

<https://botryosphaeriales.org/>, an online platform for up-to-date classification and account of taxa of Botryosphaeriales

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Abstract

Fungi are eukaryotes that inhabit various ecosystems worldwide and have a decomposing effect that other organisms cannot replace. Fungi are divided into two main groups depending on how their sexual spores are formed, viz. Ascomycota and Basidiomycota. The members of Botryosphaeriales (Dothideomycetes, Ascomycota) are ubiquitous. They are pathogenic on a wide range of hosts, causing diverse diseases including dieback, canker, leaf spots and root rots and are also reported as saprobes and endophytes worldwide. As an important fungal group, of which most are plant pathogens, it is necessary to organize data and information on Botryosphaeriales so that scientific literature can be used effectively. For this purpose, a new website, <https://botryosphaeriales.org> is established to gather all published data together with updates on the present taxonomy of Botryosphaeriales. The website consists of an easy-to-operate searching system and provides an up-to-date classification together with accounts of Botryosphaeriales taxa, including colour illustrations, descriptions, notes and numbers of species in each genus, as well as their classification. Thus, readers will be able to obtain information on botryosphaerialean taxa through this platform.

Database URL: <https://botryosphaeriales.org/>

Introduction

Botryosphaeriales (Dothideomycetes) was established in 2006, to accommodate a single family, Botryosphaeriaceae (1). Nine families—Aplosporellaceae, Botryosphaeriaceae, Endomelanconiopsisaceae, Melanopsaceae, Phyllostictaceae, Planistromellaceae, Pseudofusicoccumaceae, Saccharataceae and Septorioideaceae—were accepted in Botryosphaeriales by Wijayawardene *et al.* (2). However, based on morpho-molecular analyses and evolutionary divergence times, the number of families accepted in Botryosphaeriales was reduced to six, namely Aplosporellaceae, Botryosphaeriaceae, Melanopsaceae, Phyllostictaceae, Planistromellaceae and Saccharataceae (3, 4). Endomelanconiopsisaceae and Pseudofusicoccumaceae were synonymized under Botryosphaeriaceae and Phyllostictaceae, respectively, while Septorioideaceae was synonymized under Saccharataceae (3). Members of Botryosphaeriales are found worldwide, on many different host plants (5–17). They are endophytes, pathogens and saprobes and as opportunistic pathogens, they are of

considerable importance to agriculture, horticulture and forestry (18, 19). They cause severe diseases of economically important crops and plants leading to huge economic losses (20, 21). *Botryosphaeria*, *Diplodia*, *Dothiorella*, *Lasiodiplodia*, *Neofusicoccum* and *Phyllosticta* are the major pathogenic genera in Botryosphaeriales. *Botryosphaeria dothidea*, *Diplodia seriata*, *Lasiodiplodia theobromae* and *Neofusicoccum parvum* are associated with grapevine dieback worldwide (27). *Diplodia seriata* has been reported as a pathogen on a wide range of hosts including eucalyptus, pine and stone fruits (22–26). *Phyllosticta citricarpa* and *P. citriasiana* cause freckle on banana and brown spots on pomelo, respectively (6, 9). One species can occur on several hosts in the same country, and pathogenicity of a species can vary from one region to another (19). This reflects the importance of gathering data on these fungal taxa to understand disease epidemiology.

Aplosporellaceae, Melanopsaceae and Planistromellaceae have immersed or semi-immersed multiloculate ascostromata,

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while those of Botryosphaeriaceae, Phyllostictaceae and Saccharataceae are uniloculate (3, 8, 28, 29). Asci are bitunicate, with a thick endotunica (3, 8, 28, 29). Ascospores are hyaline or pigmented, septate or aseptate, ellipsoid to ovoid.

Conidiomata are pycnidial, uni- to multilocular, frequently embedded in stromatic tissue. Conidiogenous cells are hyaline. Conidia are hyaline or pigmented, septate or aseptate, thin- or thick-walled (3, 8, 28–32).

Table 1. List of curators for *Botryosphaerales* webpage

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botryosphaerales.org is a website dedicated to Botryosphaerales. The website focuses on providing an up-to-date account of Botryosphaerales with notes on orders, families and genera and species, keeping abreast of the current literature.

When using this website please cite:

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Highlights of Information

- Up-to-date account of Botryosphaerales
- Provide illustrations and plates of Botryosphaerales.

The website **botryosphaerales.org** is updated periodically

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Recent Genus

[Pileospora](#)
[Septorioides](#)
[Pileospora](#)

Recent Species

[Lasiodiplodia tropica](#)
[Lasiodiplodia microconidia](#)
[Lasiodiplodia brasiliensis](#)

Figure 1. The homepage of Botryosphaerales webpage.

All newly published data, which usually provide detailed descriptions and illustrations of new records, new species, new genera or new families, will be used to update the database. None of the papers generally link data from all

members of the order Botryosphaerales. Up until now, some websites involving specific groups of fungi have been established, such as <http://www.facesoffungi.org> (33), <https://onestopshopfungi.org> (34), <http://www.marinespecies.org>.

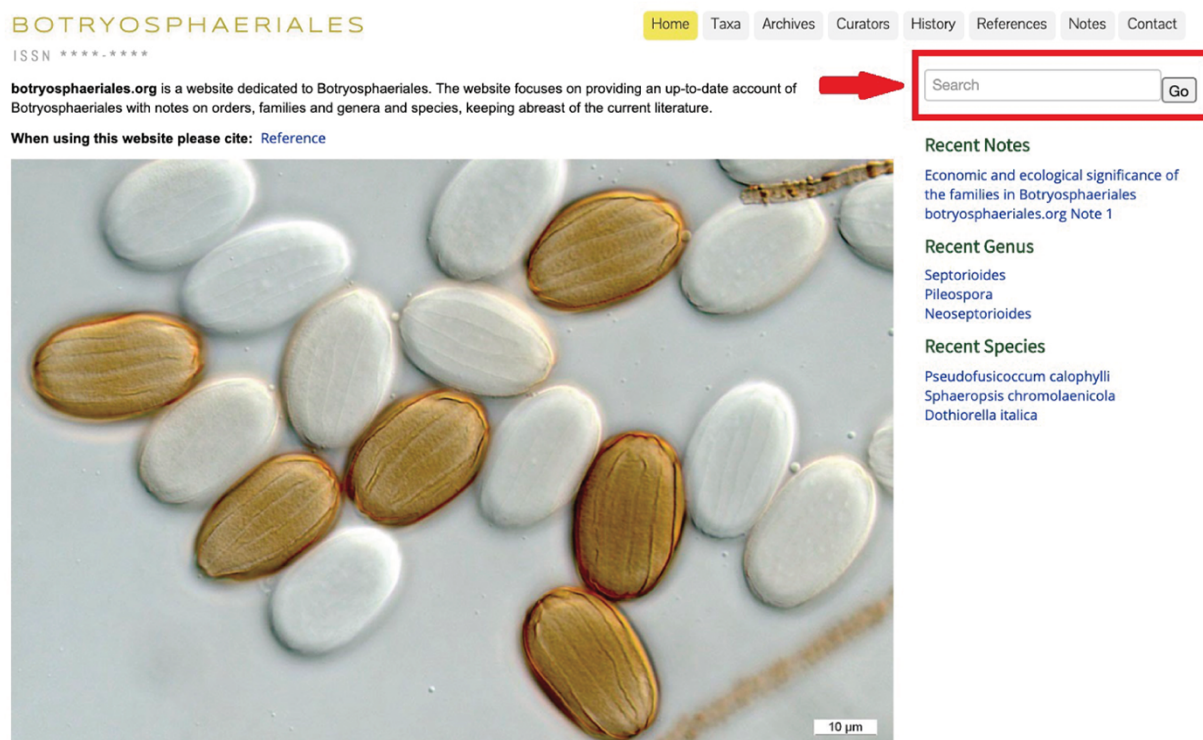


Figure 2. Red arrow indicates search tool to enter the taxon name.

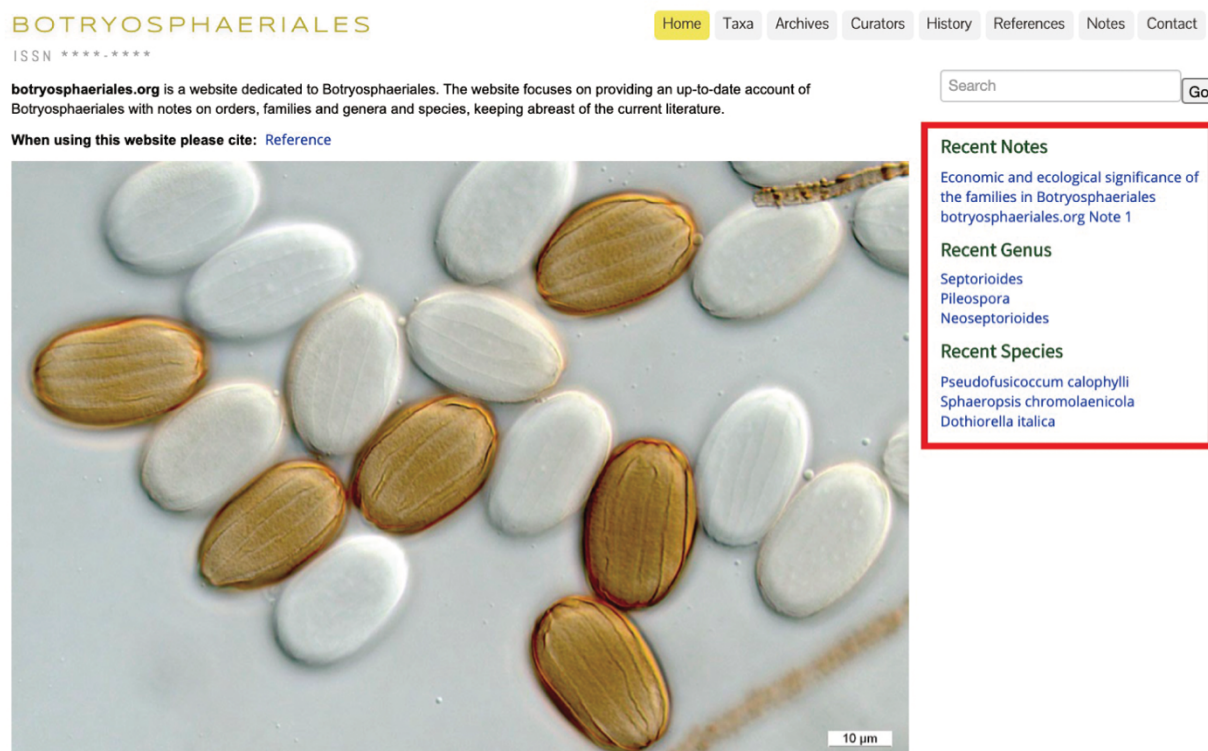


Figure 3. The recent notes, genus and species to enable easy access.

org (35), <https://fungalgenera.org> (36), <https://www.dothideomycetes.org> (37) and <https://sordariomycetes.org> (38). However, there is no database on Botryosphaerales. Therefore, in this paper, we provide a search method, designed to gather all the information about Botryosphaerales into one website.

The need for a Botryosphaerales database

Many Botryosphaerales species are associated with diseases in branches, leaves, fruits and seeds of aquatic and terrestrial plants (20, 31, 32, 39–43). In recent years, in-depth studies on Botryosphaerales have resulted in changes in the genus/family-level classification (2–4). Moreover, the number of publications and research works related to Botryosphaerales species are increasing all over the world (18, 20, 21, 44–48). With the increased number of studies on morphology, ecology and especially DNA-based phylogenetics, more and more new species are constantly being discovered. However, there are still many aspects needing clarification, such as naming new species from environmental samples, resolving the opportunistic pathogenic nature and how to define species boundaries in Botryosphaerales.

Currently over 2300 species have been described in Botryosphaerales in MycoBank based on morpho-molecular evidence (4). Most of the members of this order have

been scientifically documented. These publications on *Botryosphaerales* comprise various aspects such as taxonomy, morphology, pathogenicity or evolutionary studies. Information on Botryosphaerales taxa are scattered in over 1000 publications mainly as books and research papers. Hence, the intention of this website is to gather all data regarding taxa accepted in Botryosphaerales into a single entity that can be updated as new information becomes available.

The present website, <https://botryosphaerales.org/>, focuses on the Botryosphaerales with the following objectives: (i) gather all scattered data of accepted Botryosphaerales taxa into a single platform, (ii) provide notes on the recent changes in genera and species of Botryosphaerales with updated taxonomy and phylogeny and (iii) provide a list of all literature related to Botryosphaerales. Hence, this website will be the best platform to access information on the botryosphaeralean taxa easily with simple searches, thus reducing the time spent on searching for information.

The Botryosphaerales website

[Botryosphaerales.org](https://botryosphaerales.org/) is a website dedicated to Botryosphaerales taxa by providing an up-to-date account with descriptions, colour illustrations, culture characteristics, associated hosts, distribution and notes for order, families, genera

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Taxa

Botryosphaerales (accepted species) – click on the species to go to the entry

Aplosporellaceae

Alanomyces
Alanomyces indica

Aplosporella

Aplosporella africana
Aplosporella artocarp
Aplosporella hesperidica
Aplosporella javeedii
Aplosporella longipes
Aplosporella ginkgonis
Aplosporella macropycnidia
Aplosporella papillata
Aplosporella prunicola
Aplosporella sophorae
Aplosporella thailandica
Aplosporella yalgorensis

Botryosphaeriaceae

Alanphillipsia
Alanphillipsia aloes
Alanphillipsia aloicola
Alanphillipsia aloeigena
Alanphillipsia aloetica
Alanphillipsia euphorbiae

Barriopsis

Barriopsis archontophoenicis
Barriopsis iraniana
Barriopsis stevensiana
Barriopsis tectonae

Botryobambusa

Botryobambusa fuscococcum

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[Pileospora](#)
[Neoseptorioides](#)

Recent Species

[Pseudofusicoccum calophylli](#)
[Sphaeropsis chromolaenicola](#)
[Dothiorella italica](#)

Figure 4. The 'Taxa' view of the Botryosphaerales webpage.

and species. The website, <https://botryosphaerales.org> will be updated periodically, keeping abreast of current literature. It is convenient for all mycologists and pathologists who need information about the history and current classification status of botryosphaeralean taxa. The home page of the website has a mailbox so that mycologists, pathologists or anyone else who use this website can suggest ideas to improve it.

Construction

All fungi in the [Botryosphaerales.org](https://botryosphaerales.org) are listed according to the latest classification (3, 4, 49). Each entry includes the accepted binominal name, Index Fungorum number, Faces of Fungi number, MycoBank number, ex-type culture collection number, dry culture collection and herbarium number and GenBank accession numbers of available DNA sequences.

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Home Taxa

Taxa

Botryosphaerales (accepted species) – click on the species to go to the entry

Aplosporellaceae
Alauomyces
Alauomyces indica
Aplosporella
Aplosporella africana
Aplosporella artemisiifolia
Aplosporella chromolaenae
Aplosporella chrysosphaera
Aplosporella javensis
Aplosporella longipes
Aplosporella grisea
Aplosporella macrospora
Aplosporella papillata
Aplosporella prunicola
Aplosporella sphaerica
Aplosporella thalassica
Aplosporella yalopenensis

Botryobambusa
Botryobambusa fusicoccum

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Botryosphaerales » Botryosphaeriaceae
Botryobambusa

Botryobambusa Phook., Jian K. Liu & K.D. Hyde, in Liu et al., Fungal Diversity 57(1): 166 (2012)
Index Fungorum number: IF 801313; Facesoffungi number: FoF 02408; – 2 morphological species (Species Fungorum 2020), 2 species with molecular data.
Type species: **Botryobambusa fusicoccum** Phook., Jian K. Liu & K.D. Hyde, in Liu et al., Fungal Diversity 57(1): 166 (2012).

Notes: *Botryobambusa* was introduced by Liu et al. (2012) with a single species with both sexual and asexual morphs. Phylogenetically this genus is clearly distinguished from *Botryosphaeria*. However, it is similar to *Botryosphaeria* except for smaller asci and ascospores that are surrounded by a mucilaginous sheath. Two species are accommodated in this genus (Dissanayake et al. 2017).

Figure 5. Details of the genus *Botryobambusa*.

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Botryosphaerales Heirarchy

Read more about Botryosphaerales orders »

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- Botryosphaeriaceae
- Melanopsaceae
- Phyllostictaceae
- Planistromellaceae
- Saccharataceae

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Septorioides
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Recent Species
Pseudofusicoccum calophylli
Sphaeropsis chromolaenicola
Dothiorella italica

Figure 6. Appearance of the 'Archives' section in Botryosphaerales webpage.



This website is handled and inspected regularly by the head curator, managing curator, senior curator and three other curators with expertise on botryosphaeralean taxonomy and phylogeny (Table 1).

The website can be accessed at URL <https://botryosphaeriales.org> and comprises eight main headings, i.e. Home, Taxa, Archives, Curators, History, References, Notes and Contact. The interface is user-friendly, and each section comprises the following information.

The homepage briefly introduces the objectives of the website and has links to highlights of information. Colour photos of Botryosphaerales are displayed representing the key morphological features of this order (Figure 1). The relevant information can be accessed easily using the search box located at the right top corner (Figure 2). Beneath the search box, there is quick access to recent notes, recent genera and recent species. Clicking on these options opens the link in a new window (Figure 3).

Under the 'Taxa' heading, the recent taxonomic classification as families, genera and species of Botryosphaerales is

provided (Figure 4). In addition, an updated phylogenetic tree for the order is given at the bottom. The search box at the top left corner will facilitate quick access to each entry on the website. Clicking a listed species name will direct to the full description and details in the archives section (Figure 5).

The ‘Archives’ is the main section containing all information on every entry in the website (Figure 6). It consists of six tabs representing each family in Botrysosphaerales. Clicking on a particular family will automatically generate a dropdown list including all the genera belonging to the particular family (Figure 7). This can be further expanded into genus and species levels (Figure 7). By clicking the link for each species will open a new window containing all information on that species (Figure 8).

This section provides information about the curators who handle and update the website (Table 1; Figure 9).

This section provides a brief account of the classification of Botryosphaerales.

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Pseudofusicoccum calophylli

Pseudofusicoccum calophylli Jayasiri, E.B.G. Jones & K.D. Hyde, in Jayasiri, Hyde, Jones, McKenzie, Jeewon, Phillips, Bhat, Wanasinghe, Liu, Lu, Kang, Xu & Karunaratna, *Mycosphere* 10(1): 151 (2019)

Index Fungorum number: IF555584

Facesoffungi number: FoF05299

Holotype: MFLU 18–2153

Etymology: Referring to the host genus on which the fungus was collected, Calophyllum (Calophyllaceae)

Saprobic on Calophyllum inophyllum. **Asexual morph:** Undetermined. **Asexual morph:** Coelomycetous. *Conidiomata* 140–160 µm high × 133–197 µm diam. ($x = 144 \times 160$ µm; $n = 10$), semi-immersed, solitary, globose to subglobose, papillate, covered by host epidermal tissues, lack of ostiole. *Conidiomata wall* 30–50 µm wide ($x = 47$ µm; $n = 20$), outer pale brown textura angularis cell layers, inner hyaline textura angularis cell layer, embedded within plant tissues. *Conidiogenous cells* 10–14 × 3–5 µm ($x = 13 \times 4$ µm; $n = 20$), phialidic, ovate to cylindrical, smooth, hyaline. *Conidia* 14–17 × 4–5 µm ($x = 16 \times 4.5$ µm; $n = 30$), hyaline, ellipsoid, occasionally slightly bent or irregularly shaped, apices rounded, smooth with fine granular content, unicellular, thin-walled.

Culture characters: Conidia germinated on MEA within 24 hr. Germ tubes produced at one end or both ends of conidia. Colonies growing on MEA, reaching 35–40 mm diam. after 2 weeks at 18°C. Colonies fluffy, initially white to amber at the centre, olivaceous at the edges, becoming white to olivaceous with age.

Material examined: THAILAND, Krabi Province, Mueang Krabi District (8°2' 27" N, 98°49' 5" E), decaying fruit pericarp of Calophyllum inophyllum (Calophyllaceae), 31 August 2018, S.C. Jayasiri, C 346 (MFLU 18–2153, holotype; KUN-HKAS102429, isotype), ex-type living culture MFLUCC 17–2533, KUMCC 18–0282.

GenBank numbers: ITS: MK347764, tef1: MK340877, rpb2: MK434879, tub2: MK412885

Notes: *Pseudofusicoccum calophylli* clusters with two strains of *P. violaceum*. *Pseudofusicoccum violaceum* is characterized by bacilliform conidia with a mucilaginous sheath and larger spores compared to *P. calophylli* (33 × 9.5 vs. 16 × 4.5 µm) (Mehl et al. 2011). However, *Pseudofusicoccum calophylli* has bacilliform conidia in the immature stage but these later become irregular in shape, without a mucilaginous sheath (Fig. 129). A comparison of the ITS and tef1 nucleotides of these two strains reveals 5 (0.8%) and 5 (1.6%) nucleotide differences, which indicates that they are distinct taxa (Jeewon & Hyde 2016).

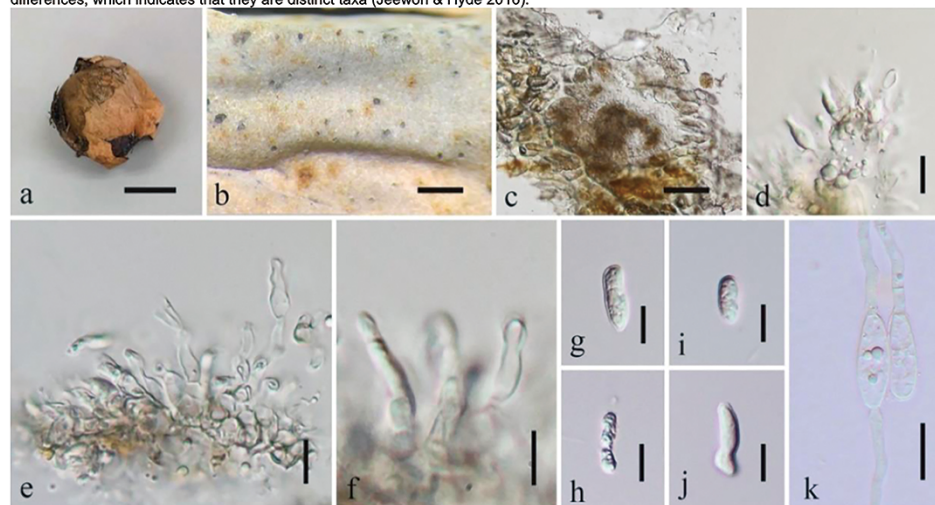


Figure 1. *Pseudofusicoccum calophylli* (MFLU 18–2153, holotype). a Host fruit. b Conidiomata on host surface. c Section through conidioma. d–f Conidiogenous cells. g–j Conidia. k Germinated conidia. Scale bars: a = 1 cm, b = 500 µm, c = 50 µm, d–k = 10 µm.

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Figure 8. An entry with description, notes and plate (15).

References

A list of the citations used in the entries and history as well as other related information are provided under this heading.

Notes

Economic and ecological significance of families in Botryosphaeriales are given in this section. In addition, trends and current applications of the species of Botryosphaeriales will be added regularly to this section.

Contact

This section provides the contact details of the website and allows users to communicate any comments and suggestions.

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Pileospora
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Recent Species

Pseudofusicoccum calophylli
Sphaeropsis chromolaenica
Dothiorella italica

Figure 9. Curators of the Botryosphaeriales webpage.

ecological restoration in high-phosphorus environment”
(Grant No: 31861143002).

Conflict of interest

None declared.

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