



## <https://www.coelomycetes.org>: Databank that contributes for the classification, identification and nomenclature of Coelomycetes

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### Abstract

Over the years, there have been continuous updates in the taxonomy of coelomycetes. In particular, traditional classification has been revised and updated based on extensive collections supplemented with morphological examinations and phylogenetic analyses. Most of the data available are scattered in the literature. In an attempt to ease the work of mycologists and bring all these data together, a website has been created, available at <https://www.coelomycetes.org>. Information provided on the webpage is in line with the current ranking and classification of taxa and will include photoplates, drawings, phylogenetic trees, notes and descriptions.

**Keywords** – asexual fungi – conidiogenesis – curators – database – website

### Introduction

Coelomycetes is an artificial group known as imperfect fungi. It was introduced by Grove (1919) to accommodate the asexual morphs of fungi such as *Phomopsis*, *Phloeospora* and

*Phyllosticta* in *Ascomycetes*. Furthermore, members have been reported to be also related to asexually reproducing basidiomycetous fungi such as *Basidiopycnis*, *Chaetospermum* and *Fibulocoela* (Nag Raj 1981, Wijayawardene et al. 2016, Liu et al. 2019, Li et al. 2020). Asexual fungi are diverse and can survive in a variety of ecological environments (Hyde et al. 2020). They can be found in soil, leaf litter, organic or manufactured sources, from fresh or saline water as well as on lichens (Jayawardena et al. 2019, Li et al. 2020). Furthermore, these imperfect fungi can live as parasites on plants, humans, vertebrates or insects (Sutton 1980).

Coelomycetes was rejected as a formal taxonomic rank and later was used as a collective term in *Ascomycota* and *Basidiomycota* (Nag Raj 1993, Li et al. 2020). Several studies have accepted accept conidiogenesis as a primary taxonomic criterion in asexual fungi (Nag Raj 1993). Wijayawardene et al. (2016) and Li et al. (2020) agree with Kendrick (2000) that coelomycetes is a term used for convenience. However, the classification of coelomycetes excluded hyphomycetes and agonomycetes because genera in coelomycetes are separated based on their conidiomata structure in combination with conidiogenesis and conidia characteristics (Sutton 1980, Nag Raj 1993, Wijayawardene et al. 2016, Gruyter et al. 2017, Li et al. 2020, Wijayawardene et al. 2020). Furthermore, conidiomata differed in terms of morphology as they have conidiophores, conidiogenous cells and conidial while ascomatal structures are available in sexual fungi. In addition, coelomycete genera can produce conidia from an acervulus, pycnidial, sporodochial-like and synnema-like those bear conidia (Sutton 1980, Nag Raj 1993, Wijayawardene et al. 2016, Li et al. 2020, Wijayawardene et al. 2020).

Conidiomata have distinct differentiation of tissue types that are assumed to be either plastic or stable. During conidia ontogeny, the cell wall either grows or is left behind for conidium initiation (Sutton 1980, Nag Raj 1993). Hughes (1953) gave an experimental description of conidiogenesis to explain the production of conidia. Sutton (1980) also used conidiogenesis as a primary characteristic to identify coelomycetes and later, Nag Raj (1993) illustrated 142 genera and over 200 appendages bearing coelomycetes with descriptions. Based on DNA sequence phylogenetic analyses, most of the species accepted by both Sutton (1980) and Nag Raj (1993) were reclassified in different orders, classes, or genera (Li et al. 2020). For example, *Tiarosporella abeietis*, *T. parca* and *T. pseudotsugae* were transferred to *Darkera* (Leotiomycetes) while *T. tritici* was placed under *Eutiarosporella* (*Botryosphaerales*) using morphological characters and phylogenetic results (Li et al. 2020). These show that, when using phylogenetic analyses, it is easier to place many species in their natural classification. However, it is common to have contradictions between phenotypic and genotypic data as pointed out by Li et al. (2020). The latter noted that the phylogenetic analyses and morphological results for dinemasporium-like and tiarosporella-like species do not correspond and this poses a taxonomic challenge. Thus, it has been suggested to use more gene regions for delineation at both generic and species level to have a better taxonomy result (Li et al. 2020). This also demonstrate that both morphological data and phylogenetic analyses are important to provide a more natural classification of coelomycetes (Li et al. 2020).

Molecular data availability has helped to link asexual taxa with their sexual morph (Shenoy et al. 2006, 2010, Li et al. 2020). Furthermore, under Article 59.1 of the International Code of Nomenclature for algae, fungi and plants, a single name is given for one fungus whether it is the asexual or sexual morph, known as “one fungus, one name” (Hawksworth 2012). Shenoy et al. (2006) proposed that for fungi that where sexual morph has not been detected, the asexual names should be used as holomorphs. Recently, Li et al. (2020) have provided a classification on hyaline coelomycetes, Wijayawardene et al. (2016) worked on the classification and taxonomy of dematiaceous coelomycetes, and Wijayawardene et al. (2020) provided a checklist for genera of coelomycetes.

### **Requirement for coelomycetes webpage**

Several genera of coelomycetes lack molecular data or the holotypes are not available and this hampers their integration into a proper classification scheme. Mycologists usually compile all fungal work that are being carried out and publish them in the form of introduction and revision of

different taxa within each respective fungal class (Wijayawardene et al. 2016, 2017, Li et al. 2020, Wijayawardene et al. 2020, Hyde et al. 2020). Nevertheless, the lack of phylogenetic data and cultures complicate the understanding of the taxonomic concept of coelomycetes and make generic delimitation difficult (Li et al. 2020).

For the time being, it is difficult to gather taxonomic data on many coelomycetes as there is no specific platform to obtain information that is related only to coelomycetes. Data on coelomycetes are difficult to retrieve and are scattered. An electronic database makes information more accessible, user- and eco-friendly. Mycologist will be a few clicks away from discovering the ongoing work that is carried out on coelomycetes. Several websites have been created to help researchers to obtain mycological research work on one platform as mentioned in Table 1 and these updated on a regular basis (Jayasiri et al. 2015, Monkai et al. 2019, Pem et al. 2019a, b, Jayawardena et al. 2019, Bundhun et al. 2020).

The coelomycetes website, <https://coelomycetes.org/>, consists of only asexual fungi and (1) provides an up-to-date outline of coelomycetes; (2) provides notes on orders, families, genera and species of coelomycetes; and (3) provides updated taxonomic accounts of each genus that is in line with current research. The webpage also has a list of references that are linked to coelomycetes.

**Table 1** List of websites.

Website names	URL links	References
<b>Marine fungi</b>	<a href="https://marinefungi.org/">https://marinefungi.org/</a>	Jones et al. (2019)
<b>Freshwater Fungi</b>	<a href="https://freshwaterfungi.org/">https://freshwaterfungi.org/</a>	Calabon et al. (2020)
<b>One Stop Shop</b>	<a href="https://onestopshopfungi.org/">https://onestopshopfungi.org/</a>	Jayawardena et al. (2019)
<b>Genera of Fungi</b>	<a href="https://fungalgenera.org/">https://fungalgenera.org/</a>	Monkai et al. (2019)
<b>Dothideomycetes</b>	<a href="https://dothideomycetes.org/">https://dothideomycetes.org/</a>	Pem et al. (2019a, b)
<b>Sordariomycetes</b>	<a href="https://sordariomycetes.org/">https://sordariomycetes.org/</a>	Bundhun et al. (2020)
<b>Faces of Fungi</b>	<a href="http://www.facesoffungi.org">http://www.facesoffungi.org</a>	Jayasiri et al. (2015)

### Coelomycetes website

The website consists of up to-date taxonomic information on coelomycetes. Notes for each genus and species along with their taxonomic placement based on current DNA sequence data analyses (phylogenies) will be uploaded regularly. Each genus or species entry will have a description, photographic plate, phylogenetic tree, lists of accepted species in each genus, and include significant information through the links from other associated webpages (Table 1). Mycologists are invited to help improve and provide feedback on the webpage by checking the information that will be displayed. This webpage will definitely provide a better understanding of coelomycetes.

### Construction

The coelomycetes website will include asexual fungi from recent classifications (Pem et al. 2019b, Hyde et al. 2020, Li et al. 2020, Bundhun et al. 2020). Index Fungorum and Faces of Fungi numbers for all species will be provided. Mycobank and herbaria numbers will also be given where available. Previously published data will be uploaded as new information are being published. The list of curators is enlisted in Table 2.

**Table 2** List of curators.

Position	Name	Contact detail
<b>Head Curators</b>	Wijayawardene NN Li WJ	nalinwijayawardene@yahoo.com winnie20070653026@163.com
<b>Managing Curator</b>	Huanraluek N	naruemon.hua@mfu.ac.th

**Table 2** Continued.

<b>Position</b>	<b>Name</b>	<b>Contact detail</b>
<b>Senior curator</b>	Jayawardena RS	ruvi.jaya@yahoo.com
<b>Curators list</b>	Bhunjun CS	avnishbhunjun@gmail.com
	Calabon MS	mscalabon@up.edu.ph
	Goonasekara ID	ishanidg@gmail.com
	Hongsanan S	sinang333@gmail.com
	Hyde KD	kdhyde3@gmail.com
	Jeewon R	r.jeewon@uom.ac.mu
	Maharachchikumbura SSN	sajeewa83@yahoo.com
	Norphanphoun C	oomchn@gmail.com
	Pem D	pem.dhandevi@gmail.com
	Phukhamsakda C	chayanard91@gmail.com
	Senanayake IC	indunilchinthani@gmail.com
	Shivas RG	roger.shivas@usq.du.au

### **Database interface and visualization**

The website <https://coelomycetes.org/> is user-friendly. It helps with quick and easy research on coelomycetous taxa. The webpage consists of the following sections:

Home (Fig. 1)

The homepage provides an overview of the website, the objectives and “Highlights of Information”.

Outline (Figs 2, 3, 4)

The outline consists of recent taxonomic classification of species, genera, families, orders and subclass in coelomycetes.

Archives (Fig. 5)

The Archives provides consistent information on a specific order, family and genus.

Curators

This segment provides the list and contacts of people who are in charge of the webpage.

History

This section provides a brief history of coelomycetes.

References

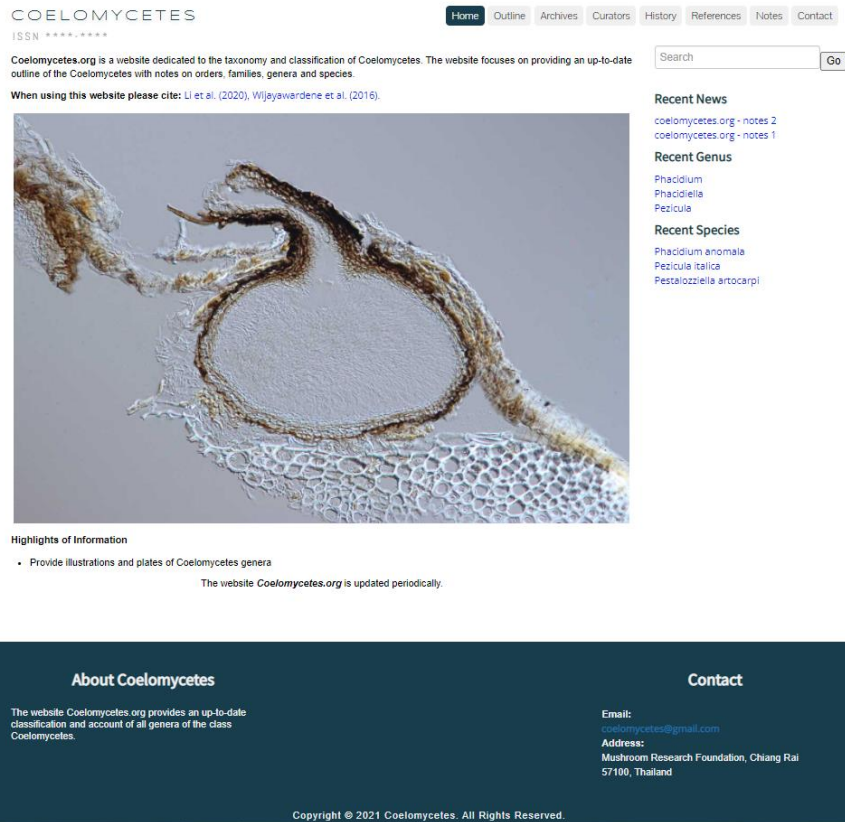
This section provides references used in the text and are hyperlinked to facilitate their search online.

Notes

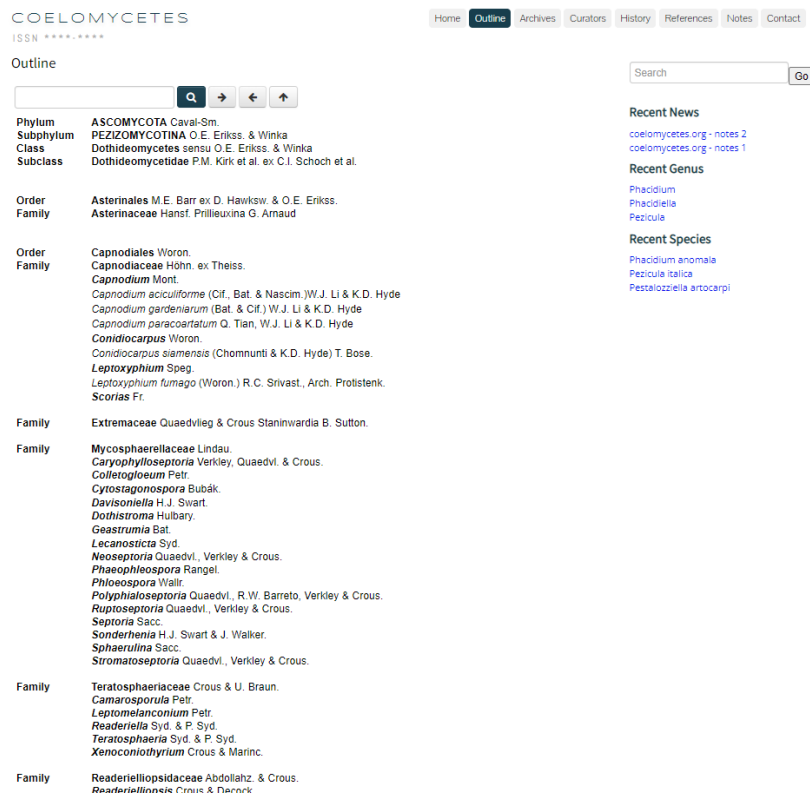
This section provides taxonomic information and any recent changes that occur on a specific coelomycete (Fig. 6; Recent genera and species uploaded).

Contact

The ‘Contact’ section helps to establish communication between users and curators. The users are allowed to add any comments and suggestions.



**Fig. 1** – Homepage that provides an overview of the website, the objectives and “Highlights of Information”.



**Fig. 2** – Outline consists of recent taxonomic classification of species, genera, families, orders and subclass in coelomycetes.

Phylum	ASCOMYCOTA, genera incertae sedis
	<i>Abrothallus</i> De Not.
	<i>Agryllopsis</i> Höhn.
	<i>Ajrekarella</i> Kamat & Kalani.
	<i>Ajrekarella polychaetriae</i> Kamat & Kalani, Mycopath.
	<i>Amerosporiopsis</i> Petr.
	<i>Anaphysmene</i> Bubák.
	<i>Angiopomopsis</i> Höhn.
	<i>Anthracoaderma</i> Speg.
	<i>Aoria</i> Cif.
	<i>Aphanofax</i> B. Sutton.
	<i>Aplocarpella</i> Syd & P. Syd.
	<i>Aristastoma</i> Tehon.
	<i>Ascochytopsis</i> Henn.
	<i>Ascochytilina</i> Petr.
	<i>Asteroconium</i> Syd & P. Syd.
	<i>Asteromidium</i> Speg.
	<i>Avettaea</i> Petr & Syd.
	<i>Barnettella</i> D. Rao & P.Rag. Rao.
	<i>Bellificauda</i> B. Sutton.
	<i>Blennoria</i> Moug. & Fr.
	<i>Botryocrea</i> Petr.
	<i>Brencklea</i> Petrak.
	<i>Brycekendrickia</i> Nag Raj.
	<i>Brycekendrickia indica</i> Nag Raj, Can. J. Bot.
	<i>Caeruleoconidia</i> Zhurb & Diederich.
	<i>Callistospore</i> Petr.
	<i>Camarosporium</i> Tassi.
	<i>Camarosporiopsis</i> Abbas et al.
	<i>Capitrostrum</i> Bat.
	<i>Carnegiespora</i> Elayo & F. Berger.
	<i>Ceratopycnis</i> Höhn.
	<i>Chaetodiplodia</i> P. Karst.
	<i>Chithramia</i> Nag Raj.
	<i>Coniambigua</i> Elayo & Diederich.
	<i>Calocline</i> Syd.
	<i>Camatopycnis</i> E.K. Cash.
	<i>Catenophora</i> Luttr.
	<i>Ceuthodiplospora</i> Dled.
	<i>Chaetoseptoria</i> Tehon.
	<i>Cheilaria</i> Lib.
	<i>Choanatiara</i> DiCosmo.
	<i>Choanatiara gracilis</i> Nag Raj, in Nag Raj & DiCosmo, Can. J. Bot.
	<i>Choanatiara lunata</i> DiCosmo & Nag Raj, in Nag Raj & DiCosmo, Can. J. Bot.
	<i>Chondropodiella</i> Höhn.
	<i>Ciliochora</i> Höhn.
	<i>Clypeopycnis</i> Petr.
	<i>Collonaemella</i> Höhn.
	<i>Comatospore</i> Piroz & Shoemaker.
	<i>Comatospore suttoni</i> Piroz & Shoemaker, Can.
	<i>Cornucopella</i> Höhn.
	<i>Cornutispora</i> Piroz.
	<i>Cornutispora limaciformis</i> Piroz.
	<i>Crandallia</i> Ellis & Sacc.
	<i>Cryptomycella</i> Höhn.

**Fig. 3** – Outline consists of recent taxonomic classification of species, genera, families, orders and subclass in coelomycetes (Continued).

Phylum	BASIDIOMYCOTA R. T. Moore.
Subphylum	AGARICOMYCOTINA Doweld.
Class	Agaricomycetes Doweld.
Subclass	Agaricomycetidae Parmasto.
Order	Agaricales underw.
Family	Phyalacriaceae Corner.
	<i>Mycotribulus</i> Nag Raj & W.B. Kendr.
	<i>Mycotribulus mirabilis</i> Nag Raj & W.B. Kendr.
Subclass	incertae sedis
Order	Corticiales K.H. Larss.
Family	Corticaceae Herter.
	<i>Giulia</i> Tassi.
	<i>Giulia tenuis</i> (Sacc.) Tassi ex Sacc. & D. Sacc.
Order	Sebacinales M. Weiss, Selosse, Rexer, A. Urb. & Oberw.
Order	Sebacinales, genus incertae sedis
	<i>Chaetospermum</i> Sacc.
	<i>Chaetospermum artocarpi</i> (Nag Raj) Nag Raj.
	<i>Chaetospermum camelliae</i> Agnihotr.
Class	Agaricomycetes, genera incertae sedis
	<i>Cenangiomycetes</i> Dyko & B. Sutton.
	<i>Ellula</i> Nag Raj.
	<i>Fibulocoela</i> Nag Raj.
	<i>Fibulocoela indica</i> Nag Raj.
	<i>Pycnovellomyces</i> R.F. Castañeda.

**Fig. 4** – Outline consists of recent taxonomic classification of species, genera, families, orders and subclass in coelomycetes (Continued).

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Coelomyces Heirarchy

Agaricomycetes incertae sedis  
[Read more about Agaricomycetes incertae sedis orders »](#)

Agaricomycetes incertae sedis

Ascomycota, genera

Basidiomycota, genera incertae sedis

Botryosphaeriales

Capnodiales

Capnodiales

Chaetomiales

Chaetosphaeriales

Conidiocarpus

Diaporthales

Glomerellales

Helotiales

Hypocreales

Medeolariales

Ostropales

Phacidiales

Phyllachorales

Pleosporales

Pleosporales

Rhizmatiales

Sordariomycetes

Xylariales

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**About Coelomyces**

The website [Coelomyces.org](#) provides an up-to-date classification and account of all genera of the class Coelomyces.

**Contact**

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Fig. 5 – Archives provides consistent information on a specific order, family and genus.

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Coelomyces.org is a website dedicated to the taxonomy and classification of Coelomyces. The website focuses on providing an up-to-date outline of the Coelomyces with notes on orders, families, genera and species.

When using this website please cite: Li et al. 2020, Wijayawardene et al. 2016.

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**Highlights of Information**

- Provide illustrations and plates of Coelomyces genera

The website [Coelomyces.org](#) is updated periodically.

**About Coelomyces** **Contact**

Fig. 6 – Recent genera and species uploaded.

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