



<https://www.dothideomycetes.org>: An online taxonomic resource for the classification, identification, and nomenclature of Dothideomycetes

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Abstract

The number of species, genera, families and orders currently known to science in the class Dothideomycetes are rapidly changing with updated phylogenetic data but there are challenges ahead in dealing with the vast amount of taxonomic data scattered in the literature. In order to provide a suitable platform to bring all this data together, a website <https://www.dothideomycetes.org> has been set up and is explained in this paper. This website provides comprehensive and updated information including detailed descriptions of voucher specimens, color photographs, illustrations, notes, phylogenetic trees, estimated numbers of species in each genus, number of species with molecular data and other useful information related to fungi that belong to the Dothideomycetes. The webpage has a head curator, managing curator and several curators with appropriate taxonomic expertise. This work is funded by the Mushroom Research Foundation, an NGO comprising seven directors trained in mycology.

Keywords – Ascomycota – Bitunicate fungi – Dothideomycetes genera – Dothideomycetes webpage – taxonomy

Introduction

The classification and nomenclature of Dothideomycetes have undergone considerable changes during the past decade and to-date this cosmopolitan class contains 36 orders and 202 families (Hongsanan et al. 2020). Traditionally the most important morphological characteristics used to define major groups in Dothideomycetes were based on the morphology of the development of the ascomata, peridium, type of the asci, ascospores and the hamathecium. (Hyde et al. 2013, 2019, Phookamsak et al. 2019). Traditionally the class was classified based on three main characters viz. the developments of the bitunicate, fissitunicate asci, hamathecium

(pseudoparaphyses) and pseudothecial ascomata (Barr 1983, 1984). Recently, the molecular phylogeny and the sexual-asexual morph connections become essential tools to classify the genera in Dothideomycetes coupled with morphological characteristics (Luo et al. 2017, Karunaratna et al. 2017). The class Dothideomycetes comprises two subclasses Dothideomycetidae (absence of pseudoparaphyses) and Pleosporomycetidae (presence of pseudoparaphyses) (Schoch et al. 2006, 2009, Liu et al. 2017).

An inclusive account of the genera of Dothideomycetes was provided by Hyde et al. (2013) to revise the taxonomic status of the class Dothideomycetes. Another recent milestone is the 'Naming and outline of Dothideomycetes–2014 including proposals for the protection or suppression of generic names' published by Wijayawardene et al. (2014). In their work, the authors accepted 1261 genera in 23 orders and 110 families and proposed single generic names following the change of the International Code of Nomenclature for algae, fungi, and plants (ICN) rule and emphasizing on 'one fungus-one name'. In line with the 'one fungus-one name', Rossman et al. (2015) provided recommendations of one name for use among pleomorphic genera in the class Dothideomycetes by the Working Group on Dothideomycetes recognized under the auspices of the International Commission on the Taxonomy of Fungi (ICTF). Wijayawardene et al. (2017) also summarized the state of knowledge and revised the classification of the Dothideomycetes in 'Notes for genera: Ascomycota'. These publications represented major advances in the taxonomy of Dothideomycetes and since then many attempts have been made to provide a natural classification of genera within Dothideomycetes (Wanasinghe et al. 2017a, b, Jayasiri et al. 2019). Other important highlights are those of Boonmee et al. (2011, 2014, 2017), Chomnunti et al. (2011, 2014), Ariyawansa et al. (2014a, 2015), Dai et al. (2014), Hongsanant et al. (2014), Li et al. (2014), Phookamsak et al. (2014, 2015a, b, 2016, 2017), Thambugala et al. (2014a, b), Tian et al. (2016), Thambugala et al. (2014a, b), Jayasiri et al. (2016), Tian et al. (2016), Boonmee et al. (2017) and Doilom et al. (2018) who studied Dothideomycetes genera that were poorly described.

Following the outline of Ascomycota 2009 which included 41 families and 116 genera in Dothideomycetes, genera *incertae sedis*, many subsequent authors attempted to refine the natural placements of the Dothideomycetes, genera *incertae sedis* based on the studies of the type specimens (Lumbsch & Huhndorf 2010, Ariyawansa et al. 2013, 2014b, Hyde et al. 2013, Dai et al. 2014, Li et al. 2014, Thambugala et al. 2014a, b, Jayasiri et al. 2016, Boonmee et al. 2017, Doilom et al. 2018). Ariyawansa et al. (2014a) examined the generic types of *Cucurbitodithis*, *Heterosphaeriopsis*, *Hyalosphaera*, *Navicella* and *Pleiositomellina*. *Cucurbitodithis* has been referred to the Cucurbitariaceae while *Navicella* and *Pleiositomellina* were transferred to Melanommataceae and Parmulariaceae respectively. *Heterosphaeriopsis* and *Hyalosphaera* were retained in Dothideomycetes, genera *incertae sedis*. Dai et al. (2014) placed *Muellerites* in Dothidotthiaceae, *Vizellopsis* in Asterinaceae and retained *Trematosphaeriopsis* and *Yoshinagella* in Dothideomycetes, genera *incertae sedis*. Li et al. (2014) accommodated *Lophiosphaerella* in Mycosphaerellaceae and referred *Bryopelta* to Mycosphaerellaceae *incertae sedis* while *Maireella* accommodated in Venturiaceae. Thambugala et al. (2014a) studied the morphology of the type specimens of *Dolabra*, *Placostromella*, *Pleosphaerellula*, *Polysporidiella* and *Pseudotrichia* and referred *Dolabra* to Chaetothyriomycetidae, genera *incertae sedis* (Eurotiomycetes); *Placostromella* to Parmulariaceae, *Pleosphaerellula* to Pleosporales, genera *incertae sedis*, *Polysporidiella* to Dothideomycetes, genera *incertae sedis* and *Pseudotrichia* to Montagnulaceae respectively based on morphology. Thambugala et al. (2014b) referred *Allosoma* to Englerulaceae; *Austropleospora* and *Karschia* to Pleosporaceae and Lichenotheliaceae respectively; *Dangeardiellais* in Pleosporales, genera *incertae sedis* and *Griggsia* in Sordariomycetes, genera *incertae sedis*. Likewise, in another similar publication, Jayasiri et al. (2016) confirmed the placement of *Cocconia*, *Endococcus* and *Lineostroma* in the families Parmulariaceae, Lichenotheliaceae and Didymosphaeriaceae respectively and retained *Dianesea* in Dothideomycetes genera *incertae sedis*. Boonmee et al. (2017) studied many type materials of the Ascomycota, genera *incertae sedis* and introduced 13 new families in Dothideomycetes. Doilom et al. (2018) established Johansoniaceae as a new family and transferred *Rivilata* and *Vonarxella* from

Saccardiaceae to Phaeothecoidiaceae and Schizothyriaceae, respectively. There are constant taxonomic changes, including updates to the existing and introduction of new species, added to this class and the taxonomy is always in a transitional state (Zhang et al. 2012, Phillips et al. 2013, Liu et al. 2015, Hyde et al. 2016, Phookamsak et al. 2017). In the updated outline of Ascomycota 2017 (Wijayawardene et al. 2018), 1138 genera listed under the class Dothideomycetes and 238 genera listed under Dothideomycetes, genera *incertae sedis* (genera that have not been confirmed by their familial placement) have to be illustrated and described based on morphology and phylogeny.

Database and the need for Dothideomycetes webpage

The current concepts on Dothideomycetes classification and the taxonomic methods used are changing rapidly and hence, establishing an appropriate database is crucial for bringing scattered data together as well as for proper dissemination of information worldwide. With the advent of DNA sequence-based phylogenetic analyses, novel species, genera, families and orders are being discovered (Doilom et al. 2017, Tibpromma et al. 2017, Wanasinghe et al. 2018, Hyde et al. 2018, 2019, Phookamsak et al. 2015b, 2017, 2019, Zhang et al. 2019). Due to this rapid evolution and discovery, it is important to realize the need for curated databases that serve to provide an overview of the evolutionary and taxonomic framework of these fungi (Jayasiri et al. 2015, Monkai et al. 2019).

Therefore, the primary objective of the website is to bring all this information together in a single comprehensive database and produce a compilation of previous as well as updated treatments within the class Dothideomycetes. The purpose of the Dothideomycetes fungi webpage is to 1) provide an up-to-date outline of the Dothideomycetes, 2) provide notes on orders, families and genera of Dothideomycetes, and 3) provide updated accounts of each genus keeping abreast of the current literature and new developments. The website will also provide a list of references dealing with Dothideomycetes. The webpages include a list of recent publications and a history of Dothideomycetes classification. Various websites deal with microfungi such as the fungal genera (<http://www.fungalgenera.org>, Monkai et al. 2019), the world register of marine species (<http://www.marinespecies.org>, Jones et al. 2019), and the faces of fungi (<http://www.facesoffungi.org>, Jayasiri et al. 2015), but, none of them deals specifically with Dothideomycetes.

Dothideomycetes website

This website provides basic and updated data on all taxonomic aspects of the Dothideomycetes. Recent notes concerning the placement and taxonomic status will be provided for each genus and will be updated periodically. Other information provided in each entry is directly related to the importance of the genera to humans or the ecosystem, industrial applications, quarantine regulations and biochemical potential, chemical diversity or applications. We will organize each genus, with descriptions, photographic plates, phylogenetic trees, lists of accepted species in each genus and include significant information through the links from other associated webpages namely, the fungal genera (<https://www.fungalgenera.org>, Monkai et al. 2019), Faces of Fungi (<http://www.facesoffungi.org>, Jayasiri et al. 2015), One Stop Shop: (<https://www.onestopshopfungi.org>, Jayawardena et al. 2019), Marine fungi: (<http://www.marinefungi.org>, Jones et al. 2019) and other forthcoming webpages (Monkai et al. 2019, Jayawardena et al. 2019).

Mycologists, taxonomists and researchers from various fields of expertise are invited from all over the world to contribute to this webpage, monitor information and suggest improvements. The Dothideomycetes webpage will provide a better understanding of existing knowledge of Dothideomycetes genera and contribute to developing knowledge in the field of taxonomy.

Construction

All fungi included in the Dothideomycetes website are listed according to the most recent classification (Wijayawardene et al. 2017, 2018). The database will include only fungi of the class

Dothideomycetes. It comprises the following headings: Home, Outline, Archives, Curators, History, References, News and Contact. Contributions will include descriptions, photographic plates, notes, phylogenetic trees and related data. For each entry, Faces of Fungi, Index Fungorum, MycoBank, herbaria, and GenBank accession numbers for sequence data if available for the illustrated species will be provided. The website has curators with mycological expertise who contribute to the increased knowledge and carry out a follow-up of updated data on the classification of Dothideomycetes fungi (Table 1).

Database interface and visualization

The website <https://www.dothideomycetes.org/archives.php> consists of many features that allow users to access data in an easy and friendly way. The homepage provides a general overview of the Dothideomycetes, the primary goals of setting up the webpage, and the 'highlights of information'. The left side of the homepage comprises recent news and recent genera published related to the Dothideomycetes. The option to find the information of genera includes:

1. Use the search box on the right-hand side of the homepage to search for a genus name.
2. Clicking on the genus name will reveal data on the genus, type species, relevant herbarium or reference material, classification, phylogeny, economic significance, importance and significant role in the scientific community.

Other useful tools include (Figs. 1–5):

1. **Home:** The homepage provides an overview of the class Dothideomycetes, goals of the website and 'Highlights of Information'.
2. **Outline:** The 'Outline' provides recent taxonomic classification of the genera, families and order of the Dothideomycetes.
3. **Archives:** The 'Archives' provides more information about a specific order or family.
4. **Curators:** This section provides the list and contact details of the curators of the website.
5. **History:** This section provides a brief history in the classification of Dothideomycetes.
6. **References:** This section provides reference list of citations used in the entries, history and related information.
7. **News:** The 'News' section publishes any event or announcement in the field of Mycology.
8. **Contact:** The 'Contact' section provides contact details of the website and allow users to address any comments and suggestions.

Table 1 List of expert curators for Dothideomycetes webpage.

Position	Name	Address	Contact details
Head Curator	Sinang Hongsanan	Shenzhen Key Laboratory of Microbial Genetic Engineering, College of Life Sciences and Oceanography, Shenzhen University, Shenzhen 518060, People's Republic of China	sinang333@gmail.com
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Table 1 Continued.

Position	Name	Address	Contact details
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	Wei Dong	Center of Excellence in Fungal Research, Mae Fah Luang University, Chiang Rai 57100, Thailand	dongwei0312@hotmail.com

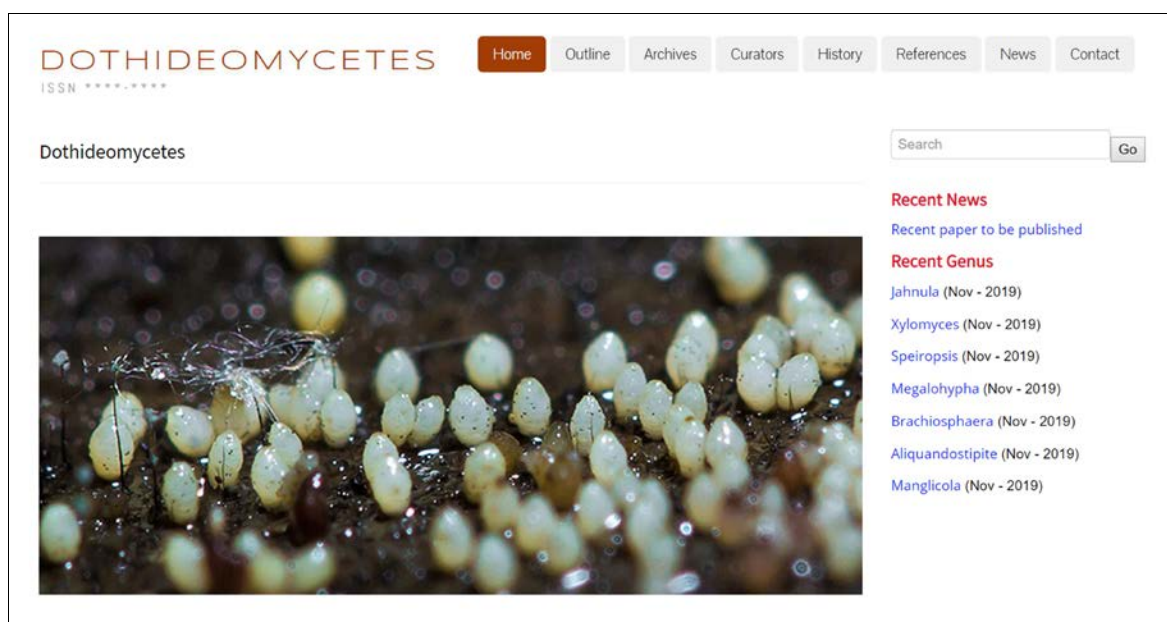


Fig. 1 – The homepage view of Dothideomycetes webpage

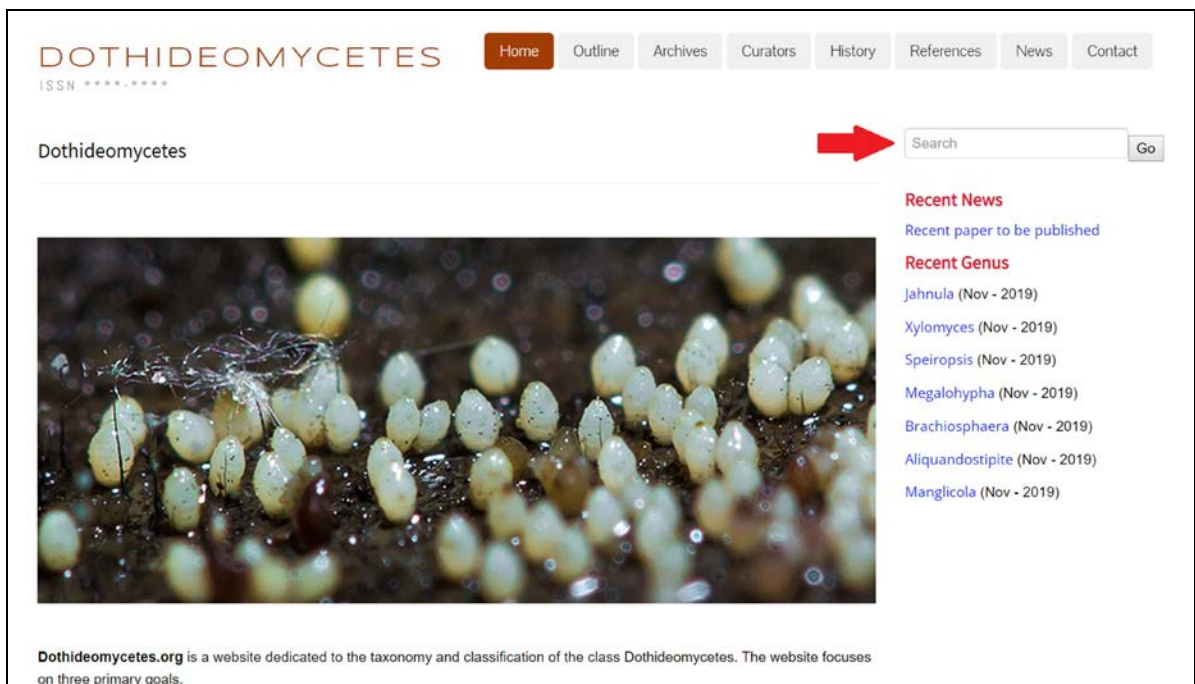


Fig. 2 – The use of search tool to find the information of genera



Fig. 3 – The recent genera uploaded

Asterinales > Asterinaceae > Dothidasteromella

Citation: Pem et al. (2019). A morphotaxonomic revision and typification of obscure Dothideomycetes genera (*incertae sedis*). Mycosphere X(X), X–X (In press)

Dothidasteromella Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 119: 421 (1910)

Epiphytic on leaf of *Cinnamomum japonicum*, forming large blackened circular areas 1–2 mm. Superficial hyphae, brown to dark brown, difficult to remove from the surface of host. **Sexual morph:** *Thyriothecia* superficial, erumpent from mycelia mass, solitary or gregarious, globose to subglobose, more or less carbonaceous, difficult to remove from the host surface, opening by linear or sometimes Y-shaped at the centre of the thyriothecium. *Peridium* comprising 2-layers, outer layer dark brown, inner layer hyaline, comprising cells of *textura angularis*. *Hamathectium* usually lacking pseudoparaphyses. *Asci* 8-spored, bitunicate, fissitunicate, oblong or subglobose, lacking a pedicel, apical region of asci usually with a thick opaque region and ocular chamber. *Ascospores* overlapping bi-seriate, hyaline, ellipsoidal to fusoid, 1-septate, strongly constricted at the septum, upper cell broader and shorter than lower cell, verrucose. **Asexual morph:** Undetermined.

Type species – *Dothidasteromella sepulta* (Berk. & M.A. Curtis) Höhn. 1910

Notes – *Dothidasteromella* was introduced by Höhnel (1910) to accommodate *Dothidasteromella sepulta* as the type species. The genus is characterized by brown to dark brown superficial hyphae forming blackened circular areas, superficial carbonaceous thyriothecia, a peridium of *textura angularis*, oblong or subglobose 8-spored asci and hyaline to brown, 1-septate, ellipsoidal to fusoid ascospores. The genus *Dothidasteromella* was placed in the family Asterinaceae based on presence of subcuticular hypostromata and superficial hyphae without appressoria by Von Arx and Müller (1975). There are currently 13 epithets under the genus *Dothidasteromella*. Hongsanan et al. (2014) studied the isotype and holotype specimen and placed the genus in *Dothideomycetes* genera *incertae sedis* as the characters of the asci and ascospores were not clear. In this study, we re-observed the holotype specimen (F56756). Based on the morphological re-examination of the specimen, it is characterized by Y-shaped thyriothecia, 8-spored oblong to subglobose asci, lacking a pedicel and 1-septate brown ascospores which are typical of the genus *Asterina*, accommodated in Asterinaceae. We therefore, place the genus *Dothidasteromella* in Asterinaceae until molecular data becomes available for further confirmation.

Dothidasteromella sepulta (Berk. & M.A. Curtis) Höhn., Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1 119: 421 (1910)

= *Asterina sepulta* Berk. & M.A. Curtis, Proc. Amer. Acad. Arts & Sci. 4: 129 (1860)

Index Fungorum number: IF 195171; Facesoffungi number: FoF 06236 Fig. 1

Epiphytic on leaf of *Cinnamomum japonicum*, forming large, blackened, 1–2 mm, circular areas. *Colonies* 2–4 µm diam., (x = 3 µm, n = 10), brown to dark brown, difficult to remove from the surface of host. **Sexual morph:** *Thyriothecia* 493–1836 diam. × 624–882 high µm (x = 1061 × 706 µm, n = 6), superficial, erumpent from mycelia mass, solitary or gregarious, globose to subglobose, more or less carbonaceous, difficult to remove from the host surface, opening by linear or sometimes Y-shaped at the centre of thyriothecium. *Peridium* 7–11.5 µm diam., comprising 2-layers, outer layer dark brown, inner layer hyaline, comprising cells of *textura angularis*. *Hamathectium* lacking pseudoparaphyses. *Asci* 27–34 × 13–23 µm (x = 30.5 × 17.8 µm, n = 10), 8-spored, bitunicate, fissitunicate, oblong or subglobose lacking a pedicel, apical region of asci usually with a thick opaque region and ocular chamber. *Ascospores* 15–16 × 4–5 µm (x = 16 × 5 µm, n = 10), overlapping bi-seriate, hyaline when immature, pale brown to dark brown at maturity, ellipsoidal to fusoid, 1-septate, strongly constricted at the septum, upper cell broader and shorter than lower cell, verrucose. **Asexual morph:** Undetermined.

Material examined – JAPAN, on the leaf of *Cinnamomum japonicum* (Lauraceae), November 1867, C. Wright (S-F56756, holotype).

Economic significance – Species of *Dothidasteromella* appear to be members of sooty moulds and they coat fruits and leaves cursorily with black mycelia, which decreases photosynthesis rates of host plants (Chomnunti et al. 2014).

Recent News

[Recent paper to be published](#)

Recent Genus

[Koordersiella](#) (Dec - 2019)

[Belizeana](#) (Dec - 2019)

[Botryochora](#) (Dec - 2019)

[Eumela](#) (Dec - 2019)

[Gibberidea](#) (Dec - 2019)

[Dothidasteromella](#) (Dec - 2019)

[Jahnula](#) (Nov - 2019)

[Xylomyces](#) (Nov - 2019)

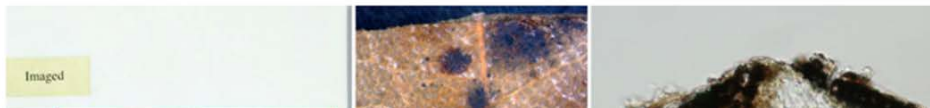


Fig. 4 – Dothideomycetes genus entry with notes and illustrations

The screenshot shows the website for Dothideomycetes. At the top, there is a navigation menu with buttons for Home, Outline, Archives (which is highlighted), Curators, History, References, News, and Contact. Below the navigation, the page title "DOTHIDEOMYCETES" is displayed along with the ISSN "*****".

The main content area is titled "Dothideomycetes Heirarchy" (sic). It features a vertical list of taxonomic levels:

- Dothideomycetes orders incertae sedis (highlighted in a dark orange bar)
- Jahnulales (highlighted in a dark orange bar)
 - Read more about Jahnulales order »
- Aliquandostipitaceae (highlighted in a grey bar)
 - Read more about Aliquandostipitaceae family »
- Aliquandostipite
- Brachiosphaera
- Jahnula
- Megalohypha
- Speiropsis
- Xylomyces
- Manglicolaceae (highlighted in a grey bar)

On the right side of the page, there is a "SEARCH BOX" and a "Recent News" section. The "Recent News" section lists several items:

- Recent paper to be published
- Recent Genus
 - Jahnula (Nov - 2019)
 - Xylomyces (Nov - 2019)
 - Speiropsis (Nov - 2019)
 - Megalohypha (Nov - 2019)
 - Brachiosphaera (Nov - 2019)
 - Aliquandostipite (Nov - 2019)
 - Manglicola (Nov - 2019)

Fig. 5 – Use of Archives tool

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