, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Weiß and Oberwinkler 2001 (taxonomy and phylogeny), Spirin et al. 2018a, 2019b (taxonomy, phylogeny, new spp.)

Myxomphalia Hora 1960, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. two species, type species *M. maura* (Fr.) Hora, North temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Antonín 1999 (type revision), Moncalvo et al. 2002 (phylogeny), Antonín and Noordeloos 2004 (Europe).

Naematelia Fr. 1818, Naemateliaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, four species, type species *N. encephala* (Pers.) Fr., mycoparasitic, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy, phylogeny).

Naganishia S. Goto 1963, Filobasidiaceae, Filobasidiales, Tremellomycetes, sexual morph unknown, 17 species, type species *N. globosa* Goto, yeast, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny), new spp. see Fotedar et al. 2018 (Qatar).

Naiadolina Redhead, Labbé & Ginns 2013, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *N. flavomerulina* (Redhead) Redhead, H. Labbé & Ginns, worldwide, sequence data available, see Redhead and Ginns 2013 (taxonomy), Hao et al. 2014 (phylogeny).

Nannfeldtiomyces Vánky 1981, Doassansiaceae, Doassansiales, Exobasidiomycetes, asexual morph unknown, two species, type species *N. sparganii* (Lagerh.) Vánky, plant parasites on leaves of Sparganiaceae, Asia, Europe, North America, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy).

Nanstelocephala Oberw. & R.H. Petersen 1990, Crepidotaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *N. physalacrioides* Oberw. & R.H. Petersen, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Naohidea Oberw. 1990, Naohideaceae, Naohideales, Cystobasidiomycetes, yeast stage known, one species, type species *N. sebacea* (Berk. & Broome) Oberw., gelatinous basidiocarps, mycoparasitic, Asia, Europe and North America, see Piątek 2002 (notes on distribution, Poland), Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Aime et al. 2006 (phylogeny), Bauer et al. 2006 (phylogeny, simple-septate basidiomycetes), Aime et al. 2014 (phylogeny), Wang et al. 2015e (phylogeny, taxonomy).

Naohidemyces S. Sato, Katsuya & Y. Hirats. 1993, Pucciniastraceae, Pucciniales, Pucciniomycetes, two species, type species *N. vaccinii* (Jørst.) S. Sato, Katsuya & Y. Hirats. ex Vanderweyen & Fraiture, biotrophic on *Vaccinium* (Ericaceae) and *Tsuga* (Pinaceae, alternate host), terrestrial, see Vanderweyen and Fraiture 2009 (validated *N. vaccinii*), Kirk et al. 2013 (genus accepted), sequence data available, see Aime 2006 (phylogeny).

Narasimhania Thirum. & Pavgi 1952, Doassansiaceae, Doassansiales, Exobasidiomycetes, one species, type species *N. alismatis* Pavgi & Thirum., plant parasites on leaves of Alismataceae, Africa, South America, South Asia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy, phylogeny).

Naucoria (Fr.) P. Kumm. 1871 (= *Alnicola* Kühner 1926), Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, 30 species, type species *N. escharioides* (Fr.) P. Kumm., worldwide, see Henrici 2008 (Britain, keys), Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Larsson et al. 2009b (phylogeny).

Navisporus Ryvarden 1980, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, eight species, type species *N. floccosus* (Bres.) Ryvarden, poroid hymenophore, wood-rotting, widespread (pantropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Vlasák et al. 2012 (USA), new spp. see Ryvarden 2018a (morphology, Cameroon, Central African Republic).

Necator Massee 1898, Corticiaceae, Corticiales, Agaricomycetes, sexual morph *Erythricium*, one species, type species *N. decretus* Massee, Southeast Asia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Neoalbatrellus Audet 2010, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, four species, type species *N. caeruleoporus* (Peck) Audet, poroid hymenophore, wood-decaying, ectomycorrhizal, worldwide, on soil, see Audet 2010 (taxonomy), sequence data available, see Audet and Luther 2015 (new sp., phylogeny, North America), Chen et al. 2017e (new sp., phylogeny, China).

Neoaleurodiscus Sheng H. Wu 2010, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *N. fujii* Sheng H. Wu 2010, wood-rotting, Japan, sequence data available, see Wu et al. 2010b (genus introduced).

Neoalpova Vizzini 2014, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *N. rubescens* (Vittad.) Vizzini, sequence data unavailable, see Vizzini 2014a (taxonomy).

Neoantrodia Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, 13 species, type species *N. serialis* (Fr.) Audet, wood-rotting, sequence data available, see Ortiz-Santana et al. 2013 (antrodia clade of Polyporales, phylogeny), Spirin et al. 2016a (phylogeny, *Antrodia s. s.*), Han et al. 2016a (brown-rot fungi, phylogeny, new genera, *Fomitopsis*).

Neoantrodiella Y.C. Dai, B.K. Cui, Jia J. Chen & H.S. Yuan 2015, Neoantrodiellaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, two species, type species *N. gypsea* (Yasuda) Y.C. Dai, B.K. Cui, Jia J. Chen & H.S. Yuan, sequence data available, see Ariyawansa et al. 2015 (taxonomy).

Neoboletus Gelardi, Simonini & Vizzini 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, eleven species, type species *N. luridiformis* (Rostk.) Gelardi, Simonini & Vizzini, mostly stipitate-pileate, ectomycorrhizal, both edible (*N. erythropus*, Boa 2004) and poisonous species(*N. venenatus*, Matsuura et al. 2007), Europe, North America, Asia, sequence data available, see Wu et al. 2014b (phylogeny).

Neoburgoa Diederich, E. Zimm. & Lawrey 2016, Hydnaceae, Cantharellales, Agaricomycetes, only asexual morph known (bulbil-forming), one species, type species *N. freyi* Diederich, Zimmermann & Lawrey, lichenicolous, widespread in the Alps, Russia, see Zhurbenko and Pino-Bodas 2017 (revision, lichenicolous fungi growing on *Cladonia*), sequence data available, see Lawrey et al. 2016 (taxonomy, phylogeny).

Neocampanella Nakasone, Hibbett & Goranova 2009, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *N. blastanos* (Boidin & Gilles) Nakasone, Hibbett & Goranova, lignicolous, Central African Republic, China, Mauritius, USA, basidioma corticioid, sequence data available, see Nakasone et al. 2009 (taxonomy).

Neoclitocybe Singer 1962, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, eleven species, type species *N. byssiseda* (Bres.) Singer, worldwide, see Kirk et al. 2013 (genus accepted), sequence data unavailable, new spp. see Sa et al. 2016 (Brazil).

Neodatronia B.K. Cui, Hai J. Li & Y.C. Dai 2014, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *N. gaoligongensis* B.K. Cui, Hai J. Li & Y.C. Dai, poroid hymenophore, wood-rotting, China, sequence data available, see Li et al. 2014b (phylogeny, monograph, China).

Neodictyopus Palacio, Robledo, Reck & Drechsler-Santos 2017, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *N. atlanticae* Palacio, Robledo & Drechsler-Santos, sequence data available Palacio et al. 2017 (taxonomy).

Neofavolus Sotome & T. Hatt. 2013, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *N. alveolaris* (DC.) Sotome & T. Hatt., poroid hymenophore, wood-rotting, widespread (temperate), sequence data available, see Sotome et al. 2013 (new sp., new combinations, phylogeny), Seelan et al. 2015 (new combination, phylogeny), Zmitrovich and Kovalenko 2016 (phylogeny), Zmitrovich 2018a (taxonomy).

Neofomitella Y.C. Dai, Hai J. Li & Vlasák 2014, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *N. rhodophaea* (Lév.) Y.C. Dai, Hai J. Li & Vlasák, pileate basidioma, poroid hymenophore, wood-rotting, widespread (Asia), sequence data available, see Li et al. 2014c (taxonomy, phylogeny, China).

Neohygrocybe Herink 1958, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *N. ovina* (Bull.) Herink, worldwide, two sections: sect. *Neohygrocybe* Herink 1958 and sect. *Tristes* (Bataille) Lodge &

Padamsee 2013, worldwide, sequence data available, see Babos et al. 2011 (phylogeny), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae).

Neolentinus Redhead & Ginns 1985, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, 14 species, type species *N. kauffmanii* (A.H. Sm.) Redhead & Ginns, wood-rotting, widespread, brown rot (*N. lepideus*), see Kirk et al. 2013 (genus accepted), some species edible (*N. lepideus* (Fr.) Redhead & Ginns), see Dai et al. 2010b (edible mushrooms, China), Jang et al. 2010 (cultivation), some species medicinal use (*N. adhaerens* (Alb. & Schwein.) Redhead & Ginns), see Dai and Yang 2008 (medicinal mushrooms, China), sequence data available, see Garcia-Sandoval et al. 2011 (phylogeny), Nagy et al. 2015 (evolution, genome), Zmitrovich and Kovalenko 2016 (phylogeny, new combinations), Vlasenko et al. 2017 (Novosibirsk, new record).

Neolentiporus Rajchenb. 1995, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *N. maculatissimus* (Lloyd) Rajchenb., poroid hymenophore, wood-rotting, brown rot, widespread (South America, Australia), see Kirk et al. 2013 (genus accepted), sequence data available, see Pildain and Rajchenberg 2013 (phylogeny, *Postia s. l.*, Argentina).

Neolysurus O.K. Mill., Ovrebo & Burk 1991, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *N. arcipulvinus* O.K. Mill., Ovrebo & Burk, terrestrial, Costa Rica, sequence data unavailable, see Kirk et al. 2013 (genus accetped).

Neomensularia F. Wu, L.W. Zhou & Y.C. Dai 2016, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, four species, type species *N. duplicata* F. Wu, L.W. Zhou & Y.C. Dai, wood-rotting, sequence data available, see Wu et al. 2016a (taxonomy), new spp. see Ji and Wu et al. 2017b (China).

Neonothopanus R.H. Petersen & Krisai 1999, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *N. nambi* (Speg.) R.H. Petersen & Krisai, see Kirk et al. 2013 (genus accepted), some species bioluminescent (*N. nambi* (Speg.) R.H. Petersen & Krisai), on tree base, Australia, South America, Central America, Malaysia, sequence data available, see Chew et al. 2015 (Malaysia, phylogeny, bioluminescent fungi), new combinations, see Capelari et al. 2011,

Neopaxillus Singer 1948, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *N. echinospermus* (Speg.) Singer, America, see Kirk et al. 2013 (genus accepted), Watling and Aime 2013 (monograph), sequence data available, new spp. see Vizzini et al. 2012a (Dominican Republic).

Neosecotium Singer & A.H. Sm. 1960, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *N. macrosporum* (Lloyd) Singer & A.H. Sm., America, Africa, sequence data unavailable, see Lizárraga et al. 2012 (Brazil), Kirk et al. 2013 (genus accepted).

Neotremella Lowy 1979, *incertae sedis*, Tremellales, Tremellomycetes, asexual morph unknown, one species, type species *N. guzmanii* Lowy, wood-decaying, North America, Mexico, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Neotyphula Wakef. 1934, *incertae sedis*, *incertae sedis*, *incertae sedis*, Basidiomycota, asexual morph unknown, one species, type species *N. guianensis* Wakef., Guyana, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Neovossia Körn. 1879, Tilletiaceae, Tilletiales, Exobasidiomycetes, one species, type species *N. moliniae* (Thüm.) Körn., plant parasite (ovaries) on Poaceae, Europa, Asia, North America, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Newinia Thaung 1973, Phakopsoraceae, Pucciniales, Pucciniomycetes, three species, type species *N. heterophragmatis* Thaung, biotrophic on Bignoniaceae, terrestrial, Nigeria, Myanmar, Thailand, sequence data unavailable, see Kirk et al. 2013 (genus accetped).

Nia R.T. Moore & Meyers 1961, Niaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *N. vibrissa* R.T. Moore & Meyers, worldwide, marine, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2001 (*N. vibrissa*, phylogeny), Yamaguchi et al. 2009 (phylogeny).

Nidula V.S. White 1902, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *N. candida* (Peck) V.S. White, worldwide, bird's nests fungi, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhao et al. 2017 (phylogeny), new spp. see Das and Zhao 2013 (India), Poinar 2014 (fossil).

Nidularia Fr. 1817, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *N. deformis* (Willd.) Fr., worldwide, bird's nests fungi, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny and Griffith 2010 (phylogeny).

Nidulariopsis Greis 1935, Geastraceae, Geastrales, Agaricomycetes, asexual morph unknown, two species, type species *N. melanocarpa* Greis, Europe, North America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Nielozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Bulleribasidiaceae, Tremellales, Tremellomycetes, sexual morph unknown, two species, type species *N. melastomae* (Nakase, Tsuzuki, F.L. Lee & M. Takash.) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, Asia, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Niemelaea Zmitr., Ezhov & Khimich 2015, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *N. consobrina* (Bres.) Zmitr., Ezhov & Khimich, poroid hymenophore, wood-rotting, widespread, sequence data available, see Tomšovský et al. 2010b (phylogeny, *Ceriporiopsis*), new combinations see Zmitrovich et al. 2015 (taxonomy, Russia, China), Papp 2016b (*N. balaenae*), Zmitrovich 2018a (taxonomy).

Nigroboletus Gelardi, Vizzini, E. Horak, T.H. Li & Ming Zhang 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *N. roseonigrescens* Gelardi, Vizzini, E. Horak, T.H. Li & Ming Zhang, stipitate-pileate, China, sequence data available, see Gelardi et al. 2015b (taxonomy, phylogeny).

Nigrohydnum Ryvarden 1987, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *N. nigrum* Ryvarden, pileate basdiome, hymenophore hydnoid to lamellate, wood-rotting, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Robledo and Gugliotta 2013 (morphology, distribution).

Nigrofomes Murrill 1904, Nigrofomitaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, three species, type species *N. melanoporus* (Mont.) Murrill, wood-rotting, worldwide, sequence data available, see Zhou et al. 2018 (accepted Nigrofomitaceae, phylogeny, taxonomy).

Nigroporus Murrill 1905, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *N. vinosus* (Berk.) Murrill, poroid hymenophore, wood-rotting, widespread (pantropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen et al. 2012 (phylogeny), Binder et al. 2013 (phylogeny, Polyporales).

Niveoporofomes B.K. Cui, M.L. Han & Y.C. Dai 2016, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *N. spraguei* (Berk. & M.A. Curtis) B.K. Cui, M.L. Han & Y.C. Dai, widespread (temperate), annual pileate basidioma, poroid hymenophore, wood-rotting, brown rot, sequence data available, see Han et al. 2016a (new combination, phylogeny, morphology).

Nochascypha Agerer 1983, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *N. filicina* (P. Karst.) Agerer, South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Nothocastoreum G.W. Beaton 1984, Mesophelliaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, one species, type species *N. cretaceum* (Lloyd) G.W. Beaton, Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny, phylogeography).

Nothocorticium Gresl. & Rajchenb. 1999, *incertae sedis*, Corticiales, Agaricomycetes, asexual morph unknown, one species, type species *N. patagonicum* Gresl. & Rajchenb., Argentina, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Notholepista Vizzini & Contu 2012, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *N. subzonalis* (Peck) Vizzini & Contu, worldwide, on the ground, never on wood, sequence data available, see Vizzini et al. 2012b (taxonomy).

Nothophellinus Rajchenb. & Pildain 2015, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *N. andinopatagonicus* (J.E. Wright & J.R. Deschamps) Rajchenb. & Pildain, proposed to accommodate *Phellinus andinopatagonicus*, wood-rotting, white rot, Argentina, Chile, sequence data available, see Rajchenberg et al. 2015 (poroid Hymenochaetaceae).

Nothoravenelia Dietel 1910, Phakopsoraceae, Pucciniales, Pucciniomycetes, three species, type species *N. japonica* Dietel, biotrophic on Burseraceae, Euphorbiaceae, terrestrial, Malawi, Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Nyssopsora Arthur 1906 (= *Oplophora* Syd. 1921), Raveneliaceae, Pucciniales, Pucciniomycetes, eleven species, type species *N. echinata* (Lév.) Arthur, biotrophic, terrestrial on Anacardiaceae, Apiaceae, Araliaceae, Meliaceae, Pittosporaceae, Sapindaceae, Asia, Australia, Europe, North America, central America (Panama), see Kirk et al. 2013 (genus accepted), sequence data available, see Baiswar et al. 2014 (identification), new spp. see de Carvalho et al. 2014 (Panama).

Obba Miettinen & Rajchenb. 2012, Gelatoporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *O. valdiviana* (Rajchenb.) Miettinen & Rajchenb., resupinate basidioma, poroid hymenophore, wood-rotting, white rot, widespread (subtropics to boreal zone), sequence data available, see Miettinen and Rajchenberg 2012 (taxonomy, phylogeny), Miettinen et al. 2016b (draft genome, *O. rivulosa*), Zmitrovich 2018a (taxonomy).

Oberwinkleria Vánky & R. Bauer 1995, Tilletiaceae, Tilletiales, Exobasidiomycetes, one species, type species *O. anulata* Vánky & C. Vánky, plant parasite (ovaries) on *Ortachne* spp. (Poaceae), Venezuela, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy).

Oberwinklerozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, three species, type species *O. yarrowii* (Á. Fonseca & Uden) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Occultifur Oberw. 1990, Cystobasidiaceae, Cystobasidiales, Cystobasidiomycetes, all species are able to develop a yeast stage or are only known as yeast (*O. brasiliensis* and *O. tropicalis*), c. nine species (probably an underestimation as some species were recently discovered as yeast stages from very different habitats), type species *O. internus* (L.S. Olive) Oberw., ecological strategies variable, mycoparasitic, endophytic, epiphytic or soil yeasts, worldwide, Kurtzman et al. 2011 (taxonomy), sequence data

available, see Aime et al. 2006 (phylogeny), Bauer et al. 2006 (phylogeny, simple-septate basidiomycetes), Aime et al. 2014 (phylogeny), Wang et al. 2015e (phylogeny, yeast), new spp. see Gomes et al. 2015 (Brazil), Kurtzman and Robnett 2015 (USA), Khunnamwong et al. 2015 (Thailand, Brazil), Khunnamwong et al. 2017, Šibanc et al. 2018 (Slovenia),

Ochropsora Dietel 1895, Uropyxidaceae, Pucciniales, Pucciniomycetes, three species, type species *O. sorbi* Dietel, biotrophic on Ranunculaceae (alternate host), Araliaceae, Elaeagnaceae, Rosaceae, terrestrial, Europe, Japan, see Kirk et al. 2013 (genus accepted), sequence data available, see Van der Merwe et al. 2007 (phylogeny).

Octaviania Vittad. 1831, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *O. asterosperma* Vittad., basidiomas sequestrate, ectomycorrhizal, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Orihara et al. 2012b (phylogeny, new spp., Japan), Choeyklin et al. 2012 (Thailand), Cabero et al. 2013 (Spain).

Odonticium Parmasto 1968, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, seven species, type species *O. romellii* (S. Lundell) Parmasto, worldwide, sequence data available, see Larsson et al. 2006 (phylogeny), Miettinen et al. 2012 (phylogeny).

Odontiochaete Rick 1940, *incertae sedis*, Cantharellales, Agaricomycetes. asexual morph unknown, one species, type species *O. alba* Rick, Host-Substratum Brazilwood, genus in need of modern interpretation, sequence data unavailable, see Kirk et al. 2008.

Odontiopsis Hjortstam & Ryvarden 1980, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, two species, type species *O. hyphodontina* Hjortstam & Ryvarden, wood-rotting, widespread, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Odontoefibula C.C. Chen & Sheng H. Wu 2018, Phanerochaetaceae, Polyporales, Agaricomycetes, one species, type species *O. orientalis* C.C. Chen & Sheng H. Wu, see Chen et al. 2018 (phylogeny, taxonomy).

Odoria V. Papp & Dima 2017, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *O. alborubescens* (Bourdot & Galzin) V. Papp & Dima, poroid hymenophore, wood-rotting, white rot, Europe, sequence data

available, see Papp and Dima 2018 (new genus, new combination, phylogeny, type study), Zmitrovich 2018a (taxonomy).

Ofella Spirin & V. Malysheva 2019, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *O. glaira* (Lloyd) Spirin & V. Malysheva, Europe (Estonia, Finland, Norway, Sweden), on strongly rotten wood of conifers (*Picea*, *Pinus*), sequence data available, see Spirin et al. 2019b (taxonomy, phylogeny).

Oligoporus Bref. 1888, Dacryobolaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 15 species, type species *O. farinosus* Bref. [current name: *O. rennyi* (Berk. & Broome) Donk], poroid hymenophore, wood-rotting, brown rot, widespread, sequence data available, see Binder et al. 2013 (phylogeny, Polyporales), new spp. see Ryvarden 2018a (new combination, morphology, Ethiopia, Malawi), new combinations, see Kotiranta et al. 2009 (nomenclature), Ryvarden and Melo 2014 (morphology), Vlasák et al. 2016 (morphology, Costa Rica), Huckfeldt and Schmidt 2017 (building-rot, Germany), Ryvarden et al. 2017 (morphology).

Olivea Arthur 1917 (=*Tegillum* Mains 1940), Chaconiaceae, Pucciniales, Pucciniomycetes, eight species, type species *O. capituliformis* (Henn.) Arthur, biotrophic, terrestrial on Euphorbiaceae, Lamiaceae, Sapotaceae, Verbenaceae, circumglobal in tropical regions, sequence data available, see Aime 2006 (phylogeny).

Oliveonia Donk 1958, Oliveoniaceae, Cantharellales, Agaricomycetes, asexual morph *Oliveorhiza* P. Roberts 1993, five species, type species *O. fibrillosa* (Burt) Donk, widespread, see Kirk et al. 2013 (genus accepted), sequence data available.

Omphaliaster Lamoure 1971, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *O. borealis* (M. Lange & Skifte) Lamoure, North temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny).

Omphalina Quél. 1886, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *O. pyxidata* (Bull.) Quél., worldwide, some species lichen-forming, see Palice et al. 2005 (*O. foliacea*), Kirk et al. 2013 (genus accepted), sequence data available, see Moreno et al. 2007 (*O. giovanellae*), Hartley et al. 2009 (phylogeny), Vizzini et al. 2012d (Italy), Osmundson et al. 2013 (DNA barcode), Zvyagina et al. 2015 (*O. discorosea*).

Omphalotus Fayod 1889 (= *Lampteromyces* Singer 1947), Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *O. olearius* (DC.) Singer, worldwide, some species bioluminescent, Jack o'Lantern mushroom (*O. olearius* (DC.) Singer), on wood, see Desjardin et al. 2008a (bioluminescent fungus), Kirk et al. 2013 (genus accepted), sequence data available, Wawrzyn et al. 2012 (genome), see Yang and Feng 2013 (China).

Onnia P. Karst. 1889, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, eight species, type species *O. circinata* (Fr.) P. Karst., wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhou 2015b (*Cylindrosporus flavidus* gen. et comb. nov. segregated from *Onnia*), new spp. see Ji et al. 2017d (global diverisity, phylogeny, species on gymnosperms).

Orphanomyces Savile 1974, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, three species, type species *O. arcticus* (Rostr.) Savile, plant parasites (leaves) on *Carex* spp. (Cyperaceae), Europe, Asia, North America, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy, phylogeny).

Osmoporus Singer 1944, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, two species, type species *O. odoratus* (Wulfen) Singer, wood-decaying, sequence data available, new combination see He et al. 2014.

Ossicaulis Redhead & Ginns 1985, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *O. lignatilis* (Pers.) Redhead & Ginns, North temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Holec and Kolařík 2013b (*O. lachnopus*), Hofstetter et al. 2014 (phylogeny, Lyophyllaceae).

Osteina Donk 1966, Dacryobolaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *O. obducta* (Berk.) Donk, poroid basidioma, wood-rotting, brown rot, widespread (Northern Hemisphere), sequence data available, see Cui et al. 2014 (phylogeny, distribution), Zmitrovich 2018a (taxonomy).

Osteomorpha G. Arnaud ex Watling & W.B. Kendr. 1979, Hydnaceae, Cantharellales, Agaricomycetes, possibly asexual morph of *Trechispora* P. Karst. 1890, see Melnik 2011 (new record, Russia), one species, type species *O. fragilis* G. Arnaud

ex Watling & W.B. Kendr., saprobes, terrestrial, genus in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Oudemansiella Speg. 1881, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *O. platensis* (Speg.) Speg., four sections: sect. *Dactylosporina* (Clémençon) Pegler & T.W.K.Young, sect. *Mucidula* (Pat.) Zhu L. Yang, Li F. Zhang, G.M. Muell., G. Kost & Rexer, sect. *Oudemansiella* and sect. *Radicatae* Clémençon, worldwide, some species edible (*O. canarii* (Jungh.) Höhn.), see Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), Xu et al. 2016a (cultivation), sequence data available, see Liu et al. 2009 (Thailand), Yang et al. 2009 (systematic arrangement), Petersen and Hughes 2010 (monograph), Wartchow 2014 (new combination).

Oxychaete Miettinen 2016, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *O. cervinogilva* (Jungh.) Miettinen, wood-rotting, sequence data available, see Miettinen et al. 2016a (polypores, Phanerochaetaceae), Zmitrovich 2018a (taxonomy).

Oxyporus (Bourdot & Galzin) Donk 1933, Oxyporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 18 species, type species *O. populinus* (Schumach.) Donk, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Zmitrovich and Malysheva 2014 (phylogeny), new spp. see Cui and Dai 2009 (China), Ryvarden and Iturriaga 2010 (Neotropical polypores), Hofm anad Ryvarden 2012 (Panama).

Pachnocybe Berk. 1836, Pachnocybaceae, Pachnocybales, Pucciniomycetes, one species, type species *P. ferruginea* Berk., Europe, in wood, see Kirk et al. 2013 (genus accepted), sequence data available, see Henk et al. 2007 (phylogeny), Vu et al. 2019 (DNA sequences).

Pachykytospora Kotl. & Pouzar 1963, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *P. tuberculosa* (Fr.) Kotl. & Pouzar, the genus was treated as a synonym of *Haploporus* Bondartsev & Singer 1944 *fide* Shen et al. 2016, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2013 (phylogeny, Polyporales).

Pachylepyrium Singer 1958, Tubariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. fulvidula* (Singer) Singer (clustered in Tubariaceae according to Matheny et al. 2015), North temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2015 (phylogeny).

Pagidospora Drechsler 1960, *incertae sedis*, *incertae sedis*, Agaricomycetes, sexual morph unknown, one species, type species *P. amoebophila* Drechsler, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Palaeocephala Singer 1962, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. cymatelloides* (Dennis & D.A. Reid) Singer, Sierra Leone, sequence data unavailable, see Antonín 2007 (Africa, monograph), Kirk et al. 2013 (genus accepted).

Panaeolina Maire 1933, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. foenisecii* (Pers.) Maire, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006 (phylogeny).

Panaeolopsis Singer 1969, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *P. sanmartiniana* Singer, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Panaeolus (Fr.) Quél. 1872, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, 15 species, type species *P. papilionaceus* (Bull.) Quél., asexual morph unknown, worldwide, saprotrophic, on soil or dung, see Kirk et al. 2013 (genus accepted), Dulay et al. 2015 (compounds), sequence data available, see Walther et al. 2005 (phylogeny), Matheny et al. 2006 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Osmundson et al. 2013 (DNA baorcode), new spp. see Hausknecht and Krisai-Greilhuber 2009 (Austria, morphology), Kaur et al. 2014 (India).

Panellus P. Karst. 1879, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 55 species, type species *P. stipticus* (Bull.) P. Karst., some species bioluminescent (*P. luminescens* (Corner) Corner, Gdns' Bull., *P. stipticus* (Bull.) P. Karst. 1879), edible Mukitake (*P. serotinus* (Pers.) Kühner), see Desjardin et al. 2008a (bioluminescent fungus), Dai et al. 2010b (edible mushrooms, China), Inoue et al. 2013 (medicinal study), Kirk et al. 2013 (genus accepted), Cortés-Pérez et al. 2017 (Mexico),

sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Osmundson et al. 2013 (DNA barcode), new spp. see Chew et al. 2015 (Malaysia, phylogeny, bioluminescent fungi).

Panus Fr. 1838, Panaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *P. conchatus* (Bull.) Fr, wood-rotting, widespread, some species medicinal use (*P. conchatus* (Bull.) Fr.), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), Sanuma et al. 2016 (edible mushrooms, Brazil), sequence data available, see Vargas-Isla et al. 2015 (mating studies, morphology, phylogeny), new spp. see Drechsler-Santos et al. 2012b (Brazil), Njouonkou et al. 2013 (Cameroon), Tibpromma et al. 2017 (Thailand), Zmitrovich et al. 2018a (Russia).

Papiliotrema J.P. Samp., M. Weiss & R. Bauer 2002, Rhynchogastremaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, 30 species, type species *P. bandonii* J.P. Samp., Gadanho, M. Weiss & R. Bauer, yeast, mycoparasite, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny), new spp. see Into et al. 2018 (Thailand, French Guiana), Yurkov and Kurtzman 2019 (USA).

Pappia Zmitr. 2018, Meruliaceae, Polyporales, Agaricomycetes, asexual morph chlamydosporic, one species, type species *P. fissilis* (Berk. & M.A. Curtis) Zmitr., tyromycetoid basidioma, wood-rotting, white rot, widespread, sequence data available, see Zmitrovich 2018a (taxonomy).

Papyrodiscus D.A. Reid 1979, *incertae sedis*, Corticiales, Agaricomycetes, asexual morph unknown, one species, type species *P. ferrugineus* D.A. Reid, Papua New Guinea, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Paragymnopus J.S. Oliveira 2019, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *P. perforans* (Hoffm.) J.S. Oliveira, worldwide, sequence data available, see Oliveira et al. 2019 (phylogeny, taxonomy).

Paragyrodon (Singer) Singer 1942, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *P. sphaerosporus* (Peck) Singer, North America, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (phylogeny).

Parahaplotrichum W.A. Baker & Partr. 2001, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, one species, type species *P. idahoense* W.A. Baker & Partr., North America, wood-decaying, sequence data unavailable, see Kirk et al. 2008.

Parajaminaea T. Kij. & Aime 2017, *incertae sedis*, Microstromatales, Exobasidiomycetes, two species, type species *P. albiziae* (Syd. & P. Syd.) Kijporn. & Aime, plant parasite (leaves) on *Albizia* (Fabaceae), Africa, saprobic yeast state vectored by birds, cultures available, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (phylogenetic classification of yeasts, Ustilaginomycotina), Kijpornyongpan and Aime 2017 (description).

Paralepistopsis Vizzini 2012, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. amoenolens* (Malençon) Vizzini, two species, type species *P. amoenolens* (Malençon) Vizzini, North Africa (Morocco), Southern and Southwestern Europe, Asia (Japan and South Korea), sequence data available, see Vizzini and Ercole 2012 (taxonomy).

Paraphelaria Corner 1966, *incertae sedis*, *incertae sedis*, Pucciniomycotina, asexual morph unknown, two species, type species *P. amboinensis* (Lév.) Corner, Java, South Pacific, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Parapterulicium Corner 1952, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *P. subarbusculum* Corner, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Parasola Redhead, Vilgalys & Hopple 2001, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 27 species, type species *P. plicatilis* (Curtis) Redhead, Vilgalys & Hopple, worldwide, saprobic, coprinoid, sequence data available, see Uljé 2005 (morphology, monograph, *Coprinus s. l.*), Nagy et al. 2010a (type studies, nomenclature), Schafer 2010 (key to sections), sequence data available, see Nagy et al. 2009 (phylogeny), Nagy et al. 2011 (phylogeny, evolution, Psathyrellaceae), Szarkándi et al. 2017 (phylogeny, morphology, new sp.), new spp. see Schafer 2014 (UK), Hussain et al. 2017 (Pakistan), Ganga and Manimohan 2018 (India), Hussain et al. 2018c (Pakistan).

Parastereopsis Corner 1976, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *P. borneensis* Corner, tubaeform basidioma,

genus in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Paratrichaptum Corner 1987, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *P. accuratum* Corner, Sumatra, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Paratritirachium Beguin, Pyck & Detandt 2012, Tritirachiaceae, Tritirachiales, Tritirachiomycetes, asexual morph known, two species, type species *P. cylindroconium* (de Hoog) Beguin, Pyck & Detandt, sequence data available, see Nguyen et al. 2013b (taxonomy), new sp. see Nguyen et al. 2014 (Canada).

Paraxerula R.H. Petersen 2010, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *P. americana* (Dörfelt) R.H. Petersen, Europe, East Asia, North America, sequence data available, see Petersen and Hughes 2010 (monograph), new spp. see Qin et al. 2014a (China).

Parvixerocomus G. Wu & Zhu L. Yang 2015, Boletaceae, Boletales, Agaricomycetes, aseuxal morph unknown, two species, type species *P. pseudoaokii* G. Wu, Kuan Zhao & Zhu L. Yang, stipitate-pileate, China, Japan, see sequence data available, see Wu et al. 2014b, 2016e (phylogeny, morphology).

Parvobasidium Jülich 1975, Cystostereaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *P. cretatum* (Bourdot & Galzin) Jülich, wood-rotting, widespread, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Parvodontia Hjortstam & Ryvarden 2004, Cystostereaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. luteocystidia* Hjortstam & Ryvarden, wood-rotting, sequence data unavailable, new spp. see Baltazar et al. 2016 (type studies, morphology).

Parvulago R. Bauer, M. Lutz, Piątek, Vánky & Oberw. 2007, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species *P. marina* (Durieu) R. Bauer, M. Lutz, Piątek, Vánky & Oberw., plant parasite (base of culms, basal leaves) on *Eleocharis parvulus* (Cyperaceae), Europe, cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy).

Pascua Takashima, Manabe, Nishimura, Sriswasdi, Ohkuma, Iwasaki & Sugita 2019, Trichosporonaceae, Trichosporonales, Tremellomycetes, sexual morph unknown,

one species, type species *P. guehoae* (Middelhoven, Scorzettii & Fell) Takashima, Manabe, Nishimura, Sriswasdi, Ohkuma, Iwasaki & Sugita, yeast, soil, Europe, sequence data available, see Takashima et al. 2019 (taxonomy, phylogeny).

Pattersoniomyces Piątek, M. Lutz & C.A. Rosa 2017, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species *P. tillandsiae* (F. Patt. ex G.P. Clinton) Piątek, M. Lutz, M.F. Landell & C.A. Rosa, plant parasite (inflorescences) on Poaceae, widespread, saprobic yeast on plant surfaces, cultures available, sequence data available, see Piątek et al. 2017 (taxonomy).

Paulisebacina Oberw., Garnica & K. Riess 2014, Sebacinaceae, Sebacinales, Agaricomycetes, asexual morph unknown, one species, type species *P. allantoidea* (R. Kirschner & Oberw.) Oberw., Garnica K. Riess & R. Kirschner, worldwide, sequence data available, see Oberwinkler et al. 2014 (taxonomy, phylogeny).

Paullicorticium J. Erikss. 1958, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, five species, type species *P. pearsonii* (Bourdot) J. Erikss., see Kirk et al. 2013 (genus accepted), sequence data available, see Hibbett and Binder 2002 (phylogenetic placement).

Paxillogaster E. Horak 1966, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *P. luteus* E. Horak, South America, basidioma sequestrate, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Paxillus Fr. 1836, Paxillaceae, Boletales, Agaricomycetes, asexual morph unknown, 19 species, type species *P. involutus* (Batsch) Fr., ectomycorrhizal, widespread, some species edible (*P. involutus* (Batsch) Fr.), see Dai et al. 2010b (edible mushrooms, China), some medicinal use (*P. involutus* (Batsch: Fr.) Fr.), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Hedh et al. 2008 (*P. involutus*), Nieto and Carbone 2009 (ecology), Vellinga et al. 2012 (*P. albidulus*, *P. ammoniavirescens*, and *P. validus* revisited), Jiménez-Ferbans and Reyes-Castill 2015 (phylogeny, taxonomy), new spp. see Gelardi et al. 2014b (south-western China), Jargeat et al. 2014, 2016 (Europe, North Africa).

Peglerochaete Sarwal & Locq. 1983, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. setiger* Sarwal & Locq., Sikkim, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pegleromyces Singer 1981, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. collybioides* Singer, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pellidiscus Donk 1959, Crepidotaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *P. pallidus* (Berk. & Broome) Donk [current name: *Crepidotus pallidus* (Berk. & Broome) Knudsen], Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes).

Peniophora Cooke 1879, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, c. 60 species, type species *P. quercina* (Pers.) Cooke, worldwide, wood-decaying, white rot (*P. cinerea* (Pers.) Cooke), see Okamoto et al. 2010 (ethanol production), Kirk et al. 2013 (genus accepted), sequence data available, see Nagy et al. 2015 (genome, evolution).

Peniophorella P. Karst. 1889, Rickenellaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, c. 25 species, type species *P. pubera* (Fr.) P. Karst., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Hallenberg et al. 2007 (*P. praetermissa* species complex), Larsson 2007a (phylogeny), new spp. see Duhem and Buyck 2011b (France).

Perenniporia Murrill 1942, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 100 species, type species *P. medulla-panis* (Jacq.) Donk, poroid hymenophore, wood-rotting, white rot, cosmopolitan, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Robledo et al. 2009 (phylogeny), new spp. see Xiong et al. 2008 (morphology, China), Choeyklin et al. 2009 (morphology, Thailand), Dai 2010a (morphology, Northeast China), De Jesus and Ryvarden 2010 (morphology, Brazil), Dai et al. 2011 (morphology, China), Decock and Ryvarden 2011 (new combination, morphology, Neotropics), Decock et al. 2011 (morphology, Cameroon), Cui and Zhao 2012 (phylogeny, China), Decock and Bitew 2012 (morphology, Ethiopia), Zhao and Cui 2012, 2013b (phylogeny, southern China), Decock and Ryvarden 2013, 2015 (morphology, Costa Rica, Zimbabwe), Zhao et al. 2013a, 2014a (phylogeny, China), Jang et al. 2015a (morphology, South Korea), Decock 2016 (morphology, Neotropics), Gomes-Silva et al. 2016 (morphology, Brazil), Spirin and Ryvarden 2016 (morphology, Mexico), Crous et al. 2017a (phylogeny,

Brazil), Huang et al. 2017 (phylogeny, southern China), Ji et al. 2017a (phylogeny, Thailand), Liu et al. 2018c (morphology, southern China), Ryvarden 2018a (morphology, Cameroon, Mozambique), Shen et al. 2018b (new species, USA), new combination, see Hattori and Sotome 2013 (morphology, type study, Malaysia).

Perenniporiella Decock & Ryvarden 2003, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *P. neofulva* (Lloyd) Decock & Ryvarden, poroid hymenophore, wood-rotting, white rot, Central and South America, sequence data available, see Robledo et al. 2009 (new sp., phylogeny, Neotropics), Decock et al. 2010 (new combination, phylogeny, Mexico, Southeastern USA).

Perenniporiopsis C.L. Zhao 2017, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. minutissima* (Yasuda) C.L. Zhao, poroid hymenophore, wood-rotting, white rot, temperate east Asia, sequence data available, see Wu et al. 2017b (taxonomy, phylogeny).

Pericladium Pass. 1875, Pericladiaceae, Ustilaginales, Ustilaginomycetes, three species, type species *P. grewiae* Pass., plant parasites (galls on stems) on Tiliacea, South Africa, South Asia, Australia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Nasr et al. 2014a (taxonomy, phylogeny).

Peridermium (Link) J.C. Schmidt & Kunze 1817 (=*Hypodermium* subgen. *Peridermium* Link 1816, = *Peridermium* (Link) Wallr. 1833), Cronartiaceae, Pucciniales, Pucciniomycetes, asexual morph of *Chrysomyxa* Unger 1840, *Coleosporium* Lév. 1847, *Cronartium* Fr. 1815, *Hyalopsora* Magnus 1902, *Melampsorella* J. Schröt. 1874, *Milesina* Magnus 1909, *Pucciniastrum* G.H. Otth 1861, *Thekopsora* Magnus 1875, c. 50 species, type species *P. elatinum* Kunze & J.C. Schmidt (cons. type), biotrophic on gymnosperms especially Pinaceae, terrestrial, North America, Mexico, Argentina, Russia, China, India, Japan, see Kirk et al. 2013 (genus accepted), sequence data available, see Vogler and Bruns 1998 (phylogeny).

Peridiopsora Kamat & Sathe 1969, Pucciniastraceae, Pucciniales, Pucciniomycetes, two species, type species *P. adelocaryi* Kamat & Sathe, biotrophic on Boraginaceae, Moraceae, terrestrial, India, sequence data unavailable, see Cummins and Hiratsuka 2003 (synonym of *Milesia*), Kirk et al. 2013 (genus accepted).

Perplexostereum Ryvarden & Tutka 2014, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *P. endocrocinum* (Berk.) Ryvarden & Tutka, wood-decaying, Europe, sequence data available, see Liu et al. 2017e (*Echinodontium*, phylogeny).

Peyronelina P.J. Fisher, J. Webster & D.F. Kane 1976, Niaceae, Agaricales, Agaricomycetes, asexual morph *Glyphium* Nitschke ex F. Lehm. 1886, one species, type species *P. glomerulata* P.J. Fisher, J. Webster & D.F. Kane, America, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Yamaguchi et al. 2009 (taxonomy).

Phacellula Syd. 1927, Cryptobasidiaceae, Exobasidiales, Exobasidiomycetes, one species, type species *P. gouaniae* Syd., parasite (leaves) on *Gouania* spp. (Rhamnaceae), Costa Rica, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Seifert and Bandoni 2001 (revision).

Phaeoaphelaria Corner 1953, Aphelariaceae, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *P. australiensis* Corner, saprobes, on wood, Australia, terrestrial, North America and Europe, genus in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phaeoclavulina Brinkmann 1897, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, 41 species, type species *P. macrospora* Brinkmann, widespread, some species are ectomycorrizal (*P. abietina* with *Pinus, Betula* and *Pseudotsuga*), see González-Ávila et al. 2013 (species diversity, ecological patterns, Mexico), sequence data available, see Giachini et al. 2010 (systemics study), Maneevun et al. 2012 (Thailand).

Phaeocollybia R. Heim 1931, Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 80 species, type species *P. lugubris* (Fr.) R. Heim, worldwide, see Kirk et al. 2013 (genus accepted), Norvell and Exeter 2007 (western North America), sequence data available, new spp. see Matheny et al. 2006 (phylogeny, including in the Hymenogastraceae clade), Halling and Horak 2008 (Costa Rica), Wei et al. 2010 (China), Coimbra et al. 2012 (Brazil), Khan et al. 2016 (Pakistan), Horak 2018 (monograph, New Zealand).

Phaeodepas D.A. Reid 1961, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. dennisii* D.A. Reid, Venezuela, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phaeolepiota Maire ex Konrad & Maubl. 1928, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. aurea* (Matt.) Maire, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Saar et al. 2009 (phylogeny, *Cystoderma*, *Cystodermella*).

Phaeolus (Pat.) Pat. 1900, Laetiporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *P. schweinitzii* (Fr.) Pat., poroid hymenophore, terrestrial or wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Ortiz-Santana et al. 2013 (phylogeny, antrodia clade), Song and Cui 2017 (phylogeny), new sp. see De Jesus and Ryvarden 2010 (morphology, Brazil), Zmitrovich 2018a (taxonomy).

Phaeomarasmius Scherff. 1897, Tubariaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *P. excentricus* Scherff., worldwide, saprotrophic, see Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Matheny et al. 2007 (phylogeny), Petersen et al. 2010 (phylogeny, accepted in Tubariaceae), Kim et al. 2015 (Korea), Horak 2018 (monograph, New Zealand, new sp.).

Phaeomycena R. Heim ex Singer & Digilio 1952, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *P. aureophylla* R. Heim, Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phaeophlebiopsis Floudas & Hibbett 2015, Phanerochaetaceae, Polyporales, Agaricomycetes, three species, asexual morph unknown, type species *P. caribbeana* D. Floudas & Hibbett, resupinate basidioma, smooth hymenophore, wood-rotting, USA, sequence data available, see Floudas and Hibbett 2015 (taxonomy, USA), Zmitrovich 2018a (taxonomy, new combinations).

Phaeopholiota Locq. & Sarwal 1983, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. crinipellis* Locq. & Sarwal, Sikkim, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phaeoporotheleum (W.B. Cooke) W.B. Cooke 1961, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. revivescens* (Berk. & M.A. Curtis) W.B. Cooke, Cuba, Argentina, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phaeoradulum Pat. 1900, *incertae sedis*, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *P. guadelupense* Pat., West Indies, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phaeosolenia Speg. 1902, Chromocyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, eight species, type species *P. platensis* Speg., South America, Brazil, see Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes), Sulzbacher et al. 2009 (Southern Brazil), Petersen et al. 2010 (phylogeny, Crepidotaceae).

Phaeotrametes Lloyd ex J.E. Wright 1966, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. decipiens* (Berk.) J.E. Wright, poroid hymenophore, wood-rotting, widespread (Southern Hemisphere), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phaeotremella Rea 1912, Phaeotremellaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, eleven species, type species *P. frondosa* (Fr.) Spirin & V. Malysheva (= *P. pseudofoliacea* Rea), yeast, mycoparasite, worldwide, cultures and sequence data available, see Liu et al. 2015b, Spirin et al. 2018b (taxonomy and phylogeny).

Phaffia M.W. Mill., Yoney. & Soneda 1976, Mrakiaceae, Cystofilobasidiales, Tremellomycetes, sexual and asexual morphs known, one species, type species *P. rhodozyma* M.W. Mill., Yoney. & Soneda, yeast, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Phakopsora Dietel 1895, Phakopsoraceae, Pucciniales, Pucciniomycetes, (= *Physopella* Arthur 1905, = *Bubakia* Arthur 1906, = *Angiopsora* Mains 1934, = *Stakmania* Kamat & Sathe 1968, = *Malupa* Y. Ono, Buriticá & J.F. Hennen 1992, = *Batistopsora* Dianese, R.B. Medeiros & L.T.P. Santos 1993, = *Uredostilbe* Buriticá & J.F. Hennen 1994, = *Uredendo* Buriticá & J.F. Hennen 1994 [nom. inval.]), 116 species, type species *P. punctiformis* (Barclay & Dietel) Dietel, asexual morphs *Malupa*,

Uredendo, *Uredostilbe*, biotrophic on c. 30 families including Fabaceae, Poaceae, Rubiaceae, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Berndt et al. 2008 (new sp., Cameroon, South Africa, Brazil), Salazar-Yepes et al. 2009 (new spp., Brazil), Berndt and Wood 2012, Ono et al. 2012 (Japan), Pota et al. 2013 (Japan), Beenken 2014 (on *Annona*), Ono 2016 (Japan), Maier et al. 2016 (new combinations, new species, Eastern and Southern Africa).

Phallobata G. Cunn. 1926, Trappeaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, one species, type species *P. alba* G. Cunn., Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny).

Phallogaster Morgan 1893, Phallogastraceae, Hysterangiales, Agaricomycetes, asexual morph unknown, one species, type species *P. saccatus* Morgan, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2008 (phylogeography), Osmundson et al. 2013 (DNA barcoding).

Phallus Junius ex L. 1753, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, 34 species, type species *P. impudicus* L., worldwide, stinkhorn, some species edible (*P. fragrans* M. Zang), see Hemmes and Desjardin 2009 (morphology, Hawaiian islands), Dai et al. 2010b (edible mushrooms, China), Dutta et al. 2012 (India), Hosaka 2012 (Thailand), Kirk et al. 2013 (genus accepted), Magnago et al. 2013b (Phallales, tropical Atlantic Forest of Brazil), sequence data availale, see Trierveiler-Pereira et al. 2014a (phylogeny, Phallales), new spp. see Calonge et al. 2008 (Madeira, Portugal), Moreno et al. 2009 (Pakistan), Desjardin and Perry 2009 (São Tomé, Africa), Li et al. 2014d, 2016d (China), Rebriev et al. 2014 (Vietnam), Adamčík et al. 2015 (China), Medeiros et al. 2017 (Brazil), Song et al. 2018a (China) .

Phanerina Miettinen 2016, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. mellea* (Berk. & Broome) Miettinen, wood-rotting, sequence data available, see Miettinen et al. 2016b (Polypores, Phanerochaetaceae), Zmitrovich 2018a (taxonomy).

Phanerochaete P. Karst. 1889, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 80 species, type species *P. velutina* (Fr.) P. Karst, see Kirk et al. 2013 (genus accepted), Spirin et al. 2017b (generic type, nomenclature, taxonomy), resupinate basidioma, varied hymenophore (smooth, hydnoid or poroid), wood-rotting,

white rot, widespread, biotechnological application, see Syed and Yadav 2012 (bioremediation, *P. chrysosporium*), Mori et al. 2017 (bioremediation, neonicotinoid insecticide, *P. sordida*), sequence data available, Martinez et al. 2004 (genome, *P. chrysosporium*), Floudas and Hibbett 2015 (new spp., phylogeny, Finland, USA), new spp. see Nakasone 2008 (morphology, new combination, type study, Germany), Hjortstam et al. 2009 (morphology, new combination, Australia, monograph), see Ghobad-Nejhad et al. 2015 (new spp., phylogeny, China), Volobuev et al. 2015 (new spp., new combination, phylogeny, Russia), Liu and He 2016a (phylogeny, China), Sádlíková and Kout 2017 (phylogeny, Thailand), new combination see Melo et al. 2012 (morphology, type study, Madeira), Miettinen et al. 2016a (phylogeny, Phanerochaetaceae).

Phanerodontia Hjortstam & Ryvarden 2010, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *P. dentata* Hjortstam & Ryvarden, the genus was treated as a synonym of *Phanerochaete* P. Karst. 1889, see Miettinen et al. 2016a (phylogeny, Phanerochaetaceae), resupinate basidioma, smooth to hydnoid hymenophore, wood-rotting, white rot, tropical, sequence data available, new sp. see Hjortstam and Ryvarden 2010c (taxonomy, Argentina).

Phaneroites Hjortstam & Ryvarden 2010, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. subquercinus* (Henn.) Hjortstam & Ryvarden, resupinate basidioma, hydnoid hymenophore, wood-rotting, white rot, widespread, sequence data unavailable, see Hjortstam and Ryvarden 2010c (taxonomy).

Phellinidium (Kotl.) Fiasson & Niemelä 1984, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, five species, type species *P. ferrugineofuscum* (P. Karst.) Fiasson & Niemelä, Europe, some species medicinal use (*P. lamaënse* (Murrill) YC Dai), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Bodeker et al. 2009 (ectomycorrhizal fungi), Zhou et al. 2016d (monograph), new spp. see Zhou et al. 2014 (America).

Phellinopsis Y.C. Dai 2010, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, ten species, type species *P. conchata* (Pers.) Y.C. Dai, wood-rotting, white rot, sequence data available, see Zhou and Qin 2013b

(phylogeny, taxonomy), Zhou 2015a (taxonomy), new spp. see Qin and Zhou 2013 (China), Rajchenberg et al. 2015 (Argentina), Zhou and Song 2017 (China).

Phellinotus Drechsler-Santos, Robledo & Rajchenb. 2016, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, two species, type species *P. neoaridus* Drechsler-Santos & Robledo, wood-rotting, white rot, poroid hymenophore, Brazil, Peru, sequence data avaiable, new spp. see Drechsler-Santos et al. 2016 (Brazil).

Phellinus Quél. 1886, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, c. 202 species, type species *P. igniarius* (L.) Quél., worldwide, some species medicinal use (*P. baumii* Pilát, *P. conchatus* (Pers.: Fr.) Quél.), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Vlasak and Kout 2011 (new combination, USA), de Campos Santana et al. 2016 (phylogeny, new sp.), new spp. see Yombiyeni et al. 2011 (Guineo-Congolian rainforest), Cui and Decock 2013 (China), Bian et al. 2016c (China), Vlasak and Vlasak 2017 (USA), Soares et al. 2018 (Brazil).

Phellodon P. Karst. 1881, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, 18 species, type species *P. niger* (Fr.) P. Karst., worldwide, terrestrial, see Kirk et al. 2013 (genus accepted), sequence data available, see Ainsworth et al. 2010 (cryptic taxa, European species), Baird et al. 2013a, b (phylogeny).

Phellopilus Niemelä, T. Wagner & M. Fisch. 2001, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *P. nigrolimitatus* (Romell) Niemelä, T. Wagner & M. Fisch., worldwide, sequence data available.

Phellorinia Berk. 1843, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. herculeana* (Pers.) Kreisel, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, Martin et al. 2000 (phylogeny).

Phenoliferia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Kriegeriaceae, Kriegeriales, Microbotryomycetes, sexual morph unknown, four species, type species *P. psychrophenolica* (Margesin & J.P. Samp.) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, psychrophilic, worldwide, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Phialastrum Sunhede 1989, Geastraceae, Geastrales, Agaricomycetes, asexual morph unknown, one species, type species *P. barbatum* (Dissing & M. Lange) Sunhede, Africa (tropical), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phlebia Fr. 1821, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 60 species, type species *P. radiata* Fr., corticioid basidioma, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny), Binder et al. 2013 (phylogeny, Polyporales), Sjökvist et al. 2012 (phylogeny), new spp. Duhem 2009 (new combinations, new name, morphology, France), Bernicchia and Gorjón 2010 (morphology, corticioid fungi, Europe, monograph, Italy), Singh et al. 2010a (morphology, India), Ghobad-Nejhad and Yurchenko 2012 (morphology, Azerbaijan), Duhem 2013 (morphology, France), Kaur et al. 2017 (India), Shen et al. 2018a (phylogeny, China), new combinations see Tura et al. 2011 (morphology, monograph, Israel), Gorjón and Greslebin 2012 (type study, New Zealand), Baltazar et al. 2016 (morphology, type study), needs revision since genus shown to be polyphyletic, see Justo et al. 2017.

Phlebiella P. Karst. 1890, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, 20 species, type species *P. vaga* (Fr.) P. Karst, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Ghobad-Nejhad and Kotiranta 2007 (phylogeny), Larsson 2007b (phylogeny).

Phlebiopsis Jülich 1978, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, 22 species, type species *P. gigantea* (Fr.) Jülich, resupinate basidioma, smooth or tuberculate hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Larsson 2007b (phylogeny), Hori et al. 2014 (genome, *P. gigantea*), new spp. see Douanla-Meli and Langer 2009a (morphology, Cameroon), Dhingra and Kaur 2011 (morphology, India), Kaur et al. 2015a (morphology, India), new combinations see Wu et al. 2010a (phylogeny, *Phanerochaete s. l.*), Floudas and Hibbett 2015 (phylogeny, *Phanerochaete s. l.*), Miettinen et al. 2016a (phylogeny, Phanerochaetaceae).

Phlebiporia Jia J. Chen, B.K. Cui & Y.C. Dai 2014, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, resupinate basidioma, poroid hymenophore, wood-rotting, China, type species *P. bubalina* Jia J. Chen, B.K. Cui &

Y.C. Dai, sequence data available, see Chen and Cui 2014b (taxonomy, phylogeny, China), Zmitrovich 2018a (taxonomy).

Phlebogaster Fogel 1980, Claustulaceae, Phallales, Agaricomycetes, asexual morph unknown, two species, type species *P. laurisylvicola* Fogel, terrestrial, Canary Islands, Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (gomphoid-phalloid fungi, phylogeny).

Phlebonema R. Heim 1929, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. chrysotingens* R. Heim, Madagascar, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phlebophyllum R. Heim 1969, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. vitellinum* R. Heim & Gilles, Gabon, sequence data unavailable, see Kirk et al. 2008.

Phlebopus (R. Heim) Singer 1936, Boletinellaceae, Boletales, Agaricomycetes, asexual morph unknown, 14 species, type species *P. colossus* (R. Heim) Singer, saprotrophs, possibly ectomycorrhizal with exotic trees, widespread (pantropical), south temperate in Australia, some species edible (*P. marginatus* (J. Drumm. ex Berk.) Watling & N.M. Greg.), see Kirk et al. 2013 (genus accepted), sequence data available, see Wu et al. 2014b (phylogeny), new spp. see Pham et al. 2012 (southern Vietnam), Baroni et al. 2015 (Mexico).

Phleogena Link 1833, Phleogenaceae, Atractiellales, Atractiellomycetes, asexual morph unknown, one species, type species *P. faginea* (Fr.) Link, saprobic, on bark of decaying deciduous trees (mainly *Fagus* and *Querqus*), worldwide (northern temperate), sequence data available, see Aime et al. 2006 (phylogeny), Bauer et al. 2006 (phylogeny, simple-septate basidiomycetes).

Phloeomana Redhead 2013, Porotheleaceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *P. speirea* (Fr.) Redhead, worldwide, basidiomas mycenoid, fuscous, on bark and decayed phloem, sequence data unavailable, see Redhead 2013a (taxonomy).

Phlyctibasidium Jülich 1974, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *P. polyporoideum* (Berk. & M.A. Curtis) Jülich, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pholiota (Fr.) P. Kumm. 1871, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 157 species, type species *P. squarrosus* Batsch, some species edible, nameko (*P. nameko* (T. Itô) S. Ito & S. Imai), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), medicinal use (*P. adiposa* sensu Holec), see Zhang et al. 2009 (compounds), Noordeloos 2011 (Europe, monograph), Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006 (phylogeny), Siegel et al. 2015 (*P. olivaceophylla*, *P. nubigena*), new spp. see Cortez 2008 (south America), Matheny and Bougher 2010 (new combination), Tian and Bau 2013 (China). Holec et al. 2014 (Europe), Holec et al. 2014 (Europe), Niveiro et al. 2014b (Argentina), Tian et al. 2016 (China).

Pholiotina Fayod 1889, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, 56 species, type species *P. blattaria* (Fr.) Fayod [current name: *Conocybe blattaria* (Fr.) Kühner], worldwide, saprotrophic, sequence data available, see Hausknecht 2009, Hausknecht et al. 2009 (temperate Asia), Malysheva 2011 (Russia), Kalamees et al. 2013 (checklist, Estonia), Osmundson et al. 2013 (DNA barcode), Tóth et al. 2013 (phylogeny, Bolbitiaceae), new spp. see Crous et al. 2017a (Russia), Siquier and Salom 2018 (Spain).

Phragmidiella Henn. 1905 (= *Santapauella* Mundk. & Thirum. 1945), Phakopsoraceae, Pucciniales, Pucciniomycetes, eight species, type species *P. markhamiae* Henn., biotrophic on Anacardiaceae, Bignoniaceae, Meliaceae, terrestrial, Tanzania, Uganda, Brazil, Caribbean, India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phragmidium Link 1816 (=*Aregma* Fr. 1815; = *Epitea* Fr. 1832; = *Lecythea* Lév. 1847; = *Phragmidium* A *Phragmidiopsis* G. Winter 1881 [1884]; = *Phragmidiopsis* (G. Winter) Mussat 1901; = *Ameris* Arthur 1906; = *Earlea* Arthur 1906; = *Frommea* Arthur 1917; = *Teloconia* Syd. 1921; = *Frommeëlla* Cummins & Y. Hirats. 1983; = *Trolliomyces* Ulbr. 1938), Phragmidiaceae, Pucciniales, Pucciniomycetes, asexual morph *Lecythea* Lév. 1847, c. 100 species, type species *P. mucronatum* (Pers.) Schltdl., biotrophic on Rosaceae, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Yun et al. 2011 (phylogeny, synonymised with *Frommeella*), new spp. see Zhuang and Wei 2009a (new records), Yang et al. 2015b (molecular analysis), Ali et al. 2017 (new combinations).

Phragmopyxis Dietel 1897 (= *Tricella* Long 1912), Uropyxidaceae, Pucciniales, Pucciniomycetes, four species, type species *P. deglubens* (Berk. & M.A. Curtis) Dietel, biotrophic on Fabaceae, terrestrial, USA, Mexico, Sierra Leone, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phragmotaenium R. Bauer, Begerow, A. Nagler & Oberw. 2001, Tilletiariaceae, Georgefischeriales, Exobasidiomycetes, five species, type species *P. indicum* (Vánky, M.S. Patil & N.D. Sharma) R. Bauer, Begerow, A. Nagler & Oberw., plant parasites (leaves, stems) on *Ischaemum* (Poaceae), saprobic yeast states, Southeast Asia, North America, cultures available, sequence data available, see Bauer et al. 2001b, Begerow et al. 2014 (taxonomy).

Phragmotelium Syd. 1921, *incertae sedis*, Pucciniales, Pucciniomycetes, c. ten species, type species *P. barnardii* (Plowr. & G. Winter) Syd., Asia, Australia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phragmoxenidium Oberw. 1990, Phragmoxenidiaceae, Tremellales, Tremellomycetes, asexual morph unknown, one species, type species *P. mycophilum* Oberw. & Schneller, on wood, North America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Phylloboletellus Singer 1952, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *P. chloephorus* Singer, stipitate-pileate, parasitic? Central and South America, see Binder and Hibbett 2006, Kirk et al. 2013 (genus accepted), sequence data available, see Nuhn et al. 2013 (phylogeny), Farid et al. 2018 (phylogeny).

Phyllobolites Singer 1942, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *P. miniatus* (Rick) Singer, south America (tropical), see Kirk et al. 2013 (genus accepted), sequence data unavailable.

Phyllogaster Pegler 1969, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. pholiotoides* Pegler, Ghana, basidioma gasteroid, sequence data unavailable, see Giachini and Castellano 2011 (putative synonym with *Gloeocantharellus*), Kirk et al. 2013 (genus accepted).

Phylloporia Murrill 1904, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 38 species, type species *P. parasitica* Murrill, basidioma resupinate, pileate or stipitate, amplectant, hymenophore poroid, terrestre,

wood rotting, white rot, worldwide, some species medicinal use (*P. ribis* (Schumach.: Fr.) Ryvarden), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Gafforov et al. 2014 (phylogeny), new spp. see Valenzuela et al. 2011 (Mexico), Zhou and Dai 2012b (China), Zhou 2016 (key, China), Decock et al. 2017 (Gabon).

Phylloporopsis Angelini, A. Farid, Gelardi, M.E. Smith, Costanzo, & Vizzini 2018, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *P. boletinoides* (A.H. Sm. & Thiers) Vizzini, Angelini, A. Farid, Gelardi, Costanzo & M.E. Sm., stipitate-pileate, North and Central America, Caribbean, sequence data available, see Farid et al. 2018 (taxonomy, phylogeny).

Phylloporus Quél. 1888, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 90 species, type species *P. pelletieri* (Lév.) Quél., stipitate-pileate, ectomycorrhizal, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Neves and Halling 2010 (phylogeny, revision, Neotropics and North America), Neves et al. 2012 (phylogeny, revision, "old world"), Zeng et al. 2013 (monograph, phylogeny, China), new spp. see Neves et al. 2010 (Guyana, South America), Montoya and Bandala 2011 (Mexico), Ye et al. 2014 (China), Pradeep et al. 2015 (India), Hosen and Li 2015, Hosen and Li 2017 (Bangladesh), Zhao et al. 2018a (China), Chuankid et al. 2019 (Asia).

Phyllopta (Fr.) Fr. 1825, *incertae sedis*, *incertae sedis*, Tremellomycetes, asexual morph unknown, one species, type species *P. biparasitica* (Fr.) Fr., wood-rotting, Europe, sequence data unavailable, see Kirk et al. 2008.

Phyllotopsis E.-J. Gilbert & Donk ex Singer 1936, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *P. nidulans* (Pers.) Singer, worldwide, saprotrophic, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006 (phylogeny).

Phyllozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Spiculogloeaceae, Spiculogloeales, Spiculogloeomycetes, sexual morphs unknown, seven species, type species *P. subbrunnea* (Nakase & M. Suzuki) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, plant material, worldwide, cultures and sequence data available, Wang et al. 2015e (taxonomy and phylogeny).

Physalacria Peck 1882, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, 33 species, type species *P. inflata* (Schwein.) Peck, saprotrophic, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Dentinger and McLaughlin 2006 (phylogeny), new spp. see Qin and Yang 2016 (China).

Physisporinus P. Karst. 1889, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 15 species, type species *P. vitreus* (Pers.) P. Karst., poroid hymenophore, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Miettinen et al. 2012 (phylogeny), Wu et al. 2017a (new spp., new combinations, phylogeny, China).

Physocystidium Singer 1962, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. cinnamomeum* (Dennis) Singer, Trinidad, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Physodontia Ryvarden & H. Solheim 1977, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *P. lundellii* Ryvarden & H. Solheim, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Brazee et al. 2014 (disturbance and diversity of wood-rotting fungi).

Physonema Lév. 1847, Phragmidiaceae, Pucciniales, Pucciniomycetes, one species, type species *P. pallidum* Bonord., worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Picipes Zmitr. & Kovalenko 2016, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, 16 species, type species *P. badius* (Pers.) Zmitr. & Kovalenko, stipitate basidioma, poroid hymenophore, wood-rotting, white rot, widespread, sequence date available, see Zmitrovich and Kovalenko 2016 (new genus, new combinations, phylogeny), Zhou et al. 2016b (new spp., new combinations, phylogeny, China), Zmitrovich 2018a (taxonomy).

Pilatotrama Zmitr. 2018, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, monotypic, type species *P. ljubarskyi* (Pilát) Zmitr., trametoid basidioma, wood-rotting, white rot, warm regions of Holarctics, see Justo and Hibbett 2011 (phylogeny), Zmitrovich 2018a (taxonomy).

Pileodon P. Roberts & Hjortstam 1998, *incertae sedis*, Gloeophyllales, Agaricomycetes, asexual morph unknown, two species, type species *P. megasporus* P.

Roberts & Hjortstam, wood-decaying, Brunei, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pileolaria Castagne 1842 (= *Discospora* Arthur 1907), Pileolariaceae, Pucciniales, Pucciniomycetes, 16 species, type species *P. terebinthi* Castagne, biotrophic on Anacardiaceae, terrestrial, see Kirk et al. 2013 (genus accepted), sequence data available, see Doungsa-ard et al. 2015 (phylogeny), new spp. see Hüseyin and Selçuk 2016 (Turkey).

Pilocintractia Vánky 2004, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, two species, type species *P. fimbristylidicola* (Pavgi & Mundk.) Vánky, plant parasites (flowers) on *Fimbrystilis* (Cyperaceae), India, Thailand, Australia, Central America, South America, cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Piloderma Jülich 1969, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, six species, type species *P. bicolor* (Peck) Jülich, ectomycorrhizal, widespread, see Zmitrovich 2008 (species manual), Kirk et al. 2013 (genus accepted), Heinonsalo et al. 2015 (ectomycorrhizal evidences), sequence data available, see Nygren et al. 2008 (nitrate reductase-encoding genes, ectomycorrhizal fungi), Tedersoo et al. 2010 (phylogeny).

Piloporia Niemelä 1982, Incrustoporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *P. sajanensis* (Parmasto) Niemelä, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Miettinen and Rajchenberg 2012 (phylogeny).

Piptoporellus B.K. Cui, M.L. Han & Y.C. Dai 2016, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *P. soloniensis* (Dubois) B.K. Cui, M.L. Han & Y.C. Dai, poroid hymenophore, wood-rotting, grows on angiosperm wood and causes a brown rot, widespread, sequence data available, see Han et al. 2016a (new spp., new combination, phylogeny, China).

Pirex Hjortstam & Ryvarden 1985, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species, *P. concentricus* (Cooke & Ellis) Hjortstam & Ryvarden, resupinate basidioma, odontoid to hydnoid or subporoid hymenophore, wood-rotting, North America, see Kirk et al. 2013 (genus

accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Floudas and Hibbett 2015 (phylogeny).

Piskurozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Piskurozymaceae, Filobasidiales, Tremellomycetes, twelve species, type species *P. cylindrica* (A. Fonseca, Scorzetti & Fell) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, sequence data available, see Liu et al. 2015b (taxonomy, phylogeny), new spp. see Yurkov et al. 2016, Kachalkin et al. 2019.

Pisolithus Alb. & Schwein. 1805, Sclerodermataceae, Boletales, Agaricomycetes, asexual morph unknown, 17 species, type species *P. arenarius* Alb. & Schwein., ectomycorrhizal, widespread, some species edible and medicinal use (*P. arhizus* (Scop.) Rauschert), see Dai and Yang 2008 (medicinal mushrooms, China), Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Rusevska et al. 2015 (phylogeny), new spp. see Phosri et al. 2012 (Southeast Asia), Martín et al. 2013a (Spain), Crous et al. 2016a (Thailand), Lebel et al. 2018 (Australasia).

Planetella Savile 1951, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, one species, type species *P. lironis* Savile, plant parasite (ovaries) on *Carex* spp. (Cyperaceae), North America, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Platycarpa Couch 1949, Eocronartiaceae, Platygloeales, Pucciniomycetes, two species, type species *P. polypodii* (Couch) Couch, America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Platygloea J. Schröt. 1887, Platygloeaceae, Platygloeales, Pucciniomycetes, c. 16 species, type species *P. nigricans* (Fr.) J. Schröt., sequence data available, see Schoch et al. 2014 (DNA sequences).

Pleurella E. Horak 1971, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. ardesiaca* (G. Stev. & G.M. Taylor) E. Horak, New Zealand, see Kirk et al. 2013 (genus accepted), sequence data available, ITS sequence (JQ694106) is publically available from a collection (PDD 87446) referred to as *Pleurella ardesiaca* from New Zealand.

Pleurocollybia Singer 1947, Biannulariaceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *P. praemultifolia* (Murrill) Singer,

America, Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Matheny et al. 2017a (*P. cibaria* belongs to Lyophyllaceae), Alvarado et al. 2018b (*P. imbricata* in Biannulariaceae, new family), new spp. see Baroni et al. 2008 (Belize), Sánchez-García and Matheny 2017 (phylogeny).

Pleurocybella Singer 1947, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *P. porrigens* (Pers.) Singer, on wood, North temperate, some species edible but suspect (*P. porrigens* (Pers.) Singer), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), reported as deadly poisonous in Japan, see Gonmori et al. 2011, Yamamoto et al. 2014), Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Suzuki et al. 2013 (Omics data), new spp. see Desjardin and Hemmes 2011 (Hawaiian Islands).

Pleuroflammula Singer 1946, Crepidotaceae, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *P. dussii* (Pat.) Singer, America, Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006, 2015 (phylogeny), Petersen et al. 2010 (phylogeny), Horak 2018 (monograph, New Zealand).

Pleuromyces Dima, P.-A. Moreau & V. Papp 2018, Tubariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. hungaricus* V. Papp, Dima & P.-A. Moreau, saprobic, sequence data available, see Crous et al. 2018b (phylogeny).

Pleurotus (Fr.) P. Kumm. 1871 (=*Antromycopsis* Pat. & Trab. 1897 *fide* Art. 59.1), Pleurotaceae, Agaricales, Agaricomycetes, asexual morph previously known in *Antromycopsis* Pat. & Trab. 1897, 25 species, type species *P. ostreatus* (Jacq.) P. Kumm., worldwide, some species edible, oyster mushroom (*P. ostreatus* (Jacq.) P. Kumm.), see Jayakumar et al. 2009 (compounds), Dai et al. 2010b (edible mushrooms), Sánchez 2010 (cultivation), Kirk et al. 2013 (genus accepted), Maftoun et al. 2015 (biodiversity, nutritional values), Sanuma et al. 2016 (edible mushrooms, Brazil), Zmitrovich and Wasser 2016 (problem of "*P. sajur-caju*" name, nomenclature), Castro-Alves et al. 2017 (immunomodulatory effects), sequence data available, see Wang et al. 2008b (mitochondrial genome), Alam et al. 2009 (*P. nebrodensis*), Estrada et al. 2010

(*P. eryngii*), Menolli et al. 2014 (Brazil), Shnyreva and Shnyreva 2015 (phylogeny), Yang et al. 2016c (mitochondrial genome), new spp. see Zervakis et al. 2014 (new combination), Takahashi et al. 2016 (Japan), Zhao et al. 2016c (Bailinggu).

Plicatura Peck 1872, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. nivea* (Fr.) P. Karst., North temperate, sequence data unavailable, Kirk et al. 2013 (genus accepted).

Plicaturopsis D.A. Reid 1964, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, two species, type species *P. crispa* (Pers.) D.A. Reid, worldwide, wood-rotting, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2010 (new order), Kohler et al. 2015 (genome), Zhou et al. 2016a (phylogeny).

Pluteus Fr. 1836, Pluteaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 500 species, type species *P. cervinus* (Schaeff.) P. Kumm., worldwide, some species edible, deer mushroom (*P. cervinus* (Schaeff.) P. Kumm. Syn., *P. atricapillus* (Batsch) Fayod), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), sequence data available, see Justo and Castro 2007 (section *Pluteus*), Minnis and Sundberg 2010 (section *Celluloderma*), Justo et al. 2011a, b (phylogeny), Menolli et al. 2015a, b, c (Brazil, phylogeny, section *Celluloderma*, section *Hispidoderma*), Holec et al. 2018 (*P. fenzlii*), new spp. see Iliffe 2010, Menolli and Capelari (2010), Menolli et al. 2010 (Brazil), Rodríguez et al. 2010 (Mexico), Justo et al. 2012 (Dominican Republic), Pradeep et al. 2012a (India), Crous et al. 2014b (Russia), Justo et al. 2014 (Holarctic), Menolli et al. 2014 (Brazil, Africa, India, Spain), Kaur and Singh 2014 (India), Ševčíková et al. 2014 (Korea, USA), Ševčíková and Borovička 2015 (Czech Republic), Xu et al. 2015a (China), Menolli et al. 2015c (Brazil), Malysheva et al. 2016 (Russia), Campi et al. 2019 (Paraguay).

Podaxis Desv. 1809, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *P. senegalensis* Desv., secotioid, subtropical dry areas, saprotrophic, see Sharma et al. 2009 (Inda), Muhsin et al. 2012 (Iraq), Kirk et al. 2013 (genus accepted), sequence data available, see Conlon et al. 2016 (South Africa, associated with termites, phylogeny), Medina-Ortiz et al. 2017 (Mexico, ethnomycology).

Podofomes Pouzar 1966, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, three species, type species *P. corrugis* (Fr.) Pouzar, stipitate basidioma, poroid hymenophore, terrestrial or wood-inhabiting, white rot, widespread (Europa, Asia), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Podohydnangium G.W. Beaton, Pegler & T.W.K. Young 1984, Hydnangiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. australe* G.W. Beaton, Pegler & T.W.K. Young, sequence data available.

Podoscypha Pat. 1900, Podoscyphaceae, Polyporales, Agaricomycetes, asexual morph unknown, 36 species, type species *P. surinamensis* (Lév.) Pat., wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Sjökvist et al. 2012 (phylogeny), Binder et al. 2013 (phylogeny), Ryvarden 2015e (new combination), Zmitrovich 2018a (taxonomy), genus in need of revision.

Podoserpula D.A. Reid 1963, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, two species, type species *P. pusio* (Berk.) D.A. Reid, saprobes, terrestrial, widespread, see Kirk et al. 2008, 2013 (genus accepted), *P. miranda* is thought to be ectomycorrhizal, as it appears to associate with *Arillastrum gummiferum*, see Ducousso et al. 2009, sequence data available, see Binder et al. 2010 (phylogeny), new spp. see Buyck et al. 2012b (New Caledonia).

Pogonoloma (Singer) Sánchez-García 2014, Pseudoclitocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *P. spinulosum* (Kühner & Romagn.) Sánchez-García, worldwide, terrestrial, presumably saprotrophic, sequence data available, see Sánchez-García et al. 2014 (taxonomy), Alvarado et al. 2018b (taxonomy).

Polioma Arthur 1907, Pucciniaceae, Pucciniales, Pucciniomycetes, five species, type species *P. nivea* (Holw.) Arthur, biotrophic on Geraniaceae, Lamiaceae, terrestrial, USA, Colombia, Ecuador, Mexico, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Poliomopsis A.W. Ramaley 1987, Uropyxidaceae, Pucciniales, Pucciniomycetes, one species, type species *P. thermopsidis* A.W. Ramaley, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Polygaster Fr. 1823, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. sampadarius* Fr., sequence data unavailable, see Kirk et al. 2008.

Polyozellus Murrill 1910, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, one species, type species *P. multiplex* (Underw.) Murrill, North America, terrestrial, blue chanterelle, some species edible (*P. multiplex* (Underw.) Murrill), can be medicinal used, see Kirk et al. 2013 (genus accepted), Nagasawa et al. 2014 (anti-angiogenesis compounds), Yang and Song 2015 (compounds), sequence data available, see Voitk et al. 2017 (*P. multiplex*, species complex).

Polyporoletus Snell 1936, Albatrellaceae, Russulales, Agaricomycetes, asexual morph unknown, four species, type species *P. sublividus* Snell, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Audet 2010 (taxonomy, phylogeny).

Polyporopsis Audet 2010, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. mexicana* (Laferr. & Gilb.) Audet, wood-rotting, sequence data available, see Audet 2010 (phylogeny, taxonomy).

Polyporus [P. Micheli ex Adans.] Fr. 1821, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 35 species, type species *P. tuberaster* (Jacq. ex Pers.) Fr., stipitate basidioma, poroid hymenophore, wood-rotting or rarely terrestrial (sclerotium), widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), some species edible or medicinal use, see Bandara et al. 2015b (review, *P. umbellatus* (Pers.) Fr.), Sanuma et al. 2016 (edible mushrooms, Brazil), sequence data available, see Zhou et al. 2016b (phylogeny, China), Zmitrovich and Kovalenko 2016 (phylogeny), Cui et al. 2019 (phylogeny, China), new spp. see Drechsler-Santos et al. 2008 (morphology, Brazil), Dai et al. 2009c (morphology, central China), Dai et al. 2014b (phylogeny, new names, Argentina, Mongolia, USA), Xue and Zhou 2014 (phylogeny, China), Hyde et al. 2016 (phylogeny, China), Runnel and Ryvarden 2016 (phylogeny, French Guiana), Si and Dai 2016 (morphology, China), Sotome et al. 2016 (phylogeny, Thailand), Tibpromma et al. 2017 (phylogeny, South Korea), new combinations, see Hattori and Sotome 2013 (morphology, type study, Malaysia), Nakasone 2015 (new names, morphology), Ryvarden et al. 2017 (morphology).

Polypus Audet 2010, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *P. dispansus* (Lloyd) Audet, see Audet 2010 (taxonomy), wood-decaying, worldwide, sequence data unavailable.

Ponticulomyces R.H. Petersen 2010, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. kedrovayae* R.H. Petersen, far East of Russia, China, Japan, sequence data available, see Petersen and Hughes 2010 (monograph), Ushijima et al. 2012 (Japan).

Poriodontia Parmasto 1982, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *P. subvinosa* Parmasto, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhao et al. 2015b (phylogeny).

Porodaedalea Murrill 1905, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 14 species, type species *P. pini* (Brot.) Murrill, worldwide, sequence data available, see Tomsovský et al. 2010a (European species).

Porodisculus Murrill 1907, Schizophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. pendulus* (Schwein.) Schwein., America, Asia, see Kirk et al. 2013 (genus accepted), sequence data available, new sp. see Lee and Jung 2008 (East Asia).

Porogramme (Pat.) Pat. 1900, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *P. dussii* (Pat.) Pat., widespread (tropical), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Binder et al. 2013 (phylogeny, Polyporales), new sp. see Ryvarden 2018a (morphology, Mozambique).

Porostereum Pilát 1937, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, 15 species, type species *P. phellodendri* Pilát, stereoid basidioma, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence date available, see Wu et al. 2010a (phylogeny).

Porotenus Viégas 1960, Uropyxidaceae, Pucciniales, Pucciniomycetes, seven species, type species *P. concavus* Viégas, biotrophic on Bignoniaceae, Verbenaceae, terrestrial, Brazil, Guatemala, Costa Rica, see Kirk et al. 2013 (genus accepted), sequence data available, see Beenken et al. 2012 (rust fungi on Annonaceae, *Dasyspora*).

Porotheleum Fr. 1818, Porotheleaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 16 species, type species *P. fimbriatum* (Pers.) Fr., worldwide, wood-rotting, sequence data available, see Jang et al. 2016 (Korea).

Porphyrellus E.-J. Gilbert 1931, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *P. porphyrosporus* (Fr. & Hök) E.-J. Gilbert, stipitate-pileate, worldwide, sequence data available, see Wu et al. 2014b (phylogeny), new spp. see Wu et al. 2016f (China), new combination see Li and Yang 2011, Cooper 2014a.

Porpoloma Singer 1952, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 13 species, type species *P. sejunctum* Singer, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Vizzini et al. 2012b (notes), Sánchez-García et al. 2014 (phylogeny), Olariaga et al. 2015b (*P. aranzadii*), Sánchez-García and Matheny 2017 (phylogeny, Tricholomatineae, evolution).

Porpolomopsis Bresinsky 2008, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *P. calyptriformis* (Berk.) Bresinsky, USA, Europe, Russia, sequence data available, see Lodge et al. 2014 (phylogeny, taxonomy, Hygrophoraceae).

Porpomyces Jülich 1982, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. mucidus* (Pers.) Jülich (*Ceriporiopsis mucida* (Pers.) Gilb. & Ryvarden), resupinate basidioma, poroid hymenophore, wood-rotting, sequence data available, see Kirk et al. 2013 (genus accepted).

Porpopycnis R. Kirschner 2012, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *P. lubae* R. Kirschner, Central America, sequence data available, see Kirschner et al. 2012 (taxonomy).

Portalia V. González, Vánky & Platas 2007, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, one species, type species *P. uljanishcheviana* (Schwarzman) V. González, Vánky & Platas, plant parasite (flowers) on *Scirpoides holoschoenus* (Cyperaceae), Spain, Kazakhstan, cultures unavailable, sequence data available, see Begerow et al. 2014, Nasr et al. 2014a (taxonomy).

Postia Fr. 1874, Dacryobolaceae, Polyporales, Agaricomycetes, asexual morph *Ptychogaster* Corda 1838, c. 40 species (needs revision since genus shown to be polyphyletic, see Shen et al. 2019), type species *P. lactea* (Fr.) P. Karst., poroid

hymenophore, wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Ortiz-Santana et al. 2013 (phylogeny, antrodia clade), Shen et al. 2019 (taxonomy, phylogeny), new spp. see Wei and Qin 2010 (morphology, China), Yuan et al. 2010 (morphology, Northern China), Hattori et al. 2011 (phylogeny, Malaysia), Cui and Li 2012 (morphology, Northeast China), Shen and Cui 2014 (phylogeny, China), Shen et al. 2014, 2015 (phylogeny, China), Dämmrich et al. 2017 (morphology, Germany), Yuan et al. 2017a (phylogeny, China), Miettinen et al. 2018 (phylogeny, new combinations, *P. caesia* complex, Northern Hemisphere), new combinations, see Papp 2014 (nomenclature, *P. caesia* complex).

Pouzaroporia Vampola 1992, Podoscyphaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. subrufa* (Ellis & Dearn.) Vampola, wood-rotting, North America, see Kirk et al. 2013 (genus accepted), sequence data available, see Justo et al. 2017 (phylogeny, family-level classification, Polyporales).

Prillingera Takashima, Manabe, Nishimura, Sriswasdi, Ohkuma, Iwasaki & Sugita 2019, Trichosporonaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, one species, type species *P. fragicola* (Takashima , Sugita, Shinoda & Nakase) Takashima, Manabe, Nishimura, Sriswasdi, Ohkuma, Iwasaki & Sugita, yeast, strawberry, Japan, sequence data available, see Takashima et al. 2019 (genome, taxonomy, phylogeny).

Proceropycnis M. Villarreal, Arenal, V. Rubio, Begerow, R. Bauer, R. Kirschner & Oberw. 2006, Hoehnelomycetaceae, Atractiellales, Atractiellomycetes, asexual, teleomorph unknown, two species, type species *P. pinicola* M. Villarreal, Arenal, V. Rubio, Begerow, R. Bauer, R. Kirschner & Oberw., ecological strategy unclear, on wood of *Pinus* spp., in beetle galleries of *Pinus* spp. and rare endopytes of *Populus trichocarpa* roots, distribution Spain, China, USA, sequence data available, see Oberwinkler et al. 2006 (integrative taxonomy, phylogeny), new spp. see Aime et al. 2018c (Oregon, USA).

Proliferobasidium J.L. Cunn. 1976, Brachybasidiaceae, Exobasidiales, Exobasidiomycetes, one species, type species *P. heliconiae* J.L. Cunn., plant parasite (leaves) on Heliconiaceae, Caribbean Basin, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2002, 2014 (taxonomy).

Prospodium Arthur 1907 (=*Coinostelium* Syd. 1939; *Nephlyctis* Arthur 1907), Uropyxidaceae, Pucciniales, Pucciniomycetes, 84 species, type species *P. appendiculatum* (Kuntze) Arthur, biotrophic on Bignoniaceae, Verbenaceae, terrestrial, warmer areas of North, South and Central America, see Kirk et al. 2013 (genus accepted), sequence data available, see Jitjak and Sanoamuang 2017 (phylogeny), new spp. see Yepes and Céspedes 2008, de Carvalho Jr and Hennen 2010 (new combinations, key to species, key to species on *Tecoma*), Silva et al. 2012 (biological control).

Protoacia Spirin & V. Malysheva 2019, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *P. delicata* Spirin & V. Malysheva, Europe (Norway, Russia, Sweden), Asia (Russian Far East), on strongly rotten wood of conifers, mostly *Picea*, sequence data available, see Spirin et al. 2019b (taxonomy, phylogeny).

Protodaedalea Imazeki 1955, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, two species, type species *P. hispida* Imazeki [current name: *Elmerina hispida* (Imazeki) Y.C. Dai & L.W. Zhou], wood-rotting, worldwide, sequence data available, see Zhou and Dai 2013b (poroid and lamellate genera, Auriculariales, taxonomy, phylogeny), Sotome et al. 2014 (new combination).

Protodontia Höhn. 1907, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, three species, type species *P. uda* Höhn., Africa (Kenya), on fallen branch of deciduous tree, sequence data available, see Spirin et al. 2019b (taxonomy, phylogeny, genus accepted).

Protogaster Thaxt. 1934, Protogastraceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *P. rhizophilus* Thaxt., on roots of *Viola*, USA, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Protogautieria A.H. Sm. 1965, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, two species, type species *P. lutea* A.H. Sm., N. America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Protoglossum Massee 1891, Cortinariaceae, Agaricales, Agaricomycetes, asexual morph unknown, eight species, type species *P. luteum* Massee, worldwide, basidioma sequestrate, see Kirk et al. 2013 (genus accepted), sequence data available, see Danks et al. 2010 (phylogeny, sequestrate *Cortinarius*, sub-alpine Australia), Orlovich et al. 2014 (sequestrate *Cortinarius*, New Zealand, phylogeny).

Protograndinia Rick 1933, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *P. cinerea* Rick, sequence data unavailable, see Kirk et al. 2008.

Protohydnum Möller 1895, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, three species, type species *P. cartilagineum* Möller, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Malysheva et al. 2018 (taxonomy).

Protomerulius Möller 1895, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, seven species, type species *P. brasiliensis* Möller, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Zhou and Dai 2013b (phylogeny, new spp.), Ryvarden 2016a (neotropical polypores, new combination).

Protoradulum Rick 1933, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *P. ceraceovitreum* Rick, Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Protostropharia Redhead, Moncalvo & Vilgalys 2013, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 14 species, type species *P. semiglobata* (Batsch) Redhead, Moncalvo, Vilgalys, sequence data available, see Wang and Tzean 2015 (China).

Protoxerula R.H. Petersen 2010, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. flavo-olivacea* R.H. Petersen, worldwide, sequence data available, see Petersen and Hughes 2010 (taxonomy).

Protubera Möller 1895, Phallogastraceae, Hysterangiales, Agaricomycetes, asexual morph unknown, 13 species, type species *P. maracuja* Möller, worldwide, see Kirk et al. 2013 (genus accetped), sequence data available, see Giachini et al. 2010 (phylogeny), Trierveiler-Pereira et al. 2014b.

Protuberella S. Imai & A. Kawam. 1958, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *P. borealis* (S. Imai) S. Imai & A. Kawam, terrestrial, Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Psathyloma Soop, J.A. Cooper & Dima 2016, Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. leucocarpum* Soop, J.A. Cooper & Dima, South Pacific (Australia, New Zealand, South America),

basidioma agaricoid, terrestrial, ectomycorrhizal, sequence data available, see Soop et al. 2016 (taxonomy, phylogeny).

Psathyrella (Fr.) Quél. 1872, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 420 species, type species *P. gracilis* Fr. [current name: *P. corrugis* (Pers.) Konrad & Maubl.], worldwide, saprotrophic, some species edible (*P. atroumbonata* Pegler), some species medicinal use [*P. candolleana* (Fr.) Maire], see Ayodele and Okhuoya 2009 (nutritional), Kirk et al. 2013 (genus accepted), Al-Habib et al. 2014 (medicinal mushroom), sequence data available, see Larsson and Örstadius 2008 (Nordic countries), Padamsee et al. 2008 (phylogeny), Vašutová et al. 2008 (sections *Pennatae* and *Spadiceae*), Örstadius et al. 2015 (phylogeny), Amandeep et al. 2015b (India), new spp. see Hoashi 2008 (Japan), Frank et al. 2010 (USA), Seok et al. 2010 (Korea), Voto 2011 (Italy), Kaur et al. 2013b (India), Corriol 2014 (France), Crous et al. 2015b (Spain), Moreno et al. 2015 (Mexico), Desjardin and Perry 2016 (São Tomé and Príncipe, Africa), Crous et al. 2017a (Costa Rica), Yan and Bau 2017, 2018b (China), Broussal et al. 2018 (France, Spain).

Pseudoarmillariella (Singer) Singer 1956, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *P. ectypoides* (Peck) Singer, North and central America, Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006 (phylogeny), Lodge et al. 2014 (phylogeny), new spp. see Yang et al. 2013b (Asia).

Pseudoauricularia Kobayasi 1982, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. papuana* Kobayasi, Papua New Guinea, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudoaustroboletus Y.C. Li & Zhu L. Yang 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, three species, type species *P. valens* (Corner) Yan C. Li & Zhu L. Yang, stipitate-pileate, China, Japan, Malaysia, Singapore, sequence data available, see Li et al. 2014g (taxonomy, phylogeny).

Pseudobaeospora Singer 1942, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 26 species, type species *P. oligophylla* (Singer) Singer, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Sánchez-García and Matheny 2017 (phylogeny, Tricholomatineae, evolution), new spp. see Voto 2009 (Italy), Vellinga 2009 (California, USA), Adamčík and Jančovičová 2011

(Slovakia), Arauzo 2011 (Spain), Schwarz 2012 (California, USA), Desjardin et al. 2014 (Hawaii, USA), Voto 2018 (Finland), Voto and Soop 2018 (New Zealand).

Pseudobensingtonia F.Y. Bai, Q.M. Wang, M. Groenewald & Boekhout 2015, Agaricostilbaceae, Agaricostilbales, Agaricostilbomycetes, sexual morph unknown, two species, type species *P. ingoldii* (Nakase & Itoh.) F.Y. Bai, Q.M. Wang, M. Groenew. & Boekhout, yeast, widespread, cultures and sequence data available, see Wang et al. 2015e (taxonomy and phylogeny).

Pseudoboletus Šutara 1991, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *P. parasiticus* (Bull.) Šutara, north temperate, stipitate-pileate, reported as parasitic on other Boletales (*Scleroderma, Pisolithus, Astraeus*) or ectomycorrhizal, see Tedersoo et al. 2010, Kirk et al. 2013 (genus accepted), sequence data available, see Zhao et al. 2015d (phylogeny).

Pseudoclathrus B. Liu & Y.S. Bau 1980, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, five species, type species *P. cylindrosporus* B. Liu & Y.S. Bau, terrestrial, China, sequence data unavailable, see Zou et al. 2008 (China, morphology), Kirk et al. 2013 (genus accepted).

Pseudoclitocybe (Singer) Singer 1956, Pseudoclitocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, 16 species, type species *P. cyathiformis* (Bull.) Singer, North temperate, South America, see Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Vizzini et al. 2011a (phylogeny, new genus), Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae), Sánchez-García and Matheny 2017 (phylogeny, Tricholomatineae, evolution), Alvarado et al. 2018b (phylogeny, morphology).

Pseudoclitopilus Vizzini & Contu 2012, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. rhodoleucus* (Sacc.) Vizzini & Contu, worldwide, basidioma agaricoid, on the ground, never on wood, sequence data available, see Vizzini et al. 2012b (taxonomy).

Pseudocolus Lloyd 1907, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, two species, type species *P. rothae* Lloyd [current name: *P. fusiformis* (E. Fisch.) Lloyd], worldwide (tropical, subtropical introduced), see Akata and Doğan 2011

(Turkish), Kirk et al. 2013 (genus accepted), sequence data available, see Hibbett and Binder 2002 (phylogeny, homobasidiomycetes).

Pseudodermatosorus Vánky 1999, Doassansiaceae, Doassansiales, Exobasidiomycetes, two species, type species *P. sagittariae* (Vánky & C. Vánky) Vánky, plant parasites (leaves) on Alismataceae, Africa, South America, South Asia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy).

Pseudodoassansia (Setch.) Vánky 1981, Doassansiaceae, Doassansiales, Exobasidiomycetes, two species, type species *P. obscura* (Setch.) Vánky, plant parasites (leaves) on Alismataceae, Africa, South America, South Asia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Pseudofavolus Pat. 1900, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *P. miquelii* (Mont.) Pat, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Sotome et al. 2008 (phylogeny, morphology).

Pseudofibroporia Yuan Y. Chen, B.K. Cui & Y.C. Dai 2017, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. citrina* Yuan Y. Chen, B.K. Cui & Y.C. Dai, poroid hymenophore, wood-rotting, growing on angiosperm wood, white rot, China, sequence data available, see Chen et al. 2017d (taxonomy, phylogeny, China).

Pseudofistulina O. Fidalgo & M. Fidalgo 1963, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *P. brasiliensis* (O. Fidalgo & M. Fidalgo) O. Fidalgo & M. Fidalgo (current name: *Fistulina brasiliensis* O. Fidalgo & M. Fidalgo), Brazil, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudogelopellis K. Tao & B. Liu 1996, Claustulaceae, Phallales, Agaricomycetes, aseuxal morph unknown, one species, type species *P. echinoperidium* K. Tao & B. Liu, China, terrestrial, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudogomphus R. Heim 1970, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, one species, type species *P. fragilissimus* R. Heim & Gilles, Gabon, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudogymnopilus Raithelh. 1974, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. pampeanus* (Speg.) Raithelh., South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudohiatula (Singer) Singer 1938, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. five species, type species *P. cyatheae* Singer, tropical, see Kirk et al. 2013 (genus accepted), sequence data available, see Petersen and Hughes 2010 (phylogeny).

Pseudohydnum P. Karst. 1868, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *P. gelatinosum* (Scop.) P. Karst., widespread, edible and medicinal use, see Dai and Yang 2008 (medicinal mushrooms, China), Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Weiß and Oberwinkler 2001 (phylogeny).

Pseudohygrophorus Velen. 1939, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. vesicarius* Velen., Europe, sequence data unavailable, see Kirk et al. 2008.

Pseudohyphozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, three species, type species *P. buffonii* (C. Ramírez) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Pseudoinonotus T. Wagner & M. Fisch. 2001, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, eight species, type species *P. dryadeus* (Pers.) T. Wagner & M. Fisch., worldwide, see Dai et al. 2008 (key, China), sequence data available, see Rajchenberg et al. 2015 (phylogeny, new combination),

Pseudolaccaria Vizzini, Contu & Z.W. Ge 2015, Biannulariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. pachyphylla* (Fr.) Vizzini & Contu, habit *Laccaria*-like, sequence data available, see Lavorato et al. 2015

(revision, *Clitocybe umbrinopurpurascens*, *Neohygrophorus*, *Pseudoomphalina*), Alvarado et al. 2018b (phylogeny).

Pseudolagarobasidium J.C. Jang & T. Chen 1985, Cerrenaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *P. leguminicola* J.C. Jang & T. Chen, resupinate basidioma, wood-rotting, saprobes, facultative pathogens, or endophytic, see Hallenberg et al. 2008, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Nakasone and Lindner 2012 (new spp., new combinations, phylogeny, type study, Australia, Belize, Brazil, Ceylon, Mauritius), new combination, see Nakasone 2015 (morphology, type study, Central Europe).

Pseudolasiobolus Agerer 1983, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. minutissimus* Agerer, tropical, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudolepiota Z.W. Ge 2017, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. zangmui* Z.W. Ge, agaricoid, saprotrophic, tropical China, sequence data available, see Ge and Yang 2017 (phylogeny, taxonomy, China).

Pseudoleucosporidium V. de Garcia, M.A. Coelho, T. Maia, L.H. Rosa, A.B.M. Vaz, C.A. Rosa, J.P. Samp., P. Gonç., M.R. Van Broock & Libkind 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph known, one species, type species *L. fasciculatum* Babeva & Lisichk., yeast, from mushroom, Russia, cultures and sequence data and cultures available, see de García et al. 2015 (sexual characteristics of *Leucosporidium*, new genus, phylogeny), Wang et al. 2015e (phylogeny).

Pseudomegasporoporia X.H. Ji & F. Wu 2017, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. neriicola* X.H. Ji & F. Wu, wood-rotting, east Asia, sequence data available, see Ji and Wu 2017a (taxonomy).

Pseudomerulius Jülich 1979, Tapinellaceae, Boletales, Agaricomycetes, asexual morph unknown, four species, type species *P. aureus* (Fr.) Jülich, widespread, some species medicinal use (*P. aureus* (Fr.) Jülich), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny, corticioid homobasidiomycetes), Binder et al. 2010 (phylogeny), Kotiranta et al. 2011 (new combinations).

Pseudomicrostroma T. Kij. & Aime 2017, *incertae sedis*, Microstromatales, Exobasidiomycetes, three species, type species *P. juglandis* (Berenger) Kijporn. & Aime, plant parasite (leaves) on *Juglans* spp. (Juglandaceae), widespread, saprobic yeast states on plants, cultures available, sequence data available, see Begerow et al. 2001, 2014, Wang et al. 2015c (phylogeney, taxonomy), Kijpornyongpan and Aime 2017 (taxonomy).

Pseudonadsoniella T.O. Kondr. & S.Y. Kondr. 2015, Meripilaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *P. brunnea* T.O. Kondr. & S.Y. Kondr., brown yeast, Antarctic, sequence data and cultures avaibale, see Kondratyuk et al. 2015 (taxonomy).

Pseudoomphalina (Singer) Singer 1956, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. six species, type species *P. kalchbrenneri* (Bres.) Singer, North temperate, see Malysheva et al. 2011 (new combination), Knudsen 2012, Kirk et al. 2013 (genus accepted), sequence data available, see Lodge et al. 2014 (phylogeny, monograph, Hygrophoraceae), Lavorato et al. 2015 (phylogeny, redescription, *Clitocybe umbrinopurpurascens*, revision, *Neohygrophorus*, *Pseudoomphalina*), Sánchez-García et al. 2017 (phylogeny, Tricholomatineae, evolution).

Pseudopiptoporus Ryvarden 1980, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *P. devians* (Bres.) Ryvarden, poroid hymenophore, wood-rotting, East Africa, India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudoporpoloma Vizzini & Consiglio 2016, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. pes-caprae* (Fr.) Vizzini & Consiglio, Europe, on soil, in grasslands, probably saprotrophic, sequence data available, see Vizzini et al. 2016b (phylogeny, morphology).

Pseudostypella McNabb 1969, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *P. nothofagi* McNabb, New Zealand, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudotomentella Svrček 1958, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, 17 species, type species *P. mucidula* (P. Karst.) Svrček,

ectomycorrhizal, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Tedersoo et al. 2010 (phylogeny, evolution).

Pseudotracya Vánky 1999, Doassansiaceae, Doassansiales, Exobasidiomycetes, one species, type species *P. otteliae* Vánky, plant parasites (vegetative parts) on Hydrocharitaceae, Australia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Pseudotremella X.Z. Liu, F.Y. Bai, A.M. Yurkov, M. Groenew. & Boekhout 2015, Bulleraceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, four species, type species *P. moriformis* (Berk.) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, mycoparasite, on wood, Europe, cultures and sequence data available, see Liu et al. 2015b (taxonomy, phylogeny).

Pseudotricholoma (Singer) Sánchez-García & Matheny 2014, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *P. umbrosum* (A.H. Sm. & M.B. Walters) Sánchez-García & Matheny, northern hemisphere, terrestrial, in woods and grasslands, probably biotrophic, possibly ectomycorrhizal, sequence data available, see Sánchez-García et al. 2014 (taxonomy), Vizzini et al. 2016b (phylogeny).

Pseudotulasnella Lowy 1964, Tulasnellaceae, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *P. guatemalensis* Lowy, saprobes, wood-rotting, Guatemale, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudotyphula Corner 1953, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. ochracea* Corner, on dead wood, Central Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pseudowrightoporia Y.C. Dai, Jia J. Chen & B.K. Cui 2015, Hericiaceae, Russulales, Agaricomycetes, asexual morph unknown, ten species, type species *P. cylindrospora* (Ryvarden) Y.C. Dai, Jia J. Chen & B.K. Cui, wood-decaying, worldwide, sequence data available, see Chen et al. 2016b (phylogeny).

Pseudoxenasma K.H. Larss. & Hjortstam 1976, Russulaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *P. verrucisporum* K.H. Larss. & Hjortstam, Europe, wood-decaying, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny).

Pseudozyma Bandoni 1985, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, five species, type species *P. prolifica* Bandoni (Syn. *Mycosarcoma maydis* Bref. *fide* McTaggart et al. 2016c), known only from saprobic states, widespread, five species 'pro tempore' are temporarily remained, see Kurtzman et al. 2011 (taxonomy), Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2000 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Psiloboletinus Singer 1945, Suillaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *P. lariceti* (Singer) Singer, Asia (temperate), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Psilocybe (Fr.) P. Kumm. 1871, Hymenogastraceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 326 species, type species *P. semilanceata* (Fr.) P. Kumm., hallucinogenic, see Redhead et al. 2007 (nomenclature), Borovička 2008 (wood rotting), Guzmán et al. 2008 (Canada), Guzmán 2009 (hallucinogenic mushrooms), Noordeloos 2009 (new combination), Guzmán et al. 2013a (Japan), Kirk et al. 2013 (genus accepted), sequence data available, see Ramírez-Cruz et al. 2013a,b (type studies, phylogeny), Borovička et al. 2011, 2015 (*P. cyanescens* complex, *P. atrobrunnea*), Silva et al. 2014, 2016 (Brazil, taxonomy, cultural characteristics), Froese et al. 2016 (potential ritual use), new spp. see Bau and Sarentoya 2009 (China), Guzmán et al. 2009, Horak et al. 2009 (Malaysia, Thailand), Guzmán and Yang 2010 (Asian). Takahashi 2011 (Japan), Borovička et al. 2012 (USA), Guzmán et al. 2012, 2014 (Thailand, Congo), Li et al. 2014h (China), Ma et al. 2014 (China), Wang and Tzean 2015 (China), Gartz and Wiedemann 2015 (Germany), Takahashi et al. 2016 (Japan), Ma et al. 2016 (China), Terashima et al. 2016 (Japan).

Ptechetelium Oberw. & Bandoni 1984, Eocronartiaceae, Platygloeales, Pucciniomycetes, one species, type species *P. cyatheae* (Syd.) Oberw. & Bandoni, Ecuador, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pteridomyces Jülich 1979, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, four species, type species *P. galzinii* (Bres.) Jülich, see Kirk et al. 2013 (genus accepted), sequence data unavailable, new spp. see Gorjón and Hallenberg 2013 (Chile).

Pterula Fr. 1825, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *P. plumosa* (Schwein.) Fr., worldwide, clavarioid,

sequence data available, see Dentinger et al. 2009 (phylogeny), Kim et al. 2015 (Korea), new spp. see Senthilarasu 2013 (India).

Pterulicium Corner 1950, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. xylogenum* (Berk. & Broome) Corner, Asia, bamboo pathogen, see Sandeep 2010 (India), Kirk et al. 2013 (genus accepted), sequence data available, see Dentinger et al. 2009 (phylogeny).

Ptychella Roze & Boud. 1879, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *P. ochracea* Boud., Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Puccinia Pers. 1794 (=*Argomyces* Arthur 1912, = *Argotelium* Arthur 1906, = *Bullaria* DC., in Lamarck & de Candolle 1805, = *Coronotelium* Syd. 1921, = *Cutomyces* Thüm. 1878, = *Dicaeoma* Gray 1821, = *Eriosporangium* Bertero ex Ruschenb. 1831, = *Jackya* Bubák 1902, = *Leptinia* Juel 1897, = *Leptopuccinia* (G. Winter) Rostr. 1902, = *Lindrothia* Syd. 1922, = *Linkiella* Syd. 1921, = *Lysospora* Arthur 1906, = *Micropuccinia* Rostr. 1902, = *Persooniella* Syd. 1922, = *Pleomeris* Syd. 1921, = *Poliomella* Syd. 1922, = *Puccinia* subgen. *Leptopuccinia* G. Winter 1881 [1884], = *Puccinidia* Mayr 1890, = *Rostrupia* Lagerh. 1889, = *Schroeterella* Syd. 1922, = *Sclerotelium* Syd. 1921, = *Solenodonta* Castagne 1845, = *Trailia* Syd. 1922), Pucciniaceae, Pucciniales, Pucciniomycetes, c. 3300 species, type species *P. graminis* Pers., biotrophic on most families of angiosperms especially common on Asteraceae, Cyperaceae, Liliaceae, Poaceae, worldwide in distribution, Kirk et al. 2013 (genus accepted), sequence data available, new spp. see McKenzie 2008, McTaggart and Shivas 2008, Khalid and Afshan 2009 (new records), Iqbal et al. 2009, Afshan et al. 2009, 2010b, c (new records), Berndt 2009, 2010a, 2013b (key to species from South Africa on *Helichrysum*, account of rust fungi in French Guiana), Liu and Hambleton 2010 (new series, molecular analysis, related to *P. striformis*), Liang and Kakishima 2011 (new name), Scholler et al. 2011, Zhuang and Wei 2011, Aliabadi and Abbasi 2012, de Carvalho and Hennben 2012 (key), Kirbag et al. 2011 (Turkey), Liu and Hambleton 2012, 2013 (molecular analysis, related to *P. graminis*, related to *P. coronata*, *P. coronata* Series *coronata* ser. nov., key), Gjærum and Lye 2014, Okane et al 2014, Abbasi and Aime 2016 (key), Gautam and Avasthi 2016a, b (checklist), Kumar et al. 2017 (key), Kakishima et al. 2018 (new name).

Pucciniastrum G.H. Otth 1861 (= *Calyptospora* J.G. Kühn 1869, = *Phragmopsora* Magnus 1875, = *Pomatomyces* Oerst. 1864), Pucciniastraceae, Pucciniales, Pucciniomycetes, c. 50 species, type species *P. epilobii* (Pers.) G.H. Otth, biotrophic on many dicotyledonous plants including Aceraceae, Betulaceae, Ericaceae, Fagaceae, Onagraceae, Pinaceae (alternate hosts), Rosaceae, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Liang and Kakishima 2011 (new name), Padamsee and McKenzie 2014 (new species, new combination, molecular analysis), Ji et al. 2019 (new spp., China).

Pucciniosira Lagerh. 1892, Pucciniosiraceae, Pucciniales, Pucciniomycetes, (=*Aecidiella* Ellis & Kelsey 1897, = *Didymosira* Clem. 1909, = *Schizospora* Dietel 1895), 17 species, type species *P. triumfettae* Lagerh., biotrophic on Asteraceae, Berberidaceae, Malvaceae, Solanaceae, terrestrial, America, Philippines, see Kirk et al. 2013 (genus accepted), sequence data available, see Zuluaga et al. 2011 (phylogeny, Colombian).

Pucciniostele Tranzschel & K.L. Kom., in Komarov 1899 (= *Klastopsora* Dietel, 1904; *Phragmostele* Clem. 1909), Phakopsoraceae, Pucciniales, Pucciniomycetes, four species, type species *P. clarkiana* (Barclay) Tranzschel & K.L. Kom., biotrophic on Saxifragaceae (*Astilbe*), terrestrial, Asia (China, India, Japan, Korea, Philippines), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Puccorchidium Beenken 2015, in Beenken & Wood, *incertae sedis*, Pucciniales, Pucciniomycetes, two species, type species *P. polyalthiae* (Petch) Beenken, asexual morph aecidium-like, biotrophic on Annonaceae, terrestrial, India, South Africa, Sri Lanka, see Beenken and Wood 2015 (taxonomy, phylogeny).

Pulchroboletus Gelardi, Vizzini & Simonini 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *P. roseoalbidus* (Alessio & Littini) Gelardi, Vizzini & Simonini, stipitate-pileate when mature, development secondary angiocarpic, ectomycorrhizal, Europe, sequence data available, see Gelardi et al. 2014a (taxonomy).

Pulveroboletus Murrill 1909, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, 38 species, type species *P. ravenelii* (Berk. & M.A. Curtis) Murrill, stipitate-pileate, see Kirk et al. 2013 (genus accepted), Kim et al. 2017 (pharmacological significance), sequence data available, new spp. see Takahashi 2007

(Japan), Degreef and De Kesel 2009 (Gabon), Li et al. 2016b (China), Wu et al. 2016f (China), Raspé et al. 2016 (Thailand), Zeng et al. 2017 (China, monogarph), Badou (Africa), a number of species in need of revision.

Punctularia Pat. 1895, Punctulariaceae, Corticiales, Agaricomycetes, asexual morph unknown, two species, type species *P. atropurpurascens* (Berk. & Broome) Petch, wood-decaying, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Knijn and Ferretti 2018 (Italy, phylogeny), Floudas et al. 2012 (genome, evolution).

Punctulariopsis Ghobad-Nejhad 2010, Punctulariaceae, Corticiales, Agaricomycetes, asexual morph unknown, four species, type species *P. subglobispora* (Hallenb. & Hjortstam) Ghobad-Nejhad, South America, Africa, sequence data available, see Ghobad-Nejhad et al. 2010 (taxonomy and phylogeny), Ariyawansa et al. 2015 (taxonomy and phylogeny).

Purpureocorticium S.H. Wu 2017, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *P. microsporum* S.H. Wu, corticioid, fruit body effused, adnate, membranaceous, east Asia, sequence data available, see Wu et al. 2018c (taxonomy).

Pusillomyces J.S. Oliveira 2019, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *P. manuripioides* J.S. Oliveira, Neotropic and Paleoarctic, sequence data available, see Oliveira et al. 2019 (phylogeny, taxonomy).

Pycnoporellus Murrill 1905, Sparassidaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *P. fibrillosus* (P. Karst.) Murrill [current name: *P. fulgens* (Fr.) Donk], poroid hymenophore, wood-rotting, brown rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Ortiz-Santana et al. 2013 (phylogeny, antrodia clade).

Pycnopulvinus Toome & Aime 2014, Heterogastridiaceae, Heterogastridiales, Microbotryomycetes, presumably asexual state, asexual morph unknown (no sporogenous cells were detected by the authors), one species, type species *P. aurantiacus* Toome & Aime, ecological strategy unclear: saprobic / mycoparasitic, on palm leaf litter (in association with other fungi) in tropical forests, Ecuador (type

locality) and Costa Rica (only from sequence data), sequence data available, see Toome and Aime 2014 (phylogeny, taxonomy).

Pycnovellomyces R.F. Castañeda 1987, *incertae sedis, incertae sedis*, Agaricomycetes, one species, type species *P. foliicola* R.F. Castañeda, Cuba, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Pyrofomes Kotl. & Pouzar 1964, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, eight species, type species *P. demidoffii* (Lév.) Kotl. & Pouzar, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovih 2018a (taxonomy), sequence data available, see Vlasák et al. 2018 (new combinations, phylogeny, North America), new sp. see Cui and Dai 2011 (morphology, China).

Pyrrhoderma Imazeki 1966, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, two species, type species *P. sendaiense* (Yasuda) Imazeki, Japan, Argentina, see Kirk et al. 2013 (genus accepted), sequence data available, see He and Dai 2012 (*Hymenochaete*, phylogeny).

Pyrrhoglossum Singer 1944, Cortinariaceae, Agaricales, Agaricomycetes, asexual morph unknown, twleve species, type species *P. pyrrhum* (Berk. & M.A. Curtis) Singer, tropical, Europe, see Kirk et al. 2013 (genus accepted), Horak 2018 (monograph, New Zealand), sequence data unavailable, new spp. see Corriol 2009 (Europe).

Quadrispora Bougher & Castellano 1993, Cortinariaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *Q. oblongispora* (G.W. Beaton, Pegler & T.W.K. Young) Bougher & Castellano, Australia, see Kirk et al. 2013 (genus accepted), sequence data available.

Quambalaria J.A. Simpson 2000, Quambalariaceae, Microstromatales, Exobasidiomycetes, seven species, type species *Q. pitereka* (J. Walker & Bertus) J.A. Simpson, plant parasites on genera *Corymbia* and *Eucalyptus* (Myrtaceae), anamorphic genus, saprobes on *Betula* (Betulacea), or isolated from human skin, South Africa, Austrlia, Europe, cultures available, sequence data available, see de Beer et al. 2006, Antropova et al. 2014, Begerow et al. 2014, Wang et al. 2015c (phylogeny), Bezerra et al. 2018 (new sp., Brazil).

Queiroziella C.R. Félix, J.D.P. Bezerra, R.P. Neves & Landell 2018, *incertae sedis, incertae sedis*, Cystobasidiomycetes, one species, type species *Q. brasiliensis* C.R.

Félix, P. Valente & Landell, yeast, colonies pink to salmon, Brazil, cultures and sequence data available, see Crous et al. 2018b (phylogeny, taxonomy).

Queletia Fr. 1872, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *Q. mirabilis* Fr., secotioid, worldwide, sequence data unavailable, see Moreno et al. 2012 (Spain), Kirk et al. 2013 (genus accepted), Kříž and Zíta 2016 (Czech Republic).

Raduliporus Spirin & Zmitr. 2006, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *R. aneirinus* (Sommerf.) Spirin & Zmitr., resupinate basidioma, poroid hymenophore, wood-rotting, white rot, widespread, sequence data available, see Gómez-Montoya et al. 2017a (phylogeny, morphology).

Radulochaete Rick 1940, *incertae sedis*, Cantharellales, Agaricomycetes, asexual morph unknown, two species, in need of modern interpretation, type species *R. ceracea* Rick, sequence data unavailable, see Kirk et al. 2008.

Radulodon Ryvarden 1972, Cerrenaceae, Polyporales, Agaricomycetes, asexual morph unknown, eleven species, type species *R. americanus* Ryvarden, hydnoid hymenophore, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Hallenberg et al. 2008 (phylogeny), Nakasone and Lindner 2012 (phylogeny), Kotiranta et al. 2017 (phylogeny), new spp. see Jyoti and Dhingra 2014 (morphology, Himalaya), Kaur et al. 2014 (morphology, India).

Radulodontia Hjortstam & Ryvarden 2008, *incertae sedis*, *incertae sedis*, Basidiomycota, asexual morph unknown, one species, type species *R. pyriformis* Hjortstam & Ryvarden, sequence data unavailable, see Hjortstam and Ryvarden 2008a (taxonomy).

Radulomyces M.P. Christ. 1960, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *R. confluens* (Fr.) M.P. Christ., worldwide, wood decaying, see Gilbertson and Nakasone 2003 (Hawaii), Ghobad-Nejhad and Kotiranta 2007 (*R. rickii*), Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny, corticioid homobasidiomycetes), Zhao et al. 2016b (taxonomy).

Radulomycetopsis Dhingra, Priyanka & J. Kaur 2012, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *R. cystidiata*

Dhingra, Priyanka & J. Kaur, India, sequence data unavailable, see Dhingra and Kaur 2012 (taxonomy).

Radulotubus Y.C. Dai, S.H. He & C.L. Zhao 2016, Pterulaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *R. resupinatus* Y.C. Dai, S.H. He & C.L. Zhao, wood-rotting, poroid, China, sequence data available, see Zhao et al. 2016b (taxonomy).

Ramakrishnania Ramachar & Bhagyan. 1979, Pucciniaceae, Pucciniales, Pucciniomycetes, one species, type species *R. ixorae* Ramachar & Bhagyan., biotrophic on Rubiaceae (*Ixora*), terrestrial, India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Ramaria Fr. ex Bonord. 1851, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, c. 230 species, type species *R. botrytis* (Pers.) Ricken, widespread, some species edible (*R. flava* (Schaef.: Fr.) Quél.), see Gursoy et al. 2010 (antioxidant activities), Kirk et al. 2013 (genus accepted), Liu et al. 2013 (anticancer, antioxidant and antibiotic activities), some species lethal (*R. rufescens*), see Huang et al. 2009 (China), sequence data available, see Nasim et al. 2008 (Pakistan, morphology), Knudson 2012 (Minnesota), new spp. see Cázares et al. 2011 (Central Mexican oak forests), Hughes et al. 2014b (Arkansas).

Ramaricium J. Erikss. 1954, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, five species, type species *R. occultum* J. Erikss., wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2005.

Ramariopsis (Donk) Corner 1950, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, 48 species, type species *R. kunzei* (Fr.) Corner, worldwide, see Kautmanová et al. 2012a, b (Europe, phylogeny), Birkebak et al. 2013 (phylogeny), Kirk et al. 2013 (genus accepted), Furtado et al. 2016 (Brazil), new spp. see Olariaga and Salcedo 2013 (new combination), Hyde et al. 2016 (Atlantic rain forest).

Ranadivia Zmitr. 2018, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *R. allantoidea* (M.L. Han, B.K. Cui & Y.C. Dai) Zmitr., corioloid basidioma, wood-rotting, brown rot, pantropical, see Zmitrovich 2018a (taxonomy).

Ravenelia Berk. 1853 (=*Cephalotelium* Syd. 1921, = *Cystingophora* Arthur 1907, = *Cystotelium* Syd. 1921, = *Dendroecia* Arthur 1906, = *Haploravenelia* Syd. 1921, = *Longia* Syd. 1921, = *Neoravenelia* Long 1903, = *Pleoravenelia* Long 1903), Raveneliaceae, Pucciniales, Pucciniomycetes, c. 250 species, type species *R. glanduliformis* Berk. & M.A. Curtis, biotrophic on Fabaceae, terrestrial, worldwide in warm climates except Europe, Australia, see Kirk et al. 2013 (genus accepted), sequence data available, see Gandhe and Kuvalekar 2007 (phylogeny), Zhao et al. 2016d (evolution), new spp. see Zhuang and Wei 2009b (China), Yepes and de Carvalho 2014 (Brazil), Hernandez et al. 2014 (online database), Ebinghaus et al. 2018 (South Africa).

Rectipilus Agerer 1973, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, eleven species, type species *R. fasciculatus* (Pers.) Agerer, cyphelloid, worldwide, sequence data available, see Bodensteiner et al. 2004 (phylogeny, cyphelloid homobasidiomycetes), Kirk et al. 2013 (genus accepted), new spp. see Gorjón and de Jesus 2014 (Brazilian Amazon), Lucas and Dentinger 2015 (Great Britain).

Renatobasidium Hauerslev 1993, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *R. notabile* Hauerslev, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Repetobasidiellum J. Erikss. & Hjortstam 1981, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *R. fusisporum* J. Erikss. & Hjortstam, saprobes, widespread, northern Europe, sequence data unavailable, see Larsson 2007b (genus *incertae sedis* in Agaricomycetes), Kirk et al. 2013 (genus accepted).

Repetobasidiopsis Dhingra & Avn.P. Singh 2008, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *R. grandispora* Dhingra & Avn.P. Singh, resupinate basidioma, smooth hymenophore, bambusicolous, widespread, sequence data unavailable available, see Dhingra and Singh 2008a (nomenclature, validation).

Repetobasidium J. Erikss. 1958, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, twelve species, type species *R. vile* (Bourdot & Galzin) J.

Erikss., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2006 (phylogeny, hymenochaetoid clade).

Resinicium Parmasto 1968, Rickenellaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, eight species, type species *R. bicolor* (Alb. & Schwein.) Parmasto, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Nakasone 2007 (monograph), Gruhn et al. 2017 (worldwide key, phylogeny, new species), new spp. see Telleria et al. 2008a (Equatorial Guinea), Baltazar et al. 2016 (type examination).

Resiniporus Zmitr. 2018, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *R. resinascens* (Romell) Zmitr., resupinate porioid basidioma, wood-rotting, white rot, widespread, see Zmitrovich 2018a (taxonomy).

Resinomycena Redhead & Singer 1981, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. ten species, type species *R. rhododendri* (Peck) Redhead & Singer, North America, Europe, Japan, see Antonín and Noordeloos 2004 (Europe), Kirk et al. 2013 (genus accepted), sequence data available, see Petersen et al. 2008 (new genus), new spp. see Desjardin et al. 2016 (Brazil), Takahashi et al. 2016 (Japan).

Resinoporia Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, eleven species, type species *R. crassa* (P. Karst.) Audet, wood-rotting, most species transformed from *Antrodia s. s*. or *Amyloporia s. s.*, sequence data available, see Ortiz-Santana et al. 2013 (antrodia clade of Polyporales, phylogeny).

Restilago Vánky 2008, *incertae sedis, incertae sedis*, Basidiomycota, asexual morph unknown, one species, type species *R. capensis* Vánky, sequence data unavailable, see Vánky 2008 (taxonomy).

Restingomyces Sulzbacher, Grebenc & Baseia 2016, Trappeaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, one species, type species *R. reticulatus* Sulzbacher, B.T. Goto & Baseia, sequestrate, Brazilian Atlantic rainforest, sequence data available, see Sulzbacher et al. 2016b (taxonomy).

Restiosporium Vánky 2000, Websdaneaceae, Ustilaginales, Ustilaginomycetes, 21 species, type species *R. meneyae* Vánky, plant parasites (fruits) on Restionaceae,

Australia, cultures unavailable, sequence data available, see Begerow et al. 2014, Nasr et al. 2014a (taxonomy).

Resupinatus Nees ex Gray 1821, Pleurotaceae, Agaricales, Agaricomycetes, asexual morph unknown, 33 species, type species *R. applicatus* (Batsch: Fr.) Gray, worldwide, basidioma cyphelloid, see Kirk et al. 2013 (genus accepted), sequence data available, see Nogueira-Melo et al. 2011 (America), Gonou-Zagou et al. 2011 (Greece), McDonald 2015 (systematics, North American collections of *R. poriaeformis* need a new name, also see Haelewaters et al. 2018).

Retiboletus Manfr. Binder & Bresinsky 2002, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, twelve species, type species *R. ornatipes* Manfr. Binder & Bresinsky, stipitate-pileate, North America, Asia, some species edible (*R. ornatipes* (Peck) Manfr. Binder & Bresinsky), see Dai et al. 2010b (edible mushrooms, China), see Gruber et al. 2013 (compounds), sequence data available, see Zeng et al. 2016 (monograph, China), new spp. see Wu et al. 2016f (China), Zeng et al. 2016 (monograph, China).

Rhacophyllus Berk. & Broome 1871 (= *Zerovaemyces* Gorovij 1977), Psathyrellaceae, Agaricales, Agaricomycetes, sexual morph *Coprinopsis* P. Karst. 1881, one species, type species *R. lilacinus* Berk. & Broome, sequence data unavailable, see Redhead et al. 2000.

Rhamphospora D.D. Cunn. 1888, Rhamphosporaceae, Doassansiales, Exobasidiomycetes, one species, type species *R. nymphaeae* D.D. Cunn., plant parasites (leaves) on genera *Castalia*, *Nymphea*, *Nuphar* (Nymphaeaceae), widespread, India, North America, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Rheubarbariboletus Vizzini, Simonini & Gelardi 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *R. armeniacus* (Quél.) Vizzini, Simonini & Gelardi, stipitate-pileate, ectomycorrhizal, Europe, sequence data available, see Vizzini 2015 (taxonomy).

Rhizochaete Gresl., Nakasone & Rajchenb. 2004, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, 13 species, type species *R. brunnea* Gresl., Nakasone & Rajchenb., resupinate basidioma, smooth to slightly tuberculate hymenophore, wood-rotting, widespread, see Zmitrovich 2018a (taxonomy), sequence

data available, see Greslebin et al. 2004 (phylogeny), Nakasone et al. 2017 (new sp., new combinations, phylogeny, morphology, type study, Belize), new combinations see Chikowski et al. 2016a, b (phylogeny, nomenclature, validation).

Rhizoctonia DC. 1805, Ceratobasidiaceae, Cantharellales, Agaricomycetes, sexual morph *Thanatephorus* Donk 1956, see Gónzalez et al. 2016, c. 50 species, type species *R. solani* J.G. Kühn, widespread, see Kirk et al. 2013 (genus accepted), *R. solani* is a serious pathogen of plant, see Zheng et al. 2013 (evolution), Chen et al. 2017c (pathogen), has priority over *Thanathephorus* see Oberwinkler et al. 2017, sequence data available, see Zheng et al. 2013 (evolution, rice sheath blight pathogen), Gónzalez et al. 2016 (phylogeny), new spp. and new combinations see Oberwinkler et al. 2013a (Germany).

Rhizocybe Vizzini, G. Moreno, P. Alvarado & Consiglio 2015, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *R. vermicularis* (Fr.) Vizzini, G. Moreno, P. Alvarado & Consiglio, in coniferous forests of the Northern hemisphere, spring and summer, basidioma clitocyboid (funnel-shaped or umbilicate), small, with conspicuous rhizomorphs, sequence data available, see Alvarado et al. 2015 (taxonomy).

Rhizomarasmius R.H. Petersen 2000, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *R. pyrrhocephalus* (Berk.) R.H. Petersen, Europe, sequence data available, see Ronikier and Ronikier 2011 (phylogeny), Moreau et al. 2015b (emendation).

Rhizopogon Fr. 1817, Rhizopogonaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 157 species, type species *R. luteolus* Fr., ectomycorrhizal, see Murata et al. 2013b, widespread (north temperate, introduced with pines in southern hemisphere), some species edible (*R. luteolus* Fr. & Nordholm), some species medicinal use (*R. piceus* Berk. & M.A. Curtis), see Dai and Yang 2008 (medicinal mushrooms, China), Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Mujic et al. 2019 (genome, phylogeny), new spp. see Grubisha et al. 2014 (eastern North America), Mujic et al. 2014 (Japan), Crous et al. 2015a (Cape Verde Islands), Koizumi and Nara 2016 (Japan), Li et al. 2016e (China).

Rhizoporia Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *R. hyalina* (Spirin, Miettinen & Kotir.)

Audet, wood-rotting, sequence data available, see Spirin et al. 2013a (phylongeny, *Antrodia s. s.*).

Rhodactina Pegler & T.W.K. Young 1989, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, three species, type species *R. himalayensis* Pegler & T.W.K. Young, basidiomas sequestrate, ectomycorrhizal, tropical Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Vadthanarat et al. 2018 (phylogeny, new sp., Thailand).

Rhodoarrhenia Singer 1964, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, eight species, type species *R. pezizoidea* (Speg.) Singer, tropical, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Rhodocollybia Singer 1939, Omphalotaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 35 species, type species *R. maculata* (Alb. & Schwein.) Singer, worldwide, see Antonín and Noordeloos 2010 (Europe), Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (Agarics, phylogeny, basidiospore ultrastructure), Keirle et al. 2010, 2012 (Hawaii, *R. laulaha*), Petersen and Hughes 2016 (phylogeny), new spp. see Eyssartier et al. 2011a (Europe), Cooper 2014b (New Zealand, new combinations), Mata et al. 2016 (neotropical), Latha et al. 2018a (India).

Rhodocybe Maire 1926, Entolomataceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *R. caelata* (Fr.) Maire, worldwide, see Kirk et al. 2013 (genus accepted), Horak 2008 (New Zealand, monograph), Noordeloos and Gates 2012a (Tasmania, Australia, morphology, monograph, as *Clitopilus s. l.*) dos Santos Silva-Filho et al. 2018 (new records, Brazil), sequence data available, see Co-David et al. 2009 (phylogeny), Kluting et al. 2014 (phylogeny), new spp. Dähncke et al. 2008 (Canary Islands, Spain), Henkel et al. 2010b (Guyana), Noordeloos et al. 2010 (Germany, as *Clitopilus*), Contu et al. 2011 (France, as *Clitopilus*), Kaur et al. 2013a (India), Crous et al. 2016b (India), Hyde et al. 2016 (India), Vizzini et al. 2016d, c, 2018 (new combination, Turkey, Estonia, Italy), Crous et al. 2017a, b (India, Italy), Sesli and Vizzini 2017 (Turkey).

Rhodofomes Kotl. & Pouzar 1990, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *R. roseus* (Alb. &

Schwein.) Vlasák, perennial basidioma, poroid hymenophore, wood-rotting, brown rot, widespread, sequence data available, see Han et al. 2016a (taxonomy, *Fomitopsis s. l.*).

Rhodofomitopsis B.K. Cui, M.L. Han & Y.C. Dai 2016, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *R. feei* (Fr.) B.K. Cui, M.L. Han & Y.C. Dai, poroid hymenophore, wood-rotting, brown rot, widespread, sequence data available, see Han et al. 2016a (new genus, new combinations, phylogeny, *Fomitopsis s. l*).

Rhodonia Niemelä 2005, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *R. placenta* (Fr.) Niemelä, K.H. Larss. & Schigel, resupinate basidioma, poroid hymenophore, wood-rotting, brown rot, widespread (circumpolar in the boreal conifer zone), sequence data available, see Martinez et al. 2009 (genome, lignocellulose conversion), Justo et al. 2017 (phylogeny, Polyporales).

Rhodosporidiobolus Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Sporidiobolaceae, Sporidiobolales, Microbotryomycetes, sexual and asexual morphs known, eleven species, type species *R. nylandii* (M. Takash. & Nakase) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015e (taxonomy and phylogeny), Urbina and Aime 2018 (diversity), Masiulionis et al. 2017, Turchetti et al. 2018 (new spp.).

Rhodotorula F.C. Harrison 1927, Sporidiobolaceae, Sporidiobolales, Microbotryomycetes, sexual and asexual morphs known, 15 species, type species *R. glutinis* (Fresen.) F.C. Harrison, yeast, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Wang et al. 2015e (taxonomy and phylogeny), Urbina and Aime 2018 (diversity).

Rhodophana Kühner 1971, Entolomataceae, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *R. nitellina* (Fr.) Papetti, worldwide, sequence data available, see Co-David et al. 2009 (phylogeny), Baroni and Matheny 2011 (phylogeny), Kluting et al. 2014 (phylogeny), Morgado et al. 2016 (phylogeny), new spp. see Consiglio and Contu 2008 (Italy, as *Rhodocybe*), Vizzini et al 2011b (Canary Islands, Spain, as *Clitopilus*), Raj et al. 2016 (India), Daniëls et al. 2017 (Niger, Africa).

Rhodotus Maire 1926, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *R. palmatus* (Bull.) Maire, Europe, North America, China, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Binder et al. 2006 (phylogeny), new spp. see Tang et al. 2014 (China).

Rhopalogaster J.R. Johnst. 1902, Rhizopogonaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *R. transversarius* (Bosc) J.R. Johnst., USA, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006 (phylogeny, gomphoid-phalloid fungi).

Rhynchogastrema B. Metzler & Oberw. 1989, Rhynchogastremaceae, Tremellales, Tremellomycetes, asexual and sexual morph known, nine species, type species *R. coronatum* B. Metzler & Oberw., yeast, filamentous, see Kirk et al. 2013 (genus accepted), cultures and sequence data available, see Liu et al. 2015b (taxonomy, phylogeny).

Rickenella Raithelh. 1973, Rickenellaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, c. ten species, type species *R. fibula* (Bull.) Raithelh., worldwide, see Antonín and Noordeloos 2004 (European taxa), Kirk et al. 2013 (genus accepted), sequence data available, see Pérez-Izquierdo et al. 2017 (phylogeny), new spp. see Latha et al. 2015a (India).

Rickiopora Westph., Tomšovský & Rajchenb. 2016, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *R. latemarginata* (Rick) Westph., Tomšovský & Rajchenb., poroid hymenophore, wood-rotting, white rot, Neotropical, sequence data available, see Westphalen et al. 2016b (taxonomy, phylogeny, biology, type study).

Riessia Fresen. 1852, *incertae sedis*, *incertae sedis*, Agaricomycetes, five species, type species *R. semiophora* Fresen., worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Riessiella Jülich 1985, *incertae sedis*, *incertae sedis*, Agaricomycetes, two species, type species *R. clavata* Jülich, S. E. Asia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Rigidoporus Murrill 1905, Meripilaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 30 species, type species *R. micromegas* (Mont.) Murrill [current

name: *R. microporus* (Sw.) Overeem *fide* Wu et al. 2017a], poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), some species plant pathogens, see Farid et al. 2009 (plantations, Malaysia, *R. microporus*), some species medicinal use, see Dai et al. 2009b (medicinal mushrooms, China, *R. ulmarius* (Sowerby) Imazeki), sequence data available, see Wu et al. 2017a (phylogeny), new spp. see Læssøe and Ryvarden 2010a (morphology, Ecuador), Ryvarden and Iturriaga 2010a (morphology, Venezuela), Vampola and Vlasák 2012 (phylogeny, Central Europe), Yuan and Dai 2012 (morphology, China), Gomes-Silva et al. 2014 (morphology, Brazil, Neotropics), Ryvarden 2014 (morphology, tropical America), Wu et al. 2017a (new combinations, phylogeny, morphology, China), Ryvarden 2018a (morphology, Zambia).

Rigidotubus J. Song, Y.C. Dai & B.K. Cui 2018, Cystostereaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *R. tephroleucus* J. Song, Y.C. Dai & B.K. Cui, wood-rotting, white rot, China, sequence data available, see Song et al. 2018c (phylogeny, taxonomy).

Rimbachia Pat. 1891, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, eleven species, type species *R. paradoxa* Pat., tropical, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), new spp. see Miettinen and Hernawati 2010 (Indonesia).

Riopa D.A. Reid 1969, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph *Sporotrichum* Link 1809, three species, type species *R. davidii* D.A. Reid, resupinate basidioma, poroid hymenophore, wood-rotting, widespread, sequence data available, see Miettinen et al. 2016a (new sp., new combination, phylogeny, type study), Zmitrovich 2018a (taxonomy).

Ripartitella Singer 1947, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *R. squamosidisca* (Murrill) Singer, tropical, see Kirk et al. 2013 (genus accepted), sequence data available, see Capelari and Asai 2009 (Brazil), Saar et al. 2009 (phylogeny), Baroni et al. 2014 (phylogeny).

Ripartites P. Karst. 1879, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *R. tricholoma* (Alb. & Schwein.) P. Karst., worldwide, see Kirk et al. 2013 (genus accepted), Tolgor et al. 2013 (China), sequence data available, see Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Osmundson et al. 2013 (DNA barcode).

Ripexicium Hjortstam 1995, *incertae sedis*, Corticiales, Agaricomycetes, asexual morph unknown, one species, type species *R. spinuliferum* (Jülich) Hjortstam, wood-decaying, Solomon Islands, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Robbauera Boekhout, Begerow, Q.M. Wang & F.Y. Bai 2015, Robbaueraceae, Robbauerales, Exobasidiomycetes, one species, type species *R. albescens* (Gokhale) Boekhout, Begerow, Q.M. Wang & F.Y. Bai, known only from saprobic states, biocontrol agent for powery mildew, possibly mycoparasite, cultures available, sequence data available, see Begerow et al. 2000, 2014, Wang et al. 2015c (taxonomy, phylogeny).

Roestelia Rebent. 1804 (=*Cancellaria* Brongn. 1825, = *Centridium* Chevall. 1826), Pucciniaceae, Pucciniales, Pucciniomycetes, asexual genus, c. 15 species, type species *R. cancellata* Rebent., typically aecial state of *Gymnosporangium*, biotrophic mainly on Rosaceae (one species on Cupressaceae), terrestrial, north temperate areas including Asia, Europe, North America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Rogersella Liberta & A.J. Navas 1978, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *R. asperula* Liberta & A.J. Navas, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2006 (phylogeny, hymenochaetoid clade).

Rogersiomyces J.L. Crane & Schokn. 1978, Hydnaceae, Cantharellales, Agaricomycetes, two species, type species *R. okefenokeensis*, USA, Asia, hypochnoid basidiomas over moistening plant debris, see Mel'nik et al. 2015 (as *Hyphobasidiofera*, Vietnam), sequence data available, see Psurtseva et al. 2016 (new species, phylogeny, life cycle).

Romagnesiella Contu, Matheny, P.-A. Moreau, Vizzini & A. de Haan 2014, Crassisporiaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *R. clavus* (Romagn.) Contu, Matheny, P.-A. Moreau, Vizzini & A. de Haan, Northern hemisphere, basidioma naucorioid, on unburnt soil or sand among mosses and grasses, sequence data available, see Matheny et al. 2015 (taxonomy), Vizzini et al. 2019 (phylogeny and taxonomy).

Roridomyces Rexer 1994, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, nine species, type species *R. roridus* (Fr.) Rexer, some species luminescent (*R. pruinosoviscidus* (Corner) A.L.C. Chew & Desjardin), see Desjardin et al. 2008a (luminescent fungus), Kirk et al. 2013 (genus accepted), sequence data available, see Chew et al. 2015 (Malaysia, phylogeny, bioluminescent fungi), Kim et al. 2015 (Korea), new spp. see Hausknecht and Krisai-Greilhuber 2008 (Italy), Miersch et al. 2010 (new combination).

Roseofavolus T. Hatt. 2003, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *R. eos* (Corner) T. Hatt., poroid hymenophore, wood-rotting, Southeast Asia, sequence data unavailable, see Kirk et al. 2008.

Roseograndinia Hjortstam & Ryvarden 2005, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *R. rosea* (Henn.) Hjortstam & Ryvarden, wood-rotting, widespread, sequence data unavailable, see Kirk et al. 2008.

Rossbeevera T. Lebel, Orihara & N. Maek. 2012 [as 'Rosbeeva'], Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, ten species, type species *R. pachydermis* (Zeller & C.W. Dodge) T. Lebel, sequestrate, ectomycorrhizal, Asia and Australasia, DNA sequence data available, new spp. see Lebel et al. 2012, Orihara et al. 2012a (China), Orihara et al. 2016b.

Royoungia Castellano, Trappe & Malajczuk 1992, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, six species, type species *R. boletoides* Castellano, Trappe & Malajczuk, sequestrate or stipitate-pileate, Australia, China, Malaysia, see Kirk et al. 2013 (genus accepted), sequence data available, see Halling et al. 2012b (phylogeny), new spp. see Wu et al. 2016f (China).

Rubellofomes B.K. Cui, M.L. Han & Y.C. Dai 2016, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *R. cystidiatus* (B.K. Cui & M.L. Han) B.K. Cui, M.L. Han & Y.C. Dai, poroid basidioma, wood-rotting, growing on angiosperm, brown rot, widespread, sequence data available, see Han et al. 2016a (taxonomy, phylogeny, *Fomitopsis s. l.*).

Rubroboletus Kuan Zhao & Zhu L. Yang 2014, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, 14 species, type species *R. sinicus* (W.F.

Chiu) Kuan Zhao & Zhu L. Yang, stipitate-pileate, worldwide, some species edible (*R. esculentus* Kuan Zhao, Hui M. Shao & Zhu L. Yang), see Zhao et al.2017 (new spp., China), sequence data available, see Zhao et al. 2014c (monograph), Janda et al. 2017 (morphology study, *R. legaliae*).

Rubroporus Log.-Leite, Ryvarden & Groposo 2002, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *R. carneoporis* Log.-Leite, Ryvarden & Groposo, stipitate or pileate basidioma, poroid hymenophore, wood-rotting (or on buried root), white rot, Belize, Brazil, sequence data unavailable, see Kirk et al. 2008.

Rugiboletus G. Wu & Zhu L. Yang 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *R. extremiorientalis* (Lj.N. Vassiljeva) G. Wu & Zhu L. Yang, stipitate-pileate, China, Far East Russia, Korea, Japan, Nepal, Thailand, Central and South America, sequence data available, see Wu et al. 2014b, 2016e (phylogeny, morphology, Boletaceae).

Rugosomyces Raithelh. 1979, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. twelve species, type species *R. onychinus* Raithelh. [current name: *Lyophyllum onychinum* (Fr.) Kühner & Romagn. ex Contu], worldwide, sequence data available, see Bellanger et al. 2015 (phylogeny).

Rugosospora Heinem. 1973, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *R. ochraceobadia* (Beeli) Heinem., tropical, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Ruinenia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Ruineniaceae, Agaricostilbales, Agaricostilbomycetes, sexual morph unknown, five species, type species *R. rubra* (Nakase, Oakada & Sugiy.) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Russula Pers. 1796, Russulaceae, Russulales, Agaricomycetes, asexual morph unknown, > 3000 species estimated, type species *R. emetica* (L.) Pers., seven subgenera, subg. *Archaea* Buyck & V. Hofst., subg. *Compactae* (Fr.) Bon, emend. Buyck & V. Hofst., subg. *Crassotunicata* Buyck & V. Hofst., subg. *Heterophyllidia* Romagnesi, subg. *Malodora* Buyck & V. Hofst., subg. *Brevipes* Buyck & V. Hofst., subg. *Russula* Buyck & V. Hofst., see Buyck et al. 2018 (taxonomy, phylogeny), > 50

sections,worldwide, ectomycorrhizal, often associated with mycoheterotroph plants (particularly orchids), commercially important edible species particularly in Asia, see Buyck 2008 (Madagascar), Geml et al. 2010, 2012b (boreal Alaska, phylogeny, Arctic, biogeography), Li et al. 2010a (China), other taxonomic studies see Adamčík and Buyck 2011a, b, 2012, 2014 (type specimens), Buyck and Adamčík 2011a,b, 2013a,b (type specimens), Kirk et al. 2013 (genus accepted), Li 2014 (morphology), Hongsanan et al. 2015 (three new subgenera), Kong et al. 2015 (ectomycorrhizal), Das et al. 2017d (three new sections and one new subsection), Elliott and Trappe 2018 (recombinations), Adamčík et al. 2013, 2018 (type specimens), Adamčík and Jančovičová 2012, 2013 (type specimens), Buyck et al. 2018a (systemics, multigene phylogeny, new subgenera, ectomycorrhizal anatomy), sequence data available, see Buyck et al. 2008b (multigene phylogeny), Li et al. 2010c (population genetics), Cao et al. 2013 (population genetics), Kleine et al. 2013 (population genetics), Park et al. 2013, 2014b (multigene phylogeny), Guo et al. 2014 (phylogeny), Shimono et al. 2014 (phylogeny), Wang et al. 2015b (population genetics), Looney et al. 2016 (multigene phylogeny), Bazzicaluppo et al. 2017 (multigene phylogeny, barcode PNW), Caboň et al. 2017 (multigene phylogeny), Geml et al. 2017 (tropical rainforests, Borneo), Lee et al. 2017 (Korea, phylogeny, section *Foetentinae*), Li et al. 2019a (barcode selection), Vidal et al. 2019 (phylogeny), selected new species per continent, North America see Adamčík et al. 2010, 2015, 2016b, Arora and Nguyen 2014, Liu et al. 2015a, Hyde et al. 2017a; Asia see Das et al. 2010, 2013b, 2017d, Li et al. 2011a, 2012, 2013a, 2015a, d, 2016, 2018a, b, 2019b, Dutta et al. 2015b, Hyde et al. 2016, Zhao et al. 2015g, Paloi et al. 2016, Sang et al. 2016, Jiang et al. 2017, Buyck et al. 2017, Jabeen et al. 2017, Zhang et al. 2017a, Lee et al 2017, Song et al. 2018e, Wang et al. 2019; Europe see Jürkheit et al. 2011, Pidlich-Aigner 2014, Adamčík et al. 2016b, Vauras et al. 2016, Melera et al. 2017, Trendel et al. 2018; South America see Cheype and Campo 2012, Miller et al. 2013; Africa see Buyck 2008, Douanla-Meli and Langer 2009c, Sanon et al. 2014, Wang et al. 2018e; Oceania see Kropp 2016, Buyck et al. 2017.

Ryvardenia Rajchenb. 1994, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *R. cretacea* (Lloyd) Rajchenb., poroid hymenophore, wood-rotting, brown rot, Southern Hemisphere (Argentina, Australia,

Chile, New Zealand), see Kirk et al. 2013 (genus accepted), sequence data available, see Pildain and Rajchenberg 2013 (phylogeny, *Postia s. l.*, Argentina).

Saccosoma Spirin 2018, Phleogenaceae, Atractiellales, Atractiellomycetes, asexual morph unknown, nine species, type species *S. farinaceum* (Höhn.) Spirin & K. Põldmaa, presumably saprobic, on decaying wood and decaying herbaceous material, worldwide (Europe, North and South America, China, St. Helena), sequence data available, new spp. see Spirin et al. 2018c (taxonomy, phylogeny), Schoutteten et al. 2018 (taxonomy).

Tow new combinations proposed:

Saccosoma jozefii (Schoutteten & Verbeken) Schoutteten, ***comb. nov.***, MB 828708

Basionym: *Helicogloea jozefii* Schoutteten & Verbeken in Cryptogamie Mycologie 39 (3): 312 (2018).

Saccosoma graminicola (Bres.) Schoutteten, ***comb. nov.***, MB 828707

Basionym: *Saccoblastia graminicola* Bres. in Annales Mycologici 1 (2): 112 (1903), non *Exobasidium graminicolum* Bres. in Krieger, *Fung. Saxon. Exsicc.*, Pilze Sachsen's: no. 664 (1892)

Sagaranella V. Hofst., Clémençon, Moncalvo & Redhead 2014, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *S. tylicolor* (Fr.) V. Hofstetter, Clémençon, Moncalvo & Redhead, worldwide, basidioma mycenoid, sequence data available, see Hofstetter et al. 2014 (phylogeny, Lyophyllaceae).

Saitozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Trimorphomycetaceae, Tremellales, Tremellomycetes, sexual morph unknown, four species, type species *S. flava* (Golubev & J.P. Samp.) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, on soil, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Sakaguchia Y. Yamada, K. Maeda & Mikata 1994, Sakaguchiaceae, Sakaguchiales, Cystobasidiomycetes, sexual and asexual morphs known, five species, type species *S. dacryoidea* (Fell, I.L. Hunter & Tallman) Y. Yamada, K. Maeda & Mikata, Antarctica, yeast, aquatic, marine, plant, see Kurtzman et al. 2011 (taxonomy),

Kirk et al. 2013 (genus accepted), sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Salmacisia D.R. Huff & A. Chandra 2008, Tilletiaceae, Tilletiales, Exobasidiomycetes, one species, type species *S. buchloeana* (Kellerm. & Swingle) D.R. Huff & Amb. Chandra, plant parasite (ovaries) on *Buchloë* (Poaceae), North America, cultures available, sequence data available, see Chandra and Huff 2008 (description), Begerow et al. 2014, Huff et al. 2017 (genome announcement).

Sampaiozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, two species, type species *S. ingeniosa* (Di Menna) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Sanghuangporus Sheng H. Wu, L.W. Zhou & Y.C. Dai 2015, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 13 species, type species *S. sanghuang* (Sheng H. Wu, T. Hatt. & Y.C. Dai) Sheng H. Wu, L.W. Zhou & Y.C. Dai, some species medicinal use (*S. sanghuang* (Sheng H. Wu, T. Hatt. & Y.C. Dai) Sheng H. Wu, L.W. Zhou & Y.C. Dai), see Lin et al. 2017 (anti-inflammatory activity), sequence data available see Zhou et al. 2016e (monograph), Raja et al. 2017 (DNA barcoding), new sp. see Ghobad-Nejhad 2015 (Iran), new combination see Tomšovský 2015.

Saprogaster Fogel & States 2001, *incertae sedis*, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *S. pinyonensis* Fogel & States, terrestrial, America, sequence data unavailable, see Kirk et al. 2008.

Sarcodon Quél. ex P. Karst. 1881, Bankeraceae, Thelephorales, Agaricomycetes, asexual morph unknown, 49 species, type species *S. imbricatus* (L.) P. Karst, terrestrial, ectomycorrhizal, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Grupe et al. 2015, 2016 (Neotropics).

Sarcodontia Schulzer 1866, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *S. mali* Schulzer [current name: *S. crocea* (Schwein.) Kotl.], hydnoid hymenophore, wood-rotting, white rot, widespread, see Szczepkowski 2010 (distribution, decay ability), Kirk et al. 2013 (genus accepted),

sequence data available, see Tomšovský et al. 2016 (phylogeny), Justo et al. 2017 (phylogeny, Polyporales), Zmitrovich 2018a (taxonomy).

Sarcomyxa P. Karst. 1891, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *S. serotina* (Pers.) P. Karst., worldwide, some species edible [*S. edulis* (Y.C. Dai, Niemelä & G.F. Qin) T. Saito, Tonouchi & T. Harada], sequence data available, see Saito et al. 2014 (phylogeny).

Sarcoporia P. Karst. 1894, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, nine species, type species *S. polyspora* P. Karst, resupinate to effused-reflexed basidioma, poroid hymenophore, wood-rotting, brown rot, widespread, sequence data available, see Justo et al. 2017 (phylogeny, classification), new sp. see Vlasák et al. 2015 (phylogeny, USA, Costa Rica).

Scalarispora Buriticá & J.F. Hennen 1994, Phakopsoraceae, Pucciniales, Pucciniomycetes, one species, type species *S. hashiokae* (Hirats. f.) Buriticá & J.F. Hennen, biotrophic on Vitaceae (*Ampelopsis*), terrestrial, China, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Sceptrulum K.H. Larss. 2014, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *S. inflatum* (Burt) K.H. Larss., wood-decaying, Europe, Jamaica, Seychelles, sequence data unavailable, see Gorjón 2012 (taxonomy), Larsson 2014 (taxonomy).

Schenella T. Macbr. 1911, Geastraceae, Geastrales, Agaricomycetes, asexual morph unknown, four species, type species *S. simplex* T. Macbr., wood-decaying, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Estrada-Torres et al. 2005 (taxonomy).

Schildia Franchi & M. Marchetti 2015, *incertae sedis*, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *S. sancti-luxurii* Franchi & M. Marchetti, Russia, sequence data available, see Franchi and Marchetti 2015 (taxonomy).

Schinzinia Fayod 1889, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. pustulosa* Fayod, East Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Schizonella J. Schröt. 1877, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, five species, type species *S. melanogramma* (DC.) J. Schröt., plant parasite (leaves) on

Carex spp. and *Kobresia myosuroides* (Cyperaceae), North America, Asia, Europe, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2014, Wang et al. 2015c (taxonomy, phylogeny).

Schizophyllum Fr. 1815, Schizophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *S. commune* Fr., worldwide, wood-rot, see Kirk et al. 2013 (genus accepted), could be pathogenic for human, see Kumar and Min 2011 (compounds), Chowdhary et al. 2013 (pathogen), Saha et al. 2013 (pathogen), sequence data available, see Ohm et al. 2010 (genome).

Schizopora Velen. 1922, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, seven species, type species *S. laciniata* Velen. (current name: *Polyporus laciniatus* Velen., worldwide, white rot (*S. paradoxa*), see Kirk et al. 2013 (genus accepted), sequence data available, see Min et al. 2015 (Genome).

Schizostoma Ehrenb. ex Lév. 1846, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. laceratum* (Ehrenb. ex Fr.) Lév., secotioid, subtropical dry areas, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Schroeteriaster Magnus 1896 (= *Uromycodes* Clem. 1909), *incertae sedis*, Pucciniales, Pucciniomycetes, four species, type species *S. alpinus* Magnus, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Scleroderma Pers. 1801, Sclerodermataceae, Boletales, Agaricomycetes, asexual morph unknown, c. 46 species, type species *S. verrucosum* (Bull.) Pers., widespread, some species edible (*S. aurantiacum* (L.) Pers.), see Dai et al. 2010b (edible mushrooms, China), some medicinal use (*S. areolatum* Ehrenb), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), Guzmán et al. 2013b (monograph, new records, Mexico), sequence data available, new spp. see Alfredo et al. 2012b (Amazon rainforest), Nouhra et al. 2012 (Argentina), Kumla et al. 2013 (Thailand), Zhang et al. 2013 (south China), Baseia et al. 2016 (Brazil), Crous et al. 2016a (Cape Verde Islands, Brazil).

Sclerogaster R. Hesse 1891, Sclerogastraceae, Geastrales, Agaricomycetes, asexual morph unknown, eleven species, type species *S. lanatus* R. Hesse, Europe, America, basidioma gasteroid, hypogeous, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2006, 2008 (phylogeny), Krakhmalnyi et al.

2014 (Israel), Alfredo et al. 2015 (*S. luteocarneus*), new spp. see Sulzbacher et al. 2016a (Brazil).

Sclerotrema Spirin & Malysheva 2017, Auriculariaceae, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *S. griseobrunneum* (K. Wells & Raitv.) Spirin & Malysheva, wood-rotting, on dry branches and logs of deciduous trees, sequence data available, see Malysheva and Spirin 2017 (taxonomy, phylogeny, stereoid basidiocarps, Auriculariales).

Scopulodontia Hjortstam 1998, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, three species, type species *S. loricata* Hjortstam & P. Roberts, wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Scopuloides (Massee) Höhn. & Litsch. 1908, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, five species, type species *S. hydnoides* (Cooke & Massee) Hjortstam & Ryvarden, resupinate basidioma, odontioid hymenophore, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2007a (phylogeny, classification), Wu et al. 2010a (phylogeny), Kuuskeri et al. 2015 (phylogeny, molecular systematics, *Phlebia*).

Scotoderma Jülich 1974, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *S. viride* (Sacc.) Jülich, wood decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Scotomyces Jülich 1978, Ceratobasidiaceae, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *S. fallax* (G. Cunn.) Jülich, saprobes, wood-decaying, widespread but rare see Gungör et al. 2013 (new record in Turkey), Ambrosia 2014 (Italy), genus in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Scutelliformis Salazar-Yepes, Pardo-Card. & Buriticá, 2007, Phragmidiaceae, Pucciniales, Pucciniomycetes, one species, type species *S. bicornus* Salazar-Yepes, Pardo-Card. & Buriticá, anamorph of *Gerwasia*, biotrophic on Rosaceae (*Rubus*), terrestrial, South America (Ecuador), sequence data unavailable, see Kirk et al. 2008.

Scutiger Paulet 1808, Albatrellaceae, Russulales, Agaricomycetes, asexual morph unknown, ten species, type species *S. tuberosus* Paulet, on soil, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Scytinopogon Singer 1945, Hydnodontaceae**,** Trechisporales, Agaricomycetes, asexual morph unknown, five species, type species *S. pallescens* (Bres.) Singer, Europe, Africa, India, see Kirk et al. 2013 (genus accepted), see Acharya 2012 (India), sequence data available, see Larsson et al. 2011 (phylogeny), new sp. see Desjardin and Perry 2015 (Africa).

Scytinostroma Donk 1956, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, 35 species, type species *S. portentosum* (Berk. & M. A. Curtis) Donk, wood-decaying, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny).

Scytinostromella Parmasto 1968, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, six species, type species *S. heterogenea* (Bourdot & Galzin) Parmasto, worldwide, wood-decaying, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny), Zmitrovich 2018a.

Sebacina Tul. & C. Tul. 1871, Sebacinaceae, Sebacinales, Agaricomycetes, asexual morph *Opadorhiza* T.F. Andersen & R.T. Moore 1996, 17 species, type species *S. incrustans* (Pers.) Tul. & C. Tul., mycorrhizal, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Oberwinkler et al. 2013b (Sebacinales, phylogeny), Riess et al. 2013 (speciation, *S. epigaea*, *S. incrustans*), Kühdorf et al. 2014 (mycorrhizal), Ruibal et al. 2014 (phylogenetic markers, Australian orchids), Tedersoo et al. 2014 (phylogeny, biogeography), new spp. see Roberts 2008a (Belize), Oberwinkler et al. 2014, Moyersoen and Weiß 2014 (Southern Venezuela), Wartchow et al. 2015b (Brazil).

Sebipora Miettinen 2012, Gelatoporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *S. aquosa* Miettinen, poroid hymenophore, wood-rotting, white rot, tropical Asia, sequence data available, see Miettinen and Rajchenberg 2012 (taxonomy, phylogeny, Indonesia).

Secotium Kunze 1840, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. ten species, type species *S. gueinzii* Kunze, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Sedecula Zeller 1941, Coniophoraceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *S. pulvinata* Zeller, USA, see Kirk et al. 2013 (genus accepted), sequence data available, see Trappe et al. 2015 (phylogeny).

Semiomphalina Redhead 1984, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. leptoglossoides* (Corner) Redhead, Papua New Guinea, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Septobasidium Pat. 1892, Septobasidiaceae, Septobasidiales, Pucciniomycetes, c. 200 species, type species *S. velutinum* Pat., worldwide, some species pathogenic, see Choi et al. 2016a (felt disease of *Schisandra chinensis*), sequence data available, see Henk and Vilgalys 2007 (phylogeny), new spp. and new record see Lu and Guo 2009, 2010a, b (China), Lu et al. 2010 (China), Chen and Guo 2011a, b (China), Lu and Guo 2011 (China), Li and Guo 2013, 2014 (China), Li et al. 2013c (China).

Serendipita P. Roberts 1993, Serendipitaceae, Sebacinales, Agaricomycetes, asexual morph unknown, eleven species, type species *S. vermifera* (Oberw.) P. Roberts, endophyte, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Zuccaro et al. 2011 (endophytic life strategies, genome and transcriptome analyses, as *Piriformospora*), Oberwinkler et al. 2014 (phylogeny), Weiß et al. 2016 (description of Family Serendipitaceae, phylogeny, ecology), new spp. see new spp. see Basiewicz et al. 2012 (Australia, as *Piriformospora*), Riess et al. 2014 (phylogenetic diversity and community structure, Europe, North America).

Serpula (Pers.) Gray 1821, Serpulaceae, Boletales, Agaricomycetes, asexual morph unknown, c. eleven species, type species *S. destruens* (Pers.) Gray, saprotrophic, see Skrede et al. 2013, widespread, some species medicinal use (*S. lacrimans* (Wulfen: Fr.) P. Karst.), see Dai and Yang 2008 (medicinal mushrooms, China), some species the agent of dry rot timber decay in buildings, see Watkinson and Eastwood 2012 (*S. lacrymans* (Wulfen) J. Schröt.), Kirk et al. 2013 (genus accepted), sequence data available, see Kauserud et al. 2007 (*S. lacrymans* (Wulfen) J. Schröt., evolution), Engh 2010 (*S. lacrymans*, evolution), Carlsen et al. 2011 (*S. himantioides* species complex), Binder et al. 2013 (phylogeny), Balasundaram et al. 2015 (DNA markers).

Serpulomyces (Zmitr.) Zmitr. 2002, Amylocorticiaceae, Amylocorticiales, Agaricomycetes, asexual morph unknown, one species, type species *S. borealis* (Romell) Zmitr. [current name: *Ceraceomyces borealis* (Romell) J. Erikss. & Ryvarden], sequence data available, see Binder et al. 2013 (phylogeny).

Seticyphella Agerer 1983, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *S. tenuispora* Agerer, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Setigeroclavula R.H. Petersen 1988, Clavariaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. ascendens* R.H. Petersen, New Zealand, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Setogyroporus Heinem. & Rammeloo 1982, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *S. verus* Heinem. & Rammeloo, stipitate-pileate, presumably ectomycorrhizal, tropical Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Shivasia Vánky, M. Lutz & Piątek 2012, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species *S. solida* (Berk.) Vánky, M. Lutz & Piątek, plant parasite (flowers) on *Schoenus* (Cyperaceae), Australasia, cultures unavailable, sequence data available, see Lutz et al. 2012, Begerow et al. 2014, Nasr et al. 2014a (taxonomy, phylogeny).

Sidera Miettinen & K.H. Larss. 2011, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, six species, type species *S. lenis* (P. Karst.) Miettinen, sequence data available, see Miettinen and Larsson 2011 (taxonomy).

Sigmogloea Bandoni & J.C. Krug 2000, *incertae sedis*, Tremellales, Tremellomycetes, asexual morph unknown, one species, type species *S. tremelloidea* Bandoni & J.C. Krug, wood-decaying, North America, sequence data unavailable, see Kirk et al. 2008.

Simocybe P. Karst. 1879, Crepidotaceae, Agaricales, Agaricomycetes, asexual morph unknown, 26 species, type species *S. centunculus* (Fr.) P. Karst., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2006 (phylogeny), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Horak 2018 (monograph, New Zealand, new sp.), new spp. see Bandala et al. 2008b (Spain), Horak and Ronikier 2011 (Europe).

Singerina Sathe & S.D. Deshp. 1981, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. indica* Sathe & S.D. Deshp., India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Singerocomus T.W. Henkel & M.E. Sm. 2016, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *S. inundabilis* (Singer) T.W. Henkel, stipitate-pileate, ectomycorrhizal, South America, sequence data available, see Henkel et al. 2016 (phylogeny, taxonomy), new sp. Magnago et al. 2018 (Brazil).

Singerocybe Harmaja 1988, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *S. viscida* Harmaja, Europe, North America, Asia, sequence data available, see Qin et al. 2014b (taxonomy).

Singeromyces M.M. Moser 1966, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *S. ferrugineus* M.M. Moser, morchelliform, presumably ectomycorrhizal with *Nothofagus*, South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Sinohygrocybe C.Q. Wang, Ming Zhang & T.H. Li 2018, Hygrophoraceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. tomentosipes* C.Q. Wang, Ming Zhang & T.H. Li, East Asia, sequence data available, see Wang et al. 2018a (taxonomy).

Sirobasidium Lagerh. & Pat. 1892, *incertae sedis*, Tremellales, Tremellomycetes , sexual and asexual morphs unknown, eight species, type species *S. sanguineum* Lagerh. & Pat., wood decaying, worldwide, see Kurtzman et al. 2011 (taxonomy), Kirk et al. 2013 (genus accepted), cultures and sequence data available, see Millanes et al. 2011 (phylogeny), Liu et al. 2015b (taxonomy, phylogeny).

Sirotrema Bandoni 1986, *incertae sedis*, Tremellales, Tremellomycetes, asexual morph unknown, three species, type species *S. pusilla* Bandoni, on fungal ascocarps, wood-decaying, worldwide, see Kirk et al. 2013 (genus accepted), cultures and sequence data available see Kachalkin et al. 2019 (taxonomy).

Sistotrema Fr. 1821, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph *Burgoa* Goid. 1937, *Ingoldiella* D.E. Shaw 1972, c. 55 species, type species *S. confluens* Pers., saprotrophic, ectomycorrhizal, see Di Marino et al. 2008, Münzenberger et al. 2012, worldwide, see Kirk et al. 2013 (genus accepted), *S. brinkmannii* was consistently isolated from bareroot nursery *Pinus banksiana* Lamb seedlings (however nature of association remains unclear), see Potvin et al. 2012 (association with host), sequence data available, see Moncalvo et al. 2006 (phylogeny),

Larsson 2007b (phylogeny), new spp. see Kotiranta and Larsson 2013 (Finland), Zhou and Qin 2013a (China), Crous et al. 2014b (Netherlands), Gruhn et al. 2017 (Martinique), Kaur et al. 2019 (India).

Sistotremastrum J. Erikss. 1958, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, six species, type species *S. suecicum* Litsch. ex J. Erikss., wood-decaying, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Telleria et al. 2013b, 2014 (Macaronesian islands, Chile).

Sistotremella Hjortstam 1984, Hydnaceae, Cantharellales, Agaricomycetes, asexual morph unknown, three species, type species *S. perpusilla* Hjortstam, wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Skeletocutis Kotl. & Pouzar 1958, Incrustoporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *S. amorpha* (Fr.) Kotl. & Pouzar, generic limits is not settled, see Justo et al. 2017, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen and Larsson 2011 (phylogeny), new spp. see Cui and Dai 2008 (morphology, China), Li et al. 2008 (morphology, China), Ryvarden 2009 (morphology, USA), Dai 2012a (morphology, China), Vlasák et al. 2012 (phylogeny, USA), Zhou and Qin 2012b (morphology, China), Cui 2013b (morphology, China), Bian et al. 2016b (phylogeny, China), Fan et al. 2017 (phylogeny, China), Korhonen et al. 2018 (*S. nivea* species complex), Miettinen and Niemelä 2018 (temperate), Ryvarden 2018a (morphology, Uganda, Zambia).

Skeletohydnum Jülich 1979, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *S. nikau* (G. Cunn.) Jülich, resupinate basidioma, hydnoid hymenophore, wood-rotting, New Zealand, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Nakasone et al. 2013 (morphology).

Skepperia Berk. 1857, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, five species, type species *S. convoluta* Berk., wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Skepperiella Pilát 1927, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, four species, type species *S. spathularia* (Berk. & M.A. Curtis) Pilát, on wood, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Skierka Racib. 1900 (= *Ctenoderma* Syd. & P. Syd. 1919), Pileolariaceae, Pucciniales, Pucciniomycetes, 13 species, type species *S. canarii* Racib., biotrophic on Burseraceae, Euphorbiaceae, Sapindaceae, Vitaceae, terrestrial, circumglobal in tropics, sequence data unavailable, see Kirk et al. 2013 (genus accepted), new spp. see Gautam and Avasthi 2017 (India).

Skvortzovia Bononi & Hjortstam 1987, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *S. furfurella* (Bres.) Bononi & Hjortstam, South America, see Kirk et al. 2013 (genus accepted), sequence data avaialble, see Miettinen and Larsson 2011 (phylogeny).

Slooffia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, four species, type species *S. tsugae* (Phaff & Carmo Souza) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny), new sp. see Yurkov et al. 2016.

Smithiogaster J.E. Wright 1975, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. volvoagaricus* J.E. Wright, secotioid, Argentina, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Smithiomyces Singer 1944, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *S. mexicanus* (Murrill) Singer, America, green houses in tropical plants/soil Dominican Republic, see Kirk et al. 2013 (genus accepted), sequence data available, see Baroni et al. 2014 (phylogeny), new sp. see Justo et al. 2015a (Dominican Republic).

Solicoccozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Piskurozymaceae, Filobasidiales, Tremellomycetes, sexual morph unknown, seven species, type species *S. aeria* (Saito) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, isolated from soil, cultures and sequence data avalaible, cultures are available, see Liu et al. 2015b (phylogeny), Yurkov et al. 2016, Yurkov and Kurtzman 2019 (new spp.).

Solioccasus Trappe, Osmundson, Manfr. Binder, Castellano & Halling 2013, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *S. polychromus* Trappe, Osmundson, Manfr. Binder, Castellano & Halling,

sequestrate, presumably ectomycorrhizal, Australia and Papua New Guinea, sequence data available, see Trappe et al. 2013 (phylogeny, taxonomy).

Sorataea Syd. 1930 (=*Allopuccinia* H.S. Jacks. 1931), Uropyxidaceae, Pucciniales, Pucciniomycetes, eight species, type species *S. amiciae* Syd., biotrophic on Fabaceae, terrestrial, Africa (Ivory Coast), South America (Bolivia, Venezuela), Asia (Indonesia, Philippines), sequence data unavailable, see Kirk et al. 2013 (genus accepted), Ono 2015b (new combination).

Sparassiella Schwarzman 1964, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *S. longistipitata* Schwarzman, wood-rotting, Kazakhstan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Sparassis Fr. 1819, Sparassidaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *S. crispa* (Wulfen) Fr., composed basidioma, wood-rotting (on roots), brown rot, widespread, some species medicinal use (*S. latifolia* Y.C. Dai & Zheng Wang), some species edible (*S. crispa*), see Dai and Yang 2008 (medicinal mushrooms, China), Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Ryoo et al. 2013 (phylogeny), new spp. see Zhao et al. 2013c (phylogeny, China), Hughes et al. 2014a (phylogeny, USA).

Sparsitubus L.W. Hsu & J.D. Zhao 1980, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *S. nelumbiformis* L.W. Hsu & J.D. Zhao, cyphelloid basdiome, wood-rotting, East Asia, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Dai et al. 2007 (phylogeny, morphology).

Spathulina Pat. 1900, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *S. lamellosa* (Pat.) Pat, South America, sequence data unavailable, see Kirk et al. 2008.

Spencerozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, one species, type species *S. crocea* (Shifrine & Phaff) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, insect, USA, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Sphacelotheca de Bary 1884, Microbotryaceae, Microbotryales, Microbotryomycetes, c. 50 species, type species *S. hydropiperis* (Schumach.) de Bary,

worldwide, pathogenic, sequence data available, see Wang et al. 2015e (phylogeny, taxonomy).

Sphaerobasidioscypha Agerer 1983, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *S. citrispora* Agerer (current name: *Flagelloscypha austrofilicis* J.A. Cooper), New Zealand, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Sphaerobasidium Oberw. 1965, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, three species, type species *S. minutum* (J. Erikss.) Oberw. ex Jülich, wood decaying, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2006 (phylogeny).

Sphaerobolus Tode 1790, Geastraceae, Geastrales, Agaricomycetes, asexual morph unknown, three species, type species *S. stellatus* Tode, on wood or coprophilous, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Geml et al. 2005 (molecular systematic), Kohler et al. 2015 (genome, evolution).

Sphaerophragmium Magnus 1891, Sphaerophragmiaceae, Pucciniales, Pucciniomycetes, 24 species, type species *S. acaciae* (Cooke) Magnus, biotrophic on Annonaceae, Fabaceae, terrestrial, circumglobal in tropics, species on Annonaceae restricted to Africa and New Guinea, see Beenken and Berndt 2010 (new species, species on Annonaceae), Kirk et al. 2013 (genus accepted), sequence data available, see McTaggart et al. 2015 (phylogeny, Australia).

Sphagnurus Redhead & V. Hofst. 2014, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. paluster* (Peck) Redhead & V. Hofstetter, sequence data available, see Redhead and Hofst 2014 (taxonomy), Bellanger et al. 2015 (phylogeny, accepted as a monophyletic genus in Lyophyllaceae).

Sphenorchidium Beenken 2015, *incertae sedis*, Pucciniales, Pucciniomycetes, two species, type species *S. xylopiae* (J.M. Yen & Sulmont) Beenken, asexual morph aecidium-like, biotrophic on Annonaceae, terrestrial, Gabon, Ivory Coast, Sierra Leone, sequence data available, see Beenken and Wood 2015 (taxonomy, phylogeny).

Sphenospora Dietel 1892, Raveneliaceae, Pucciniales, Pucciniomycetes, six species, type species *S. pallida* (G. Winter) Dietel, biotrophic on Annonaceae, Dioscoreaceae, Orchidaceae, Smilacaceae, terrestrial, Africa (Gabon), tropical America

(Brazil, Florida, USA, Guatemala, Peru, Venezuela), see Kirk et al. 2013 (genus accepted), sequence data available, see Aime 2006 (phylogeny), Beenken and Wood 2015 (phylogeny).

Spiculogloea P. Roberts 1996, Spiculogloeaceae, Spiculogloeales, Spiculogloeomycetes, sexual and asexual morph known, five species, type species *S. occulta* P. Roberts, mycoparasitic (tremelloid haustorial cells) on crust fungi and heterobasidiomycetes, distribution Europe, Canada? see Bandoni et al. 2002, sequence data available, see Aime et al. 2006 (phylogeny), Bauer et al. 2006 (phylogeny), Aime et al. 2014 (phylogeny), Wang et al. 2015e (phylogeny), new spp. see Schoutteten et al. 2018 (Belgium).

Spongiforma Desjardin, Manfr. Binder, Roekring & Flegel 2009, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *S. thailandica* Desjardin, Manfr. Binder, Roekring & Flegel, morchelliform astipitate, presumably ectomycorrhizal, tropical Asia, sequence data available, see Desjardin et al. 2009, 2011 (taxonomy, new spp., Malaysia).

Spongioides Lázaro Ibiza 1916, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *S. cryptarum* (Bull.) Lázaro Ibiza, Europe (France), sequence data unavailable, see Kirk et al. 2008.

Spongipellis Pat. 1887, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, eight species (needs revision since genus shown to be polyphyletic), type species *S. spumeus* (Sowerby) Pat., poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Tomšovský 2012 (phylogeny, Europe, *S. litschaueri*).

Spongiporus Murrill 1905, Dacryobolaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *S. leucospongia* (Cooke & Harkn.) Murrill, poroid hymenophore, wood-rotting, brown rot, widespread, sequence data available, see Ortiz-Santana et al. 2013 (phylogeny, antrodia clade).

Spongispora G. Wu, S.M.L. Lee, E. Horak & Zhu L. Yang 2018, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *S. temasekensis* G. Wu, S.M.L. Lee, E. Horak & Zhu L. Yang, stipitate-pileate, presumably ectomycorrhizal, Singapore, sequence data available, see Wu et al. 2018a (taxonomy and phylogeny).

Sporisorium Ehrenb. ex Link 1825, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, 195 species, type species *S. sorghi* Ehrenb. ex Link, plant parasites (flowers) on Poaceae, systemic, widespread, saprobic yeast states on plants, the genus is not monophyletic, cultures available, see Kirk et al. 2013 (genus accepted), sequence data available, see Begerow et al. 2000, 2014, McTaggart et al. 2012a,b,c Wang et al. 2015c (phylogeny).

Sporobolomyces Kluyver & C.B. Niel 1924 (= *Blastoderma* B. Fisch. & Breback 1894; = *Aessosporon* Van der Walt 1970; = *Sporidiobolus* Nyland 1950, see Aime et al. 2018), Sporidiobolaceae, Sporidiobolales, Microbotryomycetes, sexual and asexual morphs known, eleven species, type species *S. roseus* Kluyver & C.B. Niel, yeast, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Wang et al. 2015e (taxonomy and phylogeny), Urbina and Aime 2018 (diversity).

Spumula Mains 1935, Raveneliaceae, Pucciniales, Pucciniomycetes, seven species, type species *S. quadrifida* Mains, biotrophic on Fabaceae, terrestrial, Mexico, Philippines, sequence data unavailable, see Kirke t al. 2013 (genus accepted).

Squamanita Imbach 1946, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *S. schreieri* Imbach, worldwide, parasitic, see Kirk et al. 2013 (genus accepted), sequence data available, see Redhead et al. 1994, Vizzini and Girlanda 1997, Matheny and Griffith 2010 (mycoparasitism), Halama 2016 (Poland).

Stagnicola Redhead & A.H. Sm. 1986, Mythicomycetaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. perplexa* (P.D. Orton) Redhead & A.H. Sm., North temperate, see Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny), Vizzini et al. 2019 (phylogeny).

Staheliomyces E. Fisch. 1921, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *S. cinctus* E. Fisch, saprobic, terrestrial, America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Stalpersia Parmasto 2001, Auriscalpiaceae, Russulales, Agaricomycetes, asexual morph unknown, one species, type species *S. orientalis* Parmasto, Europe, wood-decaying, sequence data unavailable, see Kirk et al. 2008.

Stanglomyces Raithelh. 1986, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. taxophilus* Raithelh., South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Staurophallus Mont. 1845, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *S. senegalensis* Mont., terrestrial, Africa, sequence data unavailable, see Kirk et al. 2008.

Stecchericium D.A. Reid 1963, Bondarzewiaceae, Russulales, Agaricomycetes, asexual morph unknown, seven species, type species *S. seriatum* (Lloyd) Maas Geest., worldwide, wood-decaying, sequence data unavailable, see Yuan and Dai 2008a (new record, China), Kirk et al. 2013 (genus accepted), Zmitrovich 2018a.

Steccherinum Gray 1821, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *S. ochraceum* (Pers.) Gray, varied basidioma, hydnoid hymenophore, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Miettinen et al. 2012 (phylogeny, morphological plasticity), Binder et al. 2013 (phylogeny, Polyporales), new spp. see Yuan and Wu 2012 (morphology, China, East Asia), Hyde et al. 2017b (phylogeny, Brazil), Westphalen et al. 2018 (Europe), new combinations see Miettinen and Ryvarden 2016 (phylogeny, morphology).

Stegiacantha Maas Geest. 1966, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *S. petaloides* (Lloyd) Maas Geest, hydnoid hymenophore, wood-rotting, Madagascar, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Stegocintractia M. Piepenbr., Begerow & Oberw. 1999, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, six species, type species *S. luzulae* (Sacc.) M. Piepenbr., Begerow & Oberw., plant parasite (pedunculi, spikelet) on Juncaceae, North America, possibly South America, Asia, Europe, Greenland, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014, Nasr et al. 2014a, Wang et al. 2015c (taxonomy, phylogeny).

Stemastrum Raf. 1808, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *S. boscii* Raf., sequence data unavailable, see Kirk et al. 2008.

Stephanophallus MacOwan 1880, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *S. woodii* MacOwan, terrestrial, sequence data unavailable, see Kirk et al. 2008.

Stephanopus M.M. Moser & E. Horak 1975, Cortinariaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *S. azureus* M.M. Moser & E. Horak, South America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Stephanospora Pat. 1914, Stephanosporaceae, Agaricales, Agaricomycetes, asexual morph unknown, six species, type species *S. caroticolor* (Berk.) Pat., worldwide, terrestrial, basidomes sequestrate, see Kirk et al. 2013 (genus accepted), sequence data available, see Lebel et al. 2015 (cryptic diversity, Australasia, new spp.), new spp. see Guevara-Guerrero et al. 2015 (North America).

Stereophlebia Zmitr. 2018, Meruliaceae, Polyporales, Agaricomycetes, asexual morph unknown, monotypic, one species, type species *S. tuberculata* (Berk. & M.A. Curtis) Zmitr., phlebioid basidioma, wood-rotting, white rot, widespread, see Zmitrovich 2018a (taxonomy).

Stereopsis D.A. Reid 1965, Stereopsidaceae, Stereopsidales, Agaricomycetes, asexual morph unknown, 15 species, type species *S. radicans* (Berk.) D.A. Reid, terrestrial, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Sjökvist et al. 2012 (phylogeny), new spp. see Ryvarden 2012c (Costa Rica), Sjökvist et al. 2014 (*S. globosa*, new combibation).

Stereostratum Magnus 1899, Pucciniaceae, Pucciniales, Pucciniomycetes, one species, type species *S. corticioides* (Berk. & Broome) H. Magn., biotrophic on Poaceae, terrestrial, China, Japan, see Kirk et al. 2013 (genus accepted), sequence data available.

Stereum Hill ex Pers. 1794, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, c. 40 species, type species *S. hirsutum* (Willd.) Pers., worldwide, wood-decaying, see Kirk et al. 2013 (genus accepted), sequence data available, see Floudas et al. 2012 (genome).

Sterigmatomyces Fell 1966, Agaricostilbaceae, Agaricostilbales, Agaricostilbomycetes, sexual and asexual morphs known, five species, type species *S. halophilus* Fell, yeast, small basidiocarps on plants, worldwide, see Kurtzman et al.

2011 (taxonomy), cultures and sequence data available, see Wang et al. 2015e (taxonomy and phylogeny).

Sterigmatosporidium G. Kraep. & U. Schulze 1983, Cuniculitremaceae, Tremellales, Tremellomycetes, sexual and asexul morphs known, one species, type species *S. polymorphum* G. Kraep. & U. Schulze, yeast, possibly mycoparasite, on wood, bark beetle, Europe, see Kirk et al. 2013 (genus accepted), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Stilbotulasnella Oberw. & Bandoni 1982, *incertae sedis*, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *S. conidiophora* Bandoni & Oberw., saprobes, Hawaii, genus in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Stilbum Tode 1790, Chionosphaeraceae, Agaricostilbales, Agaricostilbomycetes, asexual morph unknown, c. ten species, type species *S. vulgare* Tode, worldwide, sequence data and cultures unavailable, see Kirk et al. 2013 (genus accepted), Wang et al. 2015e (taxonomy).

Stiptophyllum Ryvarden 1973, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, one species, type species *S. erubescens* (Berk.) Ryvarden, stipitate basidioma, lamellate hymenophore, wood-rotting, brown rot, Neotropical, sequence data unavailable, see de Campos-Santana and Loguercio-Leite 2008 (morphology), Kirk et al. 2013 (genus accepted).

Stollia McTaggart & R.G. Shivas 2012, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, five species, type species *S. ewartii* (McAlpine) McTaggart & R.G. Shivas, plant parasites (ovaries) on Andropogoneae (Poaceae), Australia, South America, cultures unavailable, sequence data available, see McTaggart et al. 2012b, Begerow et al. 2014, Wang et al. 2015c (phylogeny).

Strobilomyces Berk. 1851, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 27 species, type species *S. strobilaceus* (Scop.) Berk., stipitate-pileate, ectomycorrhizal, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Han et al. 2018 (biogeography, monograph), Sato et al. 2017 (diversification rate study), new spp. see Sato and Murakami 2009 (Japan), Sato et al. 2011 (Japan), Gelardi et al. 2013b (China), Antonín et al. 2015b (Korea), Ullah et al. 2019 (Pakistan).

Strobilurus Singer 1962, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, ten species, type species *S. conigenoides* (Ellis) Singer, sarotrophic, worldwide, see Shiono et al. 2008 (compounds), Kirk et al. 2013 (genus accepted), sequence data available, see Walther et al. 2005 (phylogney), Garnica et al. 2007 (agarics, phylogeny, basidiospore ultrastructure), Petersen and Hughes 2010 (phylogeny), Osmundson et al. 2013 (DNA barcode), Qin and Yang 2015 (phylogeny).

Stromatocyphella W.B. Cooke 1961, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *S. conglobata* (Burt) W.B. Cooke, on wood, North America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Stropharia (Fr.) Quél. 1872, Strophariaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 20 species, type species *S. aeruginosa* (Curtis) Quél., saprotrophic, worldwide, some species edible, see Bridge et al. 2008 (taxonomy), Cortez and da Silveira 2008 (Brazil), Bruhn et al. 2010 (cultivation), Zhang et al. 2014b (novel lectin), sequence data available, see Matheny et al. 2006 (phylogeny), new spp. see da Silva et al. 2009 (Brazil), Senthilarasu and Singh 2013a (India), Tian and Bau 2014 (China).

Stylina Syd. & P. Syd. 1921, Graphiolaceae, Exobasidiales, Exobasidiomycetes, one species, type species *S. disticha* (Ehrenb. ex Fr.) Syd. & P. Syd., plant parasite (leaves) on *Livistona* (Arecaceae), China, cultures unavailable, sequence data unavailable, see Begerow et al. 2002, 2014 (taxonomy), Kirk et al. 2013 (genus accepted).

Stypella Möller 1895, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, four species, type species *S. papillata* Möller, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson 2007b (ITS sequence, phylogeny), Spirin et al. 2019a (taxonomy, phylogeny, *S. vermiformis* group).

Stypellopsis Spirin & V. Malysheva 2018, *incertae sedis*, Auriculariales, Agaricomycetes, two species, type species *S. hyperborea* Spirin & V. Malysheva (type species) and *S. farlowii* (Burt) Spirin & K.H. Larss. (previously *Protomerulius farlowii*), North America (USA) and Europe (Norway), see Spirin et al. 2019a (genus introduced, phylogeny).

Subantrodia Audet 2017, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *S. juniperina* (Murrill) Audet, wood-rotting,

sequence data available, see Ortiz-Santana et al. 2013 (antrodia clade of Polyporales, phylogeny).

Subulicium Hjortstam & Ryvarden 1979, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, three species, type species *S. lautum* (H.S. Jacks.) Hjortstam & Ryvarden, worldwide, see Kirk et al. 2013 (genus accepted), sequence data avaiable, see Langer 2002 (phylogeny).

Subulicystidium Parmasto 1968, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, 20 species, type species *S. longisporum* (Pat.) Parmasto, wood-decaying, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Gorjón et al. 2012b (Patagonian Andes), see Ordynets et al. 2018 (phylogeny, keys)

Sugitazyma A.M. Yurkov, X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Trimorphomycetaceae, Tremellales, Tremellomycetes, sexual morph unknown, one species, type species *S. miyagiana* (Nakase, Itoh, Takem. & Bandoni) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, on fir (*Abies firma*), Japan, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Suillellus Murrill 1909, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, 23 species, type species *S. luridus* (Schaeff.) Murrill, stipitate-pileate, ectomycorrhizal, worldwide, sequence data available, new spp. see Wu et al. 2016f (China).

Suillosporium Pouzar 1958, Botryobasidiaceae, Cantharellales, Agaricomycetes, asexual morph unknown, four species, type species *S. cystidiatum* (D.P. Rogers) Pouzar, saprobic, wood-rotting, worldwide, genus in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Suillus Gray 1821, Suillaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 60 species, type species *S. luteus* (L.) Roussel, ectomycorrhizal with Pinaceae, widespread (north temperate, introduced in southern hemisphere), some species edible (*S. acidus* (Peck) Singer), some medicinal use, (*S. bovinus* (L.) Roussel), see Dai and Yang 2008 (medicinal mushrooms, China), Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Nguyen et al. 2016 (phylogeny), Min et al. 2014 (Korean *Suillus*), Zhang et al. 2017c (phylogeny), new spp. see Bruns et al. 2010 (California and Oregon, USA), Verma and

Sudhakara 2014 (India), Sarwar et al. 2015 (Pakistan), Verma and Reddy 2015 a,b (India), Qi et al. 2016 (northeast China), Shi et al. 2016 (China).

Sulzbacheromyces B.P. Hodk. & Lücking 2014, Lepidostromataceae, Lepidostromatales, Agaricomycetes, asexual morph unknown, six species, type species *S. caatingae* (Sulzbacher & Lücking) B.P. Hodk. & Lücking, terrestrial, tropical Africa, Asia and America, sequence data available, see Hodkinson et al. 2014 (phylogeny, Mexico), new spp. see Liu et al. 2017a (China).

Sutorius Halling, Nuhn & N.A. Fechner 2012, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *S. eximius* (Peck) Halling, M. Nuhn & Osmundson, stipitate-pileate, ectomycorrhizal, worldwide, DNA sequence data available, see Halling et al. 2012a (phylogeny), Chai et al. 2019 (China), amended by Wu et al. 2016f to include *Neoboletus*, or should be restricted to *Sutorius* sensu Halling et al. 2012a (Raspé and Vadthanarat, unpubl.).

Symmetrospora Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Symmetrosporaceae, *incertae sedis*, Cystobasidiomycetes, sexual morph unknown, six species, type species *S. gracilis* (Derx) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Sympodiomycopsis Sugiy., Tokuoka & Komag. 1991, *incertae sedis*, Microstromatales, Exobasidiomycetes, three species, type species *S. paphiopedili* Sugiy., Tokuoka & Komag., known only from saprobic states, plant material, see Kurtzman et al. 2011 (taxonomy), Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2001, 2014 (phylogeny, taxonomy), Wang et al. 2015c (phylogenetic classification of yeasts, Ustilaginomycotina), Kijpornyongpan and Aime 2017 (validation).

Syzygospora G.W. Martin 1937, Filobasidiaceae, Filobasidiales, Tremellomycetes, asexual morphs unknown, two species, type species *S. alba* G.W. Martin, yeast, mycoparasitic, worldwide, see Kirk et al. 2013 (genus accepted), cultures and sequence data available, see Millanes et al. 2011 (phylogeny), Liu et al. 2015b (taxonomy and phylogeny).

Szczepkamyces Zmitr. 2018, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, monotypic, type species *S. campestris* (Quél.) Zmitr., resupinate

porioid basidioma, wood-rotting, white rot, widespread, see Zmitrovich 2018a (taxonomy).

Taeniospora Marvanová 1977, Atheliaceae, Atheliales, Agaricomycetes, asexual morph *Fibulomyces* Jülich 1972, two species, type species *T. gracilis* Marvanová, Czech Republic, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Taiwanofungus Sheng H. Wu, Z.H. Yu, Y.C. Dai & C.H. Su 2004, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *T. camphoratus* (M. Zang & C.H. Su) Sheng H. Wu, Z.H. Yu, Y.C. Dai & C.H. Su, China, medicinal use, see Hsieh et al. 2010 (natural products), Geethangili and Tzeng 2011 (bioactive compounds), sequence data available, see Wu et al. 2004 (phylogeny), Yang et al. 2018a (genome and transcriptome analyses, cultivation).

Taiwanoporia T.T. Chang & W.N. Chou 2003, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *T. amylospora* T.T. Chang & W.N. Chou, China, sequence data unavailable, see Kirk et al. 2008.

Takashimella Q.M. Wang 2015, Tetragoniomycetaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, four species, type species *T. formosensis* (Nakase, Tsuzuki & M. Takash.) Q.M. Wang, yeast, worldwide, cultures and sequence data available, see Wang and Wang 2015 (ballistoconidium-forming yeasts, Trichosporonales), Liu et al. 2015b (taxonomy and phylogeny).

Tapinella E.-J. Gilbert 1931 (= *Sarcopaxillus* Zmitr., Malysheva & E.F. Malysheva 2004), Tapinellaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *T. panuoides* (Batsch) E.-J. Gilbert, see Kirk et al. 2013 (genus accepted), sequence data available, see Garnica et al. 2007 (phylogeny), Van der Linde and Haller 2013 (ecology).

Tausonia Babeva 1998, Mrakiaceae, Cystofilobasidiales, Tremellomycetes, sexual and asexual morphs known, three species, type species *T. pamirica* Babeva, yeast, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny), Kachalkin et al. 2019 (new spp.).

Tectella Earle 1909, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *T. patellaris* (Fr.) Murrill, worldwide, see Seok et

al. 2011 (Korea), Jančovičová et al. 2012 (Slovakia), Kirk et al. 2013 (genus accepted), sequence data available, see Moncalvo et al. 2002 (phylogeny).

Telomapea G.F. Laundon 1967 (= *Mapea* Boedijn 1957), Chaconiaceae, Pucciniales, Pucciniomycetes, one species, type species *T. inocarpi* (Racib.) G.F. Laundon, biotrophic on *Inocarpus* (Fabaceae), terrestrial, Indonesia, sequence data unavailable, see Kirk et al. 2008.

Tengioboletus G. Wu & Zhu L. Yang 2016, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *T. reticulatus* G. Wu & Zhu L. Yang, basidioma stipitate-pileate with tubular hymenophore, central China, sequence data available, see Wu et al. 2016f (taxonomy, China), new spp. see Zeng et al. 2018 (China).

Tephrocybe Donk 1962, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 47 species, type species *T. rancida* (Fr.) Donk, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Hofstetter et al. 2014 (phylogeny, Lyophyllaceae), Bellanger et al. 2015 (phylogeny), new spp. see Picillo 2014 (Italy).

Tephrocybella Picillo, Vizzini & Contu 2015, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *T. griseonigrescens* Picillo, Vizzini & Contu, Italy, basidioma collybioid, sequence data available, see Crous et al. 2015a (taxonomy), Hyde et al. 2017b (taxonomy).

Tephroderma Contu & Musumeci 2014, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *T. fuscopallens* Musumeci & Contu, France, Turkey, see Sesli and Topçu 2016 (Turkey), sequence data available, see Musumeci and Contu 2014b (taxonomy).

Terana Adans. 1763, Phanerochaetaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *T. coerulea* (Lam.) Kuntze, corticioid basidioma, wood-rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Floudas and Hibbett 2015 (phylogeny, *Phanerochaete s. l.*).

Terenodon Maas Geest. 1971, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, one species, type species *T. serenus* Maas Geest., Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Termiticola E. Horak 1979, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *T. rubescens* E. Horak, Papua New Guinea, Malaysia, on termite nest, see Kirk et al. 2013 (genus accepted), sequence data unavailable, genus in need of revision.

Termitomyces R. Heim 1942 (= *Termitosphaera* Cif. 1935 *fide* Art. 59.1), Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph previously known in *Termitosphaera* Cif. 1935, c. 34 species, type species *T. striatus* (Beeli) R. Heim, Africa, Southeast Asia, in nests of Macrotermitinae, edible, termite mushroom (*T. eurrhizus* (Berk.) R. Heim), see Hall et al. 2003 (edible mushrooms), Mondal et al. 2008 (chemical analysis), Dai et al. 2010b (edible mushrooms, China), Wei et al. 2009 (China, key, morphology), Osiemo et al. 2010 (Africa), Kirk et al. 2013 (genus accepted), sequence data available, see Nobre et al. 2011 (genetic population structure), Sawhasan et al. 2011 (Thailand), Siddiquee et al. 2012 (*T. heimii*), Tibuhwa 2012 (Tanzania), Karun and Sridhar 2013 (India), Hofstetter et al. 2014 (phylogeny, Lyophyllaceae), Rahmad et al. 2014 (proteomic analysis, *T. heimii*), Mossebo et al. 2017 (phylogeny), new spp. see Mossebo et al. 2011 (Cameroun), Takahashi et al. 2016 (Japan).

Testicularia Klotzsch 1832, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, three species, type species *T. cyperi* Klotzsch, plant parasites (flowers, spikelets) on *Rhynchospora* spp. (Cyperaceae), West Africa, North America, South America, Caribbean Basin, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Tetragoniomyces Oberw. & Bandoni 1981, Rhynchogastremaceae, Trichosporonales, Tremellomycetes, asexual and sexual morphs known, one species, type species *T. uliginosus* (P. Karst.) Oberw. & Bandoni, mycoparasite, on wood, Europe, on wood, see Kirk et al. 2013 (genus accepted), sequence data available, see Millanes et al. 2011 (phylogeny), Liu et al. 2015b (taxonomy and phylogeny), Pontes et al. 2017 (sequence data).

Tetrapyrgos E. Horak 1987, Marasmiaceae, Agaricales, Agaricomycetes, asexual morph unknown, 18 species, type species *T. atrocyanea* (Métrod) E. Horak, saprophytic, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Honan et al. 2015 (taxonomy, phylogeny, type studies, new spp.), Desjardin and Perry 2017 (type study).

Thanatephorus Donk 1956, Ceratobasidiaceae, Cantharellales, Agaricomycetes, asexual morph *Rhizoctonia* DC. 1805, 12 speceis, type species *T. cucumeris* (A.B. Frank) Donk, worldwide, pathogenetic, see Willocquet and Savary 2011 (rice sheath blight), sequence data available, see González et al. 2012 (genetic diversity, *T. cucumeris*), Oberwinkler et al. 2013a (*Ceratobasidium-Rhizoctonia* complex).

Thecaphora Fingerh. 1836, Glomosporiaceae, Urocystidales, Ustilaginomycetes, 61 species, type species *T. seminis-convolvuli* Liro, plant parasites (various parts of host plant) on dicots, North America, Asia, Australia, Europe, see Kirk et al. 2013 (genus accepted), Frantzeskakis et al. 2017 (life cycle, *T. thlaspeos*), cultures available, sequence data available, see Vánky et al. 2008 (taxonomy), Conforto et al. 2013 (molecular data), Begerow et al. 2014 (taxonomy), Vasighzadeh et al. 2014 (phylogeny, *T. schwarzmaniana*), Wang et al. 2015c (phylogeny, taxonomy), new spp. see Roets et al. 2008 (South Africa), Crous et al. 2018b (Australia), Kruse et al. 2018 (Greece).

Thekopsora Magnus 1875, Pucciniastraceae, Pucciniales, Pucciniomycetes, seven species, type species *T. areolata* (Fr.) Magnus, biotrophic on Betulaceae, Cornaceae, Ericaceae, Rosaceae, terrestrial, Asia (China, Japan), Europoe, Eurasia, North America, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Yang et al. 2014, 2015a (phylogeny, China), Aime et al. 2018a (phylogeny, evolution with host, Pucciniales).

Thelephora Ehrh. ex Willd. 1787, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *T. terrestris* Ehrh., ectomycorrhizal, worldwide, edible when basidiomas are young, see Sha et al. 2008 (genetic diversity), Norikura et al. 2012 (anticancer activities of *T. aurantiotincta*), Kirk et al. 2013 (genus accepted), sequence data available, see Ramírez-López et al. 2013, 2015 (phenotypic plasticity of basidioma, phylogeny, cryptic species), Wang et al. 2017b (mitochondrial genomes, *T. ganbajun*), Zmitrovich et al. 2018b (phylogeny, new combinations), new spp. see Vizzini et al. 2016a (Dominican Republic).

Thelephorella P. Karst. 1889, *incertae sedis*, Thelephorales, Agaricomycetes, asexual morph unknown, one species, type species *T. brasiliensis* P. Karst., wood-decaying, South America, sequence data unavailable, see Kirk et al. 2008.

Theleporus Fr. 1847, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, nine species, type species *T. cretaceus* Fr., poroid hymenophore, wood-

rotting, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Zhou and Dai 2012a (China), Yuan 2015 (China), new combination, see Ariyawansa et al. 2015 (Venezuela).

Thermophymatospora Udagawa, Awao & Abdullah 1986, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one specie, type species *T. fibuligera* Udagawa, Awao & Abdullah, wood-rotting, sequence data unavailable, see Kirk et al. 2008.

Thujacorticium Ginns 1988, Cyphellaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *T. mirabile* Ginns, Canada, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Tilletia Tul. & C. Tul. 1847, Tilletiaceae, Tilletiales, Exobasidiomycetes, 179 species, type species *T. caries* (DC.) Tul. & C. Tul., plant parasites (ovaries, leaves) of Poaceae, widespread, cultures available, see Kirk et al. 2013 (genus accepted), sequence data available, see Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Tilletiaria Bandoni & Johri 1972, Tilletiariaceae, Georgefischeriales, Exobasidiomycetes, sexual and asexual morphs known, one species, type species *T. anomala* Bandoni & B.N. Johri, known only from saprobic states, see Kurtzman et al. 2011 (taxonomy), Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Bauer et al. 2001a (taxonomy), Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Tilletiopsis Derx 1948, Entylomataceae, Entylomatales, Exobasidiomycetes, sexual morph *Entyloma* de Bary 1874, *Melanotaenium* de Bary 1874, three species, type species *T. washingtonensis* Nyland, worldwide, known only from saprobic states, plant pathogen, see Hamamoto et al. 2000, Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Baric et al. 2010 (white haze, Italy), Boekhout 2011 (taxonomy), Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny), Prencipe et al. 2016 (Croatia).

Tinctoporellus Ryvarden 1979, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *T. epimiltinus* (Berk. & Broome) Ryvarden, resupinate basidioma, poroid hymenophore, wood-rotting, widespread (pantropical), see Kirk et al. 2013 (genus accepted), sequence data available, see Justo

et al. 2017 (phylogeny, Polyporales), new spp. see Yuan and Wan 2012 (phylogeny, China).

Titaeella G. Arnaud ex K. Ando & Tubaki 1985, *incertae sedis*, *incertae sedis*, Agaricomycetes, one species, type species *T. capnophila* G. Arnaud ex K. Ando & Tubaki, Europe, Japan, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Tolyposporella G.F. Atk. 1897, Tilletiariaceae, Georgefischeriales, Exobasidiomycetes, six species, type species *T. chrysopogonis* G.F. Atk., plant parasites (leaves, leaf sheats) on Poaceae, maybe also Eriocaulaceae, Africa, North America, South America, Australasia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Bauer et al. 2001b (taxonomy, phylogeny), Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Tolyposporium Woronin ex J. Schröt. 1887, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, five species, type species *T. junci* (J. Schröt.) Woronin ex J. Schröt., plant parasites (various plant parts) on genera *Juncus* (Juncaceae) and *Schoenus*, *Ficinia* (Cyperaceae), North America, Australasia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Piepenbring et al. 1999 (phylogeny), Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Tomentella Pers. ex Pat. 1887, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, c. 100 species, type species *T. ferruginea* (Pers.) Pat., ectomycorrhizal, worldwide, see Kaur et al. 2010 (India), Kirk et al. 2013 (genus accepted), sequence data available, see Geml et al. 2012b, 2014a, b (Arctic, phylogeny, biogeography, coastal dunes, Europe, Andean forests, Argentina), Morgado et al. 2015, 2016 (arctic tundra, Alaska, ecology), Alvarez-Manjarrez et al. 2016 (phylogeny, Mexico), Zmitrovich et al. 2018b (phylogeny), new spp. see Yorou and Agerer 2008 (phylogeny, West Africa), Yorou et al. 2012 a,b (West Africa), Kuhar et al. 2016 (Patagonian Andes forests).

Tomentellopsis Hjortstam 1970, Thelephoraceae, Thelephorales, Agaricomycetes, asexual morph unknown, eight species, type species *T. echinospora* (Ellis) Hjortstam, ectomycorrhizal, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson 2007b (phylogeny).

Tomophagus Murrill 1905, Polyporaceae, Polyporales, Agaricomycetes, asexual morph *Thermophymatospora* Udagawa, Awao & Abdullah 1986, two species, type

species *T. colossus* (Fr.) Murrill, poroid hymenophore, wood-rotting, white rot, widespread (America, Vietnam), sequence data available, see Le et al. 2012 (new sp., phylogeny, Vietnam, genus accepted).

Trachyspora Fuckel 1861 (=*Trachysporella* Syd. 1921), Phragmidiaceae, Pucciniales, Pucciniomycetes, five species, type species *T. alchemillae* (Pers.) Fuckel, biotrophic on Rosaceae (*Alchemilla*), Euphorbiaceae, terrestrial, Europe (Switzerland), Africa (Kenya), Indonesia, Brazil, see Kirk et al. 2013 (genus accepted), sequence data available, see Maier et al. 2003 (phylogeny), Aime 2006 (phylogeny).

Tracya Syd. & P. Syd. 1901, Doassansiaceae, Doassansiales, Exobasidiomycetes, two species, type species *T. lemnae* (Setch.) Syd. & P. Syd., plant parasites on vegetative parts of Hydrocharitaceae and Lemnaceae, Europe, North America, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Trametes Fr. 1836, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 70 species, type species *T. suaveolens* (L.) Fr., poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), some species medicinal use, see Zmitrovich et al. 2012 (review, medicinal properties, *Trametes* spp.), Wasser 2017 (medicinal mushrooms, human clinical studies), sequence data available, see Tomšovsky et al. 2006 (phylogeny, Europe), Zmitrovich and Malysheva 2013 (phylogeny), Carlson et al. 2014 (phylogeny), new spp. see Ryvarden et al. 2009 (morphology, Neotropics), Læssøe and Ryvarden 2010b (morphology, Ecuador), Li and Cui 2010 (morphology, Southwest China), Ryvarden 2012a, b, 2015b (morphology, Costa Rica, Neotropics, Brazil), new combinations, see Justo and Hibbett 2011 (phylogeny), Malysheva and Zmitrovich 2011 (*Trametes hirsuta*-complex), Welti et al. 2012 (phylogeny), Spirin et al. 2015a (morphology), Ryvarden 2016c (morphology).

Trametopsis Tomšovský 2008, Irpicaceae, Polyporales, Agaricomycetes, asexual morph unknown, four species, type species *T. cervina* (Schwein.) Tomšovský, poroid hymenophore, wood-rotting, white rot, widespread, sequence data available, see Tomšovský 2008 (phylogeny, Europe), new sp. see Gómez-Montoya et al. 2017b (new combinations, phylogeny, Neotropics), Zmitrovich 2018a (taxonomy)

Tranzschelia Arthur 1906 (= *Polythelis* Arthur 1906; = *Lipospora* Arthur 1942), Uropyxidaceae, Pucciniales, Pucciniomycetes, 19 species, type species *T. cohaesa* (Long) Arthur, biotrophic on Ranunculaceae (microcyclic or macrocyclic) and heteroecious macrocyclic species on Ranunculaceae (aecial host) and Prunoideae (telial host), terrestrial, see Kirk et al. 2013 (genus accepted), sequence data available, see Wingßeld et al. 2004 (phylogeny), Scholler et al. 2014 (new species, key to American species, *T. thalictri* is probably a species complex).

Tranzscheliella Lavrov 1936, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, 17 species, type species *T. otophora* Lavrov, plant parasites (aborted flowers, stems) on Poaceae, Africa, Australia, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, Kellner et al. 2011 (phylogeny, grass smuts), Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Trappea Castellano 1990, Trappeaceae, Hysterangiales, Agaricomycetes, asexual morph unknown, three species, type species *T. darkeri* (Zeller) Castellano, China, Europe, see Kirk et al. 2013 (genus accepted), sequence data available, see Hosaka et al. 2008 (phylogeography), new spp. see Gomezreyes et al. 2014 (Mexico).

Trechinothus E.C. Martini & Trichiès 2004, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *T. smardae* (Pilát) E.C. Martini & Trichiès, Europe, sequence data unavailable, see Kirk et al. 2008.

Trechispora P. Karst. 1890, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, 48 species, type species *T. onusta* P. Karst., wood-decaying, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Rosenthal et al. 2017 (ecology, corticioid fungi in North American pinaceous forests).

Tremella Pers. 1794, Tremellaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, type species *T. mesenterica* Retz., more than 500 species described (mostly old doubtful names), 100 species accepted, some species edible, see Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), presently restricted to *T. mesenterica* lineage (other species temporarily accommodated in the genus), asexual morph as yeast, mycoparasitic, lichenicolous, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Findley et al. 2009 (phylogeny), Millanes et al. 2011 (phylogeny), Liu et al. 2015b (phylogeny), new spp. see Millanes et al. 2012 (Sweden, USA), Ariyawansa et al. 2015 (USA),

Diederich et al. 2015 (Peru), Lindgren et al. 2015 (associated with lichenized ascomycete), Malysheva et al. 2015b (Russia), Millanes et al. 2015 (Finland, Greenland, Norway, Russia, Svalbard, and Sweden), Zamora et al. 2017, 2018 (Europe, USA), Zhao et al. 2019 (China).

Tremellacantha Jülich 1980, *incertae sedis*, Auriculariales, Agaricomycetes, asexual morph unknown, one species, type species *T. sclerodontia* (Mont. & Berk.) Jülich [current name: *Protohydnum sclerodontium* (Mont. & Berk.) Hjortstam & Spooner], sequence data unavailable, see Kirk et al. 2008.

Tremellina Bandoni 1986, *incertae sedis*, Tremellales, Tremellomycetes, sexual morph *Cuniculitrema* J.P. Samp. & R. Kirschner 2001, one species, type species *T. pyrenophila* Bandoni, on fungal ascocarps, North America, sequence data unavailable, see Kirk et al. 2008.

Tremellodendropsis (Corner) D.A. Crawford 1954, Tremellodendropsidaceae, Tremellodendropsidales, Agaricomycetes, asexual morph unknown, eight species, type species *T. tuberosa* (Grev.) D.A. Crawford, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Berbee et al. 2016 (phylogeny).

Tremellogaster E. Fisch. 1924, Diplocystidiaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *T. surinamensis* E. Fisch., Surinam, Guyana, ectomycorrhizal, see Kirk et al. 2013 (genus accepted), sequence data available, see Wilson et al. 2012a (evolution).

Tremelloscypha D.A. Reid 1979, Sebacinaceae, Sebacinales, Agaricomycetes, asexual morph unknown, four species, type species *T. australiensis* D.A. Reid, Austrialia, Jamaica, some species edible (*T. gelatinosa* (Murrill) Oberw. & K. Wells), see Bandala et al. 2014 (Mexico), Kirk et al. 2013 (genus accepted), sequence data available, see Bandala et al. 2012a (Mexico, morphology), Oberwinkler et al. 2014 (phylogeny, Sebacinales).

Tretomyces K.H. Larss., Kotir. & Saaren. 2011, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, two species, type species *T. lutescens* (J. Erikss. & Ryvarden) K.H. Larss., Kotir. & Saaren., sequence data available, see Kotiranta et al. 2011 (taxonomy).

Tretopileus B.O. Dodge 1946, Corticiaceae, Corticiales, Agaricomycetes, asexual morph unknown, three species, type species *T. opuntiae* B.O. Dodge, probably plant

parasitic, USA, Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Okada et al. 1998 (phylogeny), Jayawardena et al. 2019 (phylogeny, updated notes).

Trichaptum Murrill 1904, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, 27 species, type species *T. trichomallum* (Berk. & Mont.) Murrill, worldwide, wood-decaying, some species medicinal use (*T. abietinum* (Pers.: Fr) Ryvarden), see Dai and Yang 2008 (medicinal mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Dai et al. 2009a (monograph, China, new spp.).

Trichocintractia M. Piepenbr. 1995, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, one species, type species *T. utriculicola* (Henn.) M. Piepenbr., plant parasite (spikelets) on *Rhynchospora* spp. (Cyperaceae), widespread in tropical regions, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy), Nasr et al. 2014a (phylogeny).

Trichocybe Vizzini 2010, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *T. puberula* (Kuyper) Vizzini, Northwestern Europe, sequence data available, see Vizzini et al. 2010a (taxonomy).

Tricholoma (Fr.) Staude 1857, Tricholomataceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 210 species, type species *T. flavovirens* Alb. & Schwein., worldwide, ectomycorrhizal, some species edible, matsutake (*T. matsutake* (S. Ito & S. Imai) Singer), see Hall et al. 2003 (edible mushrooms), Dai et al. 2010b (Chinese edible mushrooms), Kirk et al. 2013 (genus accepted), You et al. 2013 (antioxidant and antitumour activities), sequence data available, see Mouhamadou et al. 2008 (molecular evolution), Jargeat et al. 2010 (*T. scalpturatum* species complex), Yu et al. 2011 (phylogeny), Ota et al. 2012 (matsutake mushrooms), Murata et al. 2013a (section *Caligata*), Moukha et al. 2013a (*T. equestre* species complex), Hosen et al. 2016c (*T. sinoacerbum*), Heilmann-Clausen et al. 2017 (monograph, Europe), new spp. see Christensen and Heilmann-Clausen 2009 (Europe), Park et al. 2014a (Korea), Yang et al. 2017b (Eastern Himalaya), Ovrebo and Hughes 2018 (New Mexico and Colorado).

Tricholomella Zerova ex Kalamees 1992, Lyophyllaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *T. constricta* (Fr.) Zerova ex Kalamees, East Europe, East Asia, sequence data available, see Hofstetter et al. 2014 (phylogeny, Lyophyllaceae).

Tricholomopsis Singer 1939, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. 33 species, type species *T. rutilans* (Schaeff.) Singer, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Razaq et al. 2012 (*T. flammula*), new spp. see Vauras 2009 (Estonia), Holec and Kolařík 2013c (Europe), Olariaga et al. 2015a (cryptic speciation), Cooper and Park 2016 (New Zealand), Holec et al. 2019 (Europe).

Tricholosporum Guzmán 1975, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, seven species, type species *T. goniospermum* (Bres.) Guzmán ex T.J. Baroni, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Liu et al. 2016b (China), Angelini et al. 2017 (*T. goniospermum*, phylogeny, Tricholomatineae), new spp. see Angelini et al. 2014 (Dominican Republic), Xu et al. 2018 (China).

Trichopsora Lagerh. 1892, Pucciniosiraceae, Pucciniales, Pucciniomycetes, one species, type species *T. tournefortiae* Lagerh., biotrophic on Boraginaceae (*Tournefortia*), terrestrial, Ecuador, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Trichosporon Behrend 1890, Trichosporonaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, 12 species, type species *T. ovoides* Behrend, yeast, on wood, soil, human skin, worldwide, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy), Takashima et al. 2018 (taxonomy, phylogeny).

Trichosporonoides Haskins & J.F.T. Spencer 1967, *incertae sedis*, *incertae sedis*, Tremellomycetes, sexual morph unknown, six species, type species *T. oedocephalis* Haskins & J.F.T. Spencer, worldwide, erythritol-producing, see Sawada et al. 2009 (erythritol production), Kirk et al. 2013 (genus accepted), sequence data available, see Rosa et al. 2009 (phylogeny).

Trigonosporomyces Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, one species, type species *T. hylophilus* (Van der Walt, D.B. Scott & Klift) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, isolated from insects, South Africa, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Trimitiella Dhingra 2008, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, one species, type species *T. indica* Dhingra, India, sequence data unavailable, see Dhingra and Singh 2008a (validation).

Trimorphomyces Bandoni & Oberw. 1983, Trimorphomycetaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, two species, type species *T. papilionaceus* Oberw. & Bandoni, yeast, basidiocarps gelatinous, mycoparasite, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Triodiomyces McTaggart & R.G. Shivas 2012, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, six species, type species *T. altilis* (Syd.) McTaggart & R.G. Shivas, plant parasites (columns or inflorescence) on *Triodia* spp. (Poaceae), Australia, saprobic yeast states on plants, cultures available, sequence data available, see McTaggart et al. 2012b (taxonomy), Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Triphragmiopsis Naumov 1914 (= *Nyssopsorella* Syd. 1921), Raveneliaceae, Pucciniales, Pucciniomycetes, three species, type species *T. jeffersoniae* Naumov, biotrophic on Berberidaceae, Pinaceae, Ranunculaceae, China, Europe, Russia, Korea, sequence data unavailable, see Kirk et al. 2013 (genus accepted), Ono 2013b (microcyclic life cycle of *T. jeffersoniae*).

Triphragmium Link 1825, Raveneliaceae, Pucciniales, Pucciniomycetes, seven species, type species *T. ulmariae* (DC.) Link, biotrophic on Fabaceae, Rosaceae, terrestrial, Europe, Japan, see Kirk et al. 2013 (genus accepted), sequence data availale, see Yun et al. 2011 (phylogeny, *Frommeëlla* revisited).

Tritirachium Limber 1940, Tritirachiaceae, Tritirachiales, Tritirachiomycetes, four species, type species *T. dependens* Limber, worldwide, some species pathogenic for hunman, see Moreaes et al. 2010 (*T. oryzae*), sequence data available, see Vu et al. 2019 (DNA sequences), sequence data available, see Beguin et al. 2012 (phylogeny), new spp. see Manohar et al. 2014 (Arabian sea).

Trogia Fr. 1836, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, c. 94 species, type species *T. aplorutis* (Mont.) Fr., tough texture with clitocyboid to omphalinoid habit and possessing the ability of reviving *in situ*, worldwide, saprotrophic, some species lethal, see Shi et al. 2012 (China), Zhou et al.

2012 (compounds), Kirk et al. 2013 (genus accepted), sequence data available, see Kumar and Manimohan 2009a (India), Mi et al. 2016 (*T. venenata*), new spp. see Yang et al. 2012b (China), Dutta et al. 2017 (India).

Tropicoporus L.W. Zhou, Y.C. Dai & Sheng H. Wu 2015, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, twelve species, type species *T. excentrodendri* L.W. Zhou & Y.C. Dai, sequence data available, see Zhou et al. 2016e (morphology), new spp. see Coelho et al. 2016 (Brazil), Wu et al. 2015c (Thailand).

Trullella Zmitr. 2018, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, six species, type species *T. dentipora* (Ryvarden & Iturr.) Zmitr., wood-decaying, worldwide, sequence data available, see Miettinen and Ryvarden 2016 (taxonomy, phylogeny, as *Trulla*), Zmitrovich 2018a (taxonomy).

Truncocolumella Zeller 1939, Suillaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *T. citrina* Zeller, ectomycorrhizal, North America, see Kirk et al. 2013 (genus accepted), sequence data available, see Grubisha et al. 2001 (phylogeny).

Truncospora Pilát 1953, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, 23 species, type species *T. ochroleuca* (Berk.) Pilát (current namne: *Perenniporia ochroleucus* Berk), poroid hymenophore, wood-rotting, white rot, widespread, sequence data available, see Zhao et al. 2016f (phylogeny, North America), new spp. see Decock 2011 (morphology, new combination, São Tome, Africa), Spirin et al. 2015b (phylogeny, East Asia, Caribbean, Mexico, USA, Spain), new combinations see Zmitrovich 2018a (taxonomy).

Tsugacorticium Nakasone & Burds. 2011, *incertae sedis*, Hymenochaetales, Agaricomycetes, asexual morph unknown, one species, type species *T. kenaicum* Nakasone & Burds., Alaska, sequence data available, see Nakasone and Burdsall 2012 (monograph).

Tubaria (W.G. Sm.) Gillet 1876, Tubariaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 21 species, type species *T. furfuracea* (Pers.) Gillet, see Kirk et al. 2013 (genus accepted), sequence data available, see Matheny et al. 2007a (phylogeny), Zhang and Bau 2010 (China), Petersen et al. 2010 (phylogeny, accepted in

Tubariaceae), Antonín et al. 2012a (Czech Republic), Horak 2018 (monograph, New Zealand, new spp.), new spp. see Lathal et al. 2016a (India).

Tubariella E. Horak & Hauskn. 2002, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *T. rhizophora* E. Horak & Hauskn., Papua New Guinea, sequence data unavailable, see Kirk et al. 2008.

Tubariomyces Esteve-Rav. & Matheny 2010, Inocybaceae, Agaricales, Agaricomycetes, asexual morph unknown, three species, type species *T. inexpectatus* (M. Villarreal, Esteve-Rav., Heykoop & E. Horak) Esteve-Rav. & Matheny, Mediterranean Europe, Northern Africa, basidioma tubarioid, sequence data available, see Alvarado et al. 2010 (taxonomy), new spp. see Vizzini et al. 2013b (Italy), Matheny and Bougher 2017 (Australia).

Tubariopsis R. Heim 1931, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *T. torquipes* R. Heim, Madagascar, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Tuberculina Tode ex Sacc. 1880, Helicobasidiaceae, Helicobasidiales, Pucciniomycetes, c. 26 species, type species *T. persicina* (Ditmar) Sacc. [current name: *Helicobasidium purpureum* (Tul.) Pat.], worldwide, sequence data available, new spp. see Zhao et al. 2017d (China).

Tubosaeta E. Horak 1967, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, six species, type species *T. brunneosetosa* (Singer) E. Horak, stipitate-pileate, presumably ectomycorrhizal, tropical Africa, China?, see Zang 2001, Kirk et al. 2013 (genus accepted), sequence data available, see Vu et al. 2019 (DNA barcodes).

Tubulicium Oberw. 1965, Hydnodontaceae, Trechisporales, Agaricomycetes, asexual morph unknown, seven species, type species *T. vermiferum* (Bourdot) Oberw., wood-decaying, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2004 (phylogeny).

Tubulicrinis Donk 1956, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, 34 species, type species *T. glebulosus* (Fr.) Donk, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson et al. 2006 (phylogeny).

Tubulicrinopsis Hjortstam & Kotir. 2007, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, four species, type species *T. ellipsospora* Kotir., Hjortstam & M. Kulju, Europe, sequence data unavailable, see Kirk et al. 2008.

Tulasnella J. Schröt. 1888, Tulasnellaceae, Cantharellales, Agaricomycetes, asexul morph *Epulorhiza* R.T. Moore 1987, c. 70 species, type species *T. lilacina* J. Schröt., saprobes, ecological strategies highly diverse: saprobic, orchid mycorrhiza, ectomycorrhizal, parasitic on amoebae, associated with liverworts, wood-rotting, on other fungi, intrahymenial, endophytic in roots, widespread, see Kirk et al. 2013 (genus accepted), Oberwinkler et al. 2017 (distributional and ecological review), sequence data available, see Moncalvo et al. 2006 (phylogeny, cantharelloid clade), Veldre et al. 2013 (phylogeny, Ceratobasidiaceae, evolution), new spp. and species delimitation see Cruz et al. 2011, 2014 (tropical Andean forest, cryptic species), Almeida et al. 2014 (Brazil, as *Epulorhiza*), Linde et al. 2014, 2017 (species delineation, Australia), Cruz et al. 2016 (taxonomic revision), Solís et al. 2017 (Spain), Fujimori et al. 2019 (Japan).

Tulostoma Pers. 1794, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 83 species, type species *T. brumale* Pers., worldwide, dry environment, stalked puffballs, see de Diego Calonge and Esteban 2007 (Spain), Hanson 2008 (Sweden), Piña et al. 2010 (America), Chakraborty et al. 2013 (India), Kirk et al. 2013 (genus accepted), Trierveiler-Pereira et al. 2017 (*T. dumeticola*), sequence data available, see Larsson and Jeppson 2008 (phylogeny), new spp. see Hernández Caffot et al. 2011 (Argentina), Hussain et al. 2016 (Pakistan), Jeppson et al. 2017 (Europe), Hernández-Navarro et al. 2018 (Mexico).

Tumidapexus D.A. Crawford 1954, Aphelariaceae, Cantharellales, Agaricomycetes, asexual morph unknown, one species, type species *T. ravus* D.A. Crawford, saprobes, wood-decaying, found in New Zealand, genus in need of modern interpretation, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Turbinellus Earle 1909, Gomphaceae, Gomphales, Agaricomycetes, asexual morph unknown, five species, type species *T. floccosus* (Schwein.) Earle ex Giachini & Castellano, terrestrial, some species ectomycorrhizal, some species edible (*T. floccosus*), see Lamus et al. 2015 (central Mexico), sequence data available, see Giachini et al. 2010 (phylogeny), Giachini and Castellano 2011 (taxonomy).

Turmalinea Orihara & N. Maek. 2015, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, four species, type species *T. persicina* Orihara, sequestrate, ectomycorrhizal, Asia, sequence data available, see Orihara et al. 2016b (taxonomy).

Tygervalleyomyces Crous 2017, Typhulaceae, Agaricales, Agaricomycetes, sexual morph unknown, one species, type species *T. podocarpi* Crous, South Africa, sequence data available, see Crous et al. 2017b (taxonomy).

Tylocinum Y.C. Li & Zhu L. Yang 2016, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, one species, type species *T. griseolum* Yan C. Li & Zhu L. Yang, basidioma stipitate-pileate with tubular hymenophore, sequence data available, see Wu et al. 2016f (taxonomy, China).

Tylopilus P. Karst. 1881, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 100 species, type species *T. felleus* (Bull.) P. Karst., worldwide, some species edible (*T. alboater* (Schwein.) Murrill), see Kikuchi et al. 2009 (fruiting body formation), Dai et al. 2010b (edible mushrooms, China), Kirk et al. 2013 (genus accepted), sequence data available, see Gelardi et al. 2015c (phylogeny, China), new spp. see Osmundson and Halling 2010 (Costa Rica), Horak 2011 (revision), Sarwar et al. 2014 (Pakistan), Wu et al. 2016f (monograph, China), Magnago et al. 2017b (Brazil), Chakraborty et al. 2018 (Indian Himalaya), Liang et al. 2018 (China).

Tylospora Donk 1960, Atheliaceae, Atheliales, Agaricomycetes, asexual morph unknown, two species, type species *T. asterophora* (Bonord.) Donk, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Yamashiro et al. 2008 (phylogeny, Japan).

Tympanella E. Horak 1971, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *T. galanthina* (Cooke & Massee) E. Horak, New Zealand, basidioma gasteroid, see Kirk et al. 2013 (genus accepted), sequence data available, see Horak 2018 (New Zealand).

Typhrasa Örstadius & E. Larss. 2015, Psathyrellaceae, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *T. gossypina* (Bull.) Örstadius & E. Larss., Europe, North America, on wood or on soil, sequence data available, see Örstadius et al. 2015 (taxonomy).

Typhula (Pers.) Fr. 1818, Typhulaceae, Agaricales, Agaricomycetes, some species asexual morph *Sclerotium* Tode 1790, c. 100 species, type species *T.*

phaccorrhiza (Reichard) Fr., seven subgenera: *Typhula* Fr., *Pistillina* Quél., *Gliocoryne* Marie, *Pistillaria* Fr., *Typhulina* Berthier et Khurana, *Microtyphula* Berthier, and *Cnazonaria* Corda, saprobes or pathogens, terrestrial, worldwide of cold climate, some pathogenic species (snow molds), Typhula blight (*T. incarnata* Lach, *T. ishikariensis* S. Imai, *T. japonica* Terui, *T. phaccorrhiza* (Reichard) Fr., *T. trifolii* Rostr., *T. variabilis* Riess), see Hoshino et al. 2009a (ecophysiological characteristics), Kirk et al. 2013 (genus accepted), sequence data available, see Hoshino et al. 2009a, Gafforov and Hoshino 2015, Ikeda et al. 2015, new spp. see Olariaga et al. 2008 (herbarium specimens), Olaria and Salcedo 2009 (Spain), Hoshino et al. 2009b (seashore, Japan).

Tyromyces P. Karst. 1881, Incrustoporiaceae, Polyporales, Agaricomycetes, asexual morph unknown, c. 41 species, type species *T. chioneus* (Fr.) P. Karst., the generic limit of *Tyromyces* is not currently settled (needs revision since genus shown to be polyphyletic), poroid hymenophore, wood-rotting, white rot, cosmopolitan, see Kirk et al. 2013 (genus accepted), sequence data available, see Miettinen and Rajchenberg 2012 (phylogeny), new spp. see Mata and Ryvarden 2010 (morphology, Costa Rica), Ryvarden and Iturriaga 2011 (morphology, Venezuela), Ryvarden 2012a, d 2016b, 2018a (morphology, Costa Rica, Colombia, Venezuela, Ethiopia, Kenya, Zimbabwe), Hyde et al. 2017b (phylogeny, Brazil), new combinations see Ryvarden 2012c, 2016a (morphology, type study, Brazil), Zmitrovich 2018a (taxonomy).

Udeniomyces Nakase & Takem. 1992, Mrakiaceae, Cystofilobasidiales, Tremellomycetes, sexual morph unknown, four species, type species *U. pyricola* (Stadelmann) Nakase & Takem., yeast, widespread, see Kurtzman et al. 2011 (taxonomy), cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny).

Udeniozyma Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, one species, type species *U. ferulica* (J.P. Samp. & Uden) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, aquatic, Portugal, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Ugola Adans. 1763, *incertae sedis*, Agaricales, Agaricomycetes, sexual morph *Asterophora* Ditmar 1809, three species, type species *U. physaroides* (Fr.) Redhead & Seifert, sequence data unavailable, see Kirk et al. 2008.

Uleiella J. Schröt. 1894, Uleiellaceae, Uleiellales, Ustilaginomycetes, two species, type species *U. paradoxa* J. Schröt., plant parasites (young inflorescences) on *Araucaria* spp. (Araucariaceae), Brazil, Chile, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, see Riess et al. 2016 (taxonomy, phylogeny).

Uncobasidium Hjortstam & Ryvarden 1978, *incertae sedis*, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *U. luteolum* Hjortstam & Ryvarden, corticioid basidioma, wood-rotting, widespread (Europe, South America), sequence data unavailable, see Gorjón et al. 2012a (new sp., morphology, Patagonian Andes of Argentina), Kirk et al. 2013 (genus accepted).

Uncol Buriticá & P.A. Rodr. 2000, Uncolaceae, Pucciniales, Pucciniomycetes, one species, type species *U. diazii* Buriticá & P.A. Rodr., biotrophic on Pteridophyta (Cyatheaceae), terrestrial, Colombia, see Cummins and Hiratsuka 2003 (excluded from Pucciniales).

Ungulidaedalea B.K. Cui, M.L. Han & Y.C. Dai 2016, Fomitopsidaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *U. fragilis* (B.K. Cui & M.L. Han) B.K. Cui, M.L. Han & Y.C. Dai, poroid hymenophore, wood-rotting, brown rot, China, sequence data available, see Han et al. 2016a (taxonomy, phylogeny, *Fomitopsis s. l*), Zmitrovich 2018a (taxonomy).

Unilacryma Shirouzu, Tokum. & Oberw. 2013, Unilacrymaceae, Unilacrymales, Dacrymycetes, asexual morph unknown, one species, type species *U. unispora* (L.S. Olive) Shirouzu, Tokum. & Oberw., wood-decaying, Asia (Japan), sequence data available, see Shirouzu et al. 2013b (taxonomy, phylogeny).

Uraecium Arthur 1933, *incertae sedis*, Pucciniales, Pucciniomycetes, twelve species, type species *U. holwayi* (Arthur) Arthur, worldwide, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Uredinella Couch 1937, Septobasidiaceae, Septobasidiales, Pucciniomycetes, two species, type species *U. coccidiophaga*, worldwide, sequence data available, see Henk and Vilgalys 2007 (phylogeny), Kirk et al. 2013 (genus accepted).

Uredinopsis Magnus 1893, Pucciniastraceae, Pucciniales, Pucciniomycetes, 30 species, type species *U. filicina* (Niessl) Magnus, biotrophic on *Pteridophyta* (Osmundaceae, Polypodiaceae), Pinaceae, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see McTaggart et al. 2014 (first record of

fern rust in Australia, phylogeny), Aime et al. 2018a (phylogeny, evolution with host, Pucciniales).

Uredo Pers. 1801 (= *Mapea* Pat. 1906, = *Nigredo* (Pers.) Roussel 1806, = *Peridipes* Buriticá & J.F. Hennen 1994, = *Rubigo* (Pers.) Roussel 1806, = *Trichobasis* Lév., in Orbigny 1849, = *Uredo* ** *Nigredo* Pers. 1801), *incertae sedis*, Pucciniales, Pucciniomycetes, asexual morph particularly of *Melampsora* Castagne 1843, *Puccinia* Per. 1974, *Uromyces* (Link) Unger 1833, ca. 600 species, type species *U. betae* Pers., biotrophic on many plant families, terrestrial, worldwide, see Kirk et al. 2013 (genus accepted), sequence data availale, see McTaggart et al. 2016b (phylogeny, Australia), Wang et al. 2015e (phylogeny), new spp. see Yepes and Céspedes 2008 (neotropics), Berndt 2009 (South Africa), Mohanan 2010 (Kerala), de Carvalho Jr and Hennen 2010 (new combinations), Hernández and Cline 2010 (replaced *Uredo spinulosa* Y. Ono, nom. illeg. with *Uredo dioscoreae-doryphorae*), Zhuang and Wei 2011, 2012, 2016 (China), Berndt and Wood 2012 (South Africa).

Uredopeltis Henn. 1908, Phakopsoraceae, Pucciniales, Pucciniomycetes, seven species, type species *U. congensis* Henn., biotrophic on Burseraceae, Euphorbiaceae, Rubiaceae, Tilliaceae, terrestrial, probably circumglobal in tropics, see Kirk et al. 2013 (genus accepted), new spp. see Mohanan 2010 (Kerala).

Urocystis Rabenh. ex Fuckel 1870, Urocystidaceae, Urocystidales, Ustilaginomycetes, 166 species, type species *U. occulta* (Wallr.) A.A. Fisch. Waldh., plant parasites (leaves, stems, sometimes in flowers, fruits, roots) on dicots and monocots, widespread, see Kirk et al. 2013 (genus accepted), cultures available, sequence data available, Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Uromyces (Link) Unger 1833, nom. cons., see Art. 14, Pucciniaceae, Pucciniales, Pucciniomycetes, (= *Alveomyces* Bubák 1914, = *Capitularia* Rabenh. 1851, = *Coeomurus* Gray 1821, = *Dichlamys* Syd. & P. Syd. 1920 [1919], = *Groveola* Syd. 1921, = *Haplopyxis* Syd. & P. Syd. 1920 [1919], = *Haplotelium* Syd. 1922, = *Hypodermium* subgen. *Uromyces* Link 1816 [1815], = *Klebahnia* Arthur 1906, = *Nielsenia* Syd. 1921, = *Ontotelium* Syd. 1921, = *Poliotelium* Syd. 1922, = *Puccinella* Fuckel 1860, = *Pucciniola* L. Marchand 1829, = *Teleutospora* Arthur & Bisby 1921, = *Telospora* Arthur 1906, = *Trochodium* Syd. & P. Syd. 1920 [1919], = *Uromycopsis*

Arthur 1906), c. 1500 species, type species *U. appendiculatus* (Pers.) Link, see Kirk et al. 2013 (genus accepted), sequence data available, see Chung et al. 2008 (identification with PCR), Link et al. 2014 (genome sequence), Souza et al. 2015 (new combination, molecular analysis, key to *Uromyces* on Loranthaceae), new spp. see Chung et al. 2008 (China), McKenzie 2008 (new combinations, New Zealand), Salazar Yepes and Buriticá Céspedes 2008 (neotropics), Berndt and Baiswar 2009 (India), Thaung 2009 (Burma), Walker and van der Merwe 2009 (Australia), Zhuang and Wei 2011 (China), Berndt 2013a (key to species on Cucurbitaceae), Bahcecioglu 2014 (Turkey), Sánchez and Piepenbring 2014 (key to species on Loranthaceae), Souza et al. 2015 (Brazil).

Uromycladium McAlpine 1905 (=*Macalpinia* Arthur 1906), Pileolariaceae, Pucciniales, Pucciniomycetes, eleven species, type species *U. simplex* McAlpine, biotrophic on Fabaceae (*Acacia*, *Paraserianthes*), gall rust, terrestrial, Australia, South East Asia, South Pacific, New Zealand, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Berndt 2010b (Australia), Doungsa-ard et al. 2015 (molecular analysis, key to genus, South-East Asia).

Uropyxis J. Schröt. 1875 (= *Calliospora* Arthur 1905), Uropyxidaceae, Pucciniales, Pucciniomycetes, 15 species, type species *U. amorphae* (M.A. Curtis) J. Schröt., biotrophic on Bignoniaceae, Cucurbitaceae, Fabaceae, terrestrial, Africa, North, South and Central America, China, sequence data unavailable see Kirk et al. 2013 (genus accepted), Ordoñez and Barnes 2017 (morphology).

Ustacystis Zundel 1945, Urocystidaceae, Urocystidales, Ustilaginomycetes, two species, type species *U. waldsteiniae* (Peck) Zundel, parasitic on *Waldsteinia* (Rosaceae), see Vánky 2009 (*U. waldsteiniae*), sequence data available, see Begerow et al. 2006 (phylogeny).

Ustanciosporium Vánky 1999, Anthracoideaceae, Ustilaginales, Ustilaginomycetes, 22 species, type species *U. rhynchosporae* Vánky, plant parasite (spikelet) on Cyperaceae, widespread, cultures available, see Kirk et al. 2013 (genus accepted), sequence data available, see Piepenbring et al. 1999 (sequences data), Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Ustilago (Pers.) Roussel 1806, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, 170 species, type species *U. hordei* (Pers.) Lagerh., plant parasites (inflorescence, flowers, leaves) on Poaceae, widespread, saprobic yeast states on plants, see Kirk et al.

2013 (genus accepted), cultures available, sequence data available, see Begerow et al. 2000 (phylogeny), Vánky 2012 (overview), McTaggart et al. 2012a, 2016c (taxonomy).

Ustilentyloma Savile 1964, Ustilentylomataceae, Microbotryales, Microbotryomycetes, four species, type species *U. pleuropogonis* Savile, sequence data available, new combination see Wang et al. 2015e (phylogeny, taxonomy).

Vandasia Velen. 1922, *incertae sedis*, Phallales, Agaricomycetes, asexual morph unknown, one species, type species *V. rosea* Velen., terrestrial, sequence data unavailable, see Kirk et al. 2008.

Vanderbylia D.A. Reid 1973, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, seven species, type species *V. vicina* (Lloyd) D.A. Reid, poroid hymenophore, wood-rotting, white rot, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2013 (phylogeny), Zmitrovich 2018a (taxonomy).

Vankya Ershad 2000, Urocystidaceae, Urocystidales, Ustilaginomycetes, three species, type species *V. ornithogali* (J.C. Schmidt & Kunze) Ershad, plant parasites (leaves) on Liliaceae, North America, Asia, Europe, cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy), Wang et al. 2015c (taxonomy, phylogeny).

Vanrija R.T. Moore.1980 (= *Asterotremella* H.J. Prillinger, K. Lopandic, K. Sterflinger, E. Metzger & R. Bauer; = *Asterotremella* Prillinger, Lopandic & Sugita), Trichosporonaceae, Trichosporonales, Tremellomycetes, sexual morph unknown, nine species, type species *V. humicola* (Dasz.) R.T. Moore, yeast, soils, on wood, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy, phylogeny), Takashima et al. 2018 (taxonomy, phylogeny), new spp. see Xi et al. 2019 (China).

Vanromburghia Holterm. 1898, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *V. silvestris* Holterm., Indonesia, litter decay, sequence data unavailable, see Kirk et al. 2008.

Vararia P. Karst. 1898, Peniophoraceae, Russulales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *V. investiens* (Schwein.) P. Karst., worldwide, wood-decaying, see Karasiński 2010 (Polish resupinate Russulales, key), Kirk et al. 2013 (genus accepted), sequence data available, see and He 2016b (phylogeny, China), new spp. see Samita et al. 2012 (India).

Veloporphyrellus L.D. Gómez & Singer 1984, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, seven species, type species *V. pantoleucus* L.D. Gómez & Singer, stipitate-pileate, North and Central America, southeastern Asia, Africa, see Kirk et al. 2013 (genus accepted), sequence data available, see Li et al. 2014g (phylogeny), Wu et al. 2016f (taxonomy, China).

Veluticeps (Cooke) Pat. 1894, Gloeophyllaceae, Gloeophyllales, Agaricomycetes, asexual morph unknown, twelve species, type species *V. berkeleyana* Cooke, wood-decaying, cause a brown rot of wood, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see He and Li 2013a (China), Yang et al. 2016a (China).

Verrucospora E. Horak 1967, *incertae sedis*, Agaricales, Agaricomycetes, asexual morph unknown, two species, type species *V. verrucispora* (Beeli) E. Horak, Africa, Thailand, see Kirk et al. 2013 (genus accepted), Sysouphanthong et al. 2013b (Thailand), sequence data available, see Matheny et al. 2006 (phylogeny).

Vesiculomyces E. Hagstr. 1977, Peniophoraceae, Russulales, Agaricomycetes, one species, type species *V. citrinus* (Pers.) E. Hagstr., resupinate, wood-rotting, sequence data available, see Larsson and Larsson 2003 (phylogeny), Miller et al. 2006 (phylogeny).

Violaceomyces Albu, Toome & Aime 2015, Violaceomycetaceae, Violaceomycetales, Ustilaginomycetes, one species, type species *V. palustris* S.A. Albu, M. Toome & M.C. Aime, known only from saprobic states, plant material, cultures available, sequence data available, see Albu et al. 2015 (taxonomy).

Vishniacozyma X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout 2015, Bulleribasidiaceae, Tremellales, Tremellomycetes, sexual and asexual morphs known, eleven species, type species *V. carnescens* (Verona & Luchetti) X.Z. Liu, F.Y. Bai, M. Groenew. & Boekhout, yeast, mycoparasite, yeast morphs on plant material, worldwide, cultures and sequence data available, see Liu et al. 2015b (taxonomy and phylogeny), Yurkov and Kurtzman 2019 (new spp.).

Volvariella Speg. 1898, Pluteaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 50 species, type species *V. argentina* Speg., worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Justo et al. 2011b (phylogeny, Pluteaceae), Vizzini et al. 2011c (phylogeny), Bao et al. 2013 (genome), new spp. see

Menolli and Capelari 2008 (Brazil), Seok et al. 2009 (Korea), Justo and Castro 2010a, b (Iberian Peninsula), Senthilarasu et al. 2012 (India), Kaur et al. 2013c (India), Kaur and Singh 2014 (India), Xu et al. 2015b (China), Sá and Wartchow 2016 (Brazil).

Volvocisporium Begerow, R. Bauer & Oberw. 2001, Volvocisporiaceae, Violaceomycetales, Ustilaginomycetes, two species, type species *V. triumfetticola* (M.S. Patil) Begerow, R. Bauer & Oberw., plant parasites (leaves) on Malvacea, India, Namibia, cultures unavailable, sequence data available, see Begerow et al. 2001b, 2014 (taxonomy, phylogeny), Wang et al. 2015c (taxonomy, phylogeny).

Volvopluteus Vizzini, Contu & Justo 2011, Pluteaceae, Agaricales, Agaricomycetes, asexual morph unkown, four species, type species *V. gloiocephalus* (DC.) Vizzini, Contu & Justo, Europe, North America, sequence data available, see Justo et al. 2011a (taxonomy, phylogeny).

Vonarxula Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, one species, type species *V. javanica* (Arx & Weijman) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, plant material, Indonesia, cultures and sequence data available, see Wang et al. 2015e (taxonomy, phylogeny).

Vuilleminia Maire 1902, Vuilleminiaceae, Corticiales, Agaricomycetes, asexual morph unknown, eight species, type species *V. comedens* (Nees) Maire, wood-decaying, widespread, see Kirk et al. 2013 (genus accepted), sequence data available, see Ghobad-Nejhad et al. 2010 (phylogeny), new spp. see Ghobad-Nejhad and Ginns 2012 (North America to East Asia, Siberia, and Finland), Ghobad-Nejhad and Duhem 2014 (France).

Vustinia Kachalkin, Turchetti & Yurkov 2019, Mrakiaceae, Cystofilobasidiales, Tremellomycetes, sexual morph unknown, one species, type species *V. terrae* Kachalkin, Turchetti & Yurkov, yeast, psychrophilic, soil, Eruope, Asia, cultures and sequence data available, see Kachalkin et al. 2019 (description, phylogeny).

Waitea Warcup & P.H.B. Talbot 1962, Corticiaceae, Corticiales, Agaricomycetes, asexual morph as *Rhizoctonia zeae* Voorhees, one species, type species *W. circinata* Warcup & P.H.B. Talbot, saprotroph or plant parasitic, widespread, see Kirk et al. 2013 (genus accepted), Jayawardena et al. 2019 (full notes, phylogeny), sequence data available, Depriest et al. 2005 (phylogeny), Ghobad-Nejhad et al. 2010 (phylogeny).

Wakefieldia Corner & Hawker 1953, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, two species, type species *W. striaespora* Corner & Hawker, sequestrate, Europe, Asia, see Kirk et al. 2013 (genus accepted), sequence data available, see Kaounas et al. 2011 (*W. macrospora*, Greece).

Wallemia Johan-Olsen 1887, Wallemiaceae, Wallemiales, Wallemiomycetes, eight speices, type species *W. ichthyophaga* Johan-Olsen, worldwide, food contamination agent, see Zajc and Gunde-Cimerman 2018 (contamination of food), sequence data available, new spp. see Jančič et al. 2015 (*W. sebi* species complex), Díaz-Valderrama et al. 2017 (South America).

Websdanea Vánky 1997, Websdaneaceae, Ustilaginales, Ustilaginomycetes, one species, type species *W. lyginiae* (Websdane, Sivasith., K.W. Dixon & Pate) Vánky, plant parasite on *Lyginia barbata* (Anarthriaceae), Australia, see Kirk et al. 2013 (genus accepted), cultures unavailable, sequence data available, see Begerow et al. 2014 (taxonomy), Wang et al. 2015c (phylogeny, taxonomy).

Wielandomyces Raithelh. 1988, Bolbitiaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *W. robustus* Raithelh., Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Woldmaria W.B. Cooke 1961, Niaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *W. filicina* (Peck) Knudsen, Europe, North America, see Kirk et al. 2013 (genus accepted), sequence data available, see Bodensteiner et al. 2004 (phylogeny).

Wolfiporia Ryvarden & Gilb. 1984, Laetiporaceae, Polyporales, Agaricomycetes, asexual morph *Pachyma* Fr. 1822, six species (needs revision since genus shown to be polyphyletic, see Hussein et al. 2018), type species *W. cocos* (F.A. Wolf) Ryvarden & Gilb., widespread, wood-rotting, sclerotium-forming (*W. cocos*), see Kirk et al. 2013 (genus accepted), Zmitrovich 2018a (taxonomy), sequence data available, see Lindner and Banik 2008 (phylogeny, North America), Floudas et al. 2012 (genome, *W. cocos*), some species edible or medicinal use, see Dai et al. 2009b (medicinal mushrooms, China), see Wang et al. 2013c (Mycology, cultivation, traditional uses, phytochemistry and pharmacology), new spp. see Tibpromma et al. 2017 (phylogeny, China).

Wrightoporia Pouzar 1966, Bondarzewiaceae, Russulales, Agaricomycetes, asexual morph unknown, 32 species, type species *W. lenta* (Overh. & J. Lowe) Pouzar,

worldwide, wood-decaying, white rot, see Kirk et al. 2013 (genus accepted), sequence data available, see Chen et al. 2016b (molecular systematics), new sp. see Chen and Yu 2012 (South China), Jang et al. 2013a (South Korea), Chen and Cui 2014a (China).

Wrightoporiopsis Y.C. Dai, Jia J. Chen & B.K. Cui 2015, Hericiaceae, Russulales, Agaricomycetes, asexual morph unknown, five species, type species *W. neotropica* (Ryvarden) Y.C. Dai, Jia J. Chen & B.K. Cui, worldwide, wood-decaying, sequence data available, see Chen et al. 2016b (phylogeny).

Xanthagaricus (Heinem.) Little Flower, Hosag. & T.K. Abraham 1997, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, twelve species, type species *X. flavidorufus* (Berk. & Broome) Little Flower, Hosag. & T.K. Abraham, agaricoid, tropical, see Kirk et al. 2013 (genus accepted), sequence data available, new spp. see Hosen et al. 2017, 2018a (Asia), Hussain et al. 2018a (Pakistan), Kumla et al. 2018 (Thailand), Wang et al. 2018b (China).

Xanthoconium Singer 1944, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, ten species, type species *X. stramineum* (Murrill) Singer, stipitate-pileate, presumably ectomycorrhizal, North America, Asia, see Kirk et al. 2013 (genus accepted), some species edible, see Bessette et al. 2017 (Eastern North America), sequence data available, see Wu et al. 2016e (China), Liang et al. 2017b (China).

Xanthoporia Murrill 1916, Hymenochaetaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, three species, type species *X. andersonii* (Ellis & Everh.) Murrill, sequence data available, see Tura et al. 2011 (phylogeny).

Xanthoporus Audet 2010, Steccherinaceae, Polyporales, Agaricomycetes, asexual morph unknown, two species, type species *X. peckianus* (Cooke) Audet, stipitate basidioma, poroid hymenophore, terrestrial, widespread (Europe, North America), see Audet 2010 (taxonomy), sequence data available, see Audet 2010 (phylogeny).

Xenasma Donk 1957, Xenasmataceae, Russulales, Agaricomycetes, asexual morph unknown, 16 species, type species *X. rimicola* (P. Karst.) Donk, two subgenera, *Xenasma* and *Tubulixenasmopsis*, four sections, wood-decaying, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Binder et al. 2005 (phylogeny).

Xenasmatella Oberw. 1965, Xenasmataceae, Russulales, Agaricomycetes, asexual morph unknown, 14 species, type species *X. subflavidogrisea* (Litsch.) Oberw. ex Jülich, wood-decaying, Europe, see Kirk et al. 2013 (genus accepted), sequence data

available, see Rosenthal et al. 2017 (ecology, corticioid fungi in North American pinaceous forests), new combination see Duhem et al. 2010.

Xenodochus Schltdl. 1826, Phragmidiaceae, Pucciniales, Pucciniomycetes, two species, type species *X. carbonarius* Schltdl., biotrophic on Rosaceae (*Sanguisorba*), terrestrial, circumboreal, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Xenolachne D.P. Rogers 1947, *incertae sedis*, Tremellales, Tremellomycetes, asexual morph unknown, two species, type species *X. flagellifera* D.P. Rogers, on wood, North America, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Xenosperma Oberw. 1965, Xenasmataceae, Russulales, Agaricomycetes, asexual morph unknown, four species, type species *X. ludibundum* (D.P. Rogers & Liberta) Oberw., wood-decaying, Europe, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Xenostele Syd. & P. Syd. 1921, Pucciniaceae, Pucciniales, Pucciniomycetes, four species, type species *X. echinacea* (Berk.) Syd. & P. Syd., Asia, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Xeroceps Audet 2010, *incertae sedis*, Russulales, Agaricomycetes, asexual morph unknown, two species, type species *X. skamania* (Murrill) Audet, two species, worldwide, terrestrial, see Audet et al. 2010 (taxonomy), sequence data available, see Audet 2010.

Xerocomellus Šutara 2008, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, 17 species, type species *X. chrysenteron* (Bull.) Šutara, stipitate-pileate, ectomycorrhizal, worldwide, edible spp. see Boa 2004 (edible fungi), Šutara 2008 (genus accepted), new spp. see Cours et al. 2016a (Spain), Hernández-Restrepo et al. 2016 (Pakistan), Simonini et al. 2016 (Italy), Wu et al. 2016f (China).

Xerocomus Quél. 1887, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, c. 120 species, type species *X. subtomentosus* (L.) Quél., stipitate-pileate, ectomycorrhizal, worldwide, edible spp. see Boa 2004 (edible fungi), new spp. South America see De Meijer 2008, Husbands et al. 2013; Asia see Yan et al. 2013, Das et al. 2016, Wu et al. 2016f, Chakraborty et al. 2017a; Australia see Halling et al. 2015, new combinations see Horak 2011, many species in need of revision.

Xerocoprinus Maire 1907, Agaricaceae, Agaricales, Agaricomycetes, asexual morph unknown, one species, type species *X. arenarius* (Pat.) Maire, Africa, sequence data unavailable, see Kirk et al. 2013 (genus accepted), genus in need of revision.

Xeromphalina Kühner & Maire 1934, Mycenaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 32 species, type species *X. campanella* (Batsch) Kühner & Maire, worldwide, see Antonín and Noordeloos 2004 (Europe), Noordeloos 2012b (key), Kirk et al. 2013 (genus accepted), sequence data available, see Dogan and Karadelev 2009 (Europe), Aldrovandi et al. 2015 (*X. campanella/kauffmanii* complex), new spp. see Esteve-Raventós et al. 2010 (Mediterranean).

Xerotus Fr. 1828, *incertae sedis*, *incertae sedis*, Agaricomycetes, asexual morph unknown, four species, type species *X. afer* Fr., wood-rotting, Africa, sequence data available, see Vu et al. 2019 (sequence data).

Xerula Maire 1933, Physalacriaceae, Agaricales, Agaricomycetes, asexual morph unknown, c. 17 species, type species *X. pudens* (Pers.) Singer, worldwide, see Kirk et al. 2013 (genus accepted), sequence data available, see Petersen 2008a, b (taxonomy, basidiospores, Australia, New Zealand), Wang et al. 2008a (systematic study), Liu et al. 2009 (Thailand), Petersen and Hughes 2010 (monograph).

Xylobolus P. Karst. 1881, Stereaceae, Russulales, Agaricomycetes, asexual morph unknown, nine species, type species *X. frustulatus* (Pers.) P. Karst., worldwide, wood-decaying, see Kirk et al. 2013 (genus accepted), sequence data available, see Larsson and Larsson 2003 (phylogeny).

Xylodon (Pers.) Gray 1821, Schizoporaceae, Hymenochaetales, Agaricomycetes, asexual morph unknown, c. 60 species, type species *X. quercinus* (Pers.) Gray, see Kirk et al. 2013 (genus accepted), sequence data available, see Riebesehl and Langer 2017 (*Hyphodontia s. l.*, new combinations, keys, phylogeny).

Xylophallus (Schltdl.) E. Fisch. 1933, Phallaceae, Phallales, Agaricomycetes, asexual morph unknown, two species, type species *X. xylogenus* (Mont.) E. Fisch., terrestrial, Neotropics, wood-decaying, sequence data available, see Crous et al. 2018b (phylogeny, morphology).

Yamadamyces Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, Kriegeriaceae, Kriegeriales, Microbotryomycetes, sexual morph unknown, one species, type species *Y. rosulatus* (Golubev & Scorzetti) Q.M. Wang, F.Y. Bai, M. Groenew. &

Boekhout, yeast, psychrophilic, plant material, Europe, cultures and sequence data available, see Wang et al. 2015e (taxonomy and phylogeny).

Yelsemia J. Walker 2001, Melanotaeniaceae, Ustilaginales, Ustilaginomycetes, four species, type species *Y. arthropodii* J. Walker, plant parasites (various plant parts) on Anthericaceae, Byblidaceae, Campanulaceae, Droseraceae, North America, Southeast Asia, Australasia, cultures unavailable, sequence data unavailable, see Begerow et al. 2014 (taxonomy).

Ypsilospora Cummins 1941, Raveneliaceae, Pucciniales, Pucciniomycetes, asexual morph *Uraecium* Arthur 1933, *Uredo* Pers. 1801, three species, type species *Y. baphiae* Cummins, biotrophic on Fabaceae, terrestrial, Africa (Ghana, Ivory Coast, Nigeria, Sierra Leone), Central and South America (Argentina, Brazil, Costa Rica, El Salvador, Guatemala), sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Yuchengia B.K. Cui & K.T. Steffen 2013, Polyporaceae, Polyporales, Agaricomycetes, asexual morph unknown, one species, type species *Y. narymica* (Pilát) B.K. Cui, C.L. Zhao & K.T. Steffen, poroid hymenophore, wood-rotting, white rot, widespread (Asia, Europe, North America), sequence data available, see Zhao et al. 2013b (taxonomy, phylogeny).

Yunchangia L. Guo & B. Xu 2013, Ustilaginaceae, Ustilaginales, Ustilaginomycetes, one species, type species *Y. puccinelliae* L. Guo & B. Xu, plant parasite (leaves) on *Puccinellia* spp. (Poaceae), China, cultures unavailable, sequence data available, see Guo and Xu 2013 (taxonomy).

Yunzhangia Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout 2015, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, two species, type species *Y. auriculariae* (Nakase) Q.M. Wang, F.Y. Bai, M. Groenew. & Boekhout, yeast, worldwide, cultures and sequence data available, see Wang et al. 2015e, Kachalkin et al. 2019 (taxonomy, phylogeny).

Yurkovia Mašínová, A. Pontes, J.P. Samp. & Baldrian 2016, *incertae sedis*, *incertae sedis*, Microbotryomycetes, sexual morph unknown, one species, type species *Y. mendeliana* Mašínová, A. Pontes, J.P. Samp. & Baldrian, yeast, temperate forest soil, Eruope, cultures and sequence data available, see Mašínová et al. 2017 (taxonomy), Kachalkin et al. 2019 (new spp.).

Zaghouania Pat. 1901 (= *Cystospora* E.J. Butler), Pucciniaceae, Pucciniales, Pucciniomycetes, two species, type species *Z. phillyreae* Pat., biotrophic on Oleaceae, terrestrial, Tunisia, India, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Zangia Y.C. Li & Zhu L. Yang 2011, Boletaceae, Boletales, Agaricomycetes, asexual morph unknown, six species, type species *Z. roseola* (W.F. Chiu) Y.C. Li & Zhu L. Yang, stipitate-pileate, southern China, sequence data available, see Li et al. 2011b (taxonomy).

Zhuliangomyces Redhead 2019, Amanitaceae, Agaricales, Agaricomycetes, asexual morph unknown, five species, type species *Z. olivaceus* (Zhu L. Yang, Y.Y. Cui & Q. Cai) Redhead, worldwide, sequence data available, see Cui et al. 2018 (taxonomy, phylogeny, Amanitaceae, China), Redhead 2019 (taxonomy).

Zundeliomyces Vánky 1987, Microbotryaceae, Microbotryales, Microbotryomycetes, one species, type species *Z. polygoni* Vánky, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

Zygogloea P. Roberts 1994, *incertae sedis*, *incertae sedis*, Pucciniomycotina, asexual morph unknown, one species, type species *Z. gemellipara* P. Roberts, British Isles, Belgium, Netherlands, sequence data unavailable, see Kirk et al. 2013 (genus accepted).

2.4 Discussions

2.4.1 Notes and outline of the Basidiomycota

It is a significant challenge to keep track of names, name changes and synonyms across the whole Basidiomycota. Our work provides an overview of valid, currently used genera of Basidiomycota published so far in a single document. This work would greatly promote the establishment of a robust Basidiomycota taxonomic system by latter updates.

The outline includes 1926 genera with 1263 synonyms. For the 1926 accepted genera, we provided a short note for each genus including information on several sources such as distribution, life mode, important species and sequence data. Sequence data is one of the key aspects in our notes which was supported by citing the most recently (published after 2008) molecular studies or the important past molecular studies (published before 2008). We found that 599 genera in Basidiomycota to lack sequence data in public sequence repositories, which means nearly one third of the genera in Basidiomycota are not included in the molecular systematic study.

According to the latest version of Ainsworth & Bisby's Dictionary of the Fungi (Kirk et al. 2008), there are three subphyla, 16 classes, 52 orders, 177 families, 1589 genera and 31515 spp. in Basidiomycota. In this study, the outline updates these numbers to four subphyla, 18 classes, 68 orders, 241 families, 1926 genera and 41270 species in Basidiomycota. Agaricomycotina (30788 species) embrace most of the species in Basidiomycota and include three classes, 29 orders, 150 families and 1514 genera. *Russula*, *Cortinarius* and *Entoloma* are the top three genera in species diversity in Agaricomycotina, and they were estimated to have 3000, 2250 and 1800 species, respectively. Although the high species diversity of Agaricomycotina has largely been discovered in recent years, systematic studies still need to be carried out for very many groups. For example, in Agaricales, nearly one quarter (129/508) of the genera remained with an uncertain familial placement ('*incertae sedis*') whereas in Auriculariales, more than half (26/41) of the genera remain *incertae sedis*. In Russulales, a total of 17 new genera were introduced after 2008, although six are *incertae sedis*. Furthermore, 44 genera are *incertae sedis* in Agaricomycetes. Pucciniomycotina was estimated to comprise 8653 species including 10 classes, 22 orders, 49 families and 270

genera. Pucciniomycetes with 8168 species is the largest group in Pucciniomycotina. Compared with the other three subphyla, Pucciniomycotina presented a high diversity especially with respect to higher-level taxa which embraces more than half the classes in Basidiomycota (10 out of 18). The top three genera in species diversity are *Puccinia*, *Uromyces* and *Aecidium* with the estimated species numbers of 3300, 1500 and 800 respectively. Ustilaginomycotina is estimated to have 1805 species which includes four classes, 15 orders, 42 families and 128 genera. Ustilaginomycetes with 1185 species is the largest group in Ustilaginomycotina. Malasseziomycetes and Moniliellomycetes, the only two new classes recognized in the Basidiomycota since 2008, include an estimated 32 species. The top three genera in terms of species numbers are *Sporisorium, Tilletia* and *Ustilago* with 195, 179 and 170 species, respectively. Wallemiomycotina is a recently recognized subphylum (Zhao et al. 2017c) with 12 species estimated in a single class, two orders and two families.

2.4.2 The phylogeny and divergence times within Agaricomycotina

The phylogenetic relationships between classes in this study (Fig. 1) agree with Hibbett 2006 and Zhao et al. 2017c. The subphylum Agaricomycotina originated at 406 Mya, three classes diverged between 298 to 341 Mya and 25 orders originated between 108 to 259 Mya; these data generally agree with those given by Zhao et al. 2017c (406 Mya for Aagricomycotina, 358–393 Mya for classes and 124–350 Mya for orders). Orders in Agaricomycetes diverged between 108–259 Mya which a relativly older time range when compared to Varga et al. 2019 having divergence times of 71–181 Mya. Hysterangiales and Phallales presented more recent divergence times at 108 Mya in this study, while their divergence times were estimated 133 Mya and 159 Mya respectively in Zhao et al. 2017c.

There are 45 monophyletic families, dated with divergence times in a range of 27–178 Mya (Table 1). Noteworthly, in the Agaricales, two familes Hymenogastraceae and Tubariaceae having divergence time of 27 Mya and 54 Mya which are extremely younger than the rest families (70–125 Mya).

2.4.3 The phylogeny and divergence times within Pucciniomycotina

Phylogenetic relationships at class level within subphylum Pucciniomycotina were in general agreement with the seven-gene phylogeny in Wang et al. 2015e except that two more classes (Atractiellomycetes and Classiculomycetes) were included in this study, and there were different phylogenetic positions for Spiculogloeomycetes, Cystobasidiomycetes and Mixiomycetes between this study and Wang et al. 2015e. Tritirachiomycetes was located in a basal position without statistic support in Pucciniomycotina in Zhao et al. 2017c, while in this study, it was found sister to Agaricostilbomycetes with 0.9 PP support.

The subphylum Pucciniomycotina originated 406 Mya, and the classes originated between 211–383 Mya which generally agrees with Zhao et al. 2017c (406 for Pucciniomycotina and 245–356 Mya for classes). Orders originated between 128 to 244 Mya which also agrees with Zhao et al. 2017c (120–290 Mya). However, the divergence time of Pucciniales (275 Mya) is older than estimated by Zhao et al. 2017c (162 Mya), but it is closer to Aime et al. 2018a (215 Mya). In this study, we dated 16 families from four orders that originated between 42 to 222 Mya (Table 1). The youngest families are Ustilentylomataceae and Microbotryaceae, which originated 42 Mya, while the rest of the families in Pucciniomycotina originated between 71 to 222 Mya. The justification for the separation of Ustilentylomataceae and Microbotryaceae needs further study. Thus, the families in Pucciniomycotina originated 85–222 Mya, and most of the families originated 91–196 Mya.

Some genera in Pucciniomycotina were retained as *incertae sedis*, and the divergence times may provide a clue to resolve those taxonomic problems. For example, *Jianyunia* was sister to Chionosphaeraceae in Agaricostilbales and with the divergence time of 162 Mya, which was similar to the divergence time of most families in this subphylum. Thus, our study suggestes that *Jianyunia* is likely to represent a monotypic family, which is similar to the conclusions of Wang et al. 2015e. Similar situations are *Hasegawazyma*, which might be placed in Erythrobasidiaceae (in Erythrobasidiales) with divergence time of 102 Mya; the genera *Cyphobasidium* and *Cyrenella* (in Erythrobasidiales) should be classified in a new family which has the divergence time of 102 Mya; *Sampaiozyma* and *Curvibasidium* (in the Microbotryales) should be

included in Leucosporidiaceae with the divergence time of 91 Mya; *Gymnosporangium* (from the Pucciniales), which the telial stage only occurrs on gymnosperms, is in a distinct phylogenetic position with a divergence time of 129 Mya, which might indicate that it should be raised to family level. However, the genera *Melampsora*, *Hyalopsora* and *Pucciniastrum*, which were included in families Melampsoraceae and Pucciniastraceae, in this study, the results indicated they might belong to Coleosporiaceae with a divergence time of 133 Mya.

2.4.4 The phylogeny and divergence times within Ustilaginomycotina and Wallemiomycotina

The phylogenetic topology at the class level of Ustilaginomycotina and Wallemiomycotina in this study was almost the same as previous studies (Wang et al. 2015c, Zhao et al. 2017c), especially the relationship within the orders of Ustilaginomycetes which agreed with the four-gene phylogeny of Begerow et al. 2006, the seven-gene phylogeny of Wang et al. 2015c and the five-gene phylogeny of Riess et al. 2016. The exception is Ceraceosorales, which was at the base of Ustilaginomycetes in this study, but it was in Exobasidiomycetes in the other studies (Wang et al. 2015c, Riess et al. 2016). As in the previous studies (Begerow et al. 2006, Wang et al. 2015c, Zhao et al. 2017c), class Exobasidiomycetes was polypheletic in this study, but orders Microstromatales, Tilletiales, Golubeviales, Robbauerales, Georgefischeriales, Doassansiales and Exobasidiales were resolved as monophyletic with high statistical support within Exobasidiomycetes. For Malasseziomycetes and Moniliellomycetes, only one taxon from each class was used in this study. In this study, they were in a weakly supported sister group relationship. However, their sister group relationship was well supported in the previous studies (Wang et al. 2014; Zhao et al. 2017c), or they were not in a sister group relationship (Wang et al. 2015c; Riess et al. 2016). A better taxon sampling and sequence data are needed in the future studies to verify the phylogenetic position of these two classes in Ustilaginomycotina and to infer their divergence times. At the order level, all the orders were monophyletic with high supports. At the family level, the family Entylomataceae was not supported in this study, unlike in Wang et al. 2015c.

The subphylum Ustilaginomycotina originated 430 Mya. Ustilaginomycetes orginated at 248 Mya in this study, which generally agrees with data from Zhao et al. 2017c (Ustilaginomycetes originated at 265 Mya) and Kijpornyongpan et al. 2018 (Ustilaginomycetes originated at 239 Mya). Orders in Ustilaginomycotina originated between 172‑319 Mya with the exception of Doassansiales and Georgefischeriales, which were not dated due to their uncertain phylogenetic position. Doassansiales is sister to Georgefischeriales with a divergence time of 187 Mya in Zhao et al. 2017c, in contrast their sister group relationship was not supported in other studies (Begrow et al. 2006; Wang et al. 2015c; Riess et al. 2016). Exobasidiales was the oldest order of Exobasidiomycetes in this study and Zhao et al. 2017c. With three more families (Brachybasidiaceae, Graphiolaceae and Cryptobasidiaceae) included in this study, Exobasidiales presented an older divergence time (319 Mya) than given by Zhao et al. 2017c (265 Mya).

Except for the families in monotypic orders (such as Golubeviaceae and Robbaueraceae), 18 families are well dated in this study, and these families originated between 61‑211 Mya. The youngest families are Urocystidaceae and Floromycetaceae which originated at 61 Mya; and Cryptobasidiaceae is the oldest family in Ustilaginomycotina with a divergence time of 211 Mya. Thus, the presently range of divergence times at order and family levels are still large: 172‑319 Mya and 79‑177 Mya, respectively.

2.4.5 Divergence time and taxa ranking in Basidiomycota

Recognition of taxonomic groups has, to date, mainly been based on phenotype and phylogenetic reconstruction with different ranks being applied in a subjective manner (e.g. Ariyawansa et al. 2014; Phookamsak et al. 2014). Recently, the divergence time was used as an additional criterion and successfully applied in fungal systematics from genus to kingdom level (Zhao et al. 2016f, 2017c; Liu et al. 2017; Hongsanan et al. 2017; Tedersoo et al. 2018). Thus, the divergence time estimates of certain groups would be useful in the reconstruction of a modern taxonomic systems, especially in complex groups. For Basidiomycota, the divergence time range of most higher taxa (order and above) have been assessed, and these were 406–490 Mya for subphyla, 245–

393 Mya for classes and 120‑290 Mya for orders (Zhao et al. 2017c). In this study we used a larger dataset, and the results showed that the divergence time range of subphyla were 406‑430 Mya, classes were 211‑383 Mya and orders were 99‑323 Mya, which generally agreed to the previous study (Zhao et al. 2017c).

Furthermore, in this study we investigated the divergence time of families within Basidiomycota. The results indicated that families of Agaricomycotina diverged during 27‑178 Mya, Pucciniomycotina diverged during 85‑222 Mya and those from Ustilaginomycotina 79‑177 Mya. Compared with the divergence time of most families, the Cryptobasidiaceae should be raised to that of order due to its older divergence time compared to most current families. While the families Urocystidaceae, Floromycetaceae, Ustilentylomataceae, Microbotryaceae and Leucosporidiaceae could be combined with other families as they have a quite younger divergence time.

As we had indicated before, this study will provide new clues to resolve the taxonomic problems in the present taxonomic system of Basidiomycota, but the final decision on any groups or problems requires more in-depth studies, which need to add more related samples to get a better phylogenetic topology, including phenotypic examination and other related studies. The divergence times would furthermore provide important information toward a better understanding of the phylogeny and the evolution events of the Basidiomycota.

CHAPTER 3
PHYLOGEOGRAPHY OF *AGARICUS* SECTION *MINORES*

3.1 Introduction

Agaricus L. (Agaricaceae, Agaricales), the type genus of Agaricaceae, contains abundant species distributed across all continents (Zhao et al. 2011, Karunarathna et al. 2016). Many species in this genus are well-known because of their high commercial value, such as *A. bisporus* (J.E. Lange) Imbach and *A. subrufescens* Peck; both having been commercially cultivated for many years. It was estimated that there are about 200 species of *Agaricus* worldwide (Kirk et al. 2008). However, the number of species in this genus has increased rapidly since 2008 because new species have been introduced. In 2011, the estimated number of Agaricus was 386 (Zhao et al. 2011). To date, *Agaricus* comprises more than 500 species, as numerous new species have been introduced (Parra 2013, He et al. 2015, Dai et al. 2016, Kerrigan 2016, Li et al. 2016, Zhao et al. 2016f, Chen et al. 2017b, He et al. 2018b).

There have been a series of phylogenetic studies on *Agaricus* since 1999 (Mitchell and Bresinsky 1999), and these studies contributed to build a more robust phylogenetic framework and related taxonomic system for this genus. A taxonomic system for *Agaricus* comprising three subgenera and eight sections was used for a long time (Heinemann 1978, Parra 2008, 2013). Some of those sections have been confirmed as monophyletic groups, such as *A.* section *Bivelares* (Kauffman) L.A. Parra (Kerrigan 2008), while some others have been shown to be polyphyletic, such as section *Spissicaules* (Heinem.) Kerrigan (Parra 2008). A phylogenetic analysis with emphasis on *Agaricus* specimens from tropical areas revealed eleven new clades, mainly from tropical areas besides those eight previously diagnosed sections (Zhao et al. 2011). As a result of these phylogenetic discoveries, several sections have been proposed, such as sections *Nigrobrunnescentes* K.R. Peterson, Desjardin & Hemmes. and *Brunneopicti* Heinem (Parra et al. 2014, Chen et al. 2015a), or established, such as sections *Rarolentes* Kerrigan and *Subrutilescentes* Kerrigan (Kerrigan 2016). The most recent

study combined multi-gene phylogeny, morphology and divergence times, established a comprehensive taxonomic system for *Agaricus* (Zhao et al. 2016f). In that study, *Agaricus* was segregated into five subgenera and 20 sections, subgenus *Minores* was established and comprised three sections.

The epithet "Minores" was established in 1874 to accommodate a small group of fungi with small basidiomes (Fries 1874). Morphological and biochemical examination have shown that species in this section always have a strong positive KOH reaction and Schäffer's reaction, a single annulus, basidiomes which are flavescent on cutting and bruising, an odour of almond or anise. Most of the species in this section are saprobic and edible (Parra 2013, Zhao et al. 2016f). Historically, species of section *Minores* were known by their small basidiomes, but recent studies have shown that species from this section can also have large-sized basidiomes (Chen et al. 2012a, Liu et al. 2015a, Li et al. 2016b), which provides the possibility of developing some species as cultivated mushrooms for food (Chen et al. 2012a, 2017b).

The number of species in *A.* section *Minores* has been underestimated. Less than 20 species were known before the early 21st century (Heinemann 1978, Cappelli 1984, Singer 1986). However, recently, 21 species from Europe and 38 species from Greater Mekong Subregion have been recognized (Parra 2013, Chen et al. 2017b,). It was hypothesized that there are at least 200 species in this section worldwide (Chen et al. 2017b).

The origin and dispersal of fungi has been of great interest to mycologists. Fungi can be dispersed by human activities (Wang et al. 2012, Bing et al. 2014), insects (insect associated fungi) (Zhang et al. 2014), and also other factors like climate and geographical history (Moyersoen et al. 2003, Geml et al. 2008, Sánchez-Ramírez et al. 2015). Phylogeographical evidence suggests ectomycorrhizal mushrooms dispersed via overland routes, because of their obligate symbiotic associations with woody plants (Matheny et al. 2009, Geml et al. 2012, Wilson et al. 2012), especially *Boletus* (Dentinger et al. 2010, Feng et al. 2012), *Chroogomphus* (Li et al. 2009), *Amanita* (Geml et al. 2006, 2008), *Sparassis* and *Megacollybia* (Redhead 1989, Halling 2001, Mueller et al. 2001, Zhang et al. 2004, Hughes et al. 2007, Zhao et al. 2013c). However,

investigations on saprotrophic fungi origins and dispersal have rarely been studied (Vijaykrishna et al. 2006), especially among mushrooms.

In this study, we address the origin and dispersal of the saprotrophic mushroom genus *Agaricus* section *Minores* based on timing of evolutionary events.

3.2 Materials and Methods

3.2.1 Phylogenetic analysis

Totally 534 sequences were presented in this study. The multi-gene dataset contained 154 assembled sequences, comprising 154 ITS, 128 LSU, 123 tef1-α and 73 rpb2 sequences. Sequences information were listed in Table 2. Sequences are assembled in Geneious 9.0.2., aligned in BioEdit V.7.0.4 and adjusted manually to exclude the ambiguous regions (Hall 2007). The alignment has been submitted to TreeBase (submission ID: 20505). Bayesian Inference (BI) analysis was performed in MrBayes 3.1.2 (Ronquist and Huelsenbeck 2003). The best substitution model for ITS, LSU, tef1-α and rpb2 regions were inferred by MrModeltest2.2 (Nylander 2004): GTR+I+G for ITS, LSU and rpb2; SYM+I+G. for tef1-α. Ten million generations were run for six Markov chains, and sampled every 100th generation resulting in 100,000 trees. Burn-ins was determined in Tracer v1.6 with effective sample sizes (ESS) of 200 or higher (http://tree.bio.ed.ac.uk/software/tracer). Those trees sampled prior to searches reaching a split deviation frequency value reaching 0.01 were discarded as the burn-in, and the remaining trees were used to calculate Bayesian posterior probabilities (PP). Maximum likelihood (ML) analysis was performed in raxmlGUI 1.5b1 with GTRGAMMA model with 1000 replicates (Silvestro and Michalak 2012). Maximum parsimony analysis was performed in PAUP*4.0b 10 (Swofford 2003). One thousand heuristic searches were conducted with random sequence addition, tree bisection-reconnection (TBR) branch swapping and gaps were treated as missing data. Parsimony bootstrap values were obtained from 1000 bootstrap replicates, with starting trees obtained via stepwise addition, random sequence addition, and max-trees set to 1,000.

3.2.2 Calibration strategies and age estimation of clades within *Agaricus* section *Minores*

The age of 30 Ma of *Agaricus* subgenus *Minores* is cited from our previous study (Zhao et al. 2016f), which was conducted from a fossil-calibrated analysis referred from two Agaricomycetes fossils: *Archaeomarasmius leggetti* Hibbett, D. Grimaldi & Donoghue, as representative of the minimum age of 90 million years ago of *Agaricales* (Hibbett et al. 1997), and *Quatsinoporites cranhamii* S.Y. Sm., Currah & Stockey as representative of the minimum age of 113 million years ago of *Hymenochaetales* (Smith et al. 2004). The nrITS, nrLSU, tef1-α and rpb2 datasets of *Agaricus* subgenus *Minores* + *Agaricus subgenus Minoriopsis* + outgroup *Agaricus campestris* are aligned using MUSCLE v3.6 separately (Edgar 2004).

Divergence times were estimated using BEAST v1.8 (Drummond et al. 2012). A XML file was constructed with BEAUTI v1.8. Per-gene alignments were imported as separate partitions. Clock and substitution models were set to be unlinked (independently estimated for each gene partition). As substitution models, we used the GTR for rpb2, and HKY for nrITS, nrLSU and tef1- respectively, based on jModelTest v2 (Drummond et al. 2012). We used the uncorrelated lognormal relaxed clock model (Drummond et al. 2006, Lepage et al. 2007), specifying a gamma distribution for the ulcd.mean parameter with a shape of 1.0, scale of 0.001, and offset 0. On the calibrated nodes, we specified a prior gamma distribution with an arbitrarily long tail (scale of 4) and offset ages of 30 for *Agaricus* subgenus *Minores* (Zhao et al. 2016f). We ran Monte Carlo Markov Chains of 50 million generations, logging states every 5000 generations. We compared the log files of each run in Tracer v1.6 (Rambaut et al. 2014), evaluating convergence and mixing, ensuring that Effective Sample Sizes were at least 200. An ultrametric maximum-clade-credibility (MCC) tree was summarized using TreeAnnotator 1.8, discarding 10% of states as burn-in and annotating clades with ≥ 0.8 posterior probability.

Table 2 Sequences information of *Agaricus* used in this study

Species	Collection	ITS	LSU	ef1-α	rpb2
A. abruptibulbus	ZRL2012005	KT951356	KT951460	KT951626	
A. albosquamosus T	LD2012192	KT951394	KT951520	KT951636	
A. amoenus T	ZRL2010072	KT951348	KT951524	KT951638	
A. angusticystidiatus	**BC088**	**MG888054**	-	-	
A. angusticystidiatus	**ZRL2085**	**KT951434**	**MG835413**	-	

Table 2 Sequences information of *Agaricus* used in this study (continued)

Species	Collection	ITS	LSU	ef1-α	rpb2
***A. angusticystidiatus* T**	**ZRL2043**	**JF691553**	**MG835412**	**-**	
A. aridicola	LAPAG589	KT951331	KX084027	KX198081	-
A. armandomyces	ZRL20151693	KX684864	KX684896	KX684918	KX684940
A. armandomyces	ZRL2015991	KX684863	KX684881	KX684905	KX684926
A. armandomyces	ZRL2015997	KX684865	KX684883	KX684907	KX684928
A. armandomyces	ZRL2015998	KX684861	KX684884	KX684908	KX684929
A. armandomyces	ZRL2015999	KX684862	KX684885	KX684909	KX684930
A. armandomyces T	ZRL2015992	KX684860	KX684882	KX684906	KX684927
A. arrillagarum	LAPAG810	KF447900	KX083985	KT951592	-
A. atrodiscus	LD2012185	KT284912	KT951473	KT951653	
A. badioniveus	LD2012131	KU975117	-	-	KX198072
A. benesii	LAPAG283	JF797179	-	-	
A. bernardiformis	CA433	KT951321	KT951467	KT951577	
A. biannulatus	LAPAG611	JF896229	-	-	
A. biberi	LAPAG687	KM657919	KR006614	KR006642	
A. bingensis	ADK1992	KJ540954	-	-	
A. bisporiticus	LD2012111	KJ575611	KT951507	KT951650	
A. bisporiticus	MCR25	KJ575608	-	-	
A. bisporus	LAPAG446	KM657920	KR006611	KR006640	
A. bitorquis	CA427	KT951320	KT951491	KT951646	
A. bitorquis	WZR2012827	KM657916	KT951492	KT951647	
A. blatteus T	ZRL2012004	KT951355	KT951457	KT951608	-
A. bohusii	LAPAG562	KM657928	KR006613	KR006641	
A. boisseletii	CA123	DQ182531	-	-	
A. bonussquamulosus T	ZRL2010106	KX657047	KX656950	KX684951	-
A. brunneogracilis	ZRL258	KM657876			
A. brunneolus	LAPAG938	KU975082	KX083997	KX198062	-
A. brunneolutosus	ZRL2012049	KX657019	KX656961	-	-
A. brunneolutosus	ZRL2012050	KX657020	KX656962	-	-
A. brunneolutosus T	MS514	KU975111	KX084006	-	-
A. brunneopictus	ADK2564	JF514518	-	-	
A. brunneopileatus T	ZRL2012115	KT951404	KT951489	KT951587	
A. brunneosquamulosus	LD2012105	KJ540968	-	-	
A. brunneosquamulosus	ZRL4017	JF691549	-	-	
A. caballeroi	AH44503	KJ575605	-	-	
A. californicus	RWK 1914	DQ182509			
A. callacii	LAPAG797	KF447899	KX083984	KX198051	-
A. campbellensis	GAL9420	DQ232644	DQ232657	-	-

Table 2 Sequences information of *Agaricus* used in this study (continued)

Species	Collection	ITS	LSU	ef1-α	rpb2
A. campestris	LAPAG370	JQ903618	KP739803	KR006636	-
A. campestris	LAPAG370	KM657927	KR006607	KR006636	
A. campestroides	LAPAF2	JF727842	-	-	
A. candidolutescens T	LD2012129	KT951335	KT951525	KT951616	-
A. caribaeus	F2530	JF727856			
A. catenatus T	ZRL2012104	KX657023	KX656963	KX684957	KX685059
A. cerinupileus	ZRL2013267	KX657003	KX656947	KX684974	KX685033
A. cerinupileus	ZRL2013376	KX657004	KX656942	KX684978	KX685030
A. cerinupileus	ZRL20151116	KX684856	KX684889	KX684912	KX684933
A. cerinupileus T	ZRL2012001	KX657021	KX656957	KX684953	KX685064
A. cf. *bernardi*	CA383	KT951319	KT951469	KT951576	
A. cf. *endoxanthus*	ZRL3095	JF691554			
A. cf. *goossensiae*	ADK2171	JF514517	-	-	
A. cf. *kerriganii*	WC912	AY484681	-	-	-
A. cf. *volvatulus*	F2767	JF727848			
A. chartaceus	H6271	JF495048	-	-	-
A. chiangmaiensis	NTS113	JF514531	-	-	
A. coccyginus	ZRL2012597	KU245984	KX656969	KX684962	KX685049
A. coccyginus	ZRL2014354	KU245981	KX656936	KX684998	KX685015
A. coccyginus	ZRL2014364	KU245982	KX656931	KX684999	KX685014
A. coccyginus	ZRL2014415	KU245983	KX656933	KX685001	KX685012
A. colpetei	TL2424	JX984565	-	-	-
A. comtulus	LAPAG303	KU975078	KX083986	KX198052	-
A. comtulus	LAPAG724	KT951332	KT951448	KT951593	-
A. crassisquamosus T	ZRL2012607	KT951376	KT951510	KT951645	
A. cupressicola	LAPAG889	KT951334	KT951465	KT951649	
A. dalioensis	SHY2011071706	KM657877			
A. dalioensis	SHY2011073114	KM657878			
A. desjardinii	WZR2012907	KM657901	KT951474	KT951644	
A. dilatostipes	ZRL2014450	KX656999	KX656941	KX685003	KX685010
A. dilutibrunneus T	ZRL2012010	KT951358	KT951512	KT951569	
A. dolichopus	ZRL2012715	KT951382	KT951502	KT951573	
A. dolichopus	ZRL2014120	KT951433	-	-	
A. dulcidulus	PRM909627	KF447894	-	KX198064	-
A. duplocingulatus	ZRL3064	KJ540966	-	-	
A. edmondoi	LAPAG412	KT951326	KT951481	KT951590	-
A. elongatestipes	ZRL2013265	KX657001	KX656948	KX684973	KX685034
A. elongatestipes T	ZRL2013271	KX657002	KX656946	KX684975	KX685032

Table 2 Sequences information of *Agaricus* used in this study (continued)

Species	Collection	ITS	LSU	ef1-α	rpb2
A. endoxanthus	LAPAG225	DQ182511			
A. erectosquamosus T	LD2012165	KT951338	KT951509	KT951565	
A. erythrosarx	MURU6080	JF495068	-	-	
A. fimbrimarginatus T	LD201250	KU975119	KX084017	KX198076	-
A. flammicolor	LD201225	KU975115	KX084010	KX198070	KY427451
A. flammicolor	ZRL2012270	KU975116	KX084011	KX685007	KX685055
A. flavopileatus	MS596	KU975121	KX084022	KX198078	KY427454
A. flavopileatus	ZRL20151111	KX684857	KX684888	KX684911	KX684932
A. freirei	CA186	DQ185553	-	-	
A. friesianus	LAPAG592	KT951316	KX083992	KT951594	-
A. friesianus	ZRL2012601	KX657026	KX656970	KX684965	KX685048
A. friesianus	ZRL20151813	KX684858	KX684897	KX684919	KX684941
A. fulvoaurantiacus	ZRL20151536	KX684878	KX684893	KX684915	KX684936
A. fulvoaurantiacus	ZRL2012124	KX657024	KX656965	KX684958	KX685057
A. fulvoaurantiacus	ZRL2013468	KX656987	KX656986	KX684980	KX685028
A. fulvoaurantiacus	ZRL2014005	KX656990	KX641403	KX684983	KX685027
A. fulvoaurantiacus T	LD201404	KU975107	KX084002	KX198069	-
A. fuscofibrillosus	WC913	AY484684	-	-	
A. fuscopunctatus	LD2012115	KJ575612			
A. fuscovelatus	RWK2100	KJ577973	-	-	
A. gemlii	LAPAG286	KU975079	KX083988	KX198055	-
A. gemlii	ZRL2015832	KX684866	KX684879	KX684903	Y
A. gemloides	ZRL2012003	KX657022	KX656958	KX684954	KX685063
A. gemloides	ZRL2012017	KT633274	KX656959	KX684955	KX685061
A. gemloides	ZRL2014085	KX656989	KX641406	KX684987	KX685023
A. gemloides	ZRL2014131	KT633273	KX641407	KX684988	KX685022
A. gemloides	ZRL2015947	KX684867	KX684880	KX684904	KX684925
A. gemloides T	ZRL2014084	KT633271	KX641405	KX684986	KX685024
A. gennadii	CA339	KT951318	-	KT951575	
A. globosporus	ZRL2012652	KX657036	KX656976	KX684967	KX685042
A. globosporus T	ZRL2012656	KX657039	-	KX684968	KX685039
A. grandiomyces	ZRL2012611	KM657879			
A. grandiomyces T	ZRL2012611	KM657879	KR006624	KR006652	
A. gratolens	ZRL3093	JF691548	KT951488	-	
A. gregariomyces	ZRL2012624	KM657880			
A. haematinus	ZRL2109	KT951435	-	-	
A. haematinus	ZRL2136	JF691552	-	-	
A. heinemannianus	LAPAG302	KF447906	-	KX198056	-

Table 2 Sequences information of *Agaricus* used in this study (continued)

Species	Collection	ITS	LSU	ef1-α	rpb2
A. hondensis	RWK1938	DQ182513	-	-	
A. huijsmanii	LAPAG639	KF447889	KT951444	KT951571	-
A. iesu-et-marthae	LAPAG41	KT951326	KT951481	KT951590	-
A. iodosmus	LAPAG245	DQ182518			
A. jacobi	LAPAG52	KF447895	KX083996	KX198061	-
A. jingningensis T	ZRL20151562	KX684877	KX684895	KX684917	KX684939
A. karstomyces	ZRL2011048	KM657899			
A. kerriganii T	AH44509	KF447893	KX083999	KX198066	-
A. kunmingensis	ZRL2012015	KT951361	KT951506	KT951642	
A. kunmingensis	ZRL2012007	KT951427	-	-	
A. lamellidistans T	ZRL3099	JF691556	-	-	
A. lamelliperditus	MDBF61/96	JX984559	-	-	-
***A. langensis* T**	**ZRL20152282**	**MG763129**	**MG765264**	**MG765266**	
A. laskibarii	LAPAG115	AY943975	-	-	
A. leucocarpus T	LD201215	KU975101	KX084014	KX198074	-
A. leucolepidotus T	LD201214	KT951336	KT951519	KT951635	
A. linzhiensis T	ZRL2012618	KT951378	KT951503	KT951582	
A. litoralis	LAPAG420	KT951327	KT951483	KT951572	
A. litoraloides	ZRL2011249	KT951353	KT951523	KT951580	
A. luteofibrillosus	LD201501	KU975108	KX084003	KX198041	-
A. luteofibrillosus	ZRL2012359	KU245978	KX656967	KX684959	KX685053
A. luteofibrillosus	ZRL2014136	KU245974	KX641409	KX684990	KX685020
A. luteomaculatus	LAPAG331	KF447901	-	KX198053	-
A. luteopallidus	LD2012113	KU975124	KX084026	KX198080	-
A. magnivelaris	F2389	JF727851	-	-	
A. malangelus	ZRL2012628	KM657892			
A. mangaoensis T	ZRL2010056	KX657042	KX656956	KX684946	-
A. marisae	LAPAG138	KU975083	KX083998	KX198065	-
A. matrum T	LAPAG817	KF447896	KX083991	KX198058	-
A. megacystidiatus	LD2012179	KF305946	-	-	
A. megalosporus	ZRL2012199	KT951367	KT951470	KT951595	KT951537
A. melanocapus	ZRL2011037	KM657881			
***A. memnonius* T**	**ZRL20151118**	**MG763128**	**MG765263**		
A. menieri	CA162	DQ185567			
A. microviolaceus	ZRL2012716	KX657031	KX656978	KX684969	KX685037
A. microviolaceus	ZRL2012717	KX657032	KX656979	KX684970	KX685036
*A. microviolaceus*T	ZRL2012718	KX657033	KX656980	KX684971	KX685035
A. microvolvatulus	LD201271	KJ575614	KT951508	KT951651	

Table 2 Sequences information of *Agaricus* used in this study (continued)

Species	Collection	ITS	LSU	ef1-α	rpb2
A. microvolvatulus	Grinling70109	JF514524			
A. minorpurpureus	ZRL2013342	KX657008	KX656944	KX684977	-
A. minorpurpureus T	ZRL2010058	KX657043	KX656953	KX684947	KX685009
A. moelleri	CA209	DQ185561			
A. moelleroides	CA215	DQ185559			
A. murinocephalus	ZRL3044	JF691555	-	-	
A. neimengguensis	ZRL20151815	KX684871	KX684898	KX684920	KX684942
A. neimengguensis	ZRL20151831	KX684872	KX684899	KX684921	KX684943
A. neimengguensis	ZRL20151841	KX684868	KX684900	KX684922	KX684944
A. neimengguensis	ZRL20151843	KX684869	KX684901	KX684923	Y
A. neimengguensis T	ZRL20151845	KX684870	KX684902	KX684924	KX684945
A. nevoi	LAPAG257	KM657922	KR006606	KR006635	
A. nevoi	LAPAG535	KT951330	-	KT951574	
A. nigrobrunnescens	DEH632	JX308267	-	-	
A. nigrogracilis T	ZRL2012014	KM657882	KR006621	KR006647	
A. niveogranulatus	LD201124	KJ540959	-	-	
A. padanus	WZR2012903	KM657903	KR006616	KR006644	
A. pallens	LAPAG441	KF447898	-	KX198067	-
A. pallidobrunneus T	ZRL2012358	KT951370	KT951471	KT951566	
A. parvibicolor	ZRL2012029	KX657018	KX656960	KX684956	KX685060
A. parvibicolor T	LD2012116	KP715162	KX084016	KX198075	KY427452
A. parvitigrinus	CA158	AY899267	-	-	
A. parvubrunneus	**ZRL20161053**	**MG137001**	**MG196345**	**MG196351**	**MG196357**
A. patris	ZRL2014134	KX656990	KX641408	KX684989	KX685021
A. patris T	LD201224	KU975118	KX084012	KX198073	KY427450
A. pattersoniae	RWK1415	AY943974	-	-	
A. phaeolepidotus	CA217	DQ185552	-	-	
A. pilosporus	LAPAG227	KT951425	-	-	
A. placomyces	RWK1918_2	AF432879			
A. placomyces	RWK1959	DQ182525			
A. pocillator	DUKEJ173	U85308			
A. pseudolangei	ZRL3012	JF691551	-	-	
A. pseudolutosus	LAPAG454	KT951329	KT951453	KT951602	-
A. pseudominorpurpureus	**ZRL2013320**	**MG136999**	**MG196344**	**MG196349**	**MG196354**
A. pseudominorpurpureus	**ZRL2013341**	**MG137000**	**MG196343**	**MG196350**	**MG196356**
A. pseudopallens	ZRL2014154B	KX656995	KX656939	KX684995	KX685016
*A. pseudopallens*T	ZRL20151552	KX684874	KX684891	-	KX684938
A. pseudopratensis	CA73	DQ185558			

Table 2 Sequences information of *Agaricus* used in this study (continued)

Species	Collection	ITS	LSU	ef1-α	rpb2
A. pseudopurpurellus T	ZRL2014063	KX656988	KX641404	KX684985	KX685016
A. purpurellus	TRgmb01309	KF447903	KX083993	KX198059	-
A. purpurellus	LAPAG944	KU975076	KX083994	KX198060	-
A. purpurellus	ZRL2012588	KX657025	KX656968	KX684961	KX685050
A. purpurellus	ZRL2012605	KX657027	KX656971	Y	KX685047
A. purpurellus	ZRL2012609	KX657028	KX656972	KX684964	KX685046
A. purpurellus	ZRL2012610	KX657029	KX656973	KX684965	KX685045
A. purpurellus	ZRL2012614	KX657030	KX656974	KX684966	KX685044
A. purpureofibrillosus T	ZRL3080	JF691542	KX084021	-	-
A. purpurlesquameus	LE2016047	MF611640			
A. robustulus	ZRL2012357	KT951369	KT951496	KT951610	-
A. robustulus T	CA847	KU975086	KX084034	KX198039	-
A. rotalis	DEH1114	DQ182528			
A. rufoaurantiacus	LAPAM15	KT951313	-	KT951641	-
A. rufusfibrillosus	ZRL20151536	KX684878			
A. rufuspileus	ZRL2013325	KX657006	KX656945	KX684976	KX685031
A. rufuspileus	ZRL2013480	KX657007	KX656943	KX684981	KX685008
A. rufuspileus	ZRL2014145	KX656992	KX641410	KX684992	KX685018
A. rufuspileus	ZRL2014146	KX656993	KX656929	KX684993	KX685065
A. rufuspileus	ZRL2014147	KX656994	KX656930	KX684994	KX685017
A. rufuspileus T	ZRL2014140	KX656991	KX656937	KX684991	KX685019
A. silvaticus	ALG07 213	KT951307		KT951567	
A. sinodeliciosus	WZR2012822	KM657907	KT951518	KT951648	
A. sinoplacomyces	ZRL2012008	KM657883			
A. sinoplacomyces	ZRL2012009	KM657884			
A. sinoplacomyces	ZRL2012027	KM657885			
A. sinoplacomyces	ZRL2012028	KM657886			
A. sinoplacomyces	ZRLAG2101	KM657887			
A. sodalis T	LD2012159	KP715161	KX084014	KX198074	KY427453
A. sordidocarpus	LD201237	KJ540946	-	-	
A. subrufescens	ZRL2012722	KT951383	KT951451	KT951632	
A. subsaharianus	ADK4732	JF440300	-	-	
A. sylvaticus	LAPAG382	KM657929	KR006608	KR006637	
A. sylvaticus	ZRL2012013	KT951360	KT951500	KT951570	
A. sylvaticus	ZRL2012568	KT951371	KT951501	KT951568	
A. tibetensis	ZRL2012585	KM657895	KR006633	KR006658	
A. tibetensis	ZRL2012580	KR006604			
A. tibetensis	ZRL2012585	KM657895			

Table 2 Sequences information of *Agaricus* used in this study (continued)

Species	Collection	ITS	LSU	ef1-α	rpb2
A. tibetensis	ZRL2012617	KM657897			
A. tollocanensis	CA235	AY703913	-	-	
A. toluenolens	CA911	KJ540947	-	-	
A. trisulphuratus	LAPAF7	KM657924			
A. trisulphuratus complex	LAPAF7	KM657924	KR006605	KR006634	
A. trisulphuratus complex	Swk079	KT951343	KT951472	KT951561	
A. trisulphuratus complex	ZRL2014023	KT951428	-	-	
A. trisulphuratus complex	ZRL2014024	KT951429	-	-	
A. trisulphuratus complex	ZRL2014030	KT951432	-	-	
A. trisulphuratus complex	ZRL2132	JF691558	-	-	
A. tytthocarpus	ZRLWXH3077	KM657889	KR006618	KR006645	
A. tytthocarpus	ZRLWXH3077	KM657889			
A. variabilicolor	ZRL4002	KT951438	-	-	
A. variabilicolor	ZRL4007	KT951439	-	-	
A. variabilicolor	ZRL4012	KT951440	-	-	
A. variicystis	LD201228	KT951426	-	-	
A. variicystis T	LD201234	KT951339	KT951517	KT951562	
A. viridopurpurascens	Horak68/79	JF514525	-	-	-
A. wariatodes	TWM1589	JF495052	JF495030	-	-
A. xanthodermulus	CA160	AY899273	-	-	
A. xanthodermus	CA15	AY899271			
A. xanthodermus	LAPAG461	KM657925			
A. xanthodermus	LAPAG387	KM657923	KR006609	KR006638	
A. xanthosarcus	Goossens5415	JF514523	-	-	
A. yanzhiensis	**ZRL20162060**	**MG137002**	**MG196348**	**MG196352**	**MG196358**
A. yanzhiensis	**ZRL20162082**	**MG137003**	**MG196346**	-	-
A. yanzhiensis	**ZRL20162139**	**MG137004**	**MG196347**	**MG196353**	**MG196355**
A. sp.	GAL3083	EF460374	EF460399	-	-
A. sp.	ZD1528	KU975104	KX083987	KX198054	KY427455
A. sp.	ZRL2014380	KX656998	KX656932	KX685000	KX685013
A. sp.	CA935	KU975085	KX084036	KX198034	-
A. sp.	MS386	KU975113	KX084008	KX198044	-
A. sp.	ZRL2010079	KX657046	KX656951	KX684950	-
A. sp.	ADK3580	KU975097	-	-	-
A. sp.	NT62	JF727845	-	-	-
A. sp.	NTT72	JF514539	-	-	-
A. sp.	PYP014	KU975091	-	-	-
A. sp.	CA845	KU975084	KX084033	KX198035	-

Table 2 Sequences information of *Agaricus* used in this study (continued)

Species	Collection	ITS	LSU	ef1-α	rpb2
A. sp.	ZRL3056	JF691541	KX084020	-	-
A. sp.	ADK2751	JF514519	-	-	-
A. sp.	LD201252	KU975103	-	KX198050	-
A. sp.	ZRL2011039	KT951351	KT951449	KT951606	KT951542
A. sp.	Vellinga2360	AF482831	AF482877	-	-
A. sp.	TL2154	JF495059	-	-	-
A. sp.	TL2307	JF495058	-	-	-
A. sp.	ZRL20151437	KX684876	KX684892	KX684914	KX684935
A. sp.	ZRLWXH3067	KT951387	KT951497	KT951611	-
A. sp.	CA848	JF727864	KT951445	KT951605	-
A. sp.	NTS73	KU975099	-	-	-
A. sp.	NTT33	JF514535	-	-	-
A. sp.	PS036	KU975087	KX084035	KX198036	-
A. sp.	ZRL20151119	KX684855	KX684890	KX684913	KX684934
A. sp.	ZRLLD013	KT951384	KT951516	KT951604	-
A. sp.	ZRLWXH3402	KX657016	KX656983	KX685006	-
A. sp.	CA843	JF727866	KX084029	KX198040	-
A. sp.	ZRL2010002	KX657041	KX656954	KY427449	-
A. sp.	CA846	JF727865	KT951452	KT951601	-
A. sp.	PDD68575	AF059224	AF059224	-	-
A. sp.	GAL5812	EF460364	EF460389	-	-
A. sp.	MATA774	JF727871	-	-	-
A. sp.	LAPAM14	KT951312	-	KT951613	-
A. sp.	ZRLWXH3161	KT951391	KT951526	KT951615	-
A. sp.	ZRLWXH3064	KX657010	-	-	-
A. sp.	ZRLWXH3316	KX657015	-	-	-
A. sp.	CA486	JF797189	-	-	
A. sp.	CA820	JF727861	-	-	
A. sp.	LD2012162	KT951337	KT951493	KT951563	
A. sp.	NT020	JF797197	-	-	
A. sp.	Swk014	KT951342	KT951482	KT951654	
A. sp.	ZRL133	KT951344	KT951505	KT951656	
A. sp.	ZRL2010010	KT951347	KT951511	KT951639	
A. sp.	ZRL2010099	KT951349	KT951479	KT951564	
A. sp.	ZRL2012267	KT951368	KT951504	KT951655	
A. sp.	ZRL2012629	KM657890	KR006627	KR006656	
A. sp.	ZRLWXH3078	KT951464	KT951464	KT951643	
A. sp.	ZRL2012474	KM657893			

Table 2 Sequences information of *Agaricus* used in this study (continued)

Species	Collection	ITS	LSU	ef1-α	rpb2
A. sp.	ZRL2012582	KM657894			
A. sp.	ZRL2012616	KM657896			
A. sp.	ZRL2012629	KM657890			
A. sp.	ZRLWXH3092	KM657891			
A. sp.	F2715	JF727847			
A. sp.	NTF58	JF514527			
A. sp.	NTF61	JF514528			
A. sp.	NTS7	JF514533			
A. sp.	ZRLWXH3140	KT951441	-	-	
Heinemannomyces sp.	ZRL185	KT951346	KT951527	KT951657	

New species are in Bold which were introduced in Chapter 3, "T" refers to type.

3.3 Results

3.3.1 Phylogenetic analysis

Totally 154 assembled multi-gene sequences were included for phylogeny analysis, representing 97 phylogenetic species from the subgenus *Minores*, including 91 species of section *Minores*, three species of section *Leucocarpi*, three species of unnamed section 1; one species of subgenus *Minoriopsis* and the outgroup taxon *A. campestris*. There are 2675 bp (base pairs) in the final alignment of each assembled sequence, of which 744 characters from LSU, 541 characters from tef1-α, 776 characters from rpb2 and 614 characters from ITS.

Multi-gene trees generated from ML, MP and Bayesian analyses showed highly similar topologies with some ungrouped taxa. The ML tree is shown in Fig. 5. In this tree, section *Minores* are supported by 54% BS and 1.0 PP values, separated from other two sections *Leucocarpi* and unnamed section 1 (Fig. 5) under the clade represented as subgenus *Minores*. Within section *Minores*, 15 clades are recognized in this study and named as Clades I-XV (Fig. 5). Most of those clades are well-supported with the value of 0.9/- to 1.0/90 PP/BS, except of clades III and IX which have the less than 50% BS and 0.8 PP support.

3.3.2 Divergence time and phylogeography analysis

The MCC tree is shown in Fig. 6. The topologies of MCC are highly similar with Fig. 5 with minor differences: 1) Clade XIII comprises seven species (*A. minorpurpureus*, *A.* sp./CA843, *A. chartaceus*, *A. lamelliperditus*, *A. purpureofibrillosus*, *A.* sp./*ZRL2010002* and *A. wariatodes*) in the MCC tree with the PP values less than 0.8 (Fig. 6), but failed to group together in the ML tree (Fig. 5); 2) Clade V comprises two species (*A. megalosporus* and *A.* sp/*ZRL3056*) with a PP value under 1.0 (Fig. 2), but failed to form a clade in the ML tree (Fig. 5).

Similar geographic origin species often clustered together (Figs 5 and 6). Based on the related isolated geographic origin, 15 clades in section *Minores* are named as Clades I-XV. Generally, these clades (named as Clades II, III, IV, V, VI, VII, VIII, X, XI, XII, XIIII and XV) have good support of 1.0 PP value; and Clades I, IX and XIII have poor statistical support of 0.8, 0.7 and 0.4 PP values respectively. There are several ungrouped species: *A. huijsmanii*, *A. pseudopurpurellus*, *A. callacii*, *A. pseudolutosus*, and *A.* sp./MATA774.

Combined with the different climate types (temperate, sub-tropical and tropical) and relative isolated positions (Tibet Plateau), we named the 15 phylogenetic clades and abbreviated as EUP (Europe, temperate); NEA (Northeast Asia, temperate), NZL (New Zealand, temperate), NWA (Northwest America, temperate), ALK (Alaska, cold temperate), TBP (Tibet, plateau), AMT (America tropic), ASS (Asia, sub-tropic), AUS (Australia, tropic), AST (Asia, tropic) and AFT (Africa, tropic). We use mean stem age to represent the divergence times (Zhao et al. 2016f) of those clades. The established divergence times of those clades and ungrouped species are presented in Table 4 and Fig. 6.

Table 3 Mean of stem ages of clades and ungrouped species from section *Minores*

Clades and ungrouped species	Mean of stem age (Mya)
I	13
II	13
III	12
IV	12
V	ca. 9–16
VI	ca. 9–16
VII	9
VIII	9
IX	-
X	ca. 8–16
XI	12
XII	12
XIII	-
XIIII	ca.16–18
XV	ca.16–18
A. huijsmanii	22
A. pseudopurpurellus	18
A callacii	ca.16
A. pseudolutosus	ca.16
A. sp. /MATA774	ca.16

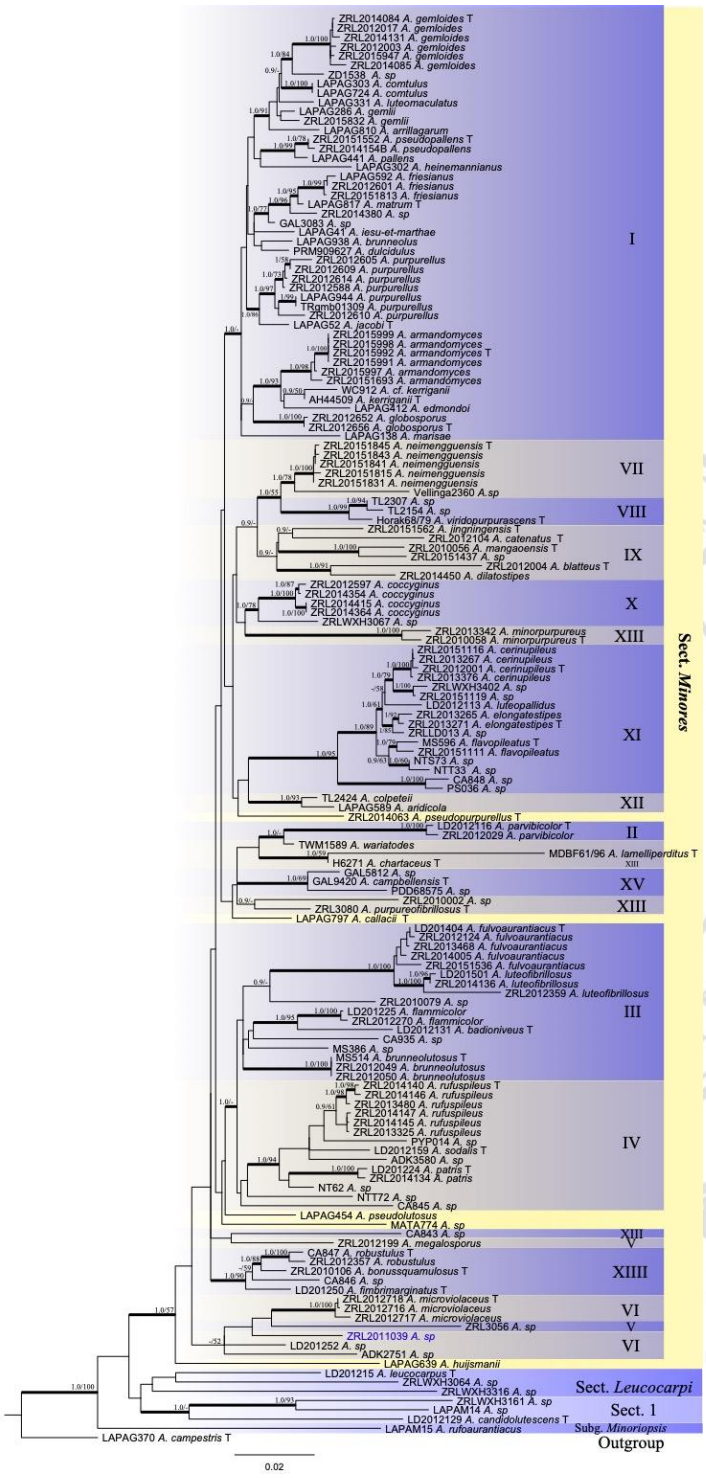

Figure 5 Maximum Likelihood (ML) tree of *Agaricus* section *Minores* based on LSU, tef1-α, rpb2 and ITS sequences with the outgroup *A. campestris*. The Bayesian posterior probabilities and bootstrap support values more than 0.9/50% (PP/BS) are indicated at the nodes. The branches in Bold means the related PP > 0.95. "T" refers to sequences from type specimen.

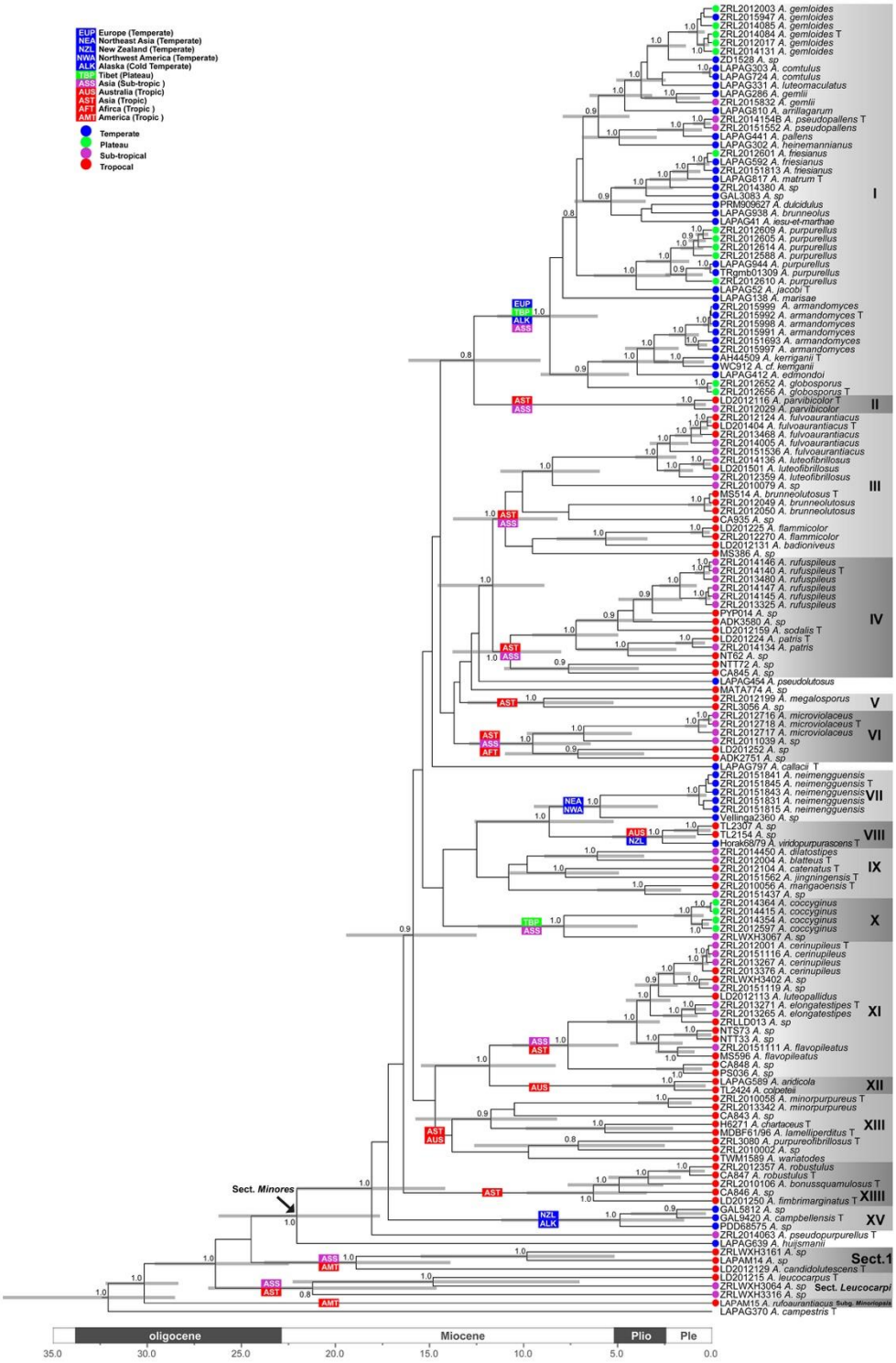

Figure 6 Maximium Clade Credibility (MCC) tree of *Agaricus* subgenus *Minores* based on LSU, tef1-α, rpb2 and ITS sequences with the outgroup *A. campestris*. Posterior probability equal and above 0.8 are indicated at the nodes. The 95 % highest posterior density (HPD) of divergence time estimation are marked by horizontal bars.

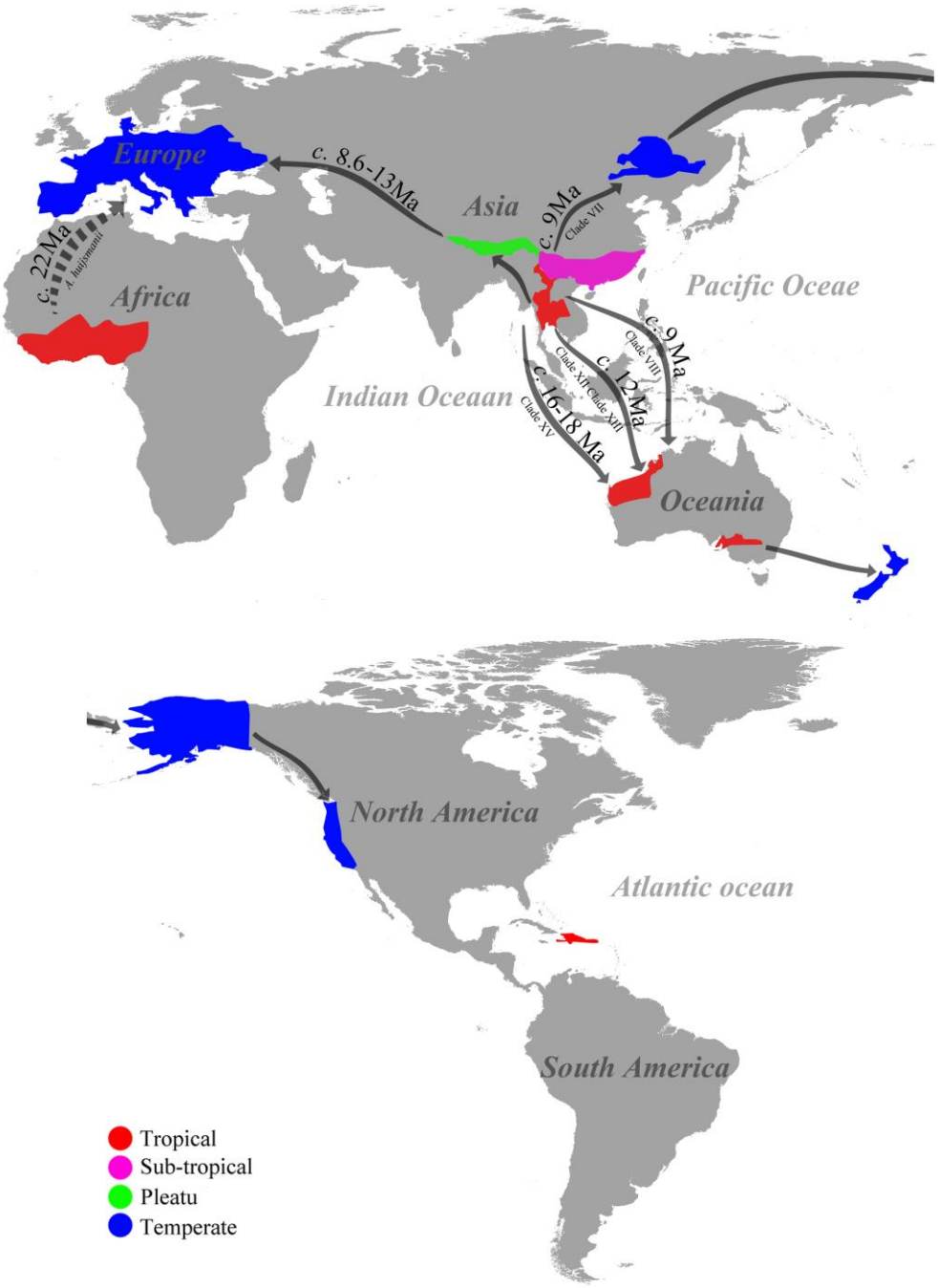

Figure 7 The hypethesized dispersal routines of species of *Agaricus* section *Minores*. The world map delimits the distribution areas of species involved in this study, and arrows indicates the major biogeographical events. Map was generated by ArcGIS v10.1 (http://esri.com/arcgis).

3.4 Conclusions

3.4.1 Phylogeny of *Agaricus* section *Minores*

Agaricus section *Minores* belongs to *A.* subgenus *Minores* in the standardized taxonomic system which was established by evidence from analysis of combined multi-gene sequence data and divergence time analyses (Zhao et al. 2016f). Our phylogenetic result shows a highly similar topology with those of Chen et al.'s work (Chen et al. 2017b). Chen et al. recognized twelve clades, which is identical to our clades I, III, IV, VI, X, XI, XIIII and XV. The exceptions are clades II, V, VIII, XII and XIII, which failed to form monophyletic lineages or had weak statistical support of less than 0.8 PP.

3.4.2 Phylogeography of *Agaricus* section *Minores*

Species of *Agaricus* section *Minores* have a worldwide distribution (Kerrigan 2008, Zhao et al. 2011, Parra 2013, Chen et al. 2017b). The evolutionary history of section *Minores* and phylogenetically closely related sections have been thought to be heavily affected by geographical and climatic factors (Zhao et al. 2011, Chen et al. 2017b). In this study, we include a large number of species from this section from different geographic area; these geographic areas are defined as 11 types (in Fig. 6, coded as EUP, NEA, NZL, NWA, ALK, TBP, ASS, AUS, AST, AFT and AMT) based on discrete units marked by the present limits of dispersal. To address the dispersal routes of species in *A.* section *Minores*, we defined the 15 phylogenetic clades (I-XV, in Figs 5, 6) with its geographical origin (Fig. 6). Both phylogeny and molecular clock analysis (Figs 5, 6) indicate that the distribution of species or clades have the same or similar climatic distributions. On the contrary the different species or clades are generally in their isolated geography areas respectively. Combined with divergence times and geographic origin of those clades and ungrouped species could speculate the origin and dispersal routes of section *Minores.*

This study shows species in the basal clade of subgenus *Minores* are all origin from tropic Africa, America and Asia, such as *A. rufoaurantiacus* Heinem., *A. candidolutescens* L.J. Chen & R.L. Zhao, and *A. leucocarpus* L.J. Chen, Callac, R.L. Zhao & K.D. Hyde, which agree with the previous study (Zhao et al. 2011, 2016f, Chen et al. 2017b). For the speciation time, tropical species is forming from 1.98 to 8.93 Mya,

which is generally older than most species origin from sub-tropical and temperate areas (forming at 1.5 to 7.7 Mya and 1.27 to 5.94 Mya respectively). Then we conclude species section *Minores* is a tropic origin group.

Even several clades (IX and XIII) are failed to established their divergence times due to the phylogenetic support values are less than 0.8 PP, the rest 13 clades are successfully dated. We then generate that there are four routes which species section *Minores* spread to North America, Oceania and Europe from their tropic origin areas (Fig. 7). We speculate that species of section *Minores* from Europe are transmigrated through two routes in different times. This conclusion is based on: in both phylogenetic topologies (Figs. 5, 6), all species from Europe (except *A. huijsmanii*) mix with species from Tibet plateau and form the clade I under fully support at top position of the trees, which is forming in 13 Mya. *Agaricus huijsmanii* which is the only Europe species out of clade I, furthermore it isolated from all other clades with a quite older divergence time of 22 Mya. Based on those results we conclude that most of the presently Europe species of section *Minores* transmigrate from south Asia, through Tibet plateau, then reach Europe in the middle Miocene. Their descendants are represented by species of clade I with age of 13 Mya in this study. However before this time, there are some pioneer species from out of south Asia reach Europe directly in the early Miocene (ca. 22 Mya), but their descendants are quite limited and *A. huijsmanii* is the only known species now.

The third route is for species of section *Minores* from tropical Asia spread towards north, reach Northeast Asia around 9 Mya and through Alaska to the west America, their descendants reflect the species of clade VII (Fig. 6, 7).

The fourth route revealed from our study is species of section *Minores* from south Asia spread towards south and finally reach Oceania. There are four sequestrate (secotioid) species of section *Minores* have been discovered (Thiers 1984, Lebel and Syme 2012, Lebel 2013). In our analysis they are distributed in four clades (VIII, XII, XIII and XV) and in different divergence times. Then we concluded there are at least three invading events occurred through this route that species section *Minores* from tropic Asia dispersed to Oceania: first time is in 16–18 Mya, the species now nest in

Clades XV; second time is around 12 Mya and represented by clades XII and XIII; and the most recent time is around 9 Mya represented by clade VIII.

The pattern of the dispersal routes revealed from this study are general identical with EM mushrooms (Sánchez-Ramírez et al. 2015), wood-decaying mushrooms (Song et al. 2016c), such as tropic origin, dispersed towards west, then reach Europe; towards north, reach northeast Asia, then through Alask to West America; towards south and reach Oceania. Moreover, our study suggests a new route for section *Minores* species that dispersed from out of south Asia to Europe directly, which different with the well-known route from tropic Asia through Tibet plateau to Europe. Does this new dispersal route exist in saprotrophic mushrooms requires further studies.

The ferocious arid climate in central Australia makes most species in section *Minores* envoluted into secotioid species. Four secotioid species can be found in Australia: *A. colpeteii* T. Lebel, *A. lamelliperditus* T. Lebel & M.D. Barrett, *A. wariatodes* (Grgur.) T. Lebel and *A. chartaceus* T. Lebel (Geml et al. 2004, Lebel and Syme 2012, Lebel 2013), and they all located in four different phylogenetic clades with different divergence times. Different phylogenetic clades and divergence times represented different invading events. Our study indicates at least three invading events occurred from tropic Asia to Oceania. This is the reason why four of the five secotioid *Agaricus* species occur in Australia, and all cluster in different phylogenetic clades.

CHAPTER 4
NEW TAXA OF *AGARICUS* FROM CHINA AND THAILAND

4.1 Introduction

Agaricus L. 1753 (Agaricaceae, Agaricales) is a well-known genus. Many species in this genus are commercially cultivated and served as food. One of the popular edible mushrooms is *A. bisporus* (J.E. Lange) Imbach, which is the most extensively cultivated mushroom in the world, accounting for 38% of world production (ISMS Edible mushrooms 2017, http://www.isms.biz/edible-mushrooms/). Another popular edible mushroom, *A. subrufescens* Peck, is also a medicinal mushroom, and contains abundant bioactive compounds, for example, some compounds extracted from the basidiomes can be used as antioxidant (De Silva et al. 2012, 2013a, b, Llarena-Hernández et al. 2017). In the field, *Agaricus* is easily recognized by its white or brown caps with fibrillose scales on the surface, free lamellae, brown spore print and annulate stipe. Under the microscope, it is characterized by brown basidiospores, single or multiseptate cheilocystidia, and often lacks pleurocystidia. Habitats of *Agaricus* are various, the most common are forests and grasslands, such as *A. campestris* L. of section *Agaricus*, which can be found gregarious in small groups or in fairy rings in grasslands. *Agaricus* also exists in arid habitats, for example, *A. colpeteorum* T. Lebel and *A. lamelliperditus* T. Lebel & M.D. Barrett of section *Minores*, which were discovered in arid zones of Australia (Lebel 2013).

The taxonomic, systematic and species delimitation of *Agaricus* inferred by morphology are variable (Cappelli 1984, Singer 1986). In the 1990s' the application of molecular techniques brought new perspectives to fungal taxonomic research including the genus *Agaricus* (White et al. 1990). Using phylogenetic analyses, the taxonomy of *Agaricus* is becoming more and more stable. Zhao et al. (2011) used ITS sequence data from *Agaricus* specimens from temperate and tropical areas to build a phylogenetic topology for the genus, which revealed eleven new clades and indicated phylogenetic relationships between temperate and tropical species. Zhao et al. (2016f) carried out

multi-gene phylogenetic and evolutionary molecular clock analyses. In that study, *Agaricus* was segregated into five subgenera and 20 sections according to the phylogenetic position and divergence time of each clade. With the recent discovery of an American subgenus and a new clade found in the Caribbean area, *Agaricus* now contains six subgenera and 23 sections (Zhao et al. 2016f, Chen et al. 2017b, Parra et al. 2018).

4.2 Materials and Methods

4.2.1 Notes and outline

DNA extraction and PCR

DNA extraction and PCR amplification were done at the Institute of Microbiology Chinese Academy of Science. Genomic DNA was extracted from dry specimens by using an E.Z.N.A. Forensic DNA Extraction Kit (D3591-01, Omega Bio-Tek) following the manufacturer's protocol. PCR amplification was performed following He et al. (2017). Primers for the internal transcribed spacer (ITS), large ribosomal subunit (LSU) and translation elongation factor (tef1-α) were ITS4/ITS5, LR5/LROR and 983f/1567r, respectively (White et al. 1990, Moncalvo et al. 2000, 2002, Morehouse et al. 2003). PCR products were sent to a commercial company for sequencing and both directions were sequenced to ensure accuracy.

Sequences preparation, phylogenetic analyses and divergence time estimation

Sequences information for *Agaricus* studies were listed in Table 2. Sequences were checked in BioEdit V.7.0.4 first (Hall 2007). Alignments were made by Muscle (Edgar 2004) for each region separately, then adjusted by hand and ambiguous regions removed. Phylogenetic trees generated by Bayesian Inference (BI) analysis were performed in MrBayes 3.1.2. (Ronquist and Huelsenbeck 2003). Ten million generations were run for six Markov chains and sampled every 100th generation resulting in 100,000 trees. Burn-in was determined in Tracer v1.6 with effective sample sizes (ESS) higher than 200 (http://tree.bio.ed.ac.uk/software/tracer). Remaining trees were used to calculate Bayesian posterior probabilities (PP). Maximum Likelihood (ML) analysis and bootstrap values calculation were performed in raxmlGUI 1.5b1

using GTRGAMMA model with 1000 replicates (Silvestro and Michalak 2012). Models selections for divergence time estimation analysis were performed in jModel Test v. 2 (Darriba et al. 2012) for each gene separately. The XML file was generated in BEAUTI v. 1.8. Priors were set according to the previous fossil-calibrated analysis which was conducted from a fossil-calibrated analysis referred from two Agaricomycetes fossils: *Archaeomarasmius leggetti* Hibbett, D. Grimaldi & Donoghue, as representative of the minimum age of 90 million years ago of Agaricales, and *Quatsinoporites cranhamii* S.Y. Sm., Currah & Stockey as representative of the minimum age of 113 million years ago of Hymenochaetales (Zhao et al. 2016f). Independent Monte Carlo Markov Chain was run by BEAST v1.8: in the study of new section in *Agaricus* subg. *Pseudochitonia*, 50 million generations was run and log states every 5,000 generations; in the phylogeography study of *Agaricus* sect. *Minores*, ten million generations were run and sampled every 100th generation resulting in 100,000 trees (Drummond et al. 2012). The log files were checked in Tracer v. 1.6 (Rambaut et al. 2014) to ensure ESS (Effective Sample Sizes) value higher than 200. The ultrametric maximum-clade-credibility (MCC) tree was summarized using TreeAnnotator 1.8, discarding 10% of states as burn-in and annotating clades with ≥ 0.8 posterior probability.

4.2.2 Morphologic study of *Agaricus*

Specimens were collected during rainy seasons (June to September) from China and Thailand, photographs of fresh specimens were taken immediately *in situ*, basidiomes were wrapped in aluminium foil or put in plastic boxes separately. Morphological characteristics including odour, basidiome size, colour and chemical reaction were recorded when the fruiting body are fresh. Every specimen was dried in an electrical food drier at 65 °C until no more moisture left, kept in a plastic ziplock bag and deposited in Herbarium Mycologicum Academiae Sinicae (HMAS) and Mae Fah Luang University Herbarium (MFLU). Anatomical and cytological characteristics including basidiospores, basidia, cystidia and pileipellis were observed under an Olympus CX31 microscope. At least 20 measurements were made. Data were analyzed and recorded as X = the mean of length by width ± SD, Q = the quotient of basidiospore length to width, and Q_m = the mean of Q values ± SD. All the protocols of morphological study followed Largent's methodology (Largent 1986). Macrochemical

reactions including KOH reaction and Schäffer's reaction are followed Chen et al. (2015a).

4.3 Results and Discussions

4.3.1 A new species and section of *Agaricus* subgenus *Pseudochitonia* from Thailand

Phylogenetic analyses

Two data matrices were made for different analyses. The first one is an ITS sequence dataset which contains 84 specimens, all belonging to subgenus *Pseudochitonia* and an outgroup *A. campestris*. This dataset was used for Bayesian and Maximum Likelihood analyses. In Bayesian Inference (BI) analysis, the best model is GTR + I + G. The second dataset was used for divergence time estimation including 63 ITS, 61 LSU and 59 tef1-α gene sequences from specimens representing the six subgenera of *Agaricus*.

The Bayesian tree from ITS sequences is shown in Figure 7. A total of 84 sequences are represented from 12 sections of subg. *Pseudochitonia* and *A. campestris* was used as outgroup. All sections are well supported both by posterior probabilities (PP) and bootstrap (BS). Phylogenetic trees generated from Bayesian and ML analyses showed identical topologies and are also almost identical with those of Zhao et al. (2016f) with the exception of *A. dilutibrunneus* R.L. Zhao, which clustered with two unknown specimens (*A.* sp./CA486 and *A.* cf. *goossensiae*/ADK2171) and formed a monophyletic clade in our analyses, isolated from all other species in the previous study (Zhao et al. 2016f). Our three specimens (ZRL2043, ZRL2085 and BC088) formed a monophyletic clade in subg. *Pseudochitonia* which is fully supported both in PP and BS values and located at an isolated position (Fig. 8).

Divergence time analysis

The multi-gene MCC tree is shown in Fig. 9. It was conducted based on the dataset of multi-gene sequences. A total of 63 specimens were included, comprising 43 specimens used in ITS analysis, 19 specimens from five subgenera and an outgroup *Heinemannomyces* sp. All subgenera and sections are well-supported statistically.

Agaricus diverged at the stem age 66 Mya (million years ago), all subgenera diverged between 29.2–33.9 Mya and sections diverged between 20–26.9 Mya. Our three specimens formed a new monophyletic clade in subg. *Pseudochitonia* with strong PP support and this clade diverged at 26.7 Mya.

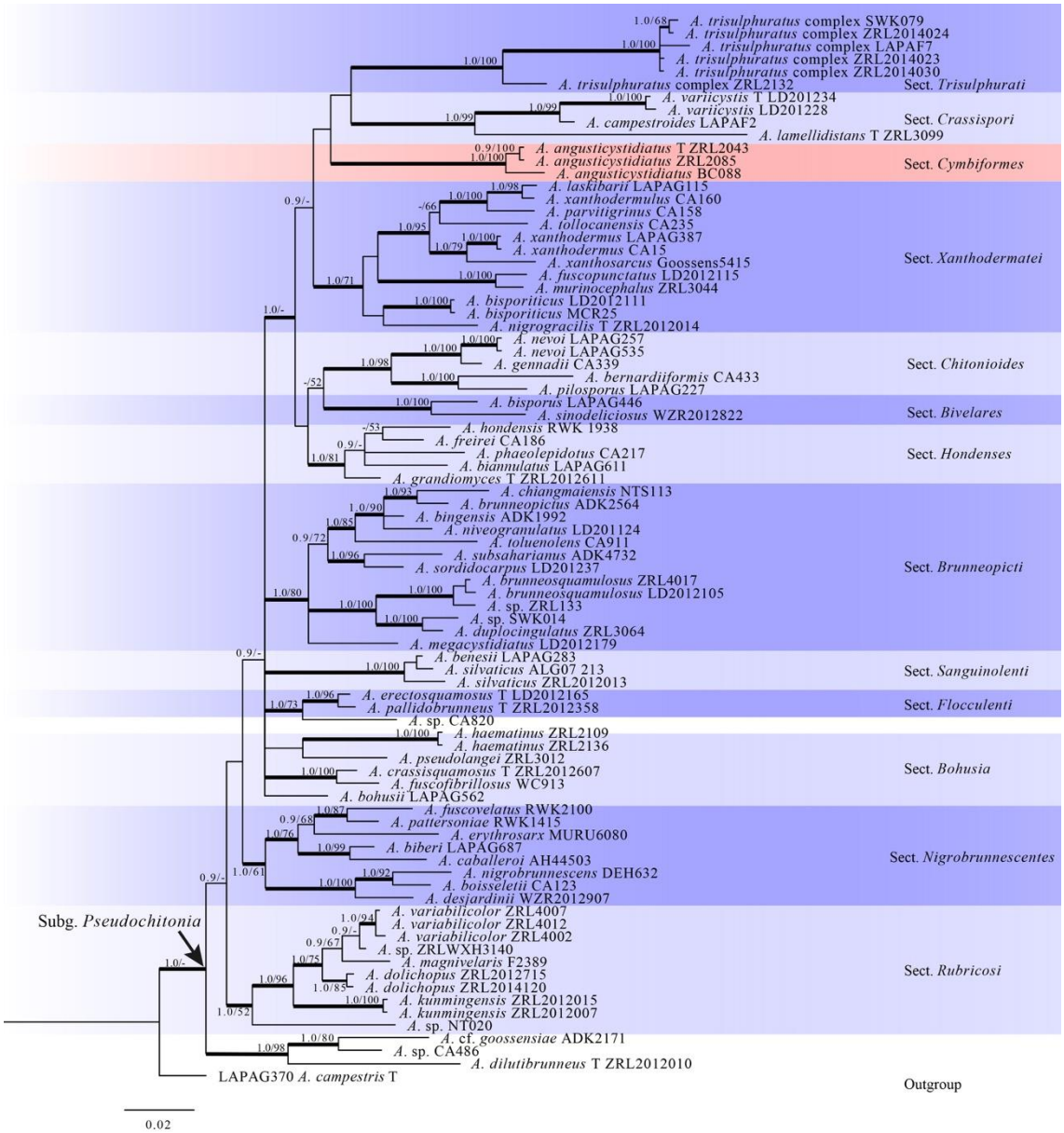

Figure 8 Phylogenetic tree of *Agaricus* subgenus *Pseudochitonia* generated from Bayesian analysis of ITS sequences, rooted with *A. campestris*. Bayesian posterior probability (PP) values ≥ 0.9 or Bootstrap support (BS) values ≥ 50% are indicated at the internodes (PP/BS). The branches in bold mean the related PP > 0.95, "T" refers to sequences from type specimen.

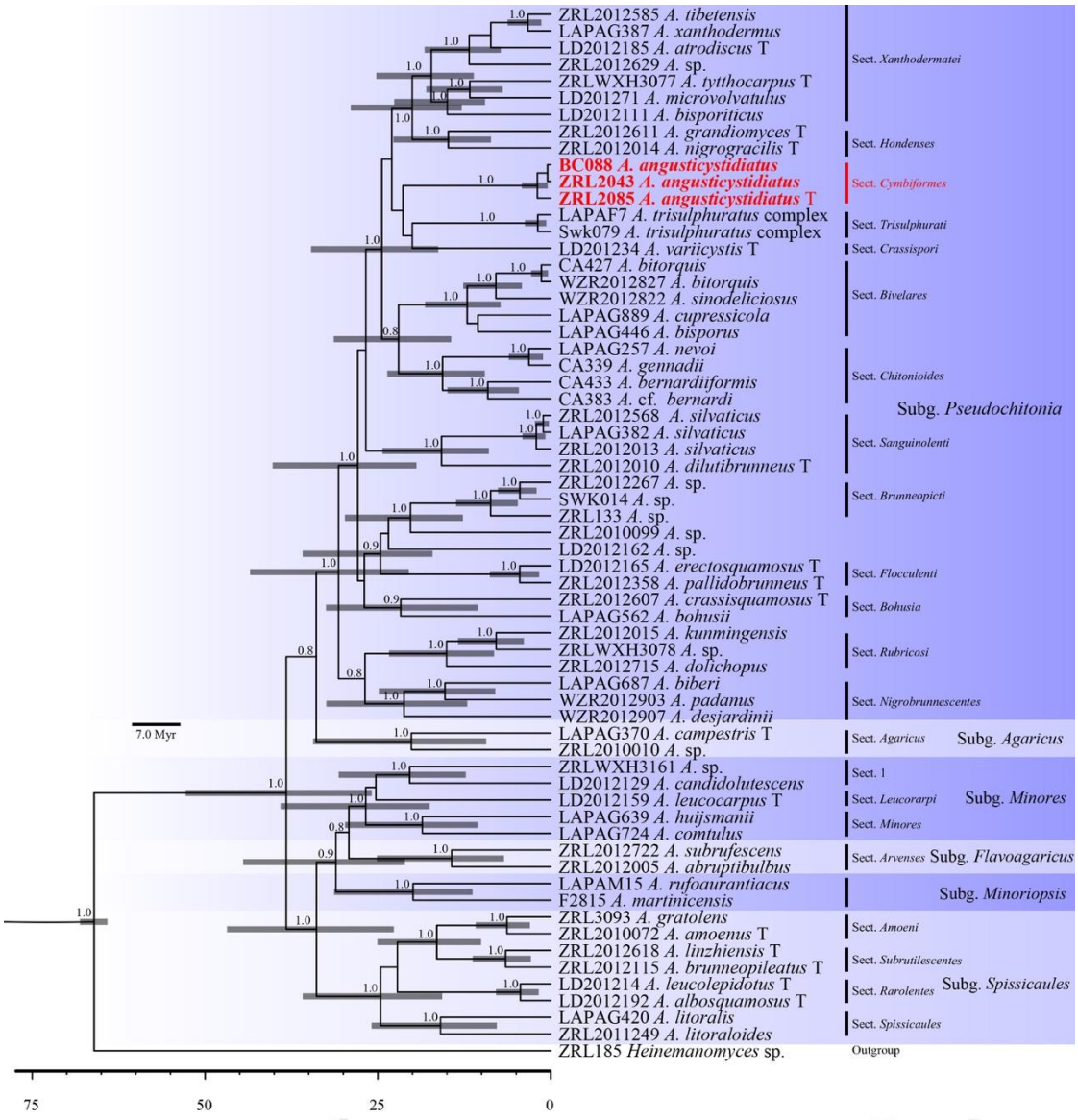

Figure 9 Maximium Clade Credibility tree of genus *Agaricus* based on ITS, LSU and tef1-α gene sequences with the outgroup *Heinemannomyces* sp. Posterior probability values equal or above 0.9 are annotated at the internodes. The 95% highest posterior density of divergence time estimation are marked by horizontal bars.

Taxonomy

Agaricus* (*Pseudochitonia*) section *Cymbiformes M.Q. He & R.L. Zhao, ***sect. nov.***

Mycobank Number: MB824147 Faceoffungi Number: FoF04104

Type species. *Agaricus angusticystidiatus* M.Q. He, Desjardin., K.D. Hyde & R.L. Zhao

Etymology. In reference to the cymbiform basidiospores.

Description. KOH reaction negative, Schäffer's reaction negative on dry specimens. No discolouration on touching, but discolouration reddish-brown on cutting. Annulus membranous. Smell strong iodoform. Basidiospores cymbiform and cheilocystidia narrow with variable shapes.

Agaricus angusticystidiatus M.Q. He, Desjardin, K.D. Hyde & R.L. Zhao, ***sp. nov.*** Fig. 10

Mycobank Number: MB825177 Faceoffungi Number: FoF04105

Etymology. refers to the narrow clavate cheilocystidia.

Type. Thailand, Chiang Mai Province, Mae Taeng, Baan Mae Sae village, on Hwy

1095 near 50 km marker, 19°14.599'N, 98°39.456'E, alt. 960 m. In rain forest dominated by *Castanopsis armata*, *Castanopsis* sp., *Pinus* sp., *Lithocarpus* sp., 26 June 2005, collected by Jennifer Kerekes. Holotype: ZRL2043 (HMAS279593); Isotype: BBH19428 and SFSUZRL2043.

Description. *Pileus* 40–80 mm diam., plano-convex, applanate, broadly umbonate; surface concentric squamulose with small skull-cup at disc, appressed, slightly fissured, light brown (6D8), brown (7E3), greyish-brown (5D5), dark brown (6D6) against the grey (8E3) background. Context 4–5 mm thick at disc, fragile, white to grey (8E3) in age. Lamellae free, crowded, lamellulae with 3–4 lengths, 3–4 mm broad, normal to slightly ventricose, brown (7E5) to dark brown (7F7-8), edge colour similar to the gill itself. Stipe 55–100 × 5–8 (base 8–15) mm, cylindrical bulbous, with rhizomorphs in most cases, hollow, surface glabrous to silky, white to dark brown (6D6). Annulus pendent or percurrent; single; upper side membranous, white; lower side surface

powdery, light yellow (4B2) grain-like dots in circulate; superior, persistent, edge entire, up to 5 mm broad. Smell of iodoform. No colour change on touching; light dull red, greyish brown (7D4) on cutting.

KOH reaction: negative. Schäffer's reaction: negative on dry specimens.

Basidiospores 5–6.5 × 3–4 (–4.5) µm [X = 5.6 ± 0.5 × 3.8 ± 0.4, Q = 1.1–2.2, Q_m = 1.52 ± 0.7, n = 20], cymbiform, some endosporium, no germ pore, brown. Basidia 10–15 × 5.5–7 µm, clavate, hyaline, smooth, 4-spored. Pleurocystidia absent. Cheilocystidia 20–30 (–45) × 5–8 µm, occasionally one septum, narrowly clavate to clavate, some with elongated top, rarely subcapitate, hyaline, smooth. Pileipellis cutis consisting of 3–5 µm diam. hyphae, hyaline, smooth, non-constricted at septa. Annulus hyphae same as pileipellis.

Habit. Gregarious on soil in rain forest which is mainly dominated by *Castanopsis armata*, *Castanopsis* sp., *Pinus* sp., *Lithocarpus* sp.

Distribution. Thailand, Chiang Mai Province (type distribution).

Other materials examined. Thailand, Chiang Mai Province, Mae Taeng, Ban Mae Sae Village, on Hwy 1095 near 50 km marker, 19°14.599'N, 98°39.456'E, elev. ca. 960 m, 3 July 2004, collected by Thitiya Boonpratuang, ZRL2085 (HMAS279594, and SFSUZRL2085); Thailand, Chiang Mai Province, Mae Taeng, Mushrooms research center, 30 July 2014, collected by Boontiya Chuankid, BC088 (MFLU 14-0903).

Notes. This new species is morphologically distinguished from other *Agaricus* species by its strong iodoform smell, context reddish-brown discolouration on cutting, cymbiform basidiospores and narrow cheilocystidia with variable shapes. Phylogenetic analyses confirmed it is a member of the subgenus *Pseudochitonia* with an isolated phylogenetic position in *Agaricus*. This new species is similar to *A. iodolens* Heinem. & Gooss.-Font. of section *Xanthodermatei*, because both have relatively slender basidiomes and odour of iodine (Naritsada et al. 2014). However, this new species has cymbiform basidiospores and a bulbous stipe, while those of *A. iodolens* are ellipsoid and an equal stipe (Zoberi 1972). *Agaricus lamellidistans* R.L. Zhao and *A. variicystis* L.J. Chen, K. D. Hyde & R. L. Zhao of section *Crassispori* resemble this new species,

because all have greyish-brown pilei and cymbiform basidiospores. These species lack discolouration on cutting, while those of *A. angusticystidiatus* have dull red discolouration on cutting (Zhao et al. 2016f).

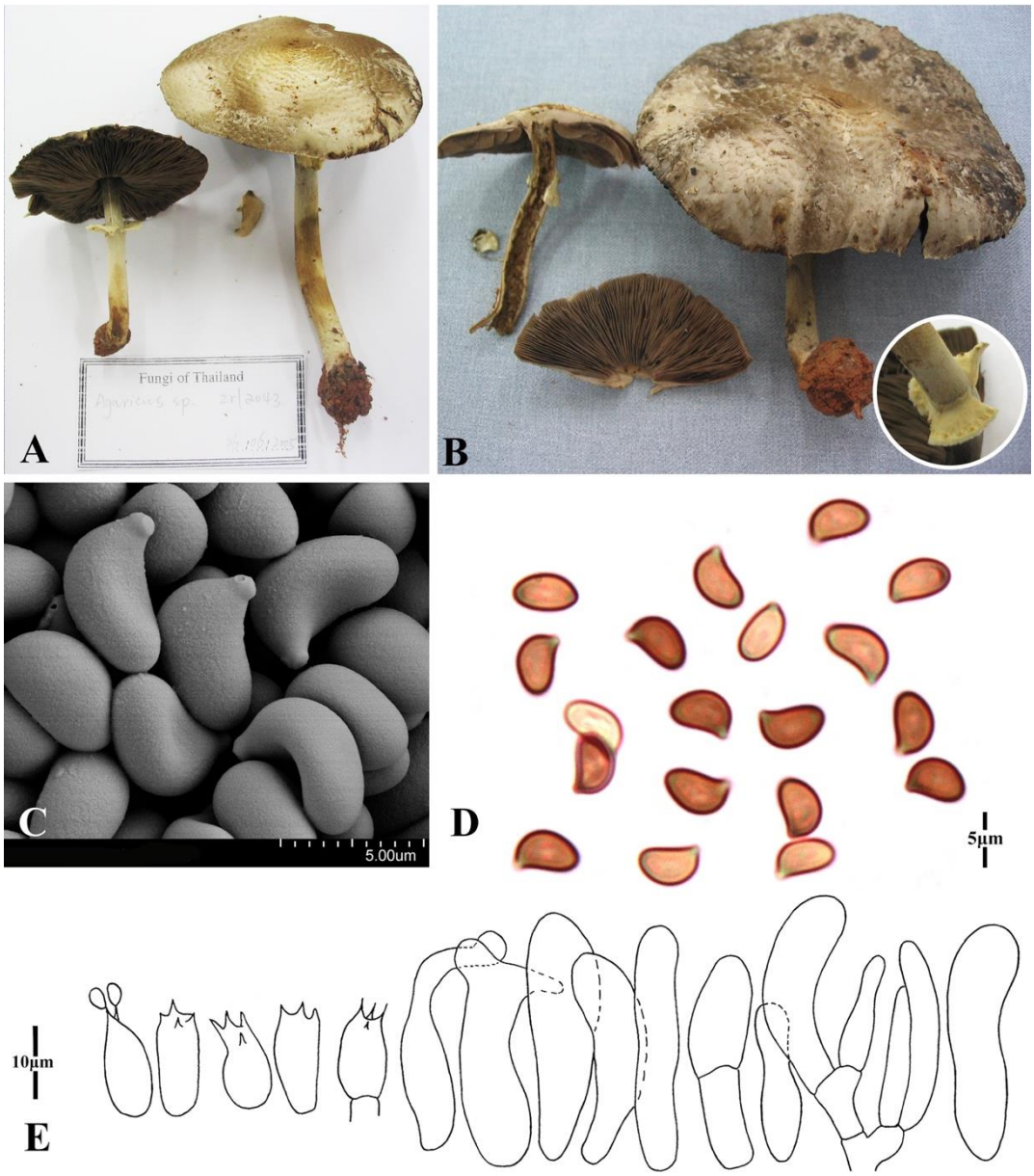

Figure 10 Morphology of *Agaricus angusticystidiatus* A, B basidiomes C, D basidiospores E basidia and cheilocystidia.

Discussion

Based on phylogenetic and morphological studies, we propose *A. angusticystidiatus* as a new species in subgenus *Pseudochitonia*. Furthermore, the dating analysis, based on multi-gene sequences, indicated that *A. angusticystidiatus* diverged at 26.7 Mya which is slightly older than other sections in *Agaricus* (18–26 Mya, in Zhao et al. 2016f). Therefore, a new section *Cymbiformes* is proposed, which presently only contains species *A. angusticystidiatus*. Thus up to now, there are six subgenera and 24 sections in the genus *Agaricus* (Zhao et al. 2016f; Chen et al. 2017b; Parra et al. 2018). Zhao et al. 2016 had conducted a reconstruction of the taxonomic system of *Agaricus*. In that study, they used the following criteria to recognize subgenera and sections: "(i) they must be monophyletic and statistically well-supported in the multi-gene analyses; (ii) their respective stem ages should be roughly equivalent and subgenera stem ages must be older than section stem ages; and (iii) they should be identifiable phenotypically, whenever possible" (Zhao et al. 2016f). That means divergence time has been used as an additional criterion to rank taxa of above species level in *Agaricus*. Later, the criterion of divergence time, along with phylogenetic, monophyletic and morphological support, has been accepted in other new subgenus and section reorganizations in *Agaricus*, such as a new subgenus *Minoriopsis* (Chen et al. 2017b); and a new section *Kerrigania* (Parra et al. 2018).

As mentioned before, this proposed new section *Cymbiformes* has a closely phylogenetic relationship with sections *Trisulphurati* and *Crassispori*. In morphology, all of them differed with other sections of *Agaricus* by the combination of negative Schäffer's reaction, chemical odours such as phenol, ink or carbolic acid and basidiospores endosporium and often cymbiform. However, section *Trisulphurati* has woolly squamules on the surfaces of the pileus and stipe and the other two sections only have appressed squamules at the centre of the pileus. Furthermore, this new section *Cymbiformes* could be separated from section *Crassispori* by its negative KOH reaction and developed annulus (the latter is positive KOH reaction and with fragile annulus) (Zhao et al. 2016f).

So far, section *Cymbiformes* is only known from a tropical area. The cymbiform basidiospores are rare in *Agaricus* species. Presently there are three *Agaricus* species

from tropical areas which have this kind of basidiospores. They are *A. angusticystidiatus* of section *Cymbiformes* and *A. lamellidistans* and *A. variicystis* of section *Crassispori* (Zhao et al. 2016f). In phylogenetic analyses, these two sections also show a close phylogenetic position, which is similar to previous studies (specimens *ZRL2043* and *ZRL2085* were treated as *A.* sp. in Zhao et al. 2011, 2016f). The presence of cymbiform basidiospores is a common character in another genus *Micropsalliota* of Agaricaceae. In phylogenetic analyses, *Agaricus* is sister to *Hymenagaricus*, then sister to *Chlorophyllum, Heinemannomyces* and *Micropsalliota* (Zhao et al. 2017c) and all of them have tropical distribution habitats. Thus we hypothesised that cymbiform basidiospores have formed at least twice in evolutionary events and are associated with tropical environments.

4.3.2 Two new species of *Agaricus* section *Xanthodermatei* from China

Phylogenetic analyses

Phylogenetic trees generated through ML and Bayesian methods were presented in Fig. 10. Two main clades were shown in section *Xanthodermatei*. One named Xan III which was supported both by bootstrap and PP values (94/1.0), whlile another clade named Xan II was not supported neither by bootstrap nor PP values. The new species *A. langensis* grouped in clade Xan III and sister to *A.* sp. (*ZRL2012629*). *Agaricus memnonius* grouped in Xan II without any sister species.

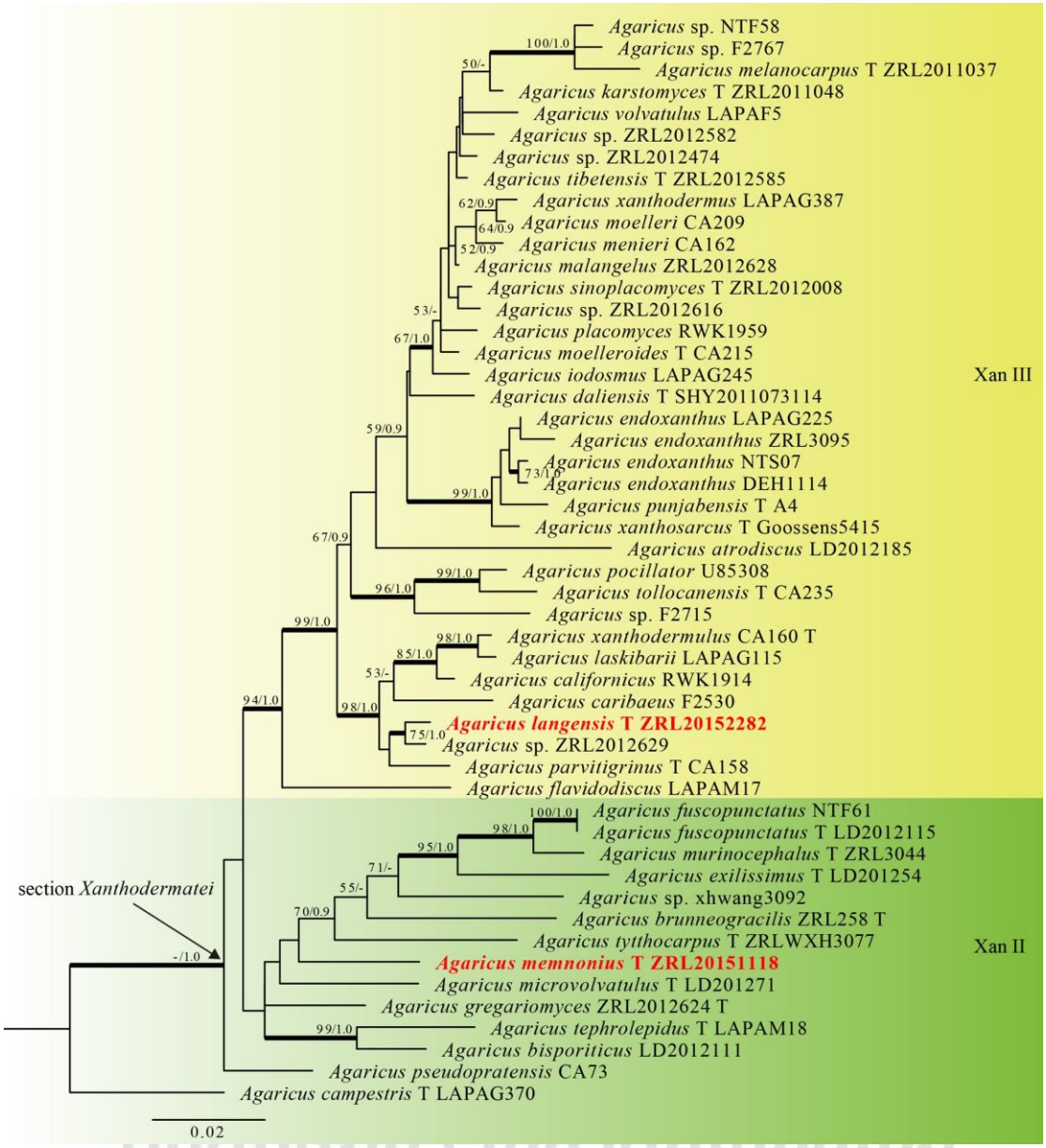

Figure 11 Maximum Likelihood (ML) tree of *Agaricus* Sect. *Xanthodermatei* based on LSU, tef1-α and ITS sequences with the outgroup *A. trisulphuratus* Berk. The bootstrap values and Bayesian posterior probabilities more than 50%/0.9 (BS/PP) are indicated at the nodes. The branches in bold mean the related PP > 0.95, "T" refers to sequences from type specimen.

Taxonomy

Agaricus memnonius M.Q. He & R.L. Zhao ***sp. nov.*** Figure 12

Fungal Names: FN570535; Faceoffungi Number: FoF 03940

Etymology: The Latin epithet ‘‘*memnonius*’’ meaning "brown-black" refers to the colour of the pileus surface.

Holotype: Sichuan Province, China, *ZRL20151118* (HMAS 0278359 Holotype).

Description: *Pileus* 50 mm in diam., plane or plano-concave, disc black or black-brown, slightly depressed, margin straight, exceeding lamellae; Surface dry, with black-brown fibrillose scales against white background, scales triangular, appressed, extremely denser at disc, scattered towards the margin. *Context*, flesh, white. *Lamellae* up to 3 mm broad, free, crowded, pink, edge even, intercalated with lamellulae. *Annulus* superous, double, membranous, white, pendant, upper side smooth, lower side cogwheel, white, edge light brown. *Stipe* 57 × 5 (8 at base) mm, white, hollow, cylindrical, surface dry, smooth, silky, with rhizomorphs. Odour unknown.

KOH reaction: positive yellow. Schäffer’s reaction: negative.

Basidiospores 4.5 – 5.3 × 3.3 – 4.1 μm, [x = 5.0 ± 0.2 × 3.6 ± 0.2, Q = 1.2 – 1.5, Q_m = 1.4 ± 0.1, n = 20], ellipsoid, smooth, thick-walled, brown. *Basidia* 15.0 – 19.5 × 6.5 – 9.3 μm, clavate, hyaline, 4-spored, smooth. *Cheilocystidia* not very conspicuous, can be single and multiseptate (generally no more than three elements), the terminal element clavate, cylindrical, 12.1 – 24.8 × 6.9 – 13.7 μm, *Pleurocystidia* absent. *Pileipellis* a cutis composed of hyphae of 4.6 – 14.4 μm in diam., smooth, cylindrical, slightly constricted at septa, pigment intracellular, light brown or brown.

Habitat: solitary on soil in forest with bamboo around.

Notes: The phylogenetic trees generated by Maximum Likelihood and Bayesian Inference analysis present the similar topology with Zhou et al. 2016. This new species is at the base position in section *Xanthodermatei* without any sister species (Figure 10).

In morphologic study, *A. memnonius* has a slender basidiome, which is similar to those European species: *A. endoxanthus* Berk. & Broome, *A. laskibarii* L.A. Parra & Arrillaga, *A. xanthodermulus* Callac & Guinb. and *A. parvitigrinus* Guinb. & Callac (Parra 2013). But they are different with the scales on the pileus: *A. memnonius* are black brown and triangular, while those of the four known species are greyish-brown and not triangular. Some Chinese original species have slender basidiome too, such as *A. gregariomyces* J.L. Zhou & R.L. Zhao and *A. karstomyces* R.L. Zhao. Compared with *A. memnonius*, however, *A. gregariomyces* has larger and elongate basidiospores (5.62 – 6.3 × 3.52 – 4.0 μm, Q = 1.6 – 1.9, Zhou et al. 2016). *Agaricus karstomyces* has dot-like scales on pileus while *A. memnonius* are triangular. Based on phylogenetical and morphologic study, *A. memnonius* is introduced as new species and characterized by its distinct phylogenetic position in section *Xanthodermatei*, slender basidiome, black-brown, triangular scales on the pileus and the single and multiseptate cheilocystidia.

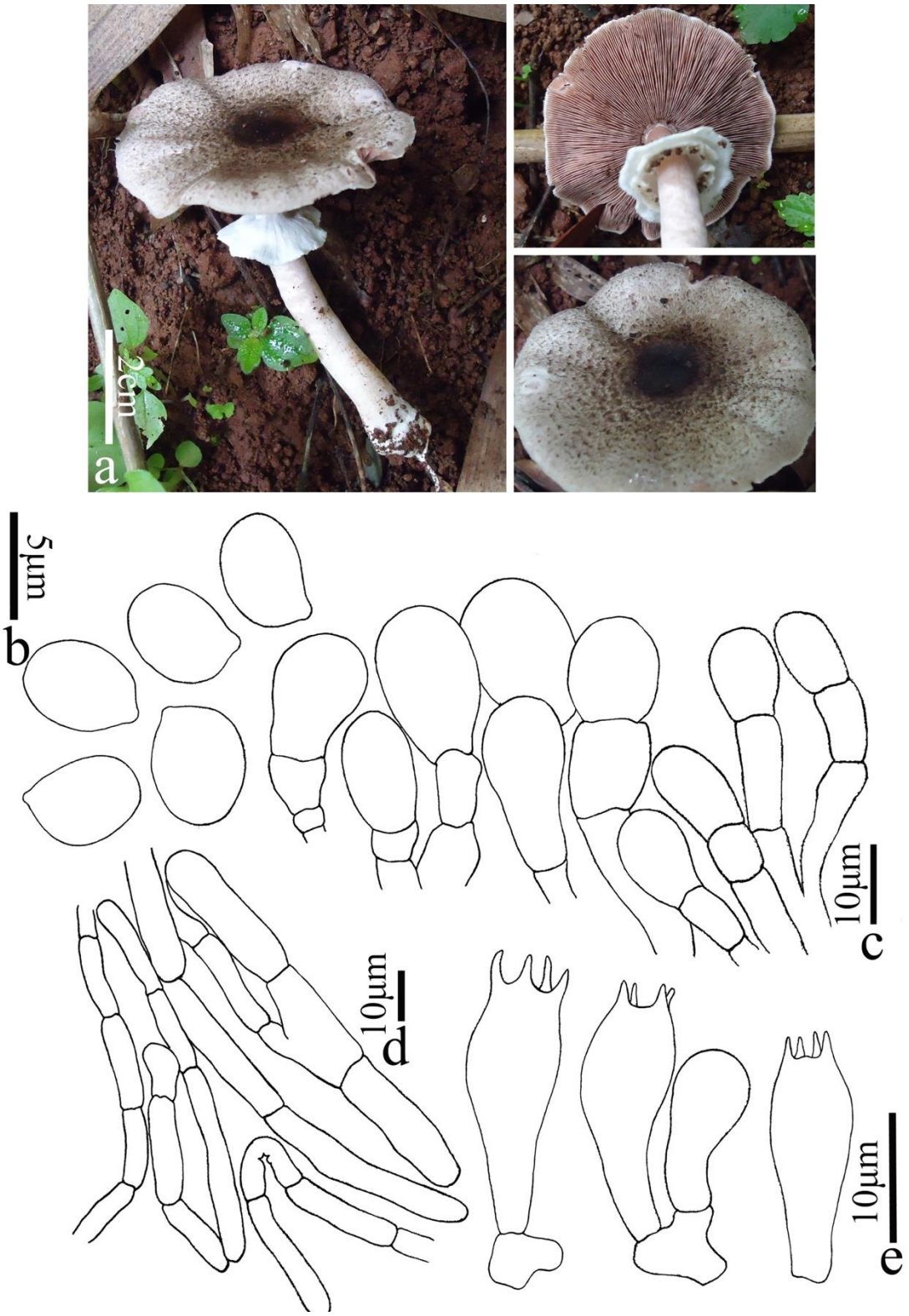

Figure 12 Morphology of *Agaricus memnonius*, a: basidiome in the feild, b: basidiospores, c: cheilocystidia, d: pileipellis hyphae, e: basidia.

Agaricus langensis M.Q. He & R.L. Zhao ***sp. nov.*** Figure 13

Fungal Names: FN570534; Faceoffungi Number: FoF 03941

Etymology: The Latin epithet ‘‘*langensis*’’ meaning “pertaining to Lang” refers to the Lang County where the holotype was collected.

Holotype: Gongga village, Lang County, Tibet, China, Alt. 3384 m, 29°16′ N, 93°11′ E, collected by Su Sheng-Yu, *ZRL20152282* (HMAS 0278317 Holotype).

Description: *Pileus* 26 – 49 mm in diam., parabolic when young, then convex, disc slightly subumbonate, margin straight, sometimes with appendiculate remains of universal veil; Surface dry, with grayish brown fibrillose scales against white background, scales appressed, covered whole pileus, denser at disc, scattered towards the margin. *Context*, flesh, white. *Lamellae* up to 5 mm broad, free, crowded, pink, edge even, intercalated with lamellulae. *Annulus* up to 6 mm in diam., superous, double, membranous, white when fresh, yellowish when dry, pendant, upper side smooth, lower side cogwheel, white, edge light brown. *Stipe* 59 – 76 × 6 – 7 (7 – 10 at base) mm, white, hollow, cylindrical, surface dry, smooth or slightly fibrillose, with rhizomorphs. Odour unknown. Basidiome flavescent when rubbed.

KOH reaction: positive yellow. Schäffer’s reaction: negative.

Basidiospores 6.3 – 8.3 (– 8.5) × 3.7 – 5.1 μm, [x = 7.2 ± 0.6 × 4.4 ± 0.3, Q = 1.4–1.9, Q_m = 1.6 ± 0.1, n = 20], ellipsoid, elongate, smooth, thick-walled, brown. *Basidia* 18.5 – 25.3 × 6.7 – 8.9 μm, clavate, hyaline, 4-spored, smooth. *Cheilocystidia* absent, *Pleurocystidia* absent. *Pileipellis* a cutis composed of hyphae of 4.8 – 12.1 μm in diam., smooth, cylindrical, slightly constricted at septa, hyaline, light brown or brown.

Habitat: scattered on soil in forest.

Notes: This new species was represented by specimen *ZRL20152282* which at the sister position to a clade composed of 32 species within section *Xanthodermatei* (Fig. Z). There are no species phylogenetically close to this new species.

Compared with morphologic characteristics of known species, *A. parvitigrinus* Guinb. & Callac assembles *A. langensis* in the field, because they both have small to

medium sized basidiome, pileus convex and covered by greyish fibrillose scales. But under microscope, *A. langensis* has larger basidiospores than those of *A. parvitigrinus* (5.8 × 3.7 μm, Parra 2013). *Agaricus menieri*, *A. xanthodermulus* and *A. xanthodermus* have the same sized basidiospores and distinct cheilocystidia (Parra 2013), but *A. langensis* absent cheilocystidia. *Agaricus tibetensis* morphologically assembles this new species mostly, because they both have small to medium sized basidiome, same sized basidiospores, and absent (or rare in *A. tibetensis*) cheilocystidia, and both origin from Tibet (Zhou et al. 2016c). However, there are 33 different positions in ITS sequences between them, and the molecular phylogeny also indicated them as different species.

Based on the phylogenic and morphologic characteristics, we introduce this new species here, and this new species is characterized by its distinct phylogenetic position in sect. *Xanthodermatei*, small to medium sized basidiome, relatively large basidiospores and absent cheilocystidia.

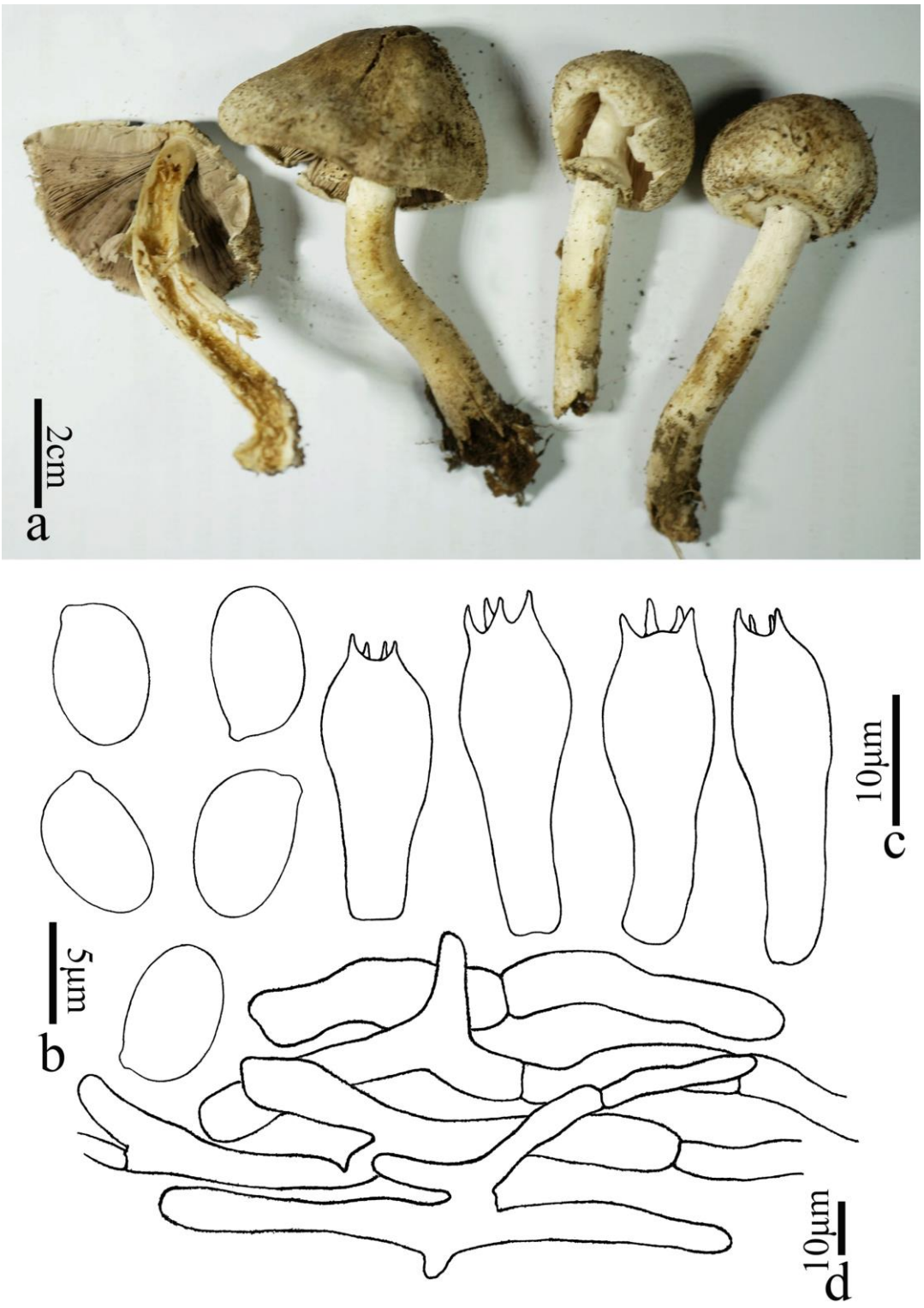

Figure 13 Morphology of *Agaricus langensis*, a: basidiome in the feild, b: basidiospores, c: basidia, d: pileipellis hyphae.

Discussion

The phylogenetic analyses results agree with the latest treatments and updated accounts of *Agaricus* section *Xanthodermatei* in Thongklang et al. (2014), Zhao et al. (2016f), Zhou et al. (2016c), Hyde et al. (2017) and Tibpromma et al. (2017). Two main clades named Xan III and Xan II are indicated in the phylogenetic trees. Our two new species located in this two clades separately with their distinct positions. Zhou et al. (2016c) introduced 8 new species of section *Xanthodermatei* from Tibet Plateau which indicated the species diversity of section *Xanthodermatei* in Himalayas and surrounding areas. Two new species introduced in this study also from the same area, which furthermore confirmed the species diversity of section *Xanthodermatei* in this area.

4.3.3 Five new species of *Agaricus* section *Minores* from China and Thailand

Phylogenetic analyses

Alignments included 109 ITS, 82 LSU and 78 tef1-α squences. Final multi-locus matrix comprising 746 bp (base pair) LSU, 545 bp tef1-α, and 627 bp ITS. Two best model for each region were GTR + I + G for ITS and LSU, and SYM + I + G for tef1-α. Section *Minores* was supported both in PP value and boostrap. Five new species were located in five different clades and separated from other known species in section *Minores*. The phylogenetic tree was presented in Figure 14.

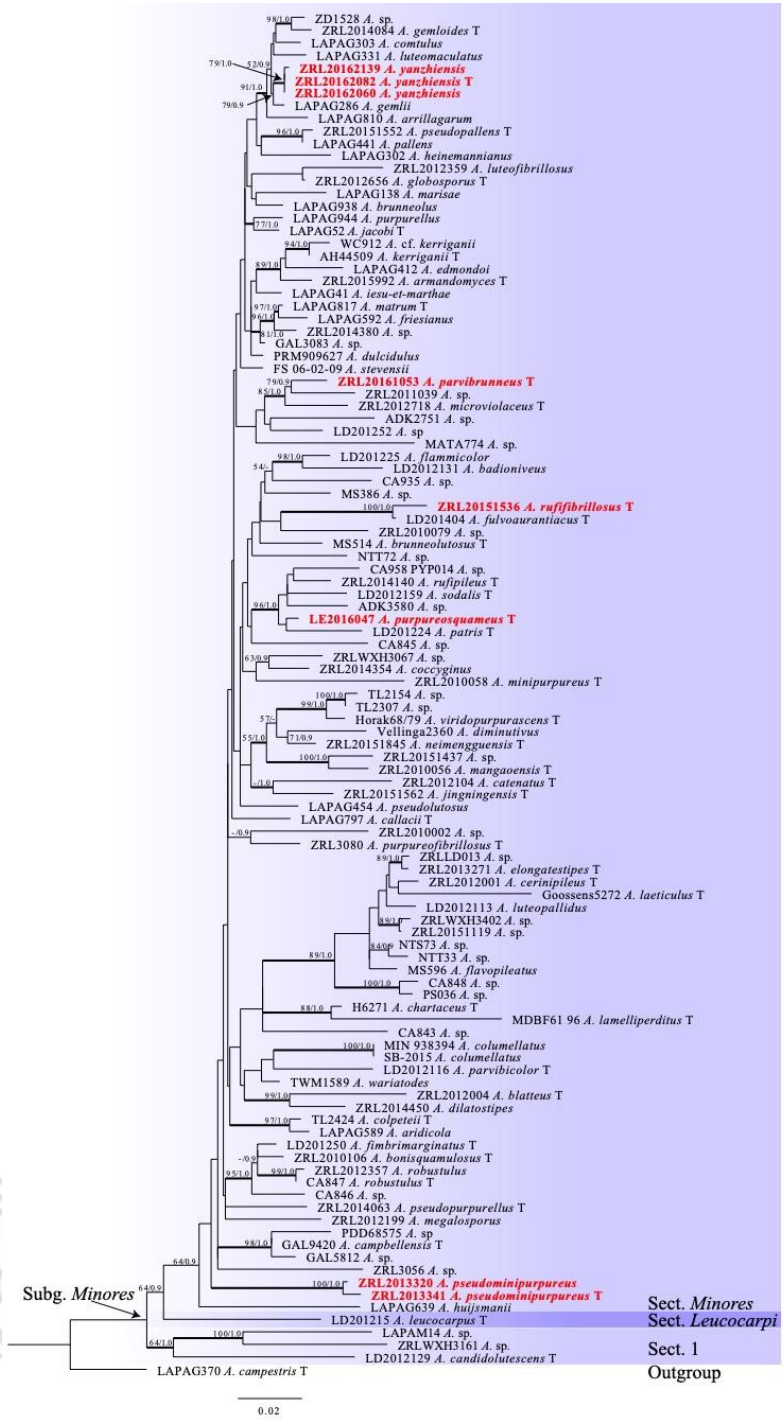

Figure 14 Maximum likelihood (ML) tree of *Agaricus* subg. *Minores* based on LSU, tef1-α and ITS sequences with the outgroup *A. campestris* L. The bootstrap values and Bayesian posterior probabilities more than 50%/0.9 (BS/PP) are indicated at the nodes. The branches in bold mean the related PP > 0.95, "T" refers to sequences from type specimen.

Taxonomy

Agaricus rufusfibrillosus M.Q. He & R.L. Zhao ***sp. nov.*** Figure 15

Index Fungorum number: IF553825 Faceoffungi Number: FoF 03627

Etymology: refer to the reddish brown fibrils on cap.

Holotype: HMAS280110

Pileus 57 – 70 mm in diam., convex first, then broadly convex when mature, disc truncate, background white, margin straight; surface dry, covered by fibrillose scales completely, scales triangular, appressed, denser at disc, scanty towards the margin, orange brown or brown, *Context* 5 mm thick, flesh, white. *Lamellae* 6 mm broad, free, crowded, normal, pinkish brown, edge even. *Annulus* 50 mm in diam., fragile, membranous, single, white, pendant, upper side smooth, the lower side slightly floccus, with cortinate fibrils around the stipe. *Stipe* 51 – 80 × 11 – 20 mm, white, hollow, cylindrical with fusiform base; surface dry, with brown fibrils. Odour of almond. No discoloration when cutting. KOH reaction: positive yellow.

Basidiospores 5.1 – 6.1 × 3.6 – 3.9 μm, [x = 5.6 ± 0.2 × 3.8 ± 0.1, Q = 1.3 – 1.6, Q_m = 1.5 ± 0.1, n = 20], ellipsoid, smooth, thick-walled, brown. *Basidia* 14.6 – 22.2 × 6.8 – 8.1 μm, clavate, hyaline, 4-spored, smooth. *Cheilocystidia* absent. *Pleurocystidia* absent. *Pileipellis* a cutis composed of hyphae of 4.2 – 13.5 μm in diam., smooth, cylindrical, light brown, no constricted at septa.

Habitat: gregarious on soil at road side.

Material examined: CHINA, Zhejiang Province, Jingning County, Cao Yutang Forest Park, 19 Aug 2015, He Mao-Qiang (HMAS 280110, **holotype**).

Notes: The simple annulus, positive yellow KOH reaction and almond odour of basidiome confirm this new species is a member of subgenus *Minores*. In phylogeny analysis, it cluster with other two species *A. fulvoaurantiacus* L.J. Chen & Karunarathna and *A. luteofibrillosus* M.Q. He, L.J. Chen & R.L. Zhao under the support of 100/1.0 BS/PP value in section *Minores*. In morphology, this three species roughly resembles each other both in the field and under microscope. In the filed, they all have middle

sized basidiome, brown or orange brown pileus and triangular scales on cap. Under microscope they all have the same basidiospores. The main differences this two known species share with *A. rufusfibrillosus* are that *A. rufusfibrillosus* has a truncate disc, while another two without, and the cheilocystidia of *A. rufusfibrillosus* is absent, other two are abundant. Compared separately, *A. rufusfibrillosus* has a shorter stipe than *A. luteofibrillosus* (60 – 141 × 5 – 14 (base 8 – 25) mm, Li et al. 2015), and annulus white on both side which of *A. fulvoaurantiacus* with yellowish flakes on the lower side (Chen et al. 2017). There are lots of polymorphisms within the species *A. fulvoaurantiacus* and *A. luteofibrillosus* (Chen et al. 2017), we therefore compared the ITS region among the three species. Besides all the polymorphisms, there are also 13 positions of *A. rufusfibrillosus* differs from this two species (see Table 4).

Table 4 ITS nucleotide differences between *A. rufusfibrillosus* and related species

Samples	**Positions in the ITS alignment (668 nts)**												
A. fulvoaurantiacus	5	94	96	530	533	542	553	563	570	585	611	613	629
MS549	T	G	-	C	C	G	A	A	A	-	C	C	C
MS316	T	G	-	C	C	G	A	A	A	-	C	C	C
LD201404 T	T	G	-	C	C	G	A	A	A	-	C	C	C
ZRL2014005	T	G	-	C	C	G	A	A	A	-	C	C	C
ZRL2013468	T	G	-	C	C	G	A	A	A	-	C	C	C
ZRL2012124	T	G	-	C	C	G	A	A	A	-	C	C	C
A. luteofibrillosus													
ZRL2013484 T	T	G	-	C	C	G	A	A	A	-	C	C	C
A. rufusfibrillosus.													
ZRL20151536 T	-	C	C	T	T	C	C	T	C	T	T	T	T

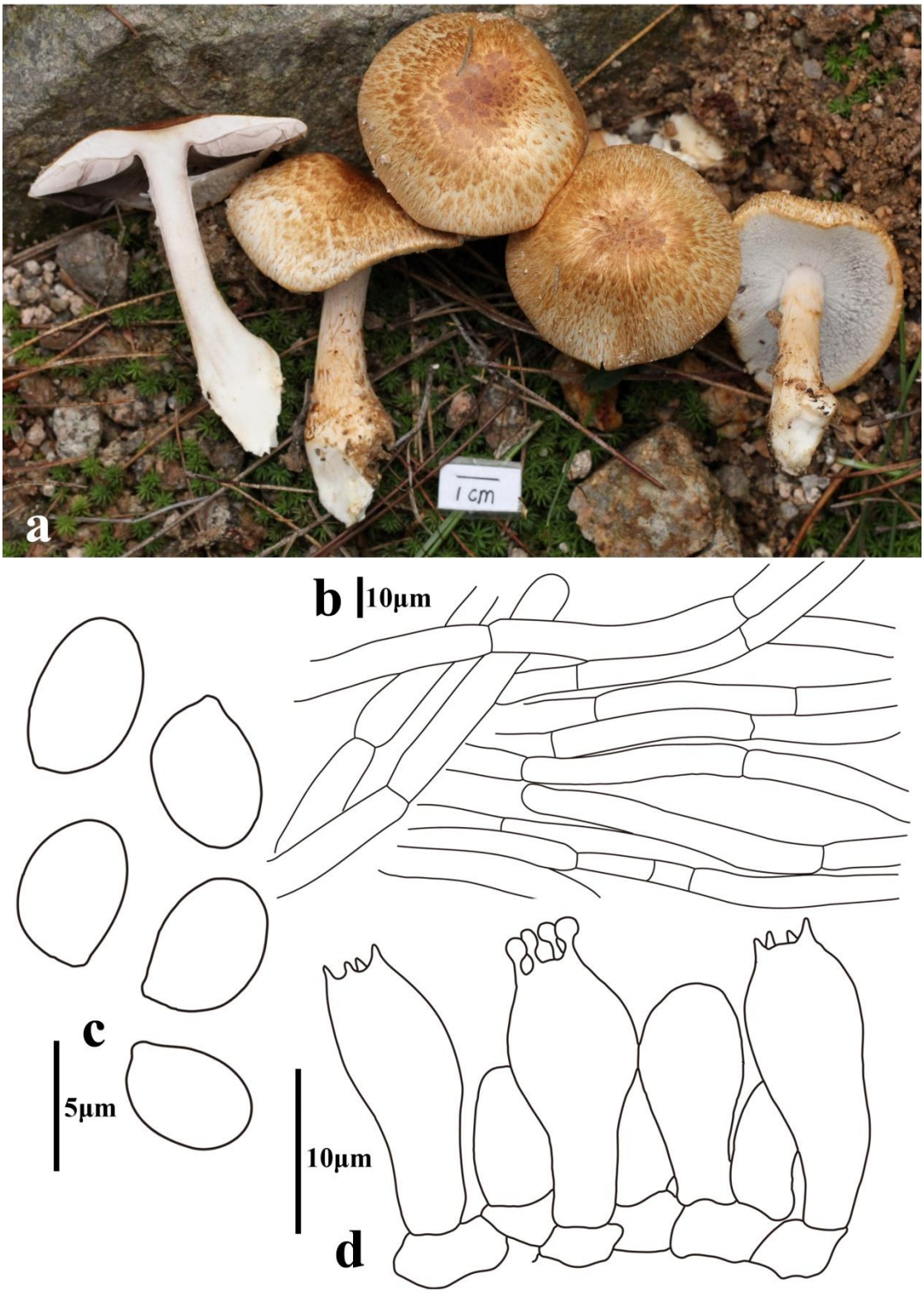

Figure 15 *Agaricus rufusfibrillosus* **a** basidiome in the filed. **b** hyphae of pileipellis. **c** basidiospores. **d** basidia.

Agaricus purpurlesquameus M.Q. He & R.L. Zhao ***sp. nov.*** Figure 16

Index Fungorum number: IF553824 Faceoffungi Number: F0F 03628

Etymology: "*purpurlesquameus*" refers to the purple scales on the pileus.

Holotype: MFLU17-1306

Pileus 35 mm in diam., convex, disc slightly truncate, background white, margin straight with appendiculate remains of universal veil; surface dry, covered by fibrillose scales, scales purple, triangular, appressed, extremely denser and thick at disc, scanty towards the margin. *Context* flesh, white. *Lamellae* up to 3mm in diam. free, crowded, normal, white to pinkish brown, edge even. *Annulus* fragile, membranous, single, white, pendant, upper side smooth, lower side tomentose. *Stipe* 34 × 6 – 10 mm, white, hollow, cylindrical; surface dry, with white fibrils below the annulus. Odour of almond or aniseed. Basidiome becomes yellow when cutting and bruising. KOH reaction: positive yellow.

Basidiospores 5.5 – 6.6 × 3.6 – 4.2 μm, [x = 6.2 ± 0.3 × 3.9 ± 0.2, Q = 1.5 – 1.7, Qm = 1.5 ± 0.1, n = 20], ellipsoid, smooth, thick-walled, brown. *Basidia* 15.7 – 26.4 × 6.5 – 8.6 μm, clavate, hyaline, 4-spored, smooth. *Cheilocystidia* 19.0 – 33.6 × 9.9 – 15.6 μm, pyriform, with yellow pigments inside. Pleurocystidia absent. *Pileipellis* a cutis composed of hyphae of 4.0 – 7.5 μm in diam., smooth, cylindrical, light brown, constricted at septa.

Habitat: solitary on soil at road side.

Material examined: THAILAND, Mae Hong Son Province, 25 Sep 2016, He Mao-Qiang (MFLU 17-1306, **holotype**).

Notes: The simple annulus, positive yellow KOH reaction and almond odour of basidiome confirm this new species is a member of subgenus *Minores*. Phylogeny analyses shows *A. purpurlesquameus* is a member of section *Minores*. It has an identical ITS sequence with NT62/*A.* sp. (ITS: JF727845, Zhao et al. 2011), so we considered they are the same species. *Agariucs purpurlesquameus* is sister to *A. patris* but lacking statistic supports. Compared with *A. patris* in morphology, both species has a purple

pileus and a single annulus with tomentose lower surface. But they differs with cheilocystidia that *A. purpurlesquameus* are pyriform while which of *A. patris* are clavate to broadly clavate or sphaeropedunculate (Chen et al. 2017b). *A. rufuspileus* and *A. sodalis* are in the same clade with LE2016047, and they can easily distinguished by basidiospores and cheilocystidia. The cheilocystidia of *A. rufuspileus* are clavate (He et al. 2017a), while *A. purpurlesquameus* are pyriform. *Agaricus sodalis* has smaller basidiospores (x = 5.4 × 3.6μm) than *A. purpurlesquameus. Agariucs purpurlesquameus* is characteristics by its purple pileus and pyriform cheilocystidia with yellow pigments.

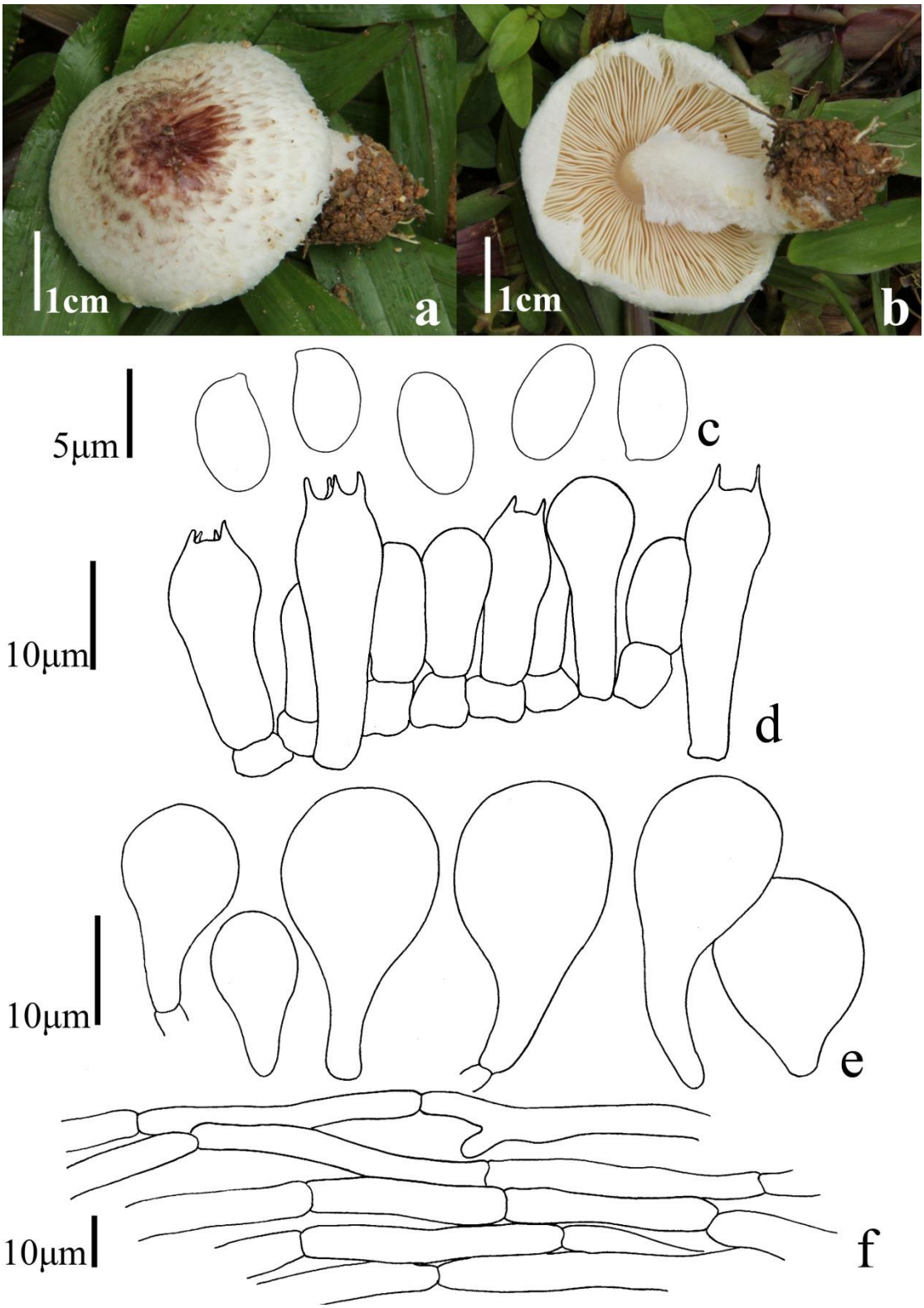

Figure 16 *Agaricus purpurlesquameus* **a–b** basidiome in the filed. **c** basidiospores. **d** basidia. **e** cheilocystidia. **f** hyphae of pileipellis.

Agaricus parvibrunneus M.Q. He & R.L. Zhao ***sp. nov.*** Figure 17

Fungal Names: FN570507; Faceoffungi Number: FoF 03851

Etymology: The epithet ‘‘parvi’’ refers to the small basidiome, “brunneus” refers to the brown fibrils on the cap.

Holotype: China, Beijing, Chaoyang District, Institute of Microbiology, 26 July 2016, collected by Bai Xuming, *ZRL20161053* (HMAS 278316 Holotype).

Original description: *Pileus* 14 – 27 mm in diam., convex when young, plane with age, disc subunbonate, margin straight, exceeding lamellae; Surface dry, with brown fibrillose scales against white background, scales triangular, appressed, denser at disc, scattered towards the margin. *Context* up to 2 mm thick, flesh, white. *Lamellae* 2 – 3 mm broad, free, crowded, pink first, then brown, edge even, intercalated with lamellulae. *Annulus* single, membranous, white, pendant, smooth on both sides. *Stipe* 21 – 32 × 3 – 7 mm, white, hollow, cylindrical, sometimes with a subbulbous base, surface dry, smooth. Odour of almonds. Basidiome strongly yellow when rubbed.

KOH reaction: positive yellow. Schäffer’s reaction: positive, reddish orange on dry specimen.

Basidiospores 5.0 – 5.8 × 3.7 – 4.1 μm, [x = 5.3 ± 0.2 × 3.9 ± 0.2, Q = 1.3 – 1.5, Q_m = 1.4 ± 0.1, n = 20], ellipsoid, smooth, thick-walled, brown. *Basidia* 13.3 – 24.7 × 6.2 – 7.5 μm, clavate, hyaline, 4-spored, smooth. *Cheilocystidia* 14.2 – 30.0 × 6.7 – 15.5 μm, single, hyaline, smooth, pyriform most, also can be clavate, septa at base, some with yellow pigment inside. *Pleurocystidia* absent. *Pileipellis* a cutis composed of hyphae of 5.0 – 6.6 μm in diam., smooth, cylindrical, hyaline or light brown.

Habitat: solitary on grassland in garden.

Notes: In the phylogenetic analyses, *A. parvibrunneus* clustered with *ZRL2011039/A.* sp. and *A. microviolaceus* M.Q. He & R.L. Zhao with the BS/PP=79/0.9 value in section *Minores*. The molecular data shows *ZRL2011039* is closely related to *A. parvibrunneus*. Due to the immature basidiome of *ZRL2011039,* it was considered as *A.*

sp. in this study. So *A. microviolaceus* is the only known species phylogenetically close to *A. parvibrunneus*.

Compared in morphology, *A. microviolaceus* and *A. parvibrunneus* both have small basidiomes, but *A. parvibrunneus* can be easily distinguished by brown pileus, while *A. microviolaceus* is purple. Many species in section *Minores* have small basidiomes (pileus diameter less than 30 mm), such as *A. blatteus* M.Q. He & R.L. Zhao, *A. minipurpureus* M.Q. He & R.L. Zhao, *A. purpureofibrillosus* Linda J. Chen, R.L. Zhao & K.D. Hyde, and *A. callacii* L.A. Parra, R. Iglesias, Fdez. -Vic. & Oyarzabal. But they all have pinkish and purple fibrils, the pileus color tends to be red while it is brown in *A. parvibrunneus*. Moreover, *A. parvibrunneus* has larger basidiospores than those of *A. blatteus* (4.5 ± 0.2 × 3.3 ± 0.2 μm) and *A. purpureofibrillosus* (4.9 ± 0.12 × 2.9 ± 0.14 μm), or smaller than those of *A. callacii* (6.2 × 4.9 μm) (Parra 2013; Chen et al. 2017b; He et al. 2017a). *Agaricus minipurpureus* has the same sized basidiospores, but its cheilocystidia are clavate while they are pyriform in *A. parvibrunneus*. Based on phylogenetic analyses and morphological characteristics, *A. parvibrunneus* is introduced here as a new species, and this new species is characterized by its small basidiomes, brown pileus and pyriform cheilocystidia.

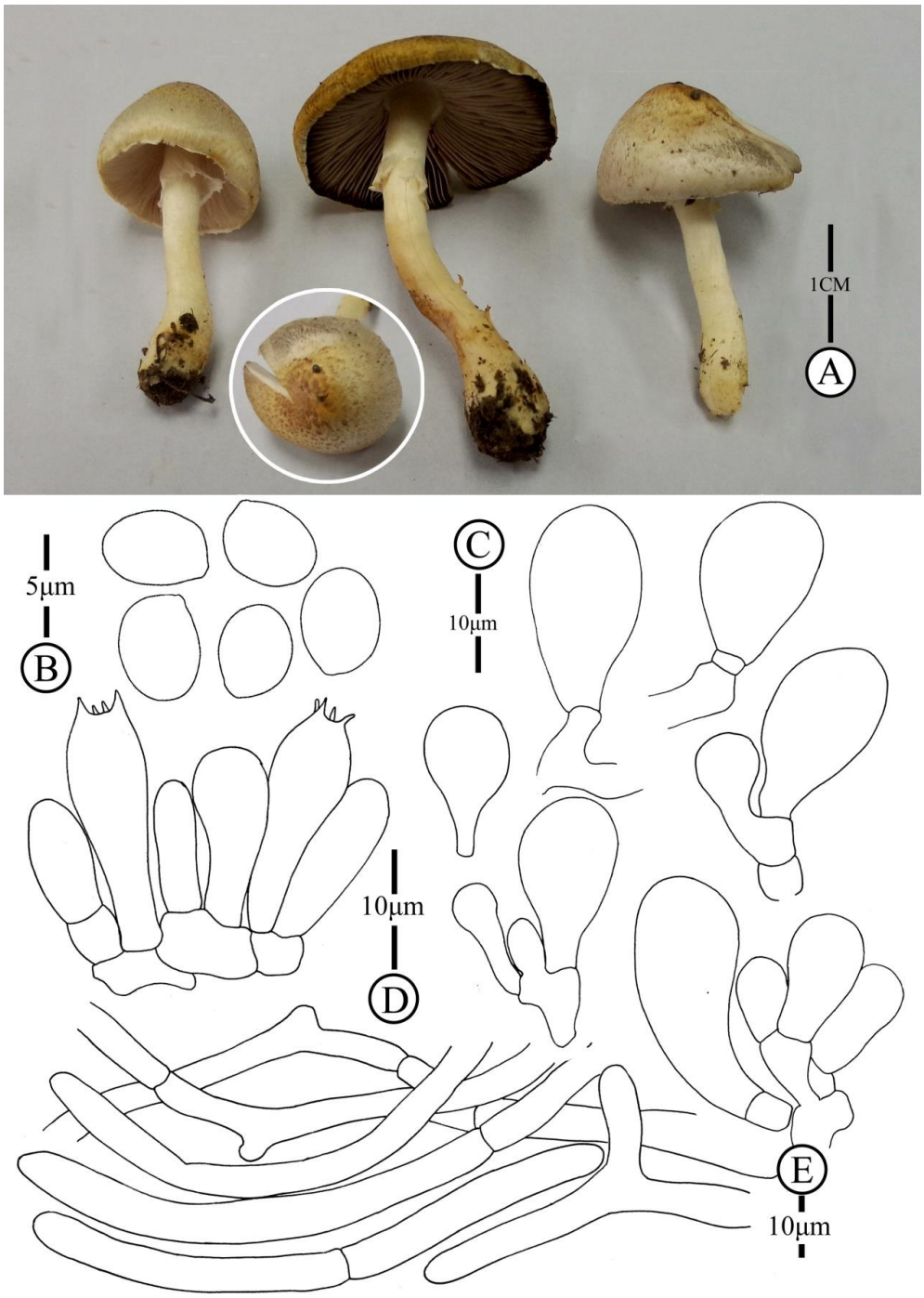

Figure 17 Morphology of *Agaricus parvibrunneus*, A: basidiomes, B: basidiospores, C: cheilocystidia, D: basidia, E pileipellis hyphae.

Agaricus pseudominipurpureus M.Q. He & R.L. Zhao sp. nov. Figure 18

Fungal Names: FN570508; Faceoffungi Number: FoF 03852

Etymology: refers to the similarity of this new species to *A. minipurpureus* in morphology.

Holotype: China, Yunnan Province, Dehong County, Tongbiguan natural reserve, 24°61′ N, 97°64′ E, altitude 1341m, 20 July 2013, collected by Zhao Ruilin, *ZRL2013341* (HMAS 278354 Holotype).

Original description: *Pileus* 14 – 26 mm in diam., parabolic first, then convex, finally plane with age, disc unbonate, margin straight, slightly exceeding lamellae, uplifted when mature; Surface dry, with plenty of appressed, purple, reddish brown fibrils against white background, denser at disc, scattered towards the margin. *Context* up to 2 mm thick, flesh, white. *Lamellae* 2 – 3 mm broad, free, crowded, pink firstly, then brown, edge even, intercalated with lamellulae. *Annulus* single, membranous, white, pendant, upper surface smooth, lower surface fibrillose. *Stipe* 24 – 43 × 2 – 3 mm, white, hollow, cylindrical, surface dry, surface below the annulus fibrillose. Odour of almonds. Basidiome strongly yellow when rubbed then orange brown immediately.

KOH reaction: positive yellow. Schäffer's reaction: positive, reddish orange on dry specimen.

Basidiospores 4.3 – 5 × 3.1 – 3.6 μm, [x = 4.6 ± 0.2 × 3.3 ± 0.1, Q = 1.3 – 1.5, Q_m = 1.4 ± 0.1, n = 20], ellipsoid, smooth, thick-walled, brown. *Basidia* 11 – 15.2 × 5 – 6.6 μm, clavate, hyaline, 4-spored, smooth. *Cheilocystidia* absent. *Pleurocystidia* absent. *Pileipellis* a cutis composed of hyphae of 6.5 – 10.5 μm in diam., smooth, cylindrical, hyaline or light brown.

Habitat: solitary on soil in forest.

Other specimens examined: China, Yunnan Province, Dehong County, Tongbiguan natural reserve, 24°61′ N, 97°65′ E, altitude 1341m, 20 July 2013, collected by Zhao Ruilin, *ZRL2013320* (HMAS 278427).

Notes: According to phylogenetic study, the two specimens (*ZRL2013320* and *ZRL2013341*) clustered at the base position of section *Minores* with fully support (BS/PP = 100/1.0 value), which is representing *A. pseudominipurpureus*. In the tree *A. pseudominipurpureus* has a distinct position. But there are many morphologically similar species, such as *A. microviolaceus*, *A. blatteus*, *A. minipurpureus*, *A. purpureofibrillosus* and *A. pseudopurpurellus*. They all have small basidiomes (pileus diameter < 30 mm), and a pileus covered by purple fibrils (He et al. 2017a). In addition, microscopically, the new species differs from all of them by the absence of cheilocystidia. *Agaricus pseudopurpurellus* is similar to this new species because both have small basidiomes, the same basidiospores in shape and size, and absent cheilocystidia. However, in their ITS sequence, those two species are different at 38 positions. The molecular phylogenetic tree also clearly showed they are different species. Based on phylogenetic and morphological characteristics, *A. pseudominipurpureus* is introduced here as a new species, and it is characterized by its small basidiomes, absence of cheilocystidia and distinct phylogenetic position in section *Minores*.

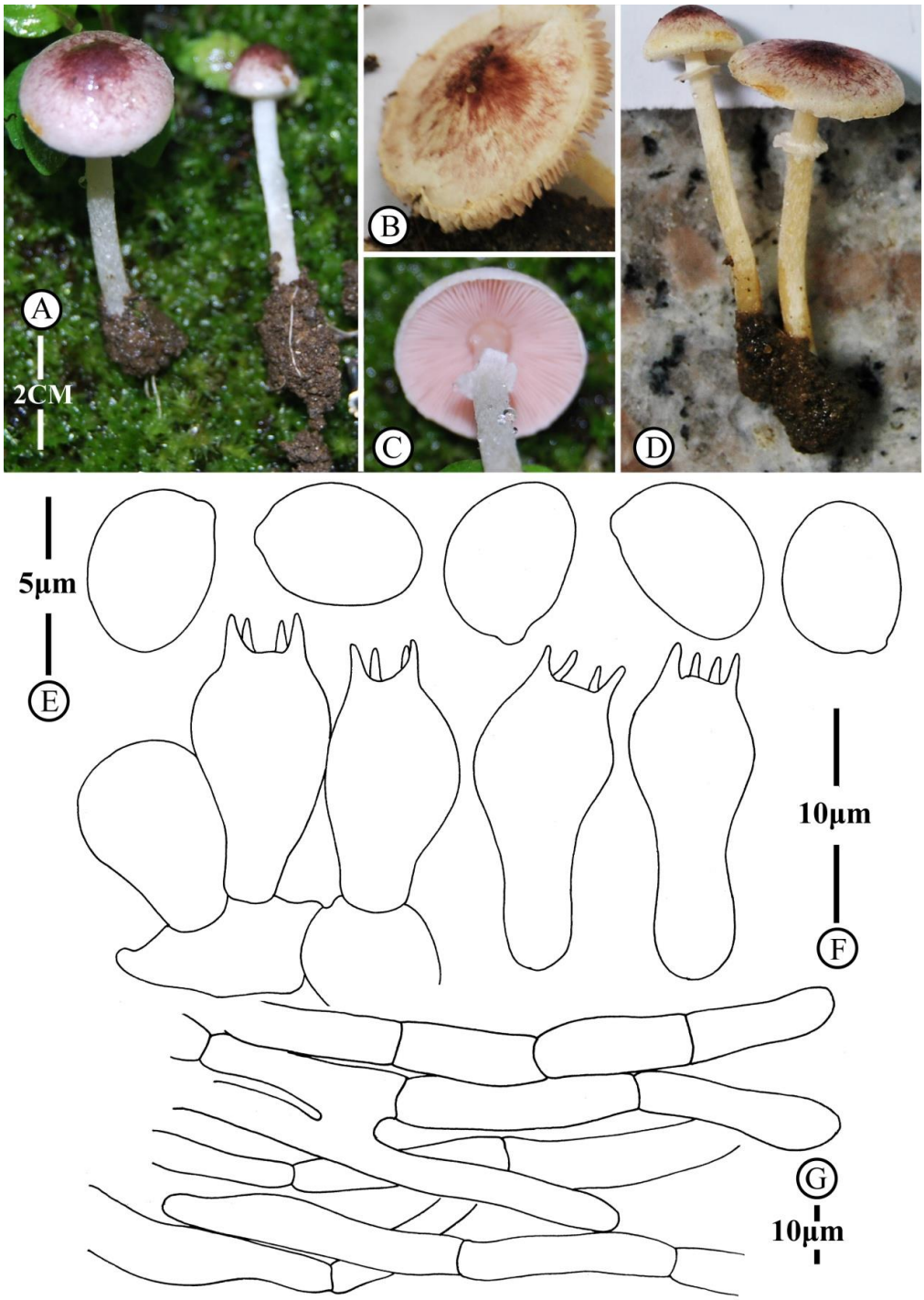

Figure 18 Morphology of *Agaricus pseudominipurpureus*, A–D: basidiomes in the feild, E: basidiospores, F: basidia, G: pileipellis hyphae.

Agaricus yanzhiensis M.Q. He & R.L. Zhao sp. nov. Figure 19

Fungal Names: FN570506; Faceoffungi Number: FoF 03850

Etymology: The epithet ‘‘yanzhiensis’’ refers to the type location, Yanzhi Mountain of Qilianshan National Natural Reserve in China.

Holotype: China, Gansu Province, Shandan County, Yanzhishan Forest Park, 38°78′ N, 101°08′ E, altitude 1765m, 31 August 2016, collected by Dai Rong-chun, *ZRL20162082* (HMAS 281083 Holotype).

Description: *Pileus* 21 – 75 mm in diam., parabolic first, then convex, finally plane with age, disc can be subunbonate when mature, margin straight, also can be uplifted when mature, slightly exceeding lamellae, sometimes with little appendiculate remains of universal veil; Surface dry, covered by appressed, brown or reddish brown fibrils, background white, denser at disc, scattered towards the margin. *Context* up to 5 mm thick, flesh, white. *Lamellae* 5 mm broad, free, crowded, white first, then pink or reddish brown, brown finally, edge even, intercalated with lamellulae. *Annulus* single, membranous, white, pendant, upper surface smooth, lower surface fibrillose, sometimes with brown pigment on the edge, connect stipe with white silky fibrils. *Stipe* 29 – 65 × 6 – 8 (12 – 18 at base) mm, white, hollow, cylindrical, some with bulbous base, surface dry, surface below the annulus fibrillose. Odour of almonds. Basidiome strongly yellow when rubbed.

KOH reaction: positive yellow. Schäffer’s reaction: positive, reddish orange on dry specimen.

Basidiospores 5.0 – 5.8 × 3.7 – 4.1 μm, [x = 5.3 ± 0.2 × 3.9 ± 0.2, Q = 1.3 – 1.5, Q_m = 1.4 ± 0.1, n = 20], ellipsoid, smooth, thick-walled, brown. *Basidia* 13.3 – 24.7 × 6.2 – 7.5 μm, clavate, hyaline, 4-spored, smooth. *Cheilocystidia* single, smooth, hyaline, pyriform, septa at base. *Pleurocystidia* absent. *Pileipellis* a cutis composed of hyphae of 6.5 – 10.5 μm in diam., smooth, cylindrical, hyaline or light brown, slightly constrict at septa.

Habitat: Gregarious on soil in forest.

Other specimens examined: China, Gansu Province, Shandan County, Yanzhishan Forest Park, 38°78′ N, 101°08′ E, altitude 1765 m, 31 August 2016, collected by Zhao Rui-lin, *ZRL20162060* (HMAS 280994). China, Gansu Province, Sunan County, Dayekou, 38°83′ N, 99°61′ E, altitude 2294m, 01 September 2016, collected by Bai Xu-Ming, *ZRL20162139* (HMAS 281085).

Notes: Our phylogenetic analyses indicated that *A. yanzhiensis* is a member of section *Minores* (Fig. 14). Three specimens (*ZRL20162060*, *ZRL20162082* and *ZRL20162139*) clustered together representing *A. yanzhiensis* with the statistic support of BS/PP=79/1.0 value, then *A. yanzhiensis* clades with ZD1528/*A.* sp., *A. gemloides*, *A. comtulus* Fr., *A. luteomaculatus* F.H. Møller and *A. gemlii* L.A. Parra, Arrillaga, M.Á. Ribes & Callac with the support of BS/PP=52/0.9 value.

In the morphological study, the phylogenetically closest species is *A. gemlii* which have six different positions in ITS, one position in LSU and eight positions in tef1-α sequences. *Agaricus gemlii* can be separated from this new species by its reddish purple fibrils on the pileus while *A. yanzhiensis* is reddish brown. Furthermore, the habitat of *A. gemlii* is damp Atlantic wood while this new species is continental cold forest which dominated by *Picea crassifolia*. There are some more species that resemble this new species, such as *A. comtulus*, *A. brunneolus* (J.E. Lange) Pilát, and *A. brunneolutosus* Linda J. Chen, Karun. & K.D. Hyde. In the field they all have middle-sized basidiomes, and brown or reddish brown pileus (Parra 2013), however *A. yanzhiensis* can be distinguished under the microscope by its larger basidiospores when compared with *A. comtulus* (4.8 × 3.4 μm) and *A. brunneolutosus* (4.3 × 2.9 μm) (Parra 2013). *Agaricus yanzhiensis* differs from *A. brunneolus* by having triangular shaped fibrils scales on the pileus while those of *A. brunneolus* does not. In addition, the breadth of lamellae of *A. brunneolus* (up to 9 mm) is nearly double than those of *A. yanzhiensis*. Based on phylogenetic analyses and morphological characteristics, we introduce *A. yanzhiensis* new to science and this species is characterized by its brown to reddish brown pileus, cheilocystidia pyriform, and often with long narrow stipe, occasionally with one septa at the base.

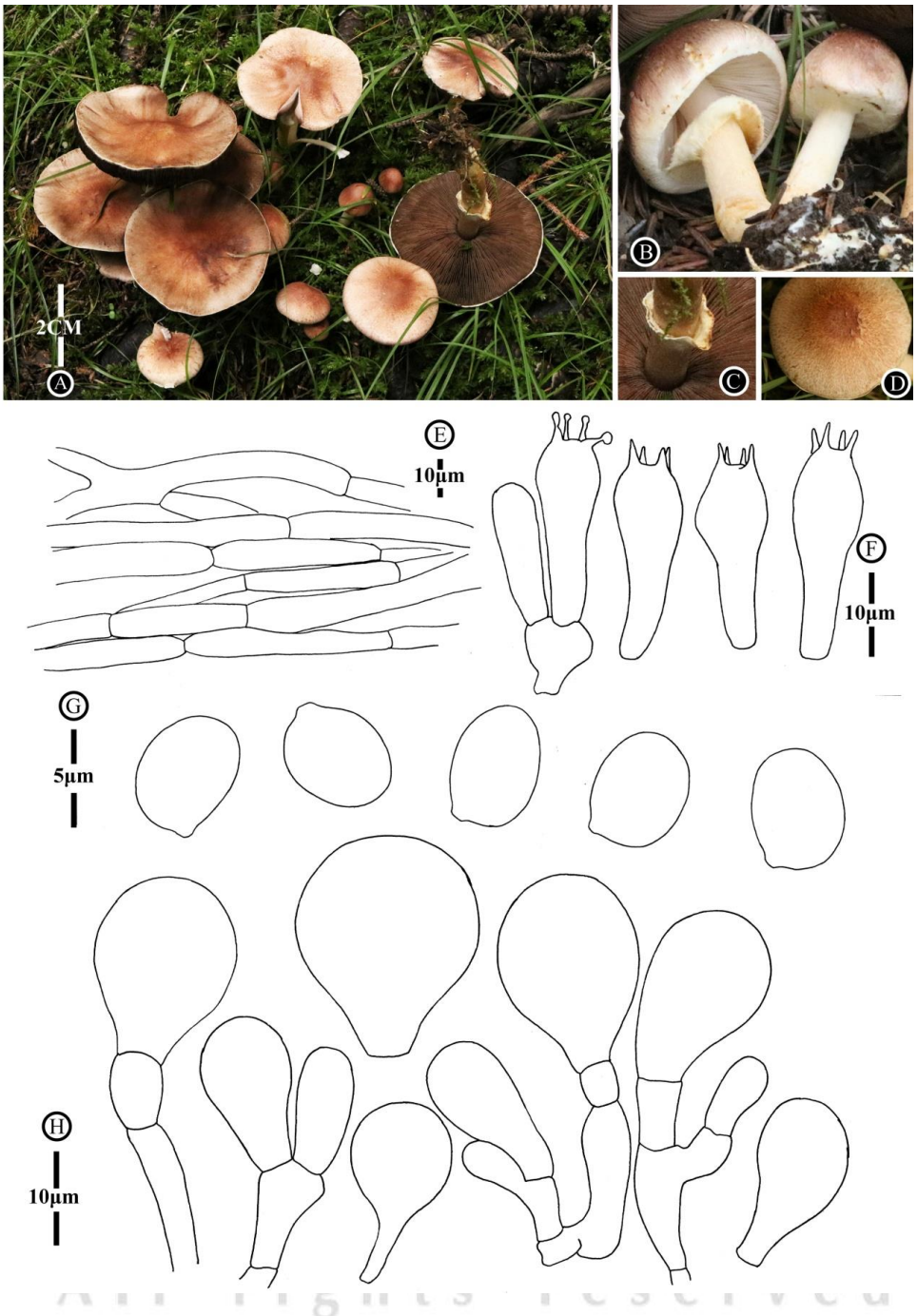

Figure 19 Morphology of *Agaricus yanzhiensis*, A–D: basidiomes in the field, E: pileipellis hyphae, F: basidia, G: basidiospores, H: Cheilocystidia.

Discussion

Members of subgenera *Minores* and *Minoriopsis* can be preliminarily separated from other subgenera of *Agaricus* in the field, because of their relatively small basidiomes, their yellow discoloration when bruised, their simple annulus and their odor of almonds. In addition, species of subgenus *Minoriopsis* are only known from the Americas. In subgenera *Minores*, morphological characteristics can be overlapped among species, so the molecular phylogeny analysis is necessary for the identification on species level. Among those three new species we proposed here, *A. pseudominipurpureus* is the example which is hard to distinguish from other known species through morphology, but can be distinguished by molecular data. Presently numerous species of *Agaricus* section *Minores* were introduced worldwide. The recent published species in section *Minores* are *A. purpureosquameus* and *A. rufifibrillosus*. Compare with these three new species in this paper morphologically, *A. purpureosquameus* has small basidiomes, purple pileus and is originally from Thailand. *Agaricus rufifibrillosus* is originally from east part of China, and it resembles *A. yanzhiensis* by its medium sized basidiomes, and reddish brown pileus. But under microscope, they can be differed by cheilocystidia which of *A. yanzhiensis* is pyriform, while *A. rufifibrillosus* is absent. Up to now, there are 24 species of this section published from China in last three years (He and Zhao 2015, Li et al. 2016b, He et al. 2017a, Hyde et al. 2017). Now section *Minores* has 83 named species including those three new species and 44 of which can be found in China, such as those species which is originally from Thailand: *A. patris* L.J. Chen, Callac, K.D. Hyde & R.L. Zhao and *A. megalosporus* J. Chen, R.L. Zhao, Karunarathna & K. D. Hyde (Chen et al. 2012a, He et al. 2017a).

CHAPTER 5
TWO NEW SPECIES OF *MICROPSALLIOTA* FROM NORTHERN THAILAND

5.1 Introduction

Micropsalliota Höhn. 1914 typified by *M. pseudovolvulata* Höhn. 1914 was originally erected to accommodate species with small, slender basidiomes in *Agaricus* (Syn. *Psalliota*). Later, this genus was emended by Heinemann (1956, 1976) and Pegler and Rayner (1969). The follow-up studies introduced new taxa mainly from tropical and subtropical areas including Asia: India (Heinemann and Little Flower 1983), Singapore, Indonesia, Malaysia, the Solomon Island (Heinemann 1980), China (Wei et al. 2015), and Thailand (Zhao et al. 2010, Chen et al. 2016c); America: Northern Argentina and Brazil (Heinemann 1989); and Africa: Java and Zaire (Heinemann 1983), and two species from temperate Mexico (Guzman-Davalos 1992, Guzman-Davalos and Heinemann 1994). So far, there could be more than 60 species of *Micropsalliota* worldwide (Zhao et al. 2010, Wei et al. 2015, Chen et al. 2016c, Parra et al. 2016).

Compared with other taxa in Agaricaceae, species in *Micropsalliota* are generally characterized by: small and slender basidiomes; brown spore print; fibrillose or squamulose pileus in brown, red, purple or white color; basidiospores ellipsoid to irregularly ellipsoid, amygdaliform or cymbiform and usually endosporium; obvious cheilocystidia in various shapes, and generally capitate or subcapitate; parallel hyphae of pileipellis usually with brown or yellow pigments in kinds of membranous, vacuolar and incrusted. Among these features, the size of basidiospores and cheilocystidia could be significant characteristics in recognizing species. For basidiospores size, species may be grouped into small-spored taxa (<5 μm long) or long-spored taxa (>5 μm long) (Zhao et al. 2010).

A monograph for *Micropsalliota* from Northern Thailand was published in 2010, which gave phylogenetic analyses of *Micropsalliota* for the first time and documented

23 species including 10 new to science and 13 new record for Thailand (Zhao et al. 2010). Latter, another one new species from Northern Thailand was introduced based on ITS sequence and morphologic characteristics (Chen et al. 2016c). Here we introduce two more new species from Northern Thailand based on ITS, LSU sequences and morphologic characteristics.

5.2 Materials and Methods

5.2.1 Morphological examination

All Specimens were collected from Northern Thailand. Photographs of basidiomes were taken in the field. Basidiomes were wrapped in the foil or put in plastic box separately. Macro morphological characteristics were recorded when specimens are fresh. Each specimen was completely dried in a food drier at 60 °C, then kept in a plastic ziplock bag and deposited in Herbarium Mycologicum Academiae Sinicae (HMAS) and Mae Fah Luang University Herbarium (MFLU). Anatomical and cytological characteristics including basidiospores, basidia, cystidia and pileipellis were observed using a light microscope. Measurements were analyzed and recorded as X = the mean of length by width ± SD, Q = the quotient of basidiospore length to width and Q_m = the mean of Q values ± SD. All the protocols of morphological studies followed Largent's methodology (Largent 1986).

5.2.2 DNA extraction and PCR

Genomic DNA of each specimen was extracted through the E.Z.N.A. Forensic DNA Extraction Kit (D3591-01, Omega Bio-Tek) following the manufacturer's protocol. PCR amplification was performed following He et al. 2017. The primers for ITS region are ITS4 and ITS5, and for LSU are LROR and LR5 (White et al. 1990, Moncalvo et al. 2000). PCR products were sent to a commercial company for sequencing and both directions were sequenced to ensure accuracy.

5.2.3 Phylogenetic analyses

Sequences were downloaded from Genbank, details of all sequences was listed in Table 5. Sequences were checked in BioEdit V.7.0.4 (Hall 2007). Alignments were made by Muscle (Edgar 2004) for each region separately, then adjusted by hand and

ambiguous regions removed. Phylogenetic tree generated by Bayesian Inference (BI) analysis was performed in MrBayes 3.1.2. The best model was GTR + I + G which inferred by Mrmodeltest2.2 both for ITS and LSU regions (Nylander 2004). Ten million generations were run for six Markov chains, and sampled every 100th generation resulting in 100,000 trees. Burn-ins was determined in Tracer v1.6 with effective sample sizes (ESS) higher than 200 (http://tree.bio.ed.ac.uk/software/tracer). Remaining trees were used to calculate Bayesian posterior probabilities (PP). Maximum likelihood (ML) analysis and bootstrap values calculation were performed in raxmlGUI 1.5b1 with GTRGAMMA model with 1000 replicates (Silvestro and Michalak 2012). Phylogenetic tree was presented in Figure 20.

Table 5 Sequences information used in the phylogenetic analyses, new taxa are in bold, "T" refers to type.

Species Name	**Specimen Number**	**ITS**	**LSU**
Micropsalliota albosericea	ZRL3049	HM436644	
M. allantoidea	ZRL2038 T	HM436648	HM436597
M. arginea	ZRL3090		HM436595
M. arginophaea	ZRL3110	HM436617	HM436577
M. bifida	ZRL3067 T	HM436640	HM436591
M. cylincystidia	**MFLUCC 17-1343 T**	**MN294513**	**MN294517**
M. brunneosperma var. *cortinata*	ZRL2129	HM436630	
M. furfuracea	ZRL3006 T	HM436621	HM436603
M. globocystis	ZRL3004	HM436634	HM436605
M. gracilis	ZRL2041	HM436647	HM436583
M. lateritia var. *vinaceipes*	ZRL2073	HM436631	
M. megarubescens	ZRL2086 T	HM436620	
M. megaspora	ZRL2051	HM436623	HM436571
M. pleurocystidiata	ZRL2023	HM436636	
M. polacana	**MFLUCC 17-1342 T**	**MN294514**	**MN294516**
M. pseudoarginea	ZRL3069	HM436643	
M. pusillissima	ZRL3047 T	HM436645	HM436594
M. rubrobrunnescens	ZRL2120 T	HM436628	HM436588
M. rubrobrunnescens var. *tibiicystis*	ZRL2121 T	HM436629	HM436589
M. subalba	ZRL2080	HM436646	HM436596
M. subarginea	ZRL2052	HM436612	HM436573
M. xanthorubescens	ZRL3083	HM436638	HM436598
M. suthepensis	ZRL3035 T		HM436584
M. geesterani	AH47609	KM923965	KM923966
M. repanda	AH47613	KP739805	KP739804
M. pseudoglobocystis	ZRL201332 T	KM889913	
M. brunneosquamata	LD201236 T	KP316210	
Hymenagaricus sp.	LD2012186	KM982451	
H. cf. *kivuensis*	BR6089	KM982454	
H. sp.	ZRL3103	KM982450	
H. ardosiicolor	Z4	KM360160	
H. ardosiicolor	LAPAF9	JF727840.1	

5.3 Results

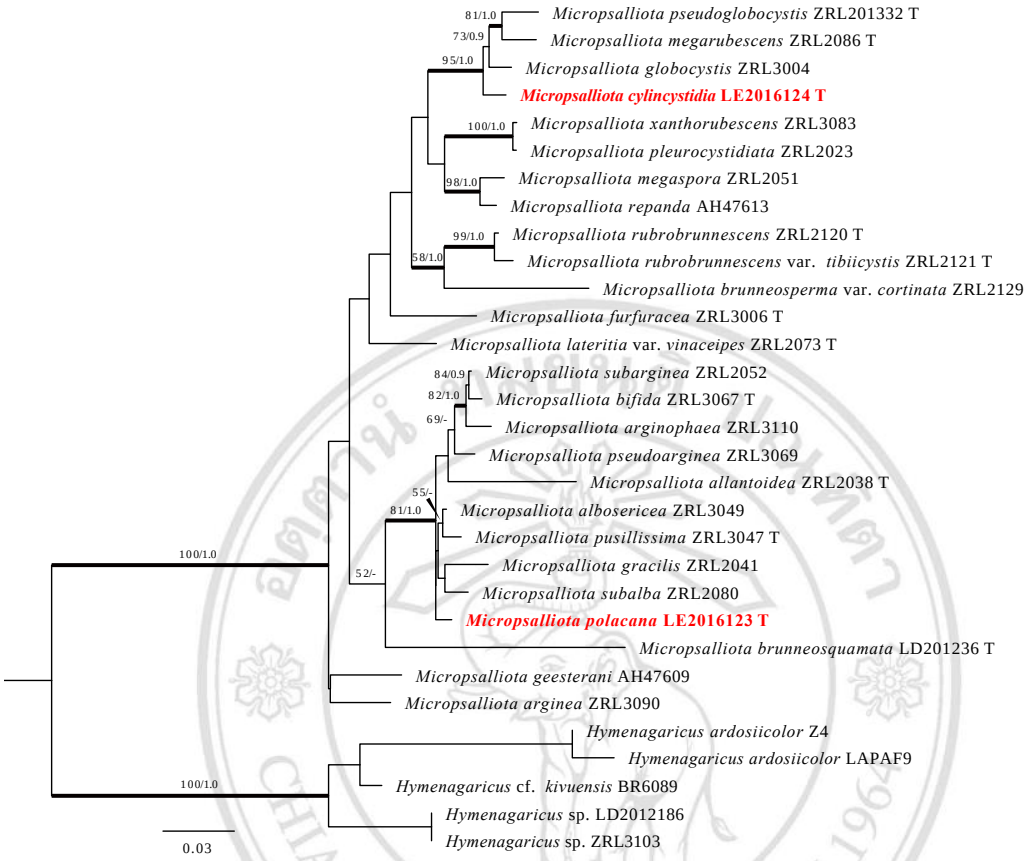

Figure 20 Maximum likelihood (ML) tree of *Micorpsalliota* based on ITS and LSU sequences with the outgroup *Hymenagaricus*. The bootstrap values and Bayesian posterior probabilities more than 50%/0.9 (BS/PP) are indicated at the nodes. The branches in bold mean the related PP > 0.95, "T" refers to sequences from type specimen.

Taxonomy

Micropsalliota cylincystidia M.Q. He, K. D. Hyde & R.L. Zhao ***sp. nov.*** Figure21

MycoBank number: MB 832247 FoF number : 06217

Etymology: in reference to the cylindrical cheilocystidia

Pileus 5 – 12 mm diam., ovoid when young, then convex, plane when mature, background white, surface finely covered with purple or purplish-brown scales, scales in triangular shape or granular, erect; lamellae free, brown, crowded; annulus single, white, membranous, persistent, superior, edge with the same color as the scales on pileus; stipes 16 – 22 × 1 – 2 mm, cylindrical, straight, white, surface with white fibrillose scales. Odor not distinctive. Getting yellow when bruised, cut or dry, then brown.

KOH reaction: brown or orange brown in the drop center on pileus, and blackish-green at edge.

Spores 5.7 – 6.7 (–7.2) × 2.9 – 3.5 μm, [x = 6.1 ± 0.3 × 3.2 ± 0.2, Q = 1.8 – 2.1, Q_m = 1.9 ± 0.1, n = 20], oblong, brown; basidia 17.2 – 26 × 5.7 – 7.4 μm, clavate, 4-spored; cheilocystidia 33.5 – 65 × 5.3 – 11.5 μm, cylindrical, some slightly with a capitate apex, hyaline, smooth; pleurocystidia absent; pileipellis a cutis composed of hyphae 2 – 23.5 μm diam., cells swollen and constricted at the septa, with incrusting and membranous brown pigments; annulus composed of hyphae 2.4 – 8.5 μm diam., hyaline, smooth, branched, and the same hyphae with the pileipellis.

Habit: solitary or scattered in soil. Known distribution: Thailand. Material examined: THAILAND, Chiang Rai Prov., Mae Fah Luang University, 16 November 2016, collected by Mao-Qiang He. *LE2016124* (Holotype: MFLUCC 17-1343).

Notes: In the phylogenetic analyses, this new species represented by LE2016124 formed a clade with three species: *M. pseudoglobocystis*, *M. megarubescens* and *M. globocystis* which got high bootstrap value and full Bayesian posterior probability (95/1.0). These three species can be easily separated from *M. cylincystidia* as they all have relatively larger basidiomes as pileus 25 – 35 mm diam. of *M. pseudoglobocystis*,

25 – 80 mm diam. of *M. megarubescens* and 17 – 60 (− 80) mm diam. of *M. globocystis* while 5 – 12 mm diam. of *M. cylincystidia* (Zhao et al. 2010, Wei et al. 2015). Basidiomes of *M. suthepensis* resembles *M. cylincystidia* as the same size and both with purple or purplish-brown scales on the pileus, however under microscope, they can be separated by the basidiospores which *M. cylincystidia* [5.7 – 6.7 (–7.2) × 2.9 – 3.5 μm] is longer than *M. suthepensi* [(4.5) – 5– 6 × 3 – 3.5 μm] (Zhao et al. 2010). *Micropsalliota cylincystidia* is characterized by cylindrical cheilocystidia which a characteristic rarely exists in the known species. There are two species with such cheilocystidia, one is *M. subarginea*, the other is *M. pseudoarginea*. However, both species with white pileus which differs from *M. cylincystidia* (Heinemann 1980, Zhao et al. 2010).

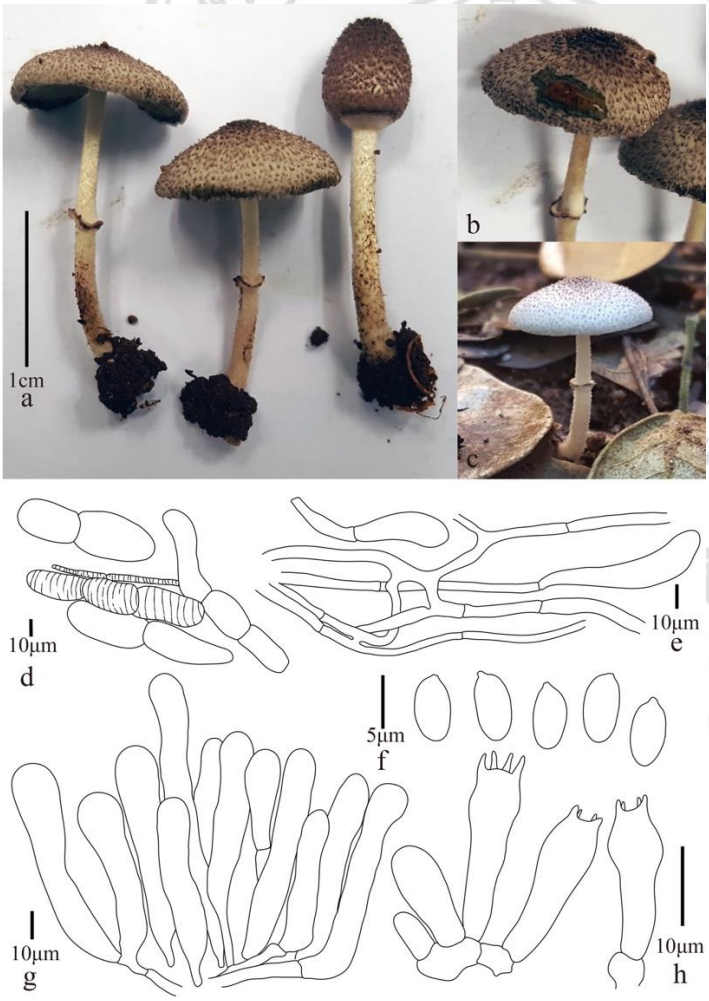

Figure 11 *Micropsalliota cylincystidia* a – c, basidiomes (b, KOH reaction on pileus); d, pileipellis; e, annulus hyphae; g, cheilocystidia; h, basidia.

Micropsalliota polacana M.Q. He, K. D. Hyde & R.L. Zhao ***sp. nov.*** Figure 22

MycoBank number: MB 832248 FoF number: 06218

Etymology: in reference to the small and white basidiomes.

Pileus 2 – 5 mm diam., convex, white, surface with fibrillose scales, sometimes in triangular, slightly erect; lamellae free, gray when young or fresh, getting brown when old or dry; annulus single, membranous, persistent, superior, white; stipes 5 – 13 × 0.3 – 0.6 mm, cylindrical, straight, white, surface with white fibrils. Odor not distinctive. Getting brown when bruised or dry.

KOH reaction: brown.

Spores 4.2 – 5.3 × 2.6 – 3.1 μm, [x = 4.9 ± 0.3 × 2.9 ± 0.2, Q = 1.5 – 1.9, Q_m = 1.7 ± 0.1, n = 20], ellipsoid, ovoid, some endosporium, brown; basidia 11.6 – 14.5 × 4.7 – 6.2 μm, clavate, 4-spored; cheilocystidia 11.1 – 38.1 × 5.6 – 11.5 μm, clavate, some slightly subcapitate, hyaline, smooth; pleurocystidia absent; pileipellis a cutis composed of hyphae 2.3 – 11.3 μm diam., smooth, hyaline, constricted at some septa; annulus composed of hyphae 2.3 – 6.4 μm diam., hyaline, smooth, branched, and ellipsoid cell 4.3 – 12.1 μm diam., hyaline, smooth.

Habit: solitary or scattered in soil. Known distribution: Thailand. Material examined: THAILAND, Chiang Rai Prov., Mae Fah Luang University, 16 November 2016, collected by Mao-Qiang He. *LE2016123* (Holotype: MFLUCC 17-1342).

Notes: In the phylogenetic analyses, this new species represented by LE2016123 clustered with other nine species with high bootstrap and full Bayesian posterior probability values (81/1.0). These nine species are *M. subarginea*, *M. bifida*, *M. arginophaea*, *M. pseudoarginea*, *M. allantoidea*, *M. albosericea*, *M. gracilis*, *M. subalba*, and *M. pusillissima*. Among these nine phylogenetically closed species, there are three species with the pileus less than 10 mm in diam., which similar with *M. polacana*. They are *M. allantoidea*, *M. albosericea*, and *M. pusillissima*. It is easy to distinguish *M. polacana* from *M. allantoidea* through the grayish brown pileus of *M. allantoidea*, which *M. polacana* is white. Compared with *M. albosericea*, they both have a white pileus, but *M. polacana* has a shorter stipes which *M. albosericea* was

longer [10 – 20 (− 30)mm]. Furthermore, the endosporium spores of *M. polacana* are also different with *M. albosericea* (Zhao et al. 2010). *Micropsalliota pusillissima* with tiny basidiomes (pileus diam. 1 – 3 mm) resembles *M. polacana* most with their white pileus and both forming similar basidiospores and cheilocystidia. But the pileus shape is different that *M. pusillissima* is conical to campanulate while *M. polacana* is convex even when mature. And also they differs with pileal surface texture that *M. pusillissima* is smooth to finely fibrillose-silky, while *M. polacana* is fibrillose to fibrillose-scales. Furthermore, they have 15 informative characters in the ITS sequence and 7 in the LSU sequences. Besides these phylogenetically species, there are also some other species with pileus diam. less than 10 mm which resembles *M. polacana*. Such as *M. alba*, *M. roseipe*, and *M. pruinosa*. However, *M. alba* have larger spores (5.5 – 7 × 3 – 4 μm), *M. roseipe* and *M. pruinosa* both have brown or reddish brown pileus which can be distinguished from *M. polacana* (Heinemann 1980, Heinemann and Little Flower 1983, Zhao et al. 2010).

Figure 22 *Micropsalliota polacana* a–c, fruiting bodies (b. KOH reaction on pileus); d, cheilocystidia; e, basidiospores; f, basidia; g, pileipellis; h, annulus hyphae.

5.4 Discussion

Micropsalliota phenotypically resembles *Agaricus* which makes difficulties to separate them especially in the field. They share macro characteristics as brown or reddish-brown pileus, brown spore print, free lamellae and annulate stipe. Also the similar staining yellow, reddish-brown, or brown when basidiomes got bruised or cut. The size of basidiomes used to be a key characteristic which could separate *Micropsalliota* from *Agaricus*, however, it would be mistaken when meet the member of *Agaricus* section *Minores* which a group also with lots of small-sized species (He et al. 2017a). Thus, it is essential to have anatomical and cytological examination to separate this two genera. Normally, the cheilocystidia of *Micropsalliota* are capitate, and basidiospores are endosporium, while those are rare for *Agaricus* as only three species forming endosporium spores: *A. angusticystidiatus*, *A. lamellidistans* and *A. variicystis*, and three species forming capitate cheilocystidia: *A. trisulphuratus*, *A. ignicolor*, and *A. variicystis*.

Plus our two new species introduced in this study, there are 26 species of *Micropsalliota* recorded in Northern Thailand. Species in *Micropsalliota* could be divided into small-spored taxa (<5 μm long) and long-spored taxa (>5 μm long). *Micropsallita polacana* is small-spored taxa (x = 4.9 ± 0.3 × 2.9 ± 0.2 μm), and *M. cylincystidia* is long-spored taxa (x = 6.1 ± 0.3 × 3.2 ± 0.2 μm). There are two species forming tiny basidiomes (pileus diam. less than 5 mm) which could be found in Northern Thailand, one is *M. pusillissima* (pileus 1 – 3 mm diam.) and the other is the new species *M. polacana* (pileus 2 – 5 mm diam.). These two species could be distinguished by the different pileus and informative characters in ITS and LSU sequences. There are three species with purple or purplish-brown pileus in Northern Thailand, one is the new species *M. cylincystidia*, and the other two are *M. globocystis* and *M. lateritia* var. *vinaceipes*. They could be easily distinguished by the different cheilocystidia shape that *M. globocystis* and *M. lateritia* var. *vinaceipes* are broadly clavate, while *M. cylincystidia* is cylindrical.

CHAPTER 6
GENERAL DISCUSSION

The Outline and notes for Basidiomycota provides an essential taxonomic tool which is easy to use by workers in various disciplines incorporating mycological fields especially for the plant pathogenic studies. The basic information in the notes provided in chapter 2 will enable people to quickly know the pathogen they have found on the plant even if they are not a mycologist. For example, they could know the species number, distribution and information without extra searches. I have also indicated some important pathogen in the pathogenic genera which could help to identify and prevent reinfection from other species in the same genus. For the mycologists, the studies we have cited in each genus will help them quickly know what kind of studies have been applied to this genus in the past years, and help them to find gaps whether it needs any further studies. Chapter 2 provides a summary of the last ten years' taxonomic studies of Basidiomycota, but numerous studies are published every year, so update all the advances periodically is necessary in the future work.

Divergence times used as an additional ranking criterion was successfully applied in many groups of fungi. In chapter 2, we provide the divergence times at the family level for Basidiomycota which is a fundamental work for the future taxonomic studies. However, some families of Basidiomycota are not dated due to the unsupported or uncertain phylogenetic position. More samples and molecular data are needed in the future work to indicate the phylogenetic relationships and divergence times of these groups approaching to make a natural and robust taxonomic framework in the systematic study of Basidiomycota.

Divergence time is not only can be applied in resolving problems in taxonomy, but also can help to solve problems in other field, for example, in chapter 3, we used divergence time to speculate the origin pattern and dispersal routes of *Agaricus* section *Minores*. After we obtain the divergence times of the taxa in different areas, we can compare the divergence time of each species or clades to speculate the origin and dispersal routes. And this could also be applied on some plant pathogenic taxa. There

are more than one host plant in the life cycle of rust fungi, so it would be a big challenge to get their real and clear relationship between their host plants, thus hard to explain or to know the origin pattern and dispersal routes of rust fungi. This problem could be solved like we have done as in chapter 3 for section *Minores* where we could compare the divergence times of all the taxa in different areas.

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