MycoKeys 9: 29–36 (2015)
doi: 10.3897/mycokeys.9.4440
http://mycokeys.pensoft.net

RESEARCH ARTICLE

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Freshwater Ascomycetes: *Jahnula purpurea* (Jahnulales, Dothideomycetes), a new species on submerged wood from Martinique Island, Lesser Antilles

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Academic editor: *Andrew Miller* | Received 1 January 2015 | Accepted 29 January 2015 | Published 9 March 2015

Citation: Fournier J, Raja HA, Shearer CA (2015) Freshwater Ascomycetes: *Jahnula purpurea* (Jahnulales, Dothideomycetes), a new species on submerged wood from Martinique Island, Lesser Antilles. MycoKeys 9: 29–36. doi: 10.3897/mycokeys.9.4440

Abstract

Jahnula purpurea J.Fourn., Raja & Shearer, a new species in the Jahnulales (Dothideomycetes) collected from submerged wood in a freshwater river in Martinique Island, Lesser Antilles, is described and illustrated. The characteristic features of the new species are: globose to subglobose, brownish black ascomata with broad, golden brown, subtending hyphae which stain the underlying wood purple; a peridial wall composed of large pseudoparenchymatic cells, which are *textura angularis* to *prismatica* in surface view; sparsely septate pseudoparaphyses embedded in a gel matrix; clavate to obclavate asci with a short pedicel; brown, one-septate, ellipsoidal, rough-walled ascospores without a gelatinous sheath or appendages. Unfortunately, because limited material was available from the type collection, we were unable to obtain molecular data. *Jahnula purpurea* is distinct from all previously described species of *Jahnula* in its ability to stain the wood purple and in a combination of ascomal, ascus, and ascospore size and morphology.

Key words

Aquatic fungi, Lotic, Submerged wood, Systematics, Morphology

Introduction

The genus *Jahnula*, typified by *Jahnula aquatica* (Plöttner and Kirschst.) Kirschst., is the largest genus in the Jahnulales, Dothideomycetes and currently contains 15 species (Hyde 1993; Hawksworth 1984; Hyde and Wong 1999; Pinruan et al. 2002; Raja and Shearer 2006; Raja et al. 2008; Sivichai and Boonyuen 2010; Suetrong et al. 2011). All species of *Jahnula* have been reported from submerged decorticated wood in freshwater habitats, mostly from tropical/subtropical habitats. Exceptions are *J. aquatica*, *J. apiospora* A. Carter, Raja & Shearer, and *J. sangamonensis* Shearer & Raja, which have been described and reported from fresh water in temperate geographical locations (Hawksworth 1984; Raja and Shearer 2006; Raja et al. 2008). Members of the Jahnulales are primarily reported from freshwater habitats, except *Manglicola guatemalensis* Kohlm. & E. Kohlm, that is a mangrove species (Suetrong et al. 2010).

In this paper, we describe and illustrate a new species of *Jahnula* that was found on submerged wood collected from a freshwater river on Martinique Island, Lesser Antilles.

Methods

The methods for collection, morphological characterization and illustration are outlined in Fournier and Lechat (2010) and Réblová et al. (2015). Asci and hamathecia were mounted in black ink (Pelikan brand) for illustrations. Culturing was attempted, but without success. Since the fungus has been collected only from the type locality thus far and limited material was available to serve as a holotype specimen, attempts made to extract DNA and obtain molecular data from a very small number of ascomata were also unsuccessful. The holotype specimen is deposited in the Illinois Natural History Survey Fungarium (ILLS).

Results

Taxonomy

Jahnula purpurea **J. Fourn., Raja & Shearer, sp. nov.**
Mycobank: MB811212
Figs 1, 2

Holotype. FWI, Martinique: Prêcheur, Anse Couleuvre, Couleuvre River, coastal rainforest, 14°50'13.05"N, 61°13'22.40"W, on submerged decorticated branch, 03 Jun. 2014, J. Fournier, MJF 14016; **(ILLS 72402)**.

Description. Ascomata 125–185 (–220) µm diam, globose to subglobose, scattered or clustered in small groups, immersed-erumpent, the base remaining immersed in the substrate, brownish black appearing black when dry, attached to subtending

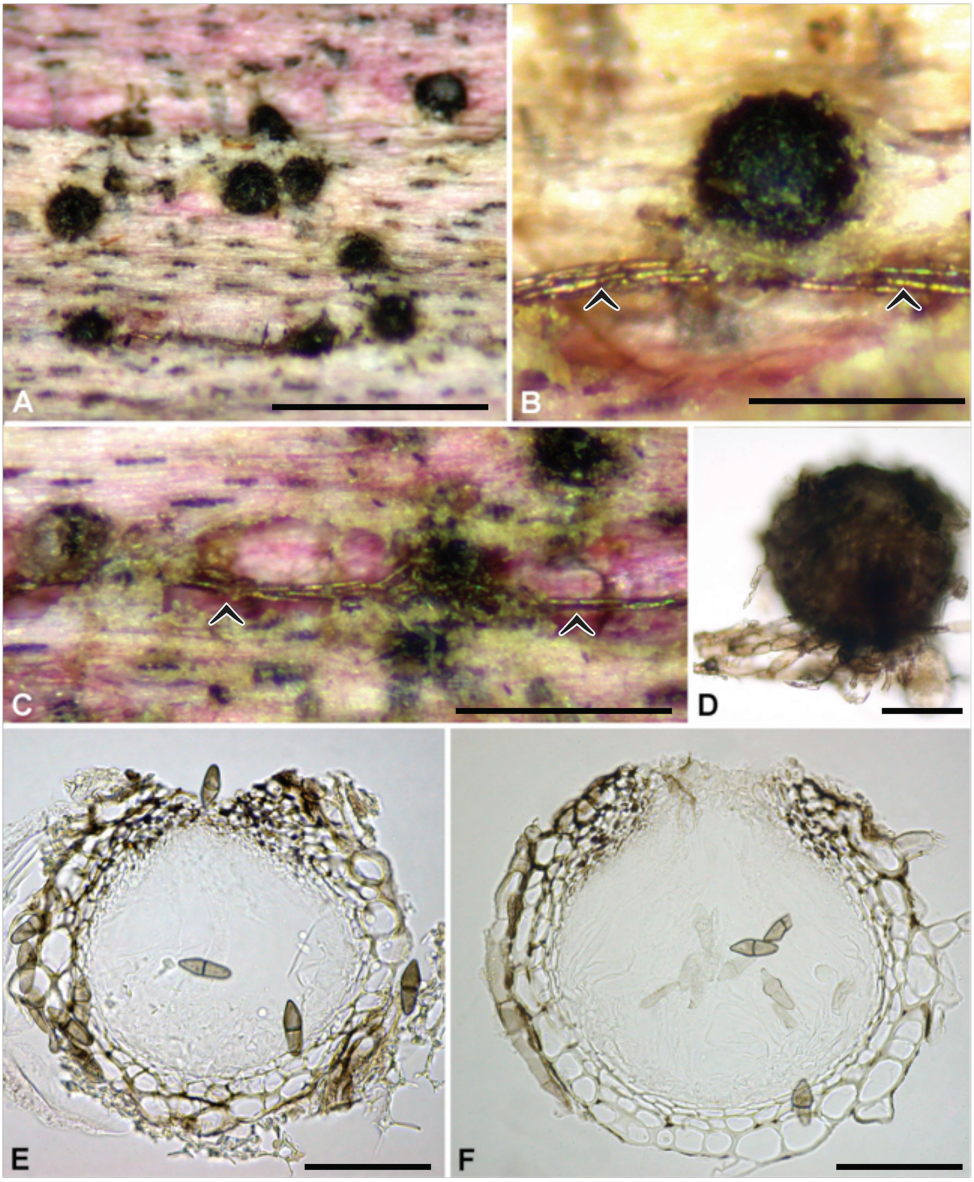

Figure 1.A–F *Jahnula purpurea* (from the HOLOTYPE; MJF 14016, ILLS 72402). **A–C** Ascomata on submerged wood. Note the purple stain. Arrowheads indicate the subtending superficial hyphae on wood, which connect multiple ascomata on wood **D** Ascoma in water showing broad hyphae emerging from the base of the fruiting body **E, F** Longitudinal section through ascoma. Note broad pseudoparenchymatic cells comprising the peridial wall. Scale bars: **A, C** = 500 µm; **B** = 1 mm; **D** = 100 µm; **E–F** = 20 µm;

golden brown hyphae 8–22 µm diam, smooth, slightly constricted at septa; hyphae form cords developing under the wood surface and linking adjacent ascomata (Fig. 1A–D); wood beneath ascomata or at the periphery of the colony stained purple; ostiole

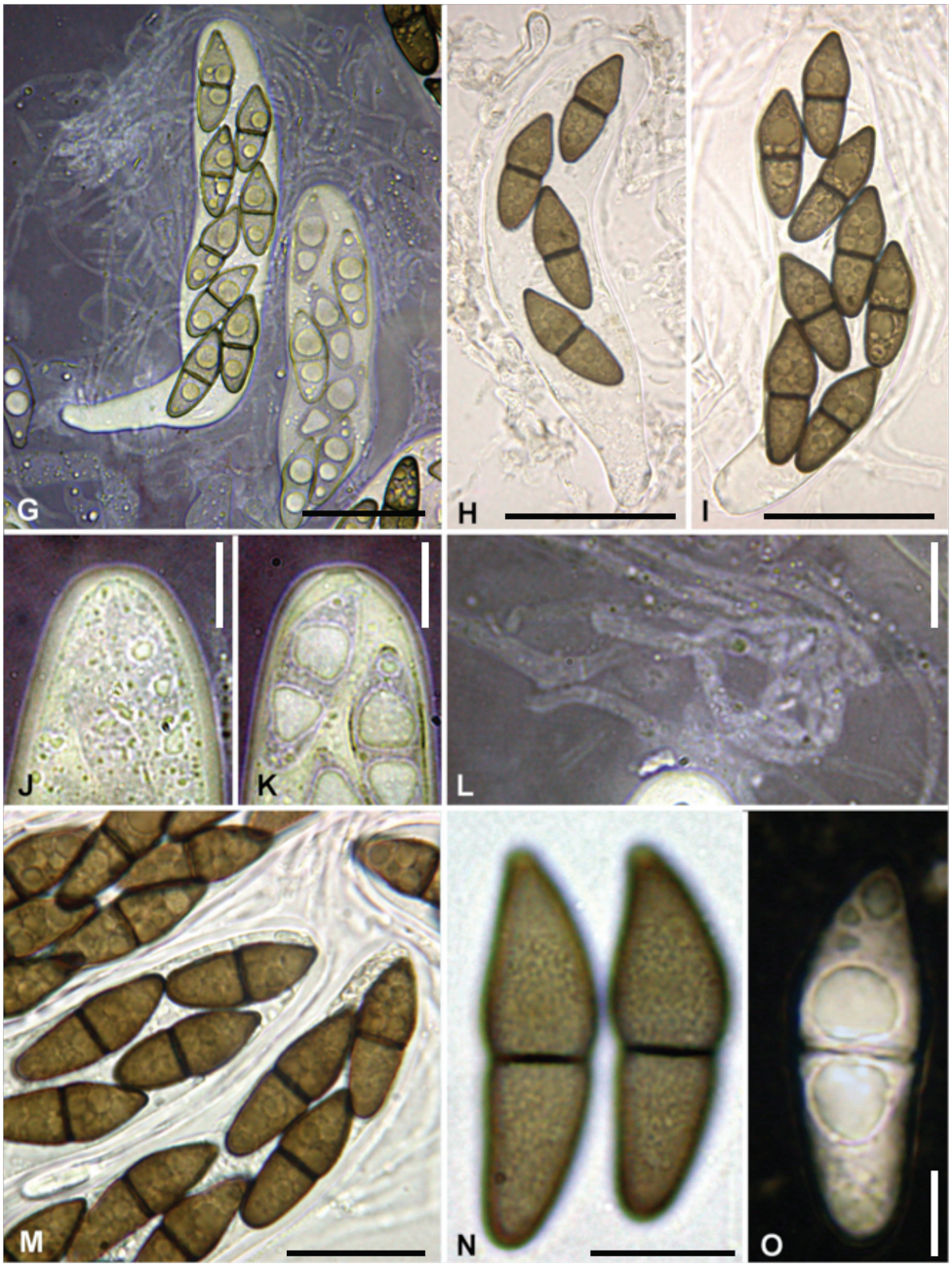

Figure 2. G–I Clavate to obclavate asci. **J, K** Ascus apex showing faint truncate ocular chamber **L** Pseudoparaphyses **M–N** Multiguttulate brown ascospores. Note ascospores showing minutely verrucose warts forming a loose reticulate pattern **O** Immature ascospore in India ink. Scale bars: **G–I, M** = 20 μm; **J–L** = 5 μm; **N, O** = 10 μm.

non-papillate, slightly depressed, pallid, rounded, minute, filled with hyaline periphyses (Fig. 1F). Peridium appearing roughened by protruding cells (Fig. 1B, D), 22–35 µm wide, two-layered: outermost layer *textura angularis,* composed of 1–2 rows of large thick-walled cells 8–18 µm in their greatest dimension, extending into hyphal appendages in places (Fig. 1F), more pigmented in upper half, inwardly lined by smaller hyaline flattened cells forming a *textura prismatica* (Fig. 1E, F). Asci 90–98 × 22.5–25 µm, bitunicate, with fissitunicate dehiscence occurring rarely, clavate to slightly obclavate, shortly pedicellate, 4–8-spored, ascospores 1–3 seriate (Fig. 2G–I); apex without (Fig. 2J) or with a faint truncate ocular chamber (Fig. 2K). Pseudoparaphyses 1–2.5 µm wide, cellular, often contorted, sparsely septate, rarely anastomosing, embedded in a gel matrix (Fig. 2G, L). Ascospores (23) 24–28 (31) × (7) 8–9 µm, (mean = 26 × 8 µm; n = 60), ellipsoid-fusiform, 1-septate, septum median to slightly submedian (0.53, N = 20), slightly constricted at the septum, upper cell wider and often apically pinched, lower cell obtusely rounded (Fig. 2H, I, M), contents densely guttulate; wall medium brown, minutely verrucose with warts partially in contact and forming a loose reticulate pattern (Fig. 2N), visible in hyaline immature ascospores; no sheath or appendages observed in aqueous nigrosin or India ink (Fig. 2O).

Etymology. From Latin "purpureus" referring to the characteristic staining of the substrate purple by this species.

Anamorph. Not known.

Known distribution. Martinique, Lesser Antilles (Known only from type locality thus far).

Discussion

Jahnula purpurea differs from all other species of *Jahnula* in that it stains the wood on which it grows purple. In addition, it is one of the species of *Jahnula*, which has minute ascomata (125–185 µm diameter). The only other species reported to have minute ascomata is *Jahnula marakotii* Sivichai & Boonyeun, a species reported from a submerged wood test block of *Azadirachta indica* from a peat swamp in Thailand (Sivichai and Boonyeun 2010). *Jahnula purpurea* differs from *J. marakotii* in a number of morphological characters such as shape and size of asci and ascospores. The asci of *J. purpurea* are clavate to obclavate (90–98 × 22.5–25 µm), while those of *J. marakotii* are cylindrical (107.5–120 × 9–11.5 µm). The ascospores of *J. purpurea* do not possess apical appendages and are larger in size (24–28 × 8–9 µm), while those of *J. markotii* are equipped with bipolar, hyaline apical appendages and are shorter (17.5–20 × 5–6.5) in size.

Jahnula purpurea should also be compared to the type species of the genus, *J. aquatica*, in that the ascospores of the two species look morphologically similar at first glance. The two species are however, quite distinct. *Jahnula purpurea* has smaller ascomata, clavate asci, and smaller ascospores, while *J. aquatica* has larger ascomata, cylindrical

asci, and larger ascospores (Hawksworth 1984; Hyde and Wong 1999; Raja and Shearer 2006). In addition, *J. purpurea* stains its wood substrate purple (Fig. 1A–C), which has never been reported for substrates on which *J. aquatica* occurs (Hawksworth 1984; Raja and Shearer 2006). Another species of *Jahnula* that is morphologically similar to *J. purpurea* in overall ascomata and ascospore morphology includes *J. australiensis*. On closer examination, however, the species are quite distinct. *Jahnula purpurea* stains subtending wood purple, a character not observed in *J. australiensis;* the asci in *J. purpurea* are clavate to obclavate, while those of *J. australiensis* are cylindrical; the ascospores of both the species are some what similar in size (24–28 × 8–9 µm in *J. purpurea* vs. 19–30 × 6–8 µm in *J. australiensis*) but those of *J. purpurea* are slightly smaller and wider.

Several species of freshwater ascomycetes in the family Amniculicolaceae are capable of staining underlying wood substrates purple (Zhang et al. 2009a; Zhang et al. 2009b; Zhang et al. 2012), a characteristic similar to *J. purpurea*. However, Amniculicolaceae is phylogenetically related to the Pleosporales, while based on morphological data presented herein *J. purpurea* belongs to the Jahnulales (Pang et al. 2002; Campbell et al. 2007; Suetrong et al. 2011).

In addition, species of *Massariosphaeria* such as *M. phaeospora* (E. Müll.) Crivelli has the ability to stain wood purple (Zhang et al. 2012). *Lophiostoma purpurascens* (K.D. Hyde & Aptroot) Aptroot & K.D. Hyde reported from submerged wood in freshwater habitats in Australia and Papua New Guinea also stains wood purple (Hyde and Aptroot 1998; Hyde et al. 2002). However *M. phaeospora*, and *L. purpurascens* are phylogenetically unrelated to the Amniculicolaceae (Zhang et al. 2012). Another recently described species, *Massariosphaeria fridae* M. Spooren stains its substrate (dead stalks of *Alisma plantago-aquatica*) red (Spooren 2007). This suggests that unrelated freshwater Dothideomycetes have the ability to stain the vicinity of their substrate red or purple. It would be interesting to study the secondary metabolites from these taxa in the future to understand if there is an underlying ecological significance to the production of bright pigments by species of both terrestrial and freshwater ascomycetes within the Dothideomycetes. Additional collections and molecular sequence data from *J. purpurea* in the future would certainly shed light on the hypothesis of purple pigment being a true phylogenetic informative character at the family-level within the Dothideomycetes as suggested by Zhang et al. (2012). The production of purple pigment on wood by *J. purpurea* suggests that pigment production might be a case of convergent evolution that could be functionally significant within the Dothideomycetes. It is also likely that different colors might be characteristic of different phylogenetic clades and might have similar or dissimilar ecological functions.

Acknowledgements

HAR would like to thank Dr. Nicholas H. Oberlies, UNCG for logistics provided to complete this manuscript. We also thank the reviewers for their valuable comments.

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