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Xylariales (Sordariomycetes, Ascomycota) of the Boston Harbor Islands

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Abstract - The Xylariales (Sordariomycetes, Ascomycota) is an order of mostly stromatic perithecial fungi generally inhabiting wood and other plant debris, as well as some important plant pathogenic species. As a follow-up to an extensive fungal inventory conducted by D. Haelewaters and colleagues since December 2012 at the Boston Harbor Islands National Recreation Area in Massachusetts, I examined members of the Xylariales in detail, including previously unreported collections. I constructed keys for included taxa, and I provide species notes, references, substrate, and collecting data of the following Xylarialean genera: *Diatrype, Eutypa, Eutypella* (Diatrypaceae); *Biscogniauxia, Camillea, Graphostroma* (Graphostromataceae); *Annulohypoxylon, Daldinia, Hypomontagnella, Hypoxylon, Jackrogersella* (Hypoxylaceae); *Lopadostoma* (Lopadostomataceae); and *Entoleuca, Kretzschmaria, Nemania, Rosellinia, Xylaria* (Xylariaceae). I herein formally describe a new species, *Xylaria finismundoensis* sp. nov., based on combined morphology and multi-locus phylogenetic analysis. This taxon provides the first evidence of a saprotrophic lifestyle for members of the E9 phylogenetic clade of *Xylaria,* previously only known as endophytes.

Introduction

Xylariales

The Xylariales (Xylariomycetidae, Sordariomycetes, Ascomycota) is a large, heterogeneous grouping of mostly stromatic perithecial fungi occurring primarily on dead plant materials. The order was first circumscribed by Nannfeldt (1932), and then later revised by Eriksson and Winka (1997) to include the Diatrypales, as well as to place it as the only order within the subclass Xylariomycetidae. Recent advances in phylogenetic methods and availability of multi-gene sequences across a large sampling of taxa within Xylariales, as well as an increased acceptance of the value of chemotaxonomic approaches (Stadler 2011, Stadler et al. 2014b), have led to an increasing refinement of the circumscription of Xylariales (Daranagama et al. 2018, Voglmayr et al. 2018, Wendt et al. 2018), with particular attention paid to the Xylariaceae sensu lato and related groups.

Historically, the Xylariaceae has been one of the largest families in the Ascomycota. As recently as 2013, it included more than 85 genera and some 1343 accepted species (Eriksson 2006, Kirk et al. 2008, Laessøe and Spooner 1994, Stadler et al. 2013). Recent revisions have helped to tame this chaos somewhat, including the erection of the family Lopadostomataceae to accommodate *Lopadostoma* and *Creosphaeria* (Senanayake et al. 2015), 2 rather anomalous genera previously

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assigned to the Xylariaceae. The most significant recent revisions, however, came with the splitting of the Xylariaceae, based on phylogenetic data roughly along the lines of the long-accepted (but never formalized) subfamily divisions (see Dennis 1961, Ju and Rogers 1996) by Wendt et al. (2018), which resurrected the Hypoxylaceae for *Hypoxylon* and allies as well as confirmed the Graphostromataceae—erected as a monotypic family by Barr et al. (1993) to accommodate *Graphostroma*—as a phylogenetically meaningful family, and moved other genera with applanate, bipartite stromata out of the Xylariaceae and into that family.

The order will continue to see taxonomic changes—new taxa, new combinations—while the exact evolutionary affinities of these groups are undergoing such tremendous revision. At present, there are 16 well-accepted families containing some 109 genera within the Xylariales (of which 32 are presently accepted within Xylariaceae), and an incredible 54 additional genera are considered Xylariales incertae sedis (Daranagama et al. 2018; Voglmayr et al. 2018, 2019; Wendt et al. 2018; Wijayawardene et al. 2020).

Endophytes

Notably, many fungi in the Xylariales are known to be common and ubiquitous endophytes—fungi that inhabit the leaves and other tissues of plants without causing disease to their host plant (Rodriguez et al. 2009, Stone et al. 2000). Much attention has been paid to the potential for these endophytic fungi to produce novel secondary metabolites with medicinal potential (e.g., Govinda Rajulu et al. 2013). However, such endophytes have traditionally been difficult to assign to specific taxa due to lack of available characters in culture (Rogers 1979, 2000, Whalley 1996). Recent innovations, however, suggests that the wealth of Xylarialean diversity present as endophytes may, in fact, also be useful in efforts to revise the taxonomy of the order, as secondary metabolites are a rich source of features to help classify taxa (Stadler 2011), and the addition of increased taxonomic sampling by utilizing endophyte cultures may significantly improve efforts at phylogenetic reconstruction (U'Ren et al. 2016).

The ecology of endophytism within Xylariales remains something of a mystery, though several hypotheses have been put forward (Bayman et al. 1998, Carroll 1999, Nelson et al. 2020). Some Xylarialean endophytes persist in the leaf litter, displaying clear abilities to participate in litter degradation and colonize additional substrates (Osono 2007; Osono and Takeda 1999, 2002), which would seem to preclude the necessity of an endophytic lifestyle. It has been proposed that endophytism in Xylarialean taxa may be an evolutionary "dead-end", simply a byproduct of mechanisms evolved to colonize woody substrates (Bayman et al. 1998). A competing theory, the so-called "Foraging Ascomycete Hypothesis" (Carroll 1999), proposes that such fungi utilize an endophytic lifestage to bridge spatiotemporal gaps in preferred substrate, persisting in the leaves despite poor conditions or lack of substrate (Nelson et al. 2020, Thomas et al. 2016).

Additionally, it has been observed that many Xylarialean endophytes have not been linked conclusively to teleomorphic (i.e., sexually reproducing) taxa, giving rise to the theory that there may be endophyte-specific lineages within the Xylariales (Okane et al. 2008, U'Ren et al. 2016). U'Ren et al. (2016) utilized a continent-scale library of endophytic isolates to add more than 1900 new Xylarialean isolates to multi-locus sequence data for 293 well-identified taxa in the most robust phylogeny of the Xylariales to date. They found several clades represented by only endophytic isolates, of which one—the "E9" endophyte clade—was within the phylogenetic bounds of the genus *Xylaria*, one of the most commonly isolated endophyte genera in the order. This finding could be taken as support for the idea that there are specifically endophytic lineages; if so, how they reproduce and disperse remains an open question.

All taxa biodiversity inventory

This study is part of an ongoing all taxa biodiversity inventory (ATBI) at the Boston Harbor Islands (BHI) National Recreation Area, Boston, MA. This is an integrated effort across multiple organizations, including the Boston Harbor Islands Partnership (BHIP), the National Park Service, and Harvard University, among others. Across multiple phases of research, this ATBI has generated data and publications on insects and other invertebrates (Clark et al. 2011; Rykken and Farrell 2013, 2018a, 2018b), lichens and bryophytes (Lagreca et al. 2005), bats (Johnson and Edward Gates 2019) and other small mammals (Nolfo-Clements 2018), birds (Paton et al. 2005), vascular plants (Elliman 2005), and non-lichenized fungi (Haelewaters et al. 2018) with a particular focus on the insect-parasitic Laboulbeniales (Haelewaters et al. 2015, 2019).

Herein I present a taxon-specific contribution to the ATBI and a follow-up to the "Preliminary Checklist of Fungi" generated previously (Haelewaters et al. 2018), focusing on the Xylariales. Herein I provide detailed keys and taxonomic descriptions to all Xylarialean taxa known from the Boston Harbor Islands, and propose 1 new species, *Xylaria finismundoensis*. This species is of particular interest because of its apparent affinity with the E9 Endophyte group of *Xylaria* previously known only as endophytes.

Methods

Samples were collected as part of a broad all-Fungi inventory effort, carried out between December 2012 and May 2017 at the Boston Harbor Islands National Recreation Area (BHI) in Massachusetts. See Haelewaters et al. (2018) for detailed sampling methodologies and site descriptions. All fungal collections studied here were deposited at the Farlow Herbarium at Harvard University (Cambridge, MA). Material identified as potentially belonging to the Xylariales was sent to the University of Oregon for detailed examination. I performed microscopy with a combination of a Zeiss Standard WL compound microscope (Zeiss, Oberkochen, Germany) fitted with ocular and stage micrometers and an Olympus SZ30 stereoscope (Tokyo, Japan). I conducted photomicroscopy using an Amscope 10MP CMOS camera (Irvine, CA) attached to the trinocular head of the Zeiss microscope and macrophotography using an Olympus Tough TG-5 camera on the macro setting with automated focus bracketing; I assembled and edited focus stacks in Zerene Stacker (Zerene Systems LLC, Richland, WA).

After determination, I prepared taxonomic descriptions to be inclusive of well-accepted descriptions for each taxon, generally broadening the range of measurements somewhat from what was observed in any particular collection. This approach allows broader applicability of published keys and descriptions. I made specific reference to Rappaz (1987), Chlebicki (2005), Glawe and Rogers (1984), and Vasilyeva and Stephenson (2004, 2006) for Diatrypaceae; to Ju et al. (1998), Laessøe et al. (1989), and Barr et al. (1993) for Graphostromataceae; to Jaklitsch et al. (2014) and Daranagama et al. (2018) for Lopadostomataceae; to Wendt et al. (2018), Miller (1961), Ju and Rogers (1996), and Stadler et al. (2014a) for Hypoxylaceae; to many works from Jack D. Rogers and Yu-Ming Ju (Ju and Rogers 2002, Rogers and Ju 1996, 2012), as well as works in collaboration with Brenda Callan (Rogers and Callan 1986) and those in collaboration with Larissa Vasilyeva and Andrew Miller (Rogers et al. 2008, Vasilyeva et al. 2007) for Xylariaceae; and the recent monograph by Petrini (2013) for *Rosellinia*.

I performed amplification and sequencing of the ITS region of the rDNA as per Haelewaters et al. (2018). Additional loci (β-tubulin, α-actin, partial LSU, and RPB2) were sequenced for collection BHI-F502, based on presumed novelty, using primers and DNA amplification as per U'Ren et al. (2016) in the Roy Lab at the University of Oregon. I performed amplification using an MJ Research PTC-200 DNA Engine thermal cycler. I froze the PCR product at -4 ºC until shipping for subsequent sequencing at Functional Biosciences, Inc. (Madison, WI) on ABI 3730xl instruments using BigDye V3.1, employing the same primers as those to generate the PCR product. Raw sequence reads were assembled and analysis was performed in Geneious 6.1 (Biomatters, Ltd., Auckland, New Zealand). Newly generated sequences for this study are deposited in NCBI's GenBank database (https://www.ncbi.nlm.nih.gov/genbank/) with accession numbers MT823470–MT823485.

I used a BLAST search against NCBI GenBank's nucleotide database to suggest placement of BHI-F502 in the "E9" clade within the genus *Xylaria.* To examine exact placement, I downloaded the final concatenated alignment containing 367 terminal taxa from U'Ren et al. (2016) from TreeBASE (http://purl.org/phylo/treebase/phylows/study/TB2:S18910) and subsetted from the full dataset the endophyte "E9" clade, representative members of the *Xylaria* "HY" clade, and *Eutypa lata* as the outgroup. Additionally, I downloaded available sequences from the epitype of *Xylaria hypoxylon* (LSU: KY610495.1; β-tubulin: KX271279.1; RPB2: KY624231.1; ITS: KY610407.1) from NCBI GenBank (Stader et al. 2014). I removed unalignable intron regions from sequences for each locus from BHI-F502 and those available from the epitype of *Xylaria hypoxylon*, and then added these sequences to the subsetted alignments using default parameters in Geneious Prime. To determine exact phylogenetic placement within the clade, I concatenated alignments for each of the 5 loci (β-tubulin, α-actin, LSU, RPB2, and 5.8S) and performed phylogenetic reconstruction using either RAxML (Stamatakis 2014) with the GTR GAMMA model, 1000 bootstrap repetitions, and partitions specified for each loci in the concatenated alignment or MrBayes 3.2.6 (Huelsenbeck and Ronquist 2001) using all standard parameters. Trees were rooted with *Eutypa lata* (Diatrypaceae) as the outgroup.

Results and Discussion

Careful examination of collections from the Boston Harbor Islands revealed 59 collections representing 26 taxa within the Xylariales, from 16 genera across 5 families. This result is a significant increase from 11 species reported in the initial checklist effort (Haelewaters et al. 2018). I describe 1 new taxon and provide keys to families, genera, and species for all observed taxa in addition to descriptions for all included taxa, with figures to illustrate novel taxa as well as many other taxa to aid identification.

Since the discovery that fungi within the Xylariaceae, particularly the genus *Xylaria*, were common endophytes (Carroll and Carroll 1978, Carroll et al. 1977), there has been speculation that there may be distinct lineages that exist exclusively or primarily within the endophytic niche (Bayman et al. 1998, Brunner and Petrini 1992, Okane et al. 2008, Osono 2007, Rodrigues et al. 1993, Thomas et al. 2016, U'Ren et al. 2016). Such theories are difficult to test, however, due in part to the lack of diagnostic features present on *Xylaria* in culture (Brunner and Petrini 1992). Importantly, U'Ren et al. (2016) included Xylarialean endophytes in their phylogenetic analysis.

The inclusion of nearly 2000 newly cultured isolates of Xylarialean endophytic fungi in U'Ren et al.'s (2016) multi-locus phylogenetic analysis, combined with available sequences data from 293 taxa within the Xylariales, allowed for the identification of monophyletic clades represented by only endophytes. Of these, only the E9 endophyte clade, sister to the *Xylaria* "HY" clade, is within the current phylogenetic bounds of the genus *Xylaria*, with several others appearing to be basal to the currently accepted definition of the family (U'Ren et al. 2016, Wendt et al. 2018). The newly described taxon from this study, *Xylaria finismundoensis* sp. nov., is placed within this E9 clade, making it the first known teleomorphic fungus from this group (Fig. 1).

Taxonomy

Key to Families of Xylariales from the Boston Harbor Islands

1. Ascospores allentoid, pale yellow or brown; ostioles prominently differentiated from stromata, often sulcate to cruciform; KOH extractable pigments absent; stromata always unipartite; anamorph libertella-like......................**Diatrypaceae**

1. Combination of features not as above: ascospores different in shape (ellipsoid to ellipsoid-inequilateral or asymmetrically attenuated) or color (brown to dark brown); if ostioles strongly differentiated from stromata, never sulcate or cruciform; KOH extractable pigments either present or absent; stromata either unipartite or bipartite..**2**

2. Stromatal tissues, at least on the ventral side, a mixture of woody substrate and fungal cells, generally surrounded by a thin, black, carbonized encasement; perithecia valsoid, with ostioles clustered into an ectostromatic disc; anamorph libertella-like ....**Lopadostomataceae (*Lopadostoma americanum*)**
2. Stromatal tissues distinct from substrate on the ventral side (though ventral tissues may be severely reduced); ostioles either clustered or uniformly distributed over stromatal surface, but perithecia never valsoid; anamorph typically nodulisporium-like or geniculosporium-like **3**

3. Stromata bipartite, always flattened against substrate (applanate, effused-pulvinate, or raised-discoid); KOH extractable pigments absent .... **Graphostromataceae**

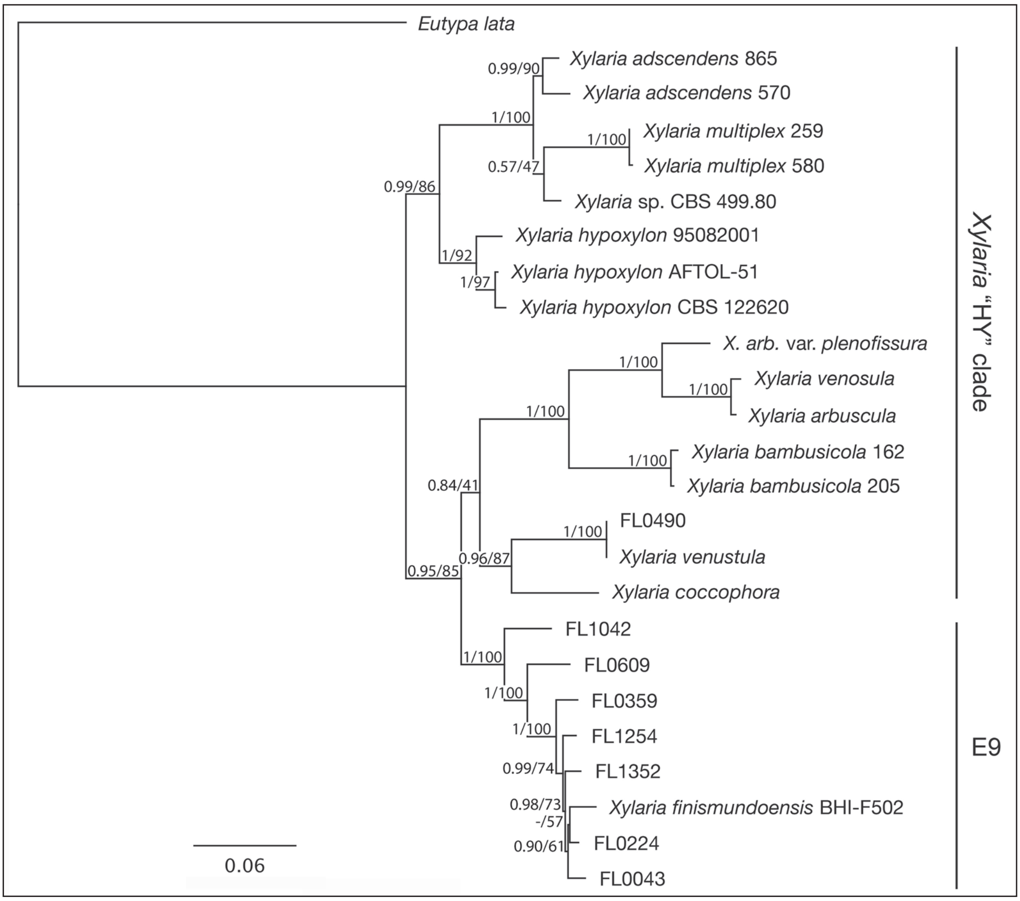

Figure 1. Phylogenetic placement of BHI-F502, the type collection of *Xylaria finismundoensis* sp. nov., based on the phylogenetic reconstruction of a 5-locus dataset of concatenated sequences with introns removed (β-tubulin, α-actin, partial LSU, RPB2, and 5.8S). The topology is the result of maximum likelihood analysis performed with RAxML (though topology was identical when Bayesian analysis was used); Bayseian posterior probabilities and ML bootstrap support values, respectively, are shown at each node. The tree is rooted with *Eutypa lata* (Diatrypaceae).

3. Stromata unipartite, either flattened against substrate or erect; with or without KOH extractable pigments **4**

4. Ascal plugs wider than tall; KOH extractable pigments generally present; internal stromatal tissues, when present, typically dark or other than white; anamorph nodulisporium-like................................**Hypoxylaceae**
4. Ascal plugs taller than wide; KOH extractable pigments absent; internal stromatal tissues, when present, typically white or pale (especially when early in stromatal development); anamorph geniculosporium-like .... **Xylariaceae**

Key to Diatrypaceae from the Boston Harbor Islands

1. Stromata discoid to pulvinate, stipitate or with a constricted base; internal stromata tissues well developed; stromata strongly differentiated from substrate; ostioles regularly spaced ....***Diatrype bullata***
1. Stromata sessile and broadly attached; internal stromata tissues well developed or not; stromata generally lacking a clear boundary between well-developed entostromatal tissues (if present) and substrate; ostioles regularly spaced or grouped into pustules..**2**

2. Stromata *bipartite* (in 2 layers, the outer dehiscent layer adhering to the underside of the bark as the stroma developes, and falling away to reveal the inner perithecial layer; outer layer often only present as remnants around the edge of mature stromata); ostioles with large openings into the perithecia (>50 µm)... .... ***Graphostroma platystomum***
2. Combination of features not as above; stromata always *unipartite* (in 1 layer); ostiolar openings into the perithecia small (<30 µm diameter).......................**3**

3. Ostioles grouped into collectively erumpent clusters, typically sulcate but sometimes rounded; perithecia valsoid; stromata emerging from substrate as pustules, united below by a common, well-developed entostromatic tissue .... ***Eutypella prunastri***
3. Ostioles separate and regularly spaces, rounded to sulcate; perithecia singular; stromata effuse within woody substrate, generally darkening the surface, without clear differentiation between entostromatic tissues and substrate ....**4 (*Eutypa*)**

4. Ascospores 6.2–11 µm × 1.5–2 µm; ostioles emerging separately, rounded or conical, entire to more or less furrowed, but never cruciform; substrate blackened at the surface..........................***Eutypa lata***
4. Ascospores 4.8–7.8 µm × 1.2–1.5 µm; ostioles emerging separately, rounded to rectangular, deeply split 3–4 times, often cruciform; substrate discolored at the surface, but generally not blackened .... **...*Eutypa maura***

Key to Graphostromataceae from the Boston Harbor Islands

1\. Ostioles level with stromatal surface and wide open, appearing as distinct holes in the stromatal surface when viewed with a hand lens; ascospores diatrypaceous (7–10 µm × 1–2 µm, hyaline or pale yellow-brown, allantoid), without obvious germ slit .... ***Graphostroma platystomum***

1\. Ostioles either level with stromatal surface or raised above it (papillate), but never wide open; ascospores either typically Xylarialean (darkly pigmented, ellipsoid to ellipsoid inequilateral) or hyaline and asymmetrically attenuated **2**

2\. Ascospores small (<11 µm long), hyaline, and asymmetrically attenuated on one end, without obvious germination site; ostioles level with stromatal surface, looking like minute pin-pricks when viewed with a hand lens .... ***Camillea punctulata***

2\. Ascospores larger (typically >14 µm long), darkly pigmented, and ellipsoid to ellipsoid-inequilateral, with an obvious hyaline germination slit; ostioles coarsely papillate, distinctly raised above the stromatal surface .... **3 (*Biscogniauxia*)**

3\. Ascospores 15.5–21 µm × 7–10 µm .... ***Biscogniauxia mediterranea***

3\. Ascospores 20–26 µm × 11.5–13 µm.. .... ***Biscogniauxia mediterranea* var. *macrospora***

Key to Hypoxylaceae from the Boston Harbor Islands

1\. Stromata more or less hemispherical, with internal concentric rings................. ....***Daldinia childiae***

1\. Stromata variable, applanate to hemispherical, but interior of stromata more or less homogeneous, without concentric rings...**2**

2\. Perithecia surrounded by a layer of hard, carbonaceous tissue; tissues below perithecia conspicuous to massive; KOH extractable pigments typically greenish olivaceous **3**

2\. Perithecia not surrounded by carbonaceous tissue; tissues below perithecia inconspicuous to absent; KOH extractable pigments orange to rust, or absent **4**

3\. Ostioles surrounded by a more or less well-developed annular disc; stromata robust, effused-pulvinate to semi-globose; ascospores 7.5–10.5 µm × 3.5–5 µm, with a straight, spore-length germ slit...***Annulohypoxylon annulatum***

3\. Ostioles papillate, but not surrounded by an annular disc; stromata thinner, effused-pulvinate to peltate, but never semiglobose; ascospores 8.5–12 µm × 3.5–5 µm, with a straight germ slit less than spore-length .... ***Jackrogersella multiformis***

4. Stromata without apparent KOH extractable pigments (or, rarely, KOH extractable pigments purple); ascospores with germ slit less than to much less than spore-length..***Hypomontagnella submonticulosum***
4. Stromata with KOH extractable pigments orange or rust; ascospores with straight germ slit, spore-length or nearly so...**5**

5. Perithecia tubular, much taller than wide; stromatal interior with distinct concentric zones; ascospores 12–16 µm in length ....***Daldinia childiae***
5. Perithecia more or less globose, similar in height and width; stromatal interior essentially homogeneous; ascospores 9–15 µm in length...............................**6**

6. Ostioles slightly elevated above stromatal surface (papillate); stromata with perithecial contours conspicuous; ascospores 9.5–15 µm × 4–6.5 µm, with a slightly sigmoid, spore-length germ slit ....***Hypoxylon lenormandii***
6. Ostioles lower than stromatal surface (umbilicate); stromata with perithecial contours inconspicuous to absent; ascospores 9–12 µm × 4–5.5 µm, with a straight, spore-length germ slit............................***Hypoxylon rubiginosum***

Key to Xylariaceae from the Boston Harbor Islands

1. Stromata essentially uniperitheciate, containing 1 (or rarely, several) perithecia; superficial on substrate (typically decorticated wood) **2**
1. Stromata multiperitheciate, containing several to many perithecia; stromata applanate to pulvinate or upright, but never surrounded by a felty or wooly subiculum (though sometimes anamorph may be present on stromatal surface)....**4**

2. Halophilic (substrate salty driftwood); subiculum lacking; stromata obtusely conical.. ***Nemania maritima***
2. Not halophilic (substrate other than salty driftwood); felty or wooly subiculum present; stromata globose to broadly rounded...........................**3 (*Rosellinia*)**

3. Stromata often embedded in a wooly, reddish-brown subiculum; ascospores typically >15µm in length, with germination slit spore-length or nearly so ....***Rosellinia corticium***
3. Stromata often embedded in a felty, sulphur-yellow subiculum; ascospores typically <15µm in length, with germination slit typically less than spore-length ....***Rosellinia subiculata***

4. Stromata essentially flattened against substrate, applanate to pulvinate **5**
4. Stromata essentially upright, taller than it is wide............................ **8 (*Xylaria*)**

5. Spores >20 µm in length; perithecia large (~1 mm diameter); mature stromata extremely carbonaceous, generally becoming extremely hard and brittle in age...**6**

5. Spores <20 µm in length; perithecia small (0.4–0.8 mm diam); mature stromata with only a thin carbonaceous layer above perithecia..........................**7**

6. Stromata large, typically several to 10 cm in length and >1 cm thick, often stipitate or connected to substrate by a constricted base, frequently fused into large aggregates; stromata becoming hollow at maturity, very brittle; ascospores 27–35 µm × 7–9 µm (length:width ratio > 3), ellipsoid inequilateral to fusoid, with germ slit much less than spore-length ....***Kretzschmaria deusta***

6. Stromata more or less orbicular in outline, fused or aggregated into a crust, not stipitate, with stromatal bases partially embedded in substrate; at maturity stromata extremely hard, with thick carbonaceous tissue above and partially surrounding perithecia; ascospores 20–33 µm × 9–12 µm (length:width ratio < 3), nearly equilateral, with germ slit spore-length ....***Entoleuca mammata***

7. Ascospores 8–10 µm × 3.5–4.5 µm, ellipsoid to reniform, with an inconspicuous, straight germ slit; stromatal tissue between the perithecia carbonaceous........... ....***Nemania beaumontii***

7. Ascospores 10–14 µm × 4–6 µm, ellipsoid, with an inconspicuous, straight germ slit; stromatal tissue between the perithecia soft, white to buff ....***Nemania serpens* var. *serpens***

8. Stromata large, often >1 cm in diameter and >6 cm in height, unbranched with broadly rounded, fertile apex; surface wrinkled and minutely wrinkled; ascospores 20–28 µm × 6–7.5 µm, with germ slit much less than spore-length..... ....***Xylaria polymorpha***

8. Stromata minute, <1 cm in height, with a sterile pointed apex; remnants of white exostromatal coating apparent on mature stromata as vertical stripes; stipe short, densely tomentose at base; ascospores 10–11 µm × 5–6 µm .... ***Xylaria finismundoensis* sp. nov.**

Diatrypaceae Nitschke

Type genus: *Diatrype* Fr., Summa Vegetabilium Scandinaviae 2:384 (1849)

Stromata with perithecia embedded in a stromata composed either of purely fungal tissue, or a mixture of fungal tissue and substrate (pseudostromata). **Ostioles** ornamented, furrowed, or sulcate, though at times faintly or rudimentary. **Ascospores** allantoid to subinequilateral, from nearly straight to strongly curved. **Asci** clavate to spindle-shaped, with a characteristic apical plug either I+ or I−.

Additional information: The most complete keys to diatrypaceous taxa globally are given in the monograph by Rappaz (1987). More-focused work can be found in Chlebicki (2005), Glawe and Rogers (1984), and Vasilyeva and Stephenson (2004, 2006).

Diatrype Fr., Summa Vegetabilium Scandinaviae 2:384 (1849)

Type species: *Diatrype disciformis* (Hoffm.) Fr.

Stromata widely effuse and applanate, or disc-shaped, flat to slightly convex, with discoid or sulcate ostioles mostly raised above the surface. **Perithecia** mostly in a single layer, though at times stacked or piled on top of each other. **Ascospores** are allantoid, hyaline yellowish to brownish. **Asci** typically clavate, 8-spored, long-stipitate, with paraphyses.

Additional information: Rappaz (1987) provides useful keys to global species of *Diatrype*. Chlebicki (2005) focuses on European species, Glawe and Rogers (1984) provide information for the Pacific Northwest, and Vasilyeva and Stephenson (2004) focus on the Great Smoky Mountain National Park in the southeastern United States.

Diatrype bullata (Hoffm.) Fr. (Fig. 2a–c)

≡ *Sphaeria bullata* Hoffm., Vegetabilia Cryptogama 1:5, t. 2:3 (1787)

≡ *Hypoxylon bullatum* (Hoffm.) Westend. & Wallays, Add. Herb. Crypt., p. 14 (1850)

Stromata present as discoid pustules in the bark, rupturing through the outer layer of the bark to reveal flat to pulvinate disc-shaped stromata; brown-gray to dark brown, circular, 3–5 mm in diameter; pustules typically evenly spaced, rarely confluent; with a compact, white entostroma, clearly differentiated from surrounding substrate by a blackened border of ectostromatic tissue; stromatal discs stipitate, or with a distinctly constricted base, blending with substrate beneath. **Perithecia**

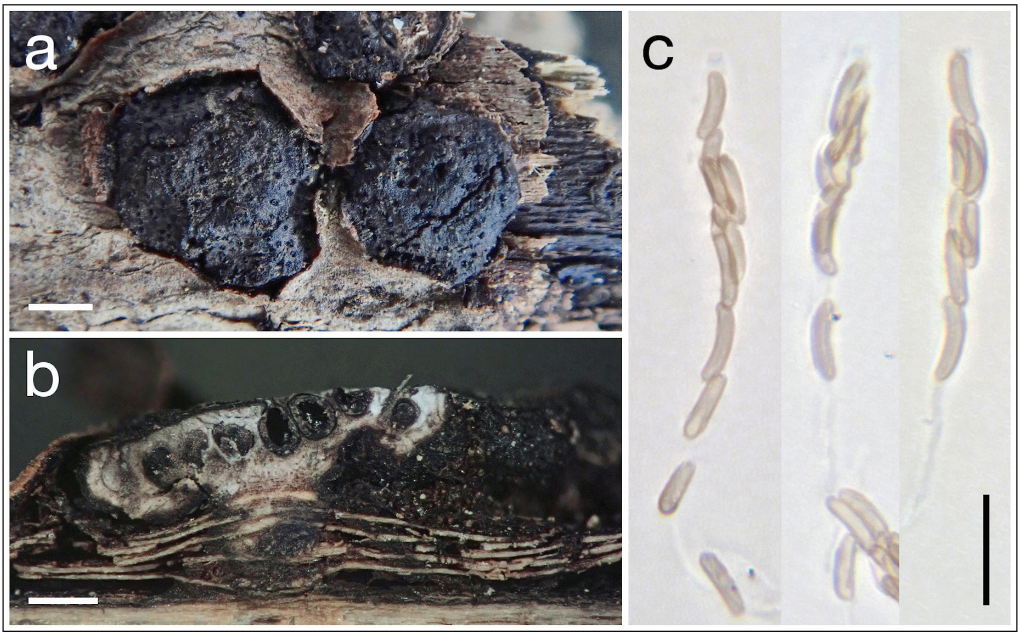

Figure 2. *Diatrype bullata* (BHI-F791): (a) stromatal habit and surface texture, showing weakly furrowed, discoid ostiolar beaks; (b) vertical section of stromata, showing perithecia and well developed white entostromatic tissue; and (c) ascospores and asci, showing faintly amyloid apical apparatus. Scale bars: a = 1000 µm; b = 500 µm; and c = 10 µm.

regularly spaced within stromatal discs, often close together or in contact, partially compressed due to crowding; spherical to ovoid, 200–300 µm in diameter by 300–400 µm tall. **Ostioles** are separately emergent (not valsoid); slightly raised above stromatal surface, discoid, often but not always irregularly and faintly furrowed or sulcate; 80–120 µm in diameter. **Ascospores** 5–8 µm × 1–1.5 µm, allantoid, pale yellow to pale brown. **Asci** are long-stipitate, the spore-bearing parts 25–35 µm long, with the stipe being at least as long as the spore-bearing parts, up to twice as long; with a faint, discoid (i.e., flattened donut shaped) apical plug, wider than it is tall, ~1 µm × 0.5 µm, blueing in Melzer's or other iodine mount (I+).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, PEDDOCKS ISLAND, corticated hardwood stick, col. Alden C. Dirks, James K. Mitchell, 42830 (FH:BHI-F791).

Notes: This taxon is easily confused with *Diatrype disciformis* (Hoffm.) Fr., being one of only a few *Diarype* species with disc-shaped stromata. Rappaz (1987), Glawe and Rogers (1984), and Chlebicki (Chlebicki 2005) all emphasize the flatness of the stromatal disc, the nearly perfectly circular outline, and the smaller size as distinguishing characteristics separating *D. disciformis* from *D. bullata*. Also of note is the distinctly constricted or stipitate stromatal base in *D. bullata*, along with the well developed white entostromatal tissues extending below the perithecia (illustrated in Chlebicki 2005); *D. disciformis* typically does not have has well-developed white entostromatic tissues completely surrounding the perithecia, but only around the necks, and rarely extending all the way to the bases. These additional discriminative characters should be helpful to anyone attempting to distinguish between these 2 similar taxa.

Eutypa Tul. & C. Tul., Sel. Fung. Carp. 2:52 (1863)

Type species: *Eutypa lata* (Pers.) Tul. & C. Tul.

Stromata widely effuse within woody substrates, causing darkening or blackening at the surface, with separate, rounded or sulcate ostioles raised above the surface. **Ascospores** are allantoid, hyaline yellowish to brownish. **Asci** typically clavate or cylindrical, 8-spored, usually long-stipitate, with paraphyses.

Additional information: Rappaz (1987) provides useful keys to global species of *Eutypa*. Glawe and Rogers (1984) provide information for the Pacific Northwest, and Vasilyeva and Stephenson (2006) focus on the Great Smoky Mountain National Park in the southeastern United States.

Eutypa lata (Pers.) Tul. & C. Tul. (Fig. 3a–c)
≡ *Sphaeria lata* Pers., Observationes Mycologicae 1:66 (1796)
≡ *Nemania lata* (Pers.) Gray, A Natural Arrangement of British Plants 1:517 (1821)
≡ *Stromatosphaeria lata* (Pers.) Grev., Flora Edinensis:357 (1824)
≡ *Diatrype lata* (Pers.) Fr., Summa Vegetabilium Scandinaviae 2:385 (1849)
≡ *Valsa lata* (Pers.) Nitschke, Pyrenomycetes Germanici 1:141 (1867)
≡ *Engizostoma latum* (Pers.) Kuntze, Revisio Generum Plantarum 3(2):474 (1898)

Stromata widely effused within the substrate, up to several centimeters in diameter, lifting the surface of the wood in confluent patches or large plates, more or less

blackening the substrate; tissues surrounding perithecia a mixture of substrate and loose mycelium, irregularly blackened, but often with a pale zone directly beneath the blackened surface. **Perithecia** close together or in contact, sometimes laterally compressed due to crowding; spherical to ovoid, 400–600 µm in diameter. **Ostioles** are separately emergent (not valsoid); prominently raised above stromatal surface, rounded to conical, often but not always faintly furrowed; 120–180 µm in diameter. **Ascospores** 6.2–11 µm × 1.5–2 µm, allantoid, pale yellow to pale brown. **Asci** are long-stipitate, the spore-bearing parts 40–60 µm long, with the stipe being at least as long as the spore-bearing parts; with a faint, discoid apical plug, wider than it is tall, ~1 µm × 0.5 µm, blueing in Melzer's or other iodine mount (I+).
Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, GREAT BREWSTER ISLAND, on dead decomposing log, col. James K. Mitchell, 8 March 2017 (FH:BHI-F611).

Eutypa maura (Fr.) Fuckel (Fig. 3d–f)
≡ *Sphaeria maura* Fr., Kongliga Svenska Vetenskapsakademiens Handlinger 39:101 (1818)
≡ *Valsa maura* (Fr.) Nitschke, Pyrenomycetes Germanici 1:133 (1867)
≡ *Eutypa maura* (Fr.) Sacc., Sylloge Fungorum 1:166 (1882)
≡ *Engizostoma maurum* (Fr.) Kuntze, Revisio Generum Plantarum 3(2):474 (1898)
Stromata widely effused within the substrate, up to several centimeters in diameter, generally not raised, darkening the substrate, grey to grey-black; tissues surrounding perithecia a mixture of substrate and loose mycelium, uniformly darkened, grey as at the surface. **Perithecia** in rows, rarely in contact, regularly spaced (~300–400 µm between individual perithecia); generally buried deeply; spherical, but often vertically flattened, 400–500 µm in diameter by 300–400 µm tall. **Ostioles** are separately emergent (not valsoid); prominently raised above stromatal surface, rounded to conical, deeply split 3–4 times; 120–160 µm in diameter. **Ascospores** 4.8–7.8 µm × 1.2–1.5 µm, allantoid, pale yellow to pale brown. **Asci** are generally long-stipitate, the spore-bearing parts 15–30 µm long, with the stipe being at least

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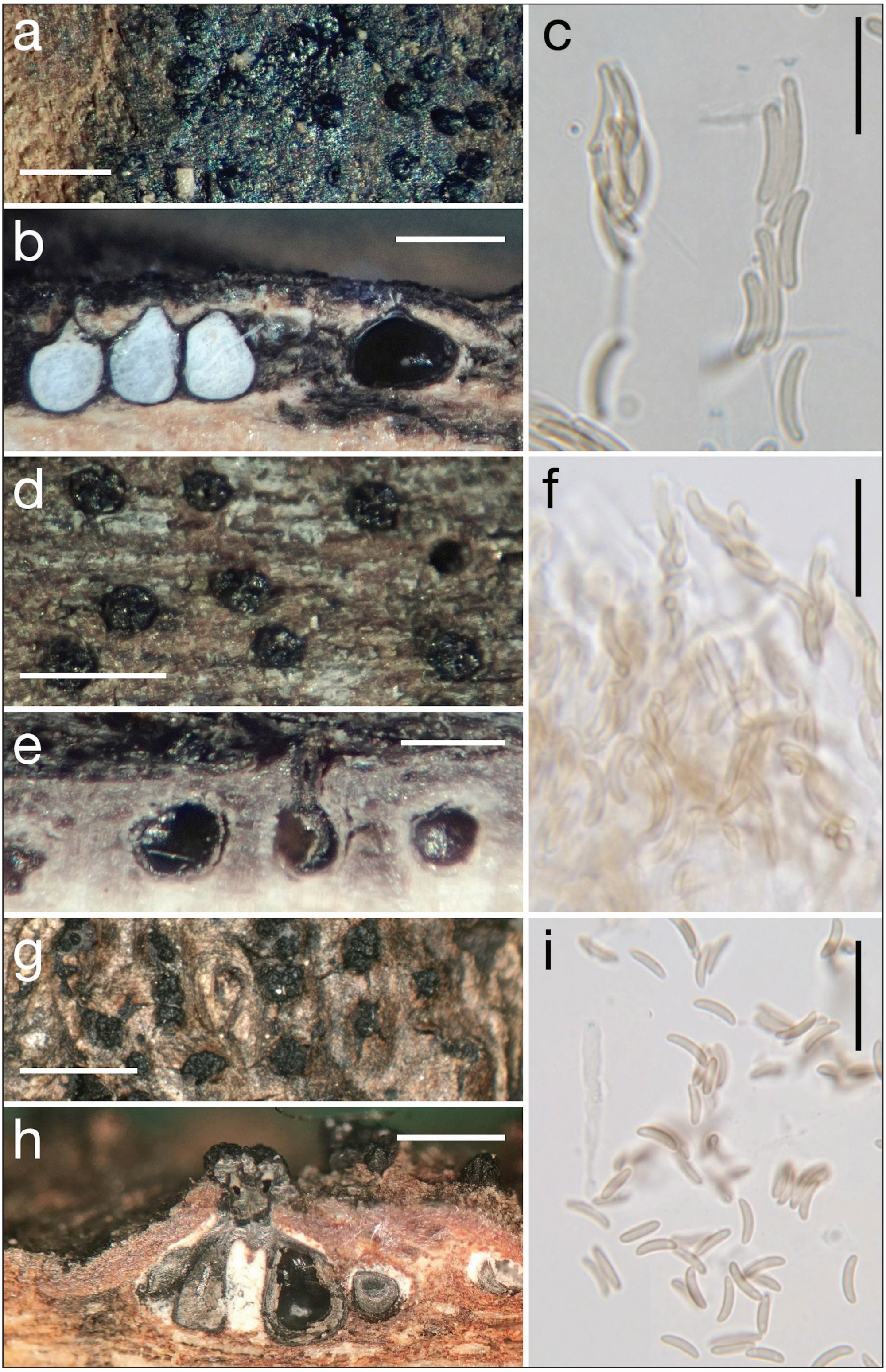
Figure 3 (following page). *Eutypa lata* (BHI-F611): (a) pseudostromatal surface, showing blackening of the overlaying surface and dome-shaped, weakly furrowed ostiolar beaks; (b) vertical section, showing perithecia, either immature and filled with cottony white mycelium, at left, or mature with asci and ascospores, at right, and irregular bands of melanization; and (c) ascospores and asci, showing faintly amyloid apical apparatus. *Eutypa maura* (BHI-F710): (d) pseudostromatal surface, showing darkening of the overlaying surface and prominent, strongly furrowed ostiolar beaks; (e) vertical section, showing deeply embedded perithecia and typical pattern of melanization, with dark zones extending downward between the perithecia; and (f) ascospores and asci, with inamyloid apical apparatus. *Eutypella prunastri* (BHI-F1007): (g) pseudostromatal surface, showing pustulate aggregations of deeply furrowed ostiolar beaks; (h) vertical section, showing valsoid perithecial arrangement and well-developed, white entostromatic tissues; and (i) loose ascospores and empty ascus, showing faintly amyloid apical apparatus. Scale bars: a, g = 1000 µm; b, d, e, h = 500 µm; and c, f, i = 10 µm.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i

as long as the spore-bearing parts; with a discoid (i.e., flattened donut shaped) apical plug non-reactive in Melzer's or other iodine mount (I−).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on decorticated deciduous branch, col. Alden C. Dirks, 26 March 2017 (FH:BHI-F710).

Notes: This specimen was on *Acer* wood, presumably *Acer pseudoplatanus* L. (Sycamore Maple) imported from Europe as a landscaping tree. This taxon shows a consistent preference for the wood of *Acer*, and is generally considered European (Rappaz 1987). This taxon is likely found in the Boston Harbor Islands as a colonist, a result of long commerce between the Boston Harbor and the European continent (Banks et al. 2015, Chapman et al. 2017). It would be interesting to know if this taxon has transitioned to using native North American *Acer* as hosts.

Rappaz (1987) reported a European distribution for *E. maura*. A search of MyCoPortal (MyCoPortal 2020) did not result in any North American records, but 2 photo-collections are available on iNaturalist, from Prospect Park, Brooklyn (iNaturalist 30345277) and Long Island (37539775), both in the state of New York. These observations are unsurprising given the proximity to a large harbor with a history of European trade, much like the Boston Harbor. While not the first report from the US, this collection appears to be a first record from Massachusetts, and the first from the US with a voucher.

According to Jacques Fournier (Rimont, France pers. comm.), this taxon is most easily identified by host affinity combined with deeply immersed perithecia under a thick layer of superficial darkened substrate, with dark coloration extending downward between the perithecia (or, taken the other way, with pale, bleached boundaries around each perithecium; see Fig. 3e).

Eutypella (Nitschke) Sacc., Atti Soc. Ven. Trent. Sci. Nat. 4:80 (1875) (nom. cons.)
Type species: *Eutypella sorbi* (Alb. & Schwein.) Sacc.

Stromata erumpent as rounded or elongate pustules in bark, with crowded perithecial beaks, rounded to sulcate, generally united below by sometimes strongly developed entostromatic tissue between and around perithecia. **Ascospores** are allantoid, hyaline yellowish to brownish. **Asci** typically clavate, 8-spored, usually long-stipitate.

Additional information: Rappaz (1987) provides useful keys to global species of *Eutypella*. Glawe and Rogers (1984) provide information for the Pacific Northwest, and Vasilyeva and Stephenson (2004) focus on the Great Smoky Mountain National Park in the southeastern United States.

Eutypella prunastri (Pers.) Sacc. (Fig. 3g–i)
≡ *Sphaeria prunastri* Pers., Synopsis Methodica Fungorum, p. 37 (1801)
≡ *Valsa prunastri* (Pers.) Fr. (1849)
≡ *Engizostoma prunastri* (Pers.) Kuntze, Revisio Generum Plantarum 3(2):475 (1898)
≡ *Eutypa prunastri* (Pers.) L.C. Tiffany & J.C. Gilman, Iowa State College Journal of Science 40:139 (1965)

Stromata rounded or elongate pustules in bark, perpendicular to the axis of the branch, up to about a centimeter long; individual or aggregated into dense clusters; with well-defined entostromatic tissue between and around perithecia, white. **Perithecia** in valsoid configuration, with ostioles individual, but emerging together in pustules; in groups of at least 5–10, often many more and piled up in several rows; globose to obovoid, 400–500 µm in diameter, with long neck. **Ostioles** are collectively emergent (valsoid arrangement), in shared peridermal clusters, which are prominently raised; individual ostioles rounded to conical, hardly raised above peridermal surface, each often split 3–4 times; 150–200 µm in diameter. **Ascospores** 4.5–7.5 µm × 1–1.5 µm, allantoid, pale yellow to pale brown. **Asci** are generally long-stipitate, the spore-bearing parts 15–30 µm long, with the stipe being at least as long as the spore-bearing parts; with a discoid apical plug bluing very faintly in Melzer's or other iodine mount (I±).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, THOMPSON ISLAND, corticated hardwood log (*Prunus* sp.), col. Danny Haelewaters, James K. Mitchell, Luis Quijada, 43031 (FH:BHI-F1007).

Notes: The substrate for BHI-1007 was tentatively identified as Rosaceae from the bark characteristics, which contributed to the identification of this collection as *Eutypella prunastri*. It is notable that Rappaz (1987) was uncertain whether or not this taxon was found in North America (though he did not rule it out), and that his description indicates a non-amyloid ascal apical plug. However, considering the tentatively identified host family together with the combination of other features present, there are few other possibilities for this collection. It would be worthwhile to attempt to re-collect this fungus for attempted culturing, to further clarify which species of *Eutypella* are present at the Boston Harbor Islands.

Graphostromataceae M.E. Barr, J.D. Rogers, & Y.M. Ju

Type genus: *Graphostroma* Piroz., Canadian Journal of Botany 52(10):2131 (1974)

Stromata effused to erumpant from bark of living or dead wood, in 2 layers (bipartite), with the outer layer dehiscent and appressed under the bark, falling away to reveal the inner layer, which bears the ascomata; without KOH-extractable pigments. **Ascospores** unicellular, allantoid and hyaline (as in *Graphostroma*) to brown and ellipsoid (as in *Biscogniauxia*), at times with appendages, with or without germ slits, without dehiscent perispores. **Asci** oblong to cylindrical.

Additional information: Ju et al. (1998) provides an excellent monographic treatment of *Biscogniauxia*; Laessøe et al. (1989) treats many taxa that were later combined into the Graphostromataceae, including the genus *Camillea*; Barr et al. (1993) was responsible for erecting the family; and *Graphostroma platystomum* is treated with the *Diatrype* in Vasilyeva and Stephenson (2004).

Biscogniauxia Kuntze

Type species: *Biscogniauxia nummularia* (Bull.) Kuntze

Stromata applanate, effused-pulvinate, rarely discoid-raised, bipartite with dehiscent outer layer, with carbonaceous tissue immediately beneath surface, and

without KOH-extractable pigments. **Ascospores** unicellular, pale brown to dark blackish brown, sometimes mature cells with a hyaline cellular appendage, typically ellipsoid inequilateral to equilateral, with (or rarely, without) a straight or sigmoid germ slit. **Asci** 8-spored, cylindrical, short-stipitate, with a discoid apical plug, amyloid or infrequently inamyloid.
Additional information: See Ju et al. (1998) for an excellent monographic treatment of *Biscogniauxia.*

Biscogniauxia mediterranea (De Not.) Kuntze (Fig. 4g–h)
≡ *Sphaeria mediterranea* De Not., Memorie della Reale Accademia delle Scienze di Torino Ser. 2, 13:96, t. 2 (1851)
≡ *Nummularia mediterranea* (De Not.) Sacc., Sylloge Fungorum 1:400 (1882)
≡ *Biscogniauxia mediterranea* var. *mediterranea*, Revisio generum plantarum 2:398 (1891)
≡ *Nummularia regia* var. *mediterranea* (De Not.) Traverso, Flora Italica Cryptogama. Pars 1: Fungi. Pyrenomycetae. Xylariaceae, Valsaceae, Ceratostomataceae 1(1):59 (1906)
≡ *Numulariola mediterranea* (De Not.) P.M.D. Martin, South African Journal of Botany 35:312 (1969)
Stromata bipartite, with an outer dehiscent layer that is shed with the bark at maturity to expose the inner, fertile layer of the stromata; applanate, tightly appressed to substrate; up to several centimeters in diameter, and more or less 1 mm thick; surface black when mature, with the outer dehiscent layer dark brown, ~0.5 mm thick; tissue beneath perithecia inconspicuous, tissue around perithecia black, carbonaceous, and extremely hard and brittle; without KOH-extractable pigments. **Perithecia** are tubular, densely packed at the stromatal surface such that they often become laterally flattened, 0.1–0.2 mm in diameter and up to 1 mm tall, with coarsely papillate ostioles raised above the stromatal surface. **Ascospores** are 15.5–21 µm × 7–10 µm, brown to dark brown, nearly equilateral, with narrowly to infrequently broadly rounded ends, and straight hyaline germ slit, spore-length or

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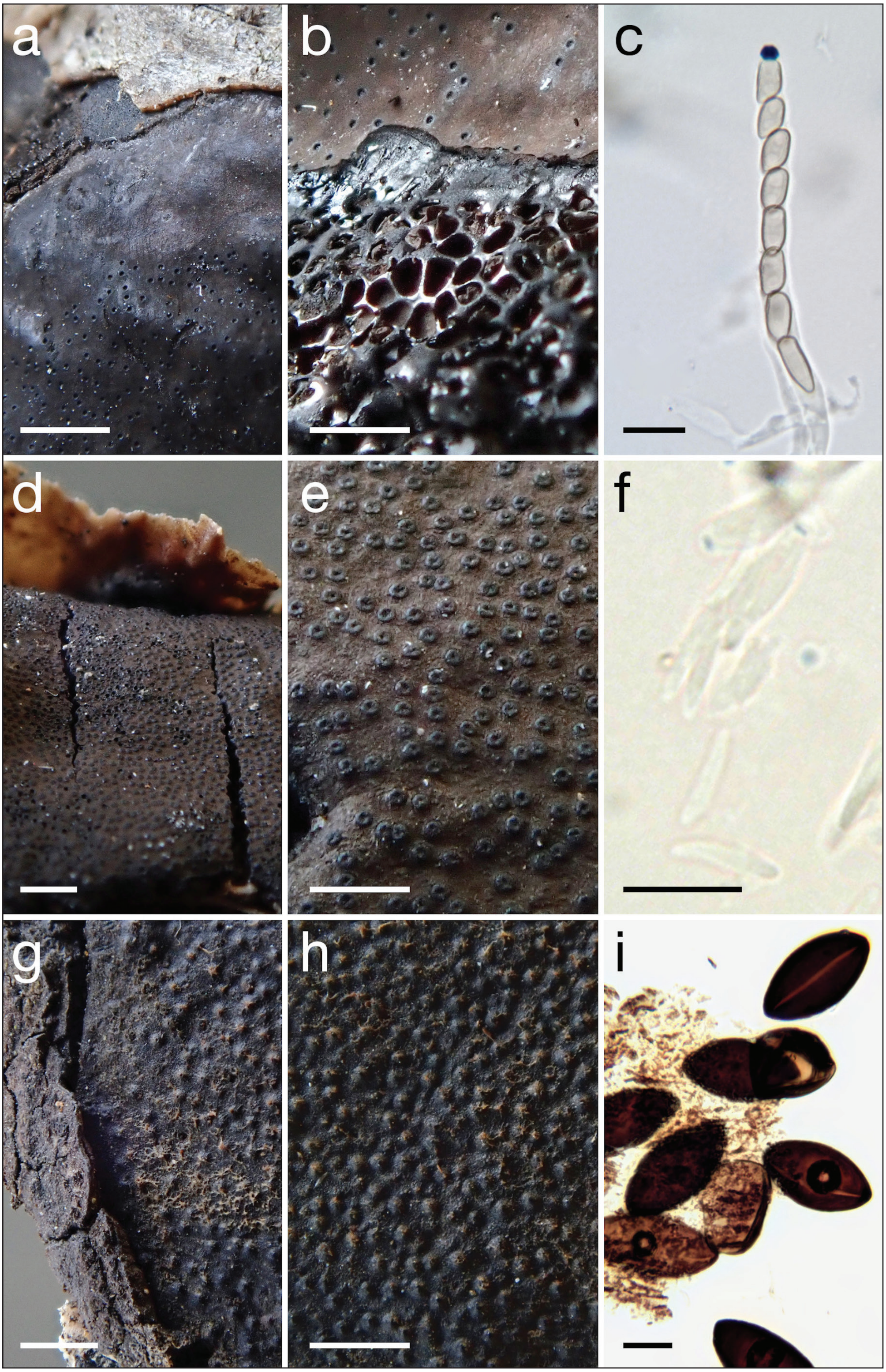
Figure 4 (following page). *Camillea punctulata* (BHI-F699): (a) stromatal surface with margin, showing the bipartite structure and characteristic development underneath the bark; (b) close up of stromatal surface, showing the punctulate ostiolar openings for which this taxon is named; and (c) ascospores inside of an ascus, showing characteristic asymmetrically rectangular-ellipsoid ascospores with one attenuated end, as well as the strongly amyloid apical apparatus. *Graphostroma platystomum* (BHI-F503): (d) stromatal surface with margin, showing the bipartite structure and characteristic development underneath the bark; (e) close up of stromatal surface, showing the elevated, wide-open discoid ostiolar openings; and (f) ascospores and asci, showing the nearly colorless ascospores and faintly amyloid apical apparatus. *Biscogniauxia mediterranea* (BHI-F064): (g) stromatal surface with margin, showing the bipartite structure and relatively thick upper layer; and (h) close up of stromatal surface, showing the distinctly papillate ostioles. *Biscogniauxia mediterranea* var. *macrospora* (BHI-F303): (i) ascospores, which are much much larger than the typical variety, and the primary morphological difference between the 2 varieties. Scale bars: a, d = 2000 µm; b, e, h = 1000 µm; and c, f, i = 10 µm.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i

nearly so. **Asci** are extremely short-stipitate, the spore-bearing parts 120–150 µm long, the stipes generally only 20–35 µm; with a discoid apical plug, wider than it is tall, 4–5 µm × 2–3 µm, blueing in Melzer's or other iodine mount (I+).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on wood, col. Danny Haelewaters, 29 September 2013 (FH:BHI-F064).

Notes: I was only able to recover a few ascospores from BHI-F064, but they are clearly in the size range provided by Ju et al. (1998) for this taxon, and quite distinctly smaller than those recovered from BHI-F303 (i.e., Fig. 4i), which was otherwise a nearly identical specimen.

Biscogniauxia mediterranea var. *macrospora* (J.H. Mill.) Y.M. Ju & J.D. Rogers (Fig. 4i)

≡ *Hypoxylon mediterraneum* var. *macrosporum* J.H. Mill., A Monograph of the World Species of Hypoxylon, p. 118 (1961)

Stromata bipartite, with an outer dehiscent layer that is shed with the bark at maturity to expose the inner, fertile layer of the stromata; applanate, tightly appressed to substrate; up to several centimeters in diameter, and more or less 1 mm thick; surface black when mature, with the outer dehiscent layer dark brown, ~0.5 mm thick; tissue beneath perithecia inconspicuous, tissue around perithecia black, carbonaceous, and extremely hard and brittle; without KOH-extractable pigments. **Perithecia** are tubular, densely packed at the stromatal surface such that they often become laterally flattened, 0.1–0.2 mm in diameter and up to 1 mm tall, with coarsely papillate ostioles raised above the stromatal surface. **Ascospores** are 20–26 µm × 11.5–13 µm, brown to dark brown, nearly equilateral, with narrowly to infrequently broadly rounded ends, and straight hyaline germ slit, spore-length or nearly so. **Asci** are extremely short-stipitate, the spore-bearing parts 120–150 µm long, the stipes generally only 20–35 µm; with a discoid apical plug, wider than it is tall, 4–5 µm × 2–3 µm, blueing in Melzer's or other iodine mount (I+).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on stump/trunk of Quercus sp., col. Danny Haelewaters, Lara A. Kappler, 29 May 2015 (FH:BHI-F303).

Notes: *Biscogniauxia mediterranea* is quite widespread in the United States, with collections authenticated by Ju et al. (1998) ranging from Alabama to New York, though Indiana and Wisconsin, all the way west to California and Oregon. In contrast, *B. mediterranea* var. *macrospora* has only been rarely reported, and this may be the first record for the northeastern part of the US.

Camillea Fr.

Type species: *Camillea leprieurii* (Mont.) Mont.

Stromata variable in shape from applanate or effused-pulvinate to upright, erumpent from bark, always bipartite with dehiscent outer layer, extremely carbonaceous throughout, and without KOH-extractable pigments. **Ascospores** unicellular, almost colorless pale yellow to pale brown, rectangular-ellipsoid to fusiform,

generally inequilateral, at times strongly attenuated at one end, with a pointed apex, without germ slits or pores, but with intricate poroid, reticulate, or echinate orientation visible by SEM. **Asci** 8-spored, cylindrical, with a discoid to rhomboid apical plug staining blue in iodine reagents (I+).
Additional information: Laessøe et al. (1989) treats many taxa that were later combined into the Graphostromataceae, including the genus *Camillea*.

Camillea punctulata (Berk. & Ravenel) Læssøe, J.D. Rogers, & Whalley (Fig. 4a–c)
≡ *Diatrype punctulata* Berk. & Ravenel, Grevillea 4(31):94 (1876)
≡ *Nummularia punctulata* (Berk. & Ravenel) Sacc., Sylloge Fungorum 1:399 (1882)
≡ *Hypoxylon punctulatum* (Berk. & Ravenel) Cooke, Grevillea 11(60):138 (1883)
≡ *Numulariola punctulata* (Berk. & Ravenel) P.M.D. Martin, South African Journal of Botany 35:288 (1969)
≡ *Numulariola punctulata* (Berk. & Ravenel) P.M.D. Martin, South African Journal of Botany 42:8 (1976)
Stromata bipartite, with an outer dehiscent layer that is shed with the bark at maturity to expose the inner, fertile layer of the stromata; applanate, tightly appressed to substrate; up to 3 cm in diameter, and more or less 1 mm thick; surface dark brown to black when mature, sometimes with red to purple tones; the outer dehiscent layer blackish, ~0.1–0.2 mm thick; tissue beneath perithecia inconspicuous, tissue around perithecia shiny black, carbonaceous, and extremely hard and brittle; without KOH-extractable pigments. **Perithecia** are tubular, densely packed at the stromatal surface such that they often become laterally flattened, 0.2–0.3 mm in diameter and up to 1 mm tall, with ostioles finely pitted, umbilicate. **Ascospores** are 7–9 µm × 3–4 µm, rectangular–ellipsoid, inequilateral, with one attenuated end forming a pointed lower apex; nearly colourless, pale yellow to light brown, without germination slits, but often with fine ornamentation visible by SEM. **Asci** are extremely short-stipitate, the spore-bearing parts 50–70 µm long, the stipes generally only half the length of the spore-bearing parts; with a large dome-shaped apical plug, conspicuously widest in the center, and taller than it is wide, 3–3.5 µm × 2–2.5 µm, strongly blueing in Melzer's or other iodine mount (I+).
Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on corticated branch, col. Danny Haelewaters, 29 September 2013 (FH:BHI-F122); THOMPSON ISLAND, on dead oak log, col. Zachary Chaves, Lawrence Millman, James K. Mitchell, Joe Warfel, 29 October 2016 (FH:BHI-F699); GRAPE ISLAND, bark of oak log, col. Lara A. Kappler, James K. Mitchell, 3 May 2017 (FH:BHI-F870).
Notes: Known from both North and Central America, this taxon seems to have a substrate preference for *Quercus* spp. (Laessøe et al. 1989). Although I could not confirm substrate identity for the collections here, BHI-F870 was collected on Grape Island where the only possible substrate is *Quercus velutina* Lam. (Balck Oak; Elliman 2005).

Graphostroma Piroz.

Type species: *Graphostroma platystomum* (Schwein.) Piroz.

Stromata applanate, effused-pulvinate, bipartite with dehiscent outer layer, with dark pithy to wood tissue immediately beneath surface, wide discoid ostioles, and without KOH-extractable pigments. **Ascospores** unicellular, nearly colorless, allantoid to suballantoid, without a germ slit or pore. **Asci** clavate, 8-spored, short-stipitate, with a faint, amyloid discoid apical plug.

Additional information: Barr et al. (1993) was responsible for erecting the family; *Graphostroma platystomum* is treated with the *Diatrype* in Vasilyeva and Stephenson (2004).

Graphostroma platystomum (Schwein.) Piroz. (Fig. 4d–f)

≡ *Sphaeria platystoma* Schwein., Schriften der Naturforschenden Gesellschaft zu Leipzig 1:31 (1822)

≡ *Diatrype platystoma* (Schwein.) Berk., Grevillea 4(31):95 (1876)

Stromata bipartite, with an outer dehiscent layer that is shed with the bark at maturity to expose the inner, fertile layer of the stromata; indefinitely effuse, applanate, tightly appressed to substrate; up to several centimeters in diameter, sometimes entirely encircling smaller substrates, and more or less 1 mm thick; often with horizontal fissures through stromata, perpendicular to the long axis of the substrate; surface dark chocolate brown when mature, but often appearing like black velvet as a result of the tightly crowded, large discoid ostiolar openings; with the outer dehiscent layer dark brown, <0.5 mm thick; tissue beneath perithecia inconspicuous; tissue around perithecia black, pithy to woody, and extremely brittle in age; without KOH-extractable pigments. **Perithecia** are globose to spherical, but often compressed due to crowding as the perithecia are densely packed, 0.2–0.4 mm in diameter and up to 0.2 mm tall, with short, wide, disc-shaped perithecial beaks extending above the stromatal surface, with wide open ostioles giving the surface of the stromata the appearance of a platter of donuts when magnified. **Ascospores** are (6–) 7–10 µm × 1–2 µm, with tapered ends; colorless, suballantoid to allantoid, somewhat inequilateral, looking nearly diatrypaceous. **Asci** are extremely short-stipitate, nearly sessile, the spore-bearing parts 30–40 µm long; with a faint, disciod apical plug, wider than it is tall, 4–5 µm × 2–3 µm, blueing in Melzer's or other iodine mount (I+).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on dead deciduous branch, col. Alden C. Dirks, Jasmin J. Camacho, Michal Gorczak, Danny Haelewaters, James K. Mitchell, 11 December 2016 (FH:BHI-F503); WORLD'S END, on dead deciduous branch, on corticated parts only, col. Danny Haelewaters, 26 March 2017 (FH:BHI-F742).

Notes: There has been disagreement over the placement of *Graphostroma platystomum* for some time, with some authors placing it in the Xylariaceae based on the nodulisporium-type anamorph (e.g., Pirozynski 1974), and others in the Diatrypaceae, primarily based on the ascospore morphology (e.g., Vasilyeva and Stephenson 2004). The Graphostromataceae was eventually erected as a monotypic family to accommodate this strange, monotypic genus with clear affinities to both the Xylariaceae and the Diatrypaceae (Barr et al. 1993). Recent multi-gene phylogenetic efforts (Daranagama et al. 2018, Wendt et al. 2018) seem to confirm closer affinities with the Xylariaceae sensu lato, and placement of *Graphostroma* sister to the *Biscogniauxia* and *Camillea*, among others. Wendt et al. (2018) brought other genera from the Xylariaceae sensu lato into Graphostromataceae (including both *Biscogniauxia* and *Camillea*) based on the strength of these phylogenetic results and similarities in anamorph forms (Graphostromataceae characteristically have xylocladium- or periconiella-type anamorphs), noting that the presence of bipartite stromata united the family, despite great divergence in spore morphology across genera.

Hypoxylaceae DC.

Type genus: *Hypoxylon* Bull.

Stromata variable, from erect to effused-pulvinate, variously colored or more frequently blackish, waxy or carbonaceous tissue immediately beneath surface and between perithecia, with or without KOH-extractable pigments. **Ascospores** unicellular, pale brown to dark blackish brown, typically ellipsoid inequilateral, typically with a hyaline germ slit. **Asci** 8-spored, cylindrical, stipitate, with a discoid apical plug, amyloid or infrequently inamyloid, sometimes lacking, broader than it is tall.
Additional information: The family was resurrected by Wendt et al. (2018), which provides current circumscription; global keys for taxa previously considered *Hypoxylon* (including *Annulohypoxylon*, *Jackrogersella*, and *Hypomontagnella*) are available in the monograph by Ju and Rogers (1998), while the earlier monograph by Miller (1961) is still the best place to find descriptions and illustrations of some taxa; an excellent monograph of the genus *Daldina* by Stadler et al. (2014b) provides keys and descriptions for that genus.

Annulohypoxylon Y.M. Ju, J.D. Rogers, & H.M. Hsieh

Type species: *Annulohypoxylon truncatum* (Starbäck) Y.M. Ju, J.D. Rogers, & H.M. Hsieh

Stromata spherical to applanate or effused-pulvinate, often convergent into a crust, with carbonaceous stromatal material surrounding individual perithecia present, stromatal surface typically blackish at maturity, ostioles always papillate (though sometimes minutely), encircled with an annulate disc, and with or without KOH-extractable pigments. **Ascospores** unicellular, pale brown to dark blackish brown, typically ellipsoid inequilateral to equilateral, with (or rarely, without) a straight, sigmoid, or spiral germ slit. **Asci** 8-spored, cylindrical, stipitate, with a discoid apical plug, amyloid or infrequently inamyloid, sometimes lacking.
Additional information: The genus *Annulohypoxylon* was segregated from *Hypoxylon* by Hsieh et al. (2005); global keys for (as *Hypoxylon* sect. *Annulata*) are available in the monograph by Ju and Rogers (1998), while the earlier monograph by Miller (1961) is still the best place to find some descriptions and illustrations.

Annulohypoxylon annulatum (Schwein.) Y.M. Ju, J.D. Rogers, & H.M. Hsieh (Fig. 5a–d)

≡ *Sphaeria annulata* Schwein., Journal of the Academy of Natural Sciences Philadelphia 5:11 (1825)
≡ *Hypoxylon annulatum* (Schwein.) Mont., Historia Física y Política de Chile. Botánica. Flora Chilena 7:445 (1850)
= *Sphaeria marginata* Schwein., Transactions of the American Philosophical Society 4(2):190 (1832)
= *Hypoxylon marginatum* (Schwein.) Berk., Outlines of British Fungology, p. 387 (1860)
= *Hypoxylon vernicosum* Ellis & Everh., American Naturalist 31:426 (1897)
= *Hypoxylon marginatum* var. *emarginata* Theiss., Annales Mycologici 7(2):156 (1909)
= *Hypoxylon circumscribum* Lloyd, Mycological Writings 7 (Letter 73):1312 (1924)

Stromata pulvinate to hemispherical, with inconspicuous perithecial mounds; up to 2 cm in diameter, and as much as 0.5 cm in thickness; surface blackish when mature, at times showing brown to olivaceous tones; tissue beneath perithecia massive, dark brown to black, woody or carbonaceous in texture, without any concentric zonation whatsoever, though radial texture may be apparent; with KOH-extractable pigments greenish olivaceous to dull green. **Perithecia** spherical to obovoid, 0.3–0.5 mm in diameter, often slightly higher than broad; with a layer of carbonaceous stromatal material surrounding individual perithecia. **Ostioles** distinctly conical-papillate, shiny; surrounded by a convex, "*truncatum*"-type disc, up to 0.5 mm in diameter. **Ascospores** are 7.5–11 µm × 3.5–5 (–6) µm, brown to dark brown, ellipsoid-inequilateral, with narrowly rounded ends, and a straight hyaline germ slit, spore-length or nearly so, on the more curved side. **Asci** are short-stipitate, the spore-bearing parts 67–80 µm long, the stipes at least half as long as

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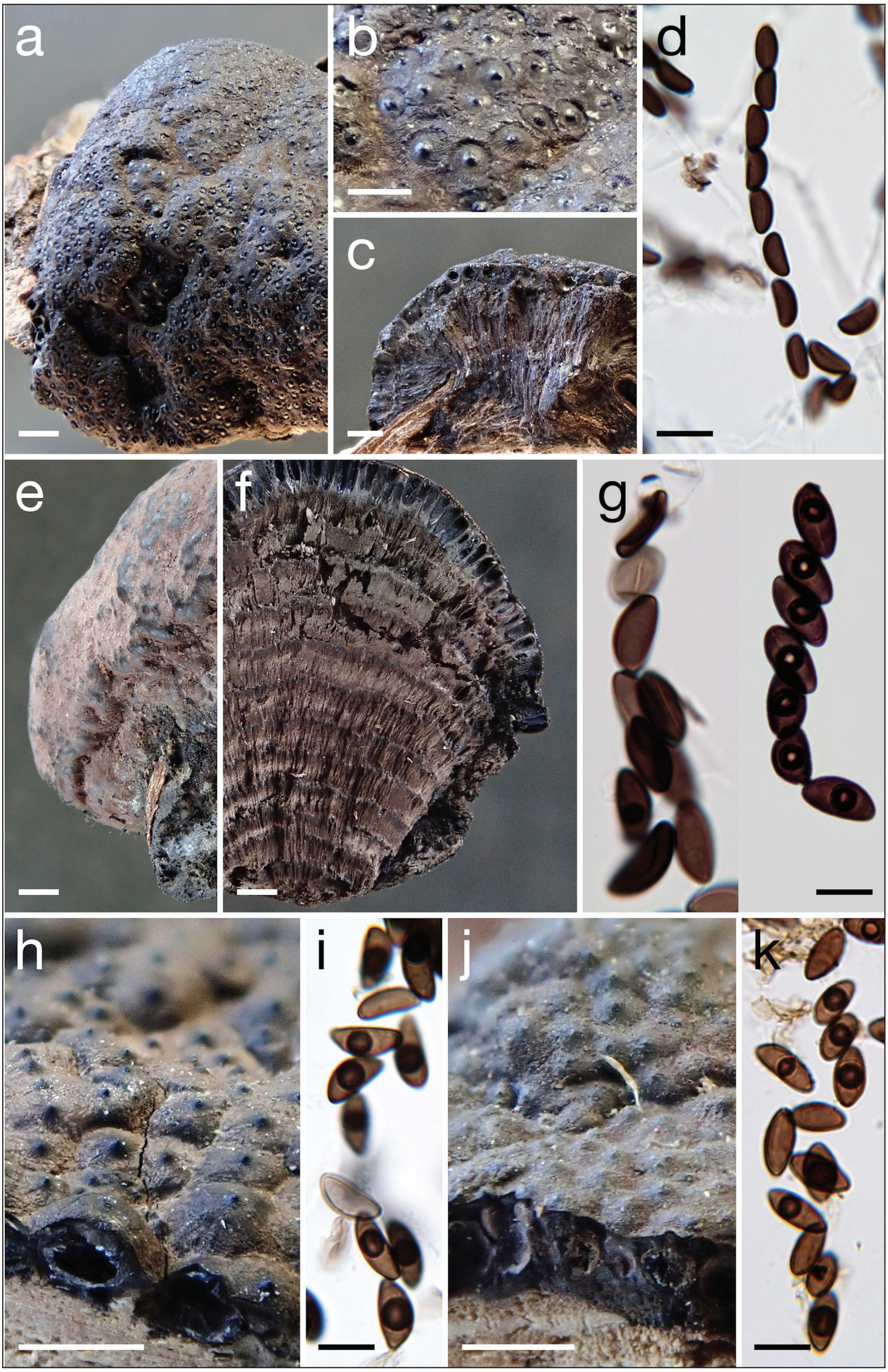
Figure 5 (following page). *Annulohypoxylon annulatum* (BHI-F024): (a) stromatal habit, showing the hemispherical shape and inconspicuous perithecial mounds; (b) stromatal surface texture, clearly showing the "*truncatum*"-type annualate discs and papillate ostioles; (c) vertical section of stromata, showing the globose perithecia and lack of internal concentric zones (note the radial texture, however); and (d) ascospores and asci, with discoid amyloid apical apparatus. *Daldinia childiae* (BHI-F416): (e) close-up of stromata, showing clavate shape with broad stipe and distinct boundary of fertile (perithecial) region; (f) vertical section of stromata, showing the densely packed, tubular perithecia and internal concentric zonation; and (g) ascospores and asci, with discoid amyloid apical apparatus, from a collection with intact asci (BHI-F367). *Hypomontagnella submonticulosum* (BHI-F609): (h) close up of stromatal surface with vertical section, showing slightly compressed globose perithecia, dark rusty-brown surface color, and distinctly papillate ostioles; and (i) ascospores showing narrowly rounded to acute ends; this material did not have intact asci. *Jackrogersella multiforme*: (j) close up of stromatal surface with vertical section, showing obvoid perithecia slightly higher than broad, blackish brown surface color, distinctly papillate ostioles, and a conspicuous layer of fungal tissue beneath the perithecia; and (k) ascospores showing narrowly rounded ends and less than spore-length germ slits; this material did not have intact asci. Scale bars: a, c, e–f, h, j = 1000 µm; b = 500 µm; and d, g, i, k = 10 µm.


a
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the spore-bearing parts; with a discoid apical plug, wider than it is tall, ~1.5–2 µm × 0.5 µm, blueing in Melzer's or other iodine mount (I+).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on corticated fallen branch, col. Danny Haelewaters, Kevin Healy, Rosanne Healy, Sarah Verhaeghen, 14 September 2013 (FH:BHI-F024); WORLD'S END, decorticated and corticated sections of hardwood log, col. Danny Haelewaters, James K. Mitchell, Luis Quijada, 43014 (FH:BHI-F941).

Notes: This taxon is very similar to *Annulohypoxylon truncatum* (Schwein.) Y.M.Ju, which is known from the southern United States and Mexico. *Annulohypoxylon truncatum* is easily distinguished by its thin, effused-pulvinate stromata, rather than the massive, hemispherical stromata of *A. annulatum* (Ju and Rogers 1996).

Daldinia Ces. & De Not.

Type species: *Daldinia concentrica* (Bolton) Ces. & De Not.

Stromata spherical to turbinate, either sessile or stipitate, the tissue below the perithecial layer concentrically zoned, with alternating light and dark regions, pithy to woody, with or without KOH-extractable pigments. **Ascospores** unicellular, pale brown to dark brown, typically ellipsoid inequilateral to equilateral, with a spore-length straight to slightly sigmoid germ slit generally on the more convex side of the spore. **Asci** 8-spored, cylindrical, stipitate, with a discoid apical plug, amyloid (I+).

Additional information: An excellent monograph of the genus *Daldina* by Stadler et al. (2014b) provides keys and descriptions for this genus.

Daldinia childiae J.D. Rogers & Y.M. Ju (Fig. 5e–g)

= *Daldinia concentrica* (Bolton: Fr.) Ces. & De Not. f. *intermedia* C.G. Lloyd, Mycological Writings 5, Large Pyrenomycetes, p. 24. 1919.

Stromata spherical to turbinate, with a constricted base or short, wide stipe; interior tissues concentrically zoned, with alternating layers of pale grey-brown with darker blackish-brown layers, 0.5–1 mm thick, with pithy or woody texture; perithecial contours typically inconspicuous, though at times showing through clearly; up to several centimeters in diameter, though typically broader than tall; may be confluent or aggregated, though more typically solitary and scattered; surface dark brown to sepia, becoming blackish in age, as the outer surface wears away to reveal the harder, more carbonized tissue beneath; KOH-extractable pigments pale grey-yellow or parchment, ranging through amber to a warm cinnamon brown. **Perithecia** are tubular, densely packed at the stromatal surface, 0.3–0.5 mm in diameter and up to 1.5 mm tall, with slightly papillate ostioles. **Ascospores** are 12–16 µm × 5.5–7.5 µm, brown to dark brown, ellipsoid-inequilateral, with narrowly rounded ends, and a straight hyaline germ slit, spore-length, on the more curved side. **Asci** are short-stipitate, the spore-bearing parts 80–100 µm long, the stipes generally less than half as long the spore-bearing parts; with a disciod apical plug, wider than it is tall, ~3 µm × 0.5 µm, blueing in Melzer's or other iodine mount (I+).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, PEDDOCKS ISLAND, on base of corticated stump, col. Danny Haelewaters, 7 September 2013 (FH:BHI-F004); WORLD'S END, on wood, col.

Danny Haelewaters, 29 September 2013 (FH:BHI-F102); PEDDOCKS ISLAND, on bark of deciduous log, col. Lara A. Kappler, 17 July 2015 (FH:BHI-F367); PEDDOCKS ISLAND, on bark of dead, deciduous tree trunk, col. Lara A. Kappler, 17 July 2015 (FH:BHI-F372); THOMPSON ISLAND, on corticated dead deciduous wood, col. Danny Haelewaters, Lara A. Kappler, 18 August 2015 (FH:BHI-F416); PEDDOCKS ISLAND, on decorticated fallen log, col. Danny Haelewaters, Sarah Verhaeghen, 30 May 2015 (FH:BHI-F313); PEDDOCKS ISLAND, on wood, col. Danny Haelewaters, Lawrence Millman, Joseph Warfel, 29 August 2015 (FH:BHI-F452); PEDDOCKS ISLAND, on wood, col. Danny Haelewaters, Lawrence Millman, Joseph Warfel, 29 August 2015 (FH:BHI-F465).

Notes: This cosmopolitan taxon is by far the most common *Daldinia* in the United States, and for decades has been consistently confused with *D. concentrica*, which is strictly European in distribution (Stadler et al. 2014b).

Hypomontagnella Sir, L. Wendt, & C. Lambert

Type species: *Hypomontagnella monticulosa* (Mont.) Sir, L. Wendt, & C. Lamb

Stromata are much as in *Hypoxylon*, but differ in having a woody to carbonaceous stromatal interior without colored granules; with minutely papillate ostioles, sometimes surrounded by a black annulate disc; and without apparent KOH-extractable pigments in mature stromata. **Ascospores** unicellular, pale brown to dark blackish brown, typically ellipsoid inequilateral to equilateral, with (or rarely, without) a straight, sigmoid, or spiral germ slit; spores are differentiated from those of *Annulohypoxylon* and *Jackrogersella* by the smooth or transversally striate perispores. **Asci** 8-spored, cylindrical, stipitate, with a discoid apical plug, amyloid or infrequently inamyloid, sometimes lacking.

Additional information: The genus *Hypomontagnella* was segregated from *Hypoxylon* by Lambert et al. (2019), which includes excellent illustrations and keys to accepted taxa and, importantly, morphologically similar taxa.

Hypomontagnella submonticulosa (Y.-M. Ju & J.D. Rogers) Sir, L. Wendt, & C. Lambert (Fig. 5h–i)

≡ *Hypoxylon submonticulosum* Y.-M. Ju & J.D. Rogers, Mycologia Memoirs 20:189 (1996)

Stromata applanate to effused-pulvinate, with mostly inconspicuous perithecial mounds, though some deeper folds and clefts present; up to several centimeters in diameter, and as much as 0.7 cm in thickness; surface dark rusty brown to blackish; with hardly any tissue beneath perithecia; tissues surrounding perithecia blackish, woody or carbonaceous in texture; without apparent KOH-extractable pigments. **Perithecia** globose, 0.3–0.6 mm in diameter; without a layer of carbonaceous stromatal material surrounding individual perithecia. **Ostioles** minutely conical-papillate; not surrounded by an annular disc. **Ascospores** are 9–12 (–13.5) µm × 4–5 µm, light brown to brown, ellipsoid-inequilateral, with narrowly to infrequently broadly rounded ends, and a straight to slightly oblique hyaline germ slit, notably less than spore-length. **Asci** are short-stipitate, the spore-bearing parts 75–100 µm long, the stipes generally two-thirds to three-quarters as long as the spore-bearing parts; with a discoid apical plug, wider than it is tall, ~3 µm × 2 µm, blueing in Melzer's or other iodine mount (I+).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on wood, col. Danny Haelewaters, 29 September 2013 (FH:BHI-F060); WORLD'S END, on disintegrating stump of old deciduous tree, col. Danny Haelewaters, Lara A. Kappler, 29 May 2015 (FH:BHI-F308); GREAT BREWSTER ISLAND, on dead decomposing log, col. Lara A. Kappler, 8 March 2017 (FH:BHI-F609).

Notes: Young stromata may have purple KOH-extractable pigments, disappearing in age. This taxon is the temperate counterpart to the more tropical *Hypomontagnella monticulosa*, which has darker, more obviously inequilateral ascospores, and a spore-length germ slit (Ju and Rogers 1996). The perithecial diameters of these collections are slightly larger than those reported by Ju and Rogers (Ju and Rogers 1996).

Hypoxylon Bull.

Type species: *Hypoxylon fragiforme* (Pers.) J. Kickx f.

Stromata spherical to applanate or effused-pulvinate, often convergent into a crust, carbonaceous stromatal material surrounding individual perithecia absent, stromatal surface colored to blackish at maturity, ostioles usually umbilicate (though sometimes minutely papillate), never encircled with an annulate disc, and with or without KOH-extractable pigments. **Ascospores** unicellular, pale brown to dark blackish brown, typically ellipsoid inequilateral to equilateral, with (or rarely, without) a straight, sigmoid, or spiral germ slit. **Asci** 8-spored, cylindrical, stipitate, with a discoid apical plug, amyloid or infrequently inamyloid, sometimes lacking.

Additional information: Global keys (as *Hypoxylon* sect. *Hypoxylon,* including many taxa that have since been segregated out of this genus) are available in the monograph by Ju and Rogers (1998), while the earlier monograph by Miller (1961) is still the best place to find some descriptions and illustrations.

Hypoxylon cf. *lenormandii* Berk. & M.A. Curtis

= *Hypoxylon oodes* Berk. & Broome, J. Linn. Soc., Bot. 14:122. 1873 (sensu Miller 1961)

Stromata effused-pulvinate, with conspicuous to very conspicuous perithecial mounds, at times appearing almost rosellinioid, but always with perithecial mounds connected by a thin layer of stromatal tissue; up to 3 cm in diameter, but only ~1 mm thick; surface dark grey-brown to purple-brown; with hardly any tissue beneath perithecia; tissues surrounding perithecia blackish, woody or carbonaceous in texture, with dull ochre apparent immediately beneath the surface; with KOH-extractable pigments warm yellow-brown or cinnamon ranging to dark rusty brown or ocher. **Perithecia** globose to spherical, 0.4–0.6 mm in diameter; without a layer of carbonaceous stromatal material surrounding individual perithecia. **Ostioles** minutely conical-papillate; not surrounded by an annular disc. **Ascospores** are 9.5–15(–16) µm × 4–6.5(–7) µm, brown to dark brown, ellipsoid-inequilateral, with narrowly rounded ends, and a slightly sigmoid hyaline germ slit, spore-length. **Asci**

are short-stipitate, the spore-bearing parts 70–100 µm long, the stipes generally half as long as the spore-bearing parts; with a discoid apical plug, wider than it is tall, ~2.5 µm × 1 µm, blueing in Melzer's or other iodine mount (I+).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, PEDDOCKS ISLAND, on wood, col. Zachary Chaves, 24 September 2016 (FH:BHI-F679).

Notes: This collection was in poor condition, but the combination of available features (ascospore morphology, KOH-extractable pigments, stromatal surface texture and color) all point to *Hypoxylon lenormandii*. This taxon can be easily confused with some members of the *H. rubiginosum* (Pers.: Fr.) Fr. species complex, however, which is more common; *H. rubiginosum* can be distinguished by having umbilicate ostioles, inconspicuous perithecial contours, and a distinctly straight germ slit (reference). *Hypoxylon lenormandii* is typically tropical or subtropical in distribution (Ju and Rogers 1996), so more investigation—including the use of HPLC-MS chemotaxonomic approaches (Stadler et al. 2004a)—may be warranted to confirm the presence of this taxon at the Boston Harbor Islands.

Jackrogersella L. Wendt, Kuhnert, & M. Stadler

Type species: *Jackrogersella multiformis* (Fr.) L. Wendt, Kuhnert & M. Stadler

Stromata differ from *Annulohypoxylon* priciply by containing cohaerin/multiformin type azaphilones as predominant stromatal pigments; typically without annulate discs surrounding the ostiole. **Ascospores** unicellular, pale brown to dark blackish brown, typically ellipsoid inequilateral to equilateral, with (or rarely, without) a straight, sigmoid, or spiral germ slit. **Asci** 8-spored, cylindrical, stipitate, with a discoid apical plug, amyloid or infrequently inamyloid, sometimes lacking.

Additional information: The genus *Jackrogersella* was segregated from *Annulohypoxylon* by Wendt et al. (2018) as part of the resurrection of the Hypoxylaceae; the genus encompasses those previous *Annulohypoxylon* species that have papillate ostioles and lack conspicuous ostiolar disks, though they are also defined by unique pigment chemistry. Wendt et al. (2018) has lists of accepted taxa and keys to species, and there are aditional keys (under *Hypoxylon* sect. *Annulata*) in the monograph by Ju and Rogers (1998).

Jackrogersella multiformis (Fr.) L. Wendt, Kuhnert, & M. Stadler (Fig. 5j–k)
≡ *Sphaeria multiformis* Fr., Observationes mycologicae 1:169 (1815)
≡ *Hypoxylon multiforme* (Fr.) Fr., Summa vegetabilium Scandinaviae 2:384 (1849)
≡ *Annulohypoxylon multiforme* (Fr.) Y.M. Ju, J.D. Rogers & H.M. Hsieh, Mycologia 97(4):859 (2005)
= *Hypoxylon granulosum* Bull., Histoire des champignons de la France I:176, t. 487:2 (1791)
= *Sphaeria rubiformis* Pers., Annalen der Botanik (Usteri) 11:20 (1794)
= *Sphaeria rubiformis* var. *effusa* Pers., Neues Magazin für die Botanik 1:82 (1794)
= *Sphaeria pulvinata* R. Hedw., Observ. Bot., pl. 8, fig. A (1802)
= *Sphaeria granulosa* (Bull.) Sowerby, Coloured Figures of English Fungi 3, pl. 355 (1803)

= *Sphaeria cinereofusca* Schumach., Enumeratio Plantarum, in Partibus Sællandiae Septentrionalis et Orientalis Crescentium 2:164 (1803)
= *Sphaeria crustacea* Sowerby, Coloured Figures of English Fungi 3, tab. 372, fig. 11 (1803)
= *Sphaeria peltata* DC. & Lam., Flore Française 2:287 (1805)
= *Sphaeria deusta* Wahlenb., Flora Lapponica, No. 995 (1812)
= *Peripherostoma granulosum* (Bull.) Gray, A Natural Arrangement of British Plants 1:514 (1821)
= *Nemania crustacea* (Sowerby) Gray, A Natural Arrangement of British Plants 1:517 (1821)
= *Stromatosphaeria elliptica* Grev., Flora Edinensis, p. 357 (1824)
= *Sphaeria rubiginosa* Spreng., Caroli Linnaei Systema Vegetabilium 4(1):385 (1827)
= *Sphaeria corrugata* Fr., Elenchus Fungorum 2:70 (1828)
= *Sphaeria transversa* Schwein., Transactions of the American Philosophical Society 4(2):191 (1832)
= *Hypoxylon corrugatum* (Fr.) Fr., Summa Vegetabilium Scandinaviae 2:384 (1849)
= *Hypoxylon crustaceum* (Sowerby) Nitschke, Pyrenomycetes Germanici 1:49 (1867)
= *Hypoxylon multiforme* var. *effusum* (Pers.) Cooke & Ellis, Grevillea 5(33):33 (1876)
= *Hypoxylon transversum* (Schwein.) Sacc., Sylloge Fungorum 1:391 (1882)
= *Hypoxylon multiforme* var. *granulosum* (Bull.) Sacc., Sylloge Fungorum 1:364 (1882)
= *Hypoxylon hookeri* Berk. ex Cooke, Grevillea 11(60):129 (1883)
= *Rosellinia callimorpha* P. Karst., Hedwigia 23:84 (1884)
= *Hypoxylon granulosum* var. *luxurians* Rehm, Annales Mycologici 3(3):229 (1905)
= *Hypoxylon multiforme* var. *luxurians* (Rehm) Sacc. & Trotter, Sylloge Fungorum 22:314 (1913)
= *Hypoxylon callimorphum* (P. Karst.) P.M.D. Martin, South African Journal of Botany 33:325 (1967)
= *Hypoxylon callimorphum* (P. Karst.) P.M.D. Martin, South African Journal of Botany 42(1):72 (1976)

Stromata peltate, at least in part, often aggregated into a crust, with mostly inconspicuous perithecial mounds; up to 4 cm in diameter, and as much as 0.7 cm in thickness; surface dark brown to blackish brown when mature; with significant tissue beneath perithecia, blackish, woody or carbonaceous in texture; with KOH-extractable pigments olivaceous to greenish olivaceous, rarely apricot to sienna. **Perithecia** obovoid, 0.4–0.7 mm in diameter, slightly higher than broad; with a layer of carbonaceous stromatal material surrounding individual perithecia. **Ostioles** conical-papillate; not surrounded by an annular disc. **Ascospores** are 8.5–12 µm × 3.5–5 µm, light brown to brown, ellipsoid-inequilateral, with narrowly rounded ends, and a straight hyaline germ slit, notably less than spore-length, on the more curved side. **Asci** are long-stipitate, the spore-bearing parts 70–80 µm long, the stipes generally slightly longer than the spore-bearing parts; with a discoid (i.e., flattened donut shaped) apical plug, wider than it is tall, ~2 µm × 1 µm, blueing in Melzer's or other iodine mount (I+).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, PEDDOCKS ISLAND, on wood, col. Danny Haelewaters, Lawrence Millman, Joseph Warfel, 29 August 2015 (FH:BHI-F464).

Notes: The genus *Jackrogersella* was segregated from *Annulohypoxylon* relatively recently (Wendt et al. 2018), primarily on the basis of the presence of a unique class of pigment chemicals, cohaerin/multiformin type azaphilones combined with phylogenetic placement. Interestingly, most members of this clade are also easily separated from *Annulohypoxylon* s. str. by the notable absence of an annular disc. The ITS sequence generated for this collection (GenBank acc. no. MF161278) from the checklist effort (Haelewaters et al. 2018) appears to belong instead to a *Cosmospora* or other Hypocrealean parasite of Xylarialean fungi.

Lopadostomataceae Daranag. & K.D. Hyde [as "Lopadostomaceae"]
Type genus: *Lopadostoma* (Nitschke) Traverso

Stromata immersed to erumpent, present as blisters or pustules under the bark, or as coalescent masses with abrupt margins (in *Creosphaeria*), typically multiperitheciate, in a single layer or multiple layers, with perithecia clustered, with either long ostiolar necks or ostiolar canal lined with pale tissue (in *Creosphaeria*). **Ascospores** unicellular, pale brown to dark blackish brown, typically ellipsoid equilateral, with a spore-length germ slit. **Asci** 4- or 8-spored, cylindrical, stipitate, with an amyloid apical apparatus.

Additional information: The family was erected by Senanayake et al. (2015) to accommodate *Lopadostoma* and *Creosphaeria*. Læssøe and Spooner (1994), Rappaz (1995) and Lu and Hyde (2000) each have useful keys to morphologically similar genera, including *Anthostoma*, *Anthostomella, Lopadostoma,* and others.

Lopadostoma (Nitschke) Traverso
Type species: *Lopadostoma turgidum* (Pers.) Traverso

Stromata pustulate to widely effused, immersed, erumpent from bark, containing 1 to several groups of subglobose or flask-shaped perithecia, each group clustered in a valsoid arrangement, with long ostiolar necks converging on a discrete, dark-brown to black ectostromatic disc. **Ascospores** unicellular, pale brown to dark blackish brown, typically ellipsoid equilateral, with a spore-length germ slit. **Asci** 8-spored, cylindrical, stipitate, with an amyloid apical apparatus.

Additional information: The genus *Lopadostoma* was revised by Jaklitsch et al. (2014), who provide excellent keys and illustrations.

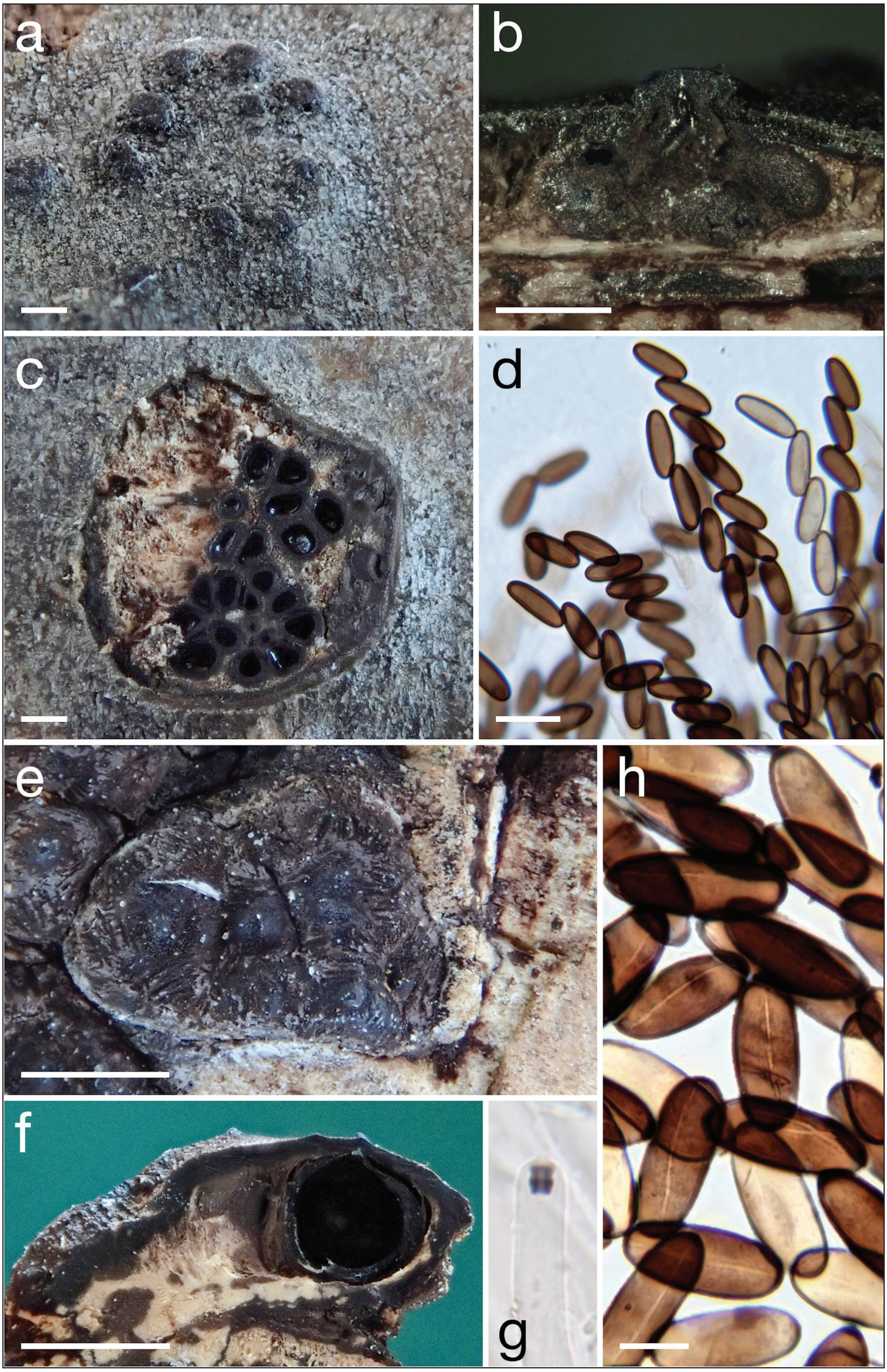
Lopadostoma cf. *americanum* Jaklitsch, J. Fourn., J.D. Rogers, & Voglmayr (Fig. 6a–d)

Stromata immersed in bark, pustulate-erumpent, typically multiperitheciate, either scattered or in small groups, 2–3 mm in diameter, but may appear larger when occurring in groups; with a black, flat to convex, circular ectostromatic disc emerging above the bark; delimited from surrounding bark by a black carbonized line; tissue around and beneath the perithecia composed of un-altered substrate mixed with fungal tissue, sometimes with white mycelium visible throughout. **Perithecia** arranged in a valsoid configuration, 6–12 per stromata, typically all in 1 layer, but rarely with some below in large stromata; subglobose to globose, at times compressed when pressed together; 0.4–0.9 mm diam, with long converging ostiolar necks, opening at the ectostromatic disc. **Ascospores** are (8.2–)9.2–11.5(–13.7) µm × (3.3–)3.5–4.2(–4.7) µm, equilateral ellipsoid, brown to dark brown; with a straight, spore-length germ slit on both sides of the spore, running the circumference of the spore, long-wise. **Asci** typically long stipitate, with the stipe nearly as long as the spore-bearing parts; spore-bearing 50–80 µm; with an apical plug wider than tall, ~2 µm × 1 µm, blueing in Melzer's or other iodine mount (I+), discoid (i.e., flattened donut shaped).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, THOMPSON ISLAND, on fallen hardwood branch, col. James K. Mitchell, 6 March 2017 (FH:BHI-F577).

Notes: *Lopadostoma americanum* is reportedly associated with white oaks (*Quercus* spp.) across North America (Jaklitsch et al. 2014); the substrate for BHI-F577 is presumed to be oak, but I cannot confirm this at present. This specimen was collected towards the northern end of Thompson Island, in a Norway maple forest—with only *Acer platanoides* L. (Norway Maple) and *Quercus robur* L. (English Oak) (Elliman 2005). There are a few notable differences between this specimen and the published description, however: *L. americanum* is described as having nearly black ascospores, and the stomata are described as being "separate, scattered, rarely in contact". I observed in BHI-F577 divergence at both of these traits, this collection having notably paler ascospores, as well as stromatal pustules that occur at times in groups of 8–12. Unfortunately, both efforts to culture and to directly amplify DNA from this material failed. In the absence of phylogenetic data, I am left with the best morphological fit, which would appear to be *Lopadostoma americanum*, despite these differences. It would be wise for an effort to be made to recollect *Lopadostoma* from the Boston Harbor Islands, however, to confirm the occurrence of this taxon.

Figure 6 (following page). *Lopadostoma americanum* (BHI-F577): (a) pseudostromatal surface, showing pustulate aggregations of ectostromatic discs above the bark; (b) transverse section through a group of pseudostromata, showing crowded and compressed globose perithecia surrounded by loose tissue resulting from the mixture of fungal mycelium and substrate; (c) vertical section, showing valsoid perithecial arrangement and shared ectostromatic disc; and (d) ascospores and asci, showing the equilateral spore shape and spore-length germ slits on both sides. *Entoleuca mammata* (BHI-F593): (e) stromatal surface, showing characteristic splitting into semi-regular cuboid to orbicular sections, with faint parallel depressions visible along the margins of each section; (f) vertical section, showing the abundant, highly carbonized tissue encasing the stromata, the large perithecia with papillate ostioles, and the mixing of fungal tissue and substrate towards the base of the stromata; (g) ascus with amyloid apical apparatus, with distinct central swelling; and (h) ascospores, showing slightly sigmoid, spore-length germ slits. Scale bars: a–c, e–f = 1000 µm; d, g–h = 10 µm.


a
b
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g

Xylariaceae Tul. & C. Tul.

Type genus: *Xylaria* Hill ex Schrank

Stromata variable in shape, from effused and applanate through aggregations of pulvinate or turbinate stromata, to large, erect stromata, but typically with a dark surface coloration and white to cream interior flesh, at least when young; multi- or uniperitheciate, but with perithecia always embedded in stromatal tissues. **Ascospores** unicellular (or rarely, with 2 cells), brown to dark blackish brown, variable in shape, but typically ellipsoid inequilateral, mostly a germination slit. **Asci** 4- or 8-spored, cylindrical, stipitate, with or without an amyloid or inamyloid apical apparatus, typically taller than it is broad.

Additional information: The Xylariaceae is by far the largest and most heterogeneous family in the Xylariales. Until relatively recently, this family accommodated most genera within the order, but the circumscription of the family has been steadily narrowed as groups of taxa are segregated to other related families (e.g., Senanayake et al. 2014, Wendt et al. 2018). One of the best keys to genera in the Xylariaceae sensu lato (J.D. Rogers, University of Washington, Pullman, WA, pers. comm.) is published for the Hawaiian islands (Rogers and Ju 2012). Other useful keys to genera can be found in Rogers et al. (2008) and Sir et al. (2012), though revised keys considering new taxonomic revisions remain wanting. Other works from Rogers (1979, 2000) may be useful in understanding the family, both as it was (sensu lato) and as it currently exists (sensu stricto).

Entoleuca Syd.

Type species: *Entoleuca callimorpha* Syd.

Stromata effused to effused-pulvinate, broken into orbicular or turbinate sections, each containing one to several globose perithecia, with surface at first whitish turning to dull black in maturity, with abundant carbonaceous tissue beneath the stromatal surface. **Ascospores** unicellular, brown to dark blackish brown, ellipsoid inequilateral, with a spore-length germ slit. **Asci** 8-spored, cylindrical, stipitate, with an amyloid apical apparatus taller than broad.

Additional information: Despite some difference, *Entoleuca* would appear to be closely related to *Rosellinia* (Wendt et al 2018). Currently, there are only 3 species within this genus; see Rogers and Ju (1996) for the original segregation from Hypoxylon, and Ju et al. (2004) for a description of the third species.

Entoleuca mammata (Wahlenberg: Fr.) J.D. Rogers & Y.-M. Ju (Fig. 6e–h)

≡ *Sphaeria mammata* Wahlenb., Flora Suecica 2:1003 (1826)

≡ *Hypoxylon mammatum* (Wahlenb.) P. Karst., Notiser ur Sällskapets pro Fauna et Flora Fennica Förhandlingar 8:212 (1866)

≡ *Nemania mammata* (Wahlenb.) Granmo, Rapport Botanisk Serie, p. 32 (1995)

= *Sphaeria pruinata* Klotzsch, Linnaea 8:489 (1833)

Stromata are multiperitheciate, effused to effused-pulvinate (though on plants with thick, hard bark, they may be discrete, immersed to erumpent, and orbicular), with a matte black surface, often marked by faint parallel depressions, and splitting into regular to irregular sections, cuboid to orbicular, each containing few to several perithecia; stromata are 1 to several cm in diameter, with discrete sections 2–5 mm in diameter, and seem to be limited by the substrate, and 1–2 mm thick; carbonaceous material immediately beneath the surface is abundant and thick, making the stromata quite hard and brittle; tissues below the perithecia pale brown, mixed with substrate; without KOH extractable pigments. **Perithecia** are large, spherical to globose, 700–1000 µm diameter. **Ostioles** are conic-papillate, slightly above the surface of the stromata. **Ascospores** are 20–33 µm × 9–12 µm, brown, ellipsoid, nearly equilateral, with broadly rounded ends; with a straight to slightly oblique hyaline germ slit that is spore-length or nearly so on the more flattened side. **Asci** stipes, 30–40 µm, are much shorter than then the fertile parts, 140–200 µm, with an apical plug slightly taller than it is broad, ~4–5 µm × 3.5–5 µm, blueing in Melzer's or other iodine mount (I+), with a distinct bunge at the upper rim, urn shaped.

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, GRAPE ISLAND, on corticated aspen (*Populus*) log, col. Danny Haelewaters, Jacob Plotnick, 30 October 2014 (FH:BHI-F279a); GRAPE ISLAND, on bark of dead deciduous tree, col. Lara A. Kappler, 29 July 2015 (FH:BHI-F389); GRAPE ISLAND, on bark of dead deciduous tree, col. Lara A. Kappler, 30 July 2015 (FH:BHI-F396); GRAPE ISLAND, on bark of dead deciduous tree, col. Danny Haelewaters, Lara A. Kappler, 19 August 2015 (FH:BHI-F426); THOMPSON ISLAND, on fallen corticated deciduous branch, col. James K. Mitchell, 6 March 2017 (FH:BHI-F593); GREAT BREWSTER ISLAND, on bark of dead tree, col. Alden C. Dirks, 8 March 2017 (FH:BHI-F604); GRAPE ISLAND, on bark of mostly decorticated branch, col. Alden C. Dirks, Lara A. Kappler, 21 March 2017 (FH:BHI-F641); GRAPE ISLAND, on stick, col. Alden C. Dirks, Lara A. Kappler, 21 March 2017 (FH:BHI-F654).

Notes: This relatively common fungus has been a frustration to identify for many, due to difficulties in accessing previously published descriptions and illustrations. The commonly cited reference for a description of the teleomorph of *E. mammata* is Miller's (1961) monograph of the genus *Hypoxylon* (as *H. mammatum*), a book that has been out of print for decades and which is not available online. The other often-cited description of this fungus is from Petrini and Müller's (1986) work on European species of *Hypoxylon* and allies, published in *Mycologia Helvetica*, a Swiss mycological journal that was active from 1983 to 2001, and is also not available online. I hope that the publication of this detailed description may alleviate the problem of no access to accurate descriptions of this species.

Kretzschmaria Fr.

Type species: *Kretzschmaria clavus* (Fr.) Sacc.

Stromata restricted- to effused-pulvinate ("ustulinioid") or clavate to turbinate ("kretzschmarioid"), often confluent and merging to form broad crusts connected to substrate by narrow connectives, lacking KOH-extractable pigments, with abundant carbonaceous tissue beneath the stromatal surface, interior tissues at first whitish or pale grey, darkening and disintegrating in age, often leaving stromata hollowed at maturity. **Ascospores** unicellular, brown to dark blackish brown, el-

lipsoid inequilateral, with a straight to sigmoid germ slit of variable length. **Asci** 8-spored, cylindrical, stipitate, with an amyloid apical apparatus taller than broad.
Additional information: Keys for the genus *Kretzschmaria* can be found in the monograph by Rogers and Ju (1998), and a useful regional treatment from the southeast of the United States is also available (Rogers et al. 2008).

Kretzschmaria deusta (Hoffm.: Fr.) P. Martin
≡ *Lycoperdon fraxineum* Huds., Flora Anglica, p. 641 (1778)
≡ *Sphaeria deusta* Hoffm., Vegetabilia Cryptogama 1:3, t. 1:2 (1787)
≡ *Hypoxylon ustulatum* Bull., Histoire des Champignons de la France I:176, t. 487:1 (1791)
≡ *Sphaeria fraxinea* (Huds.) Sibth., Flora Oxoniensis, p. 401 (1794)
≡ *Nemania deusta* (Hoffm.) Gray, A Natural Arrangement of British Plants 1:516 (1821)
≡ *Discosphaera deusta* (Hoffm.) Dumort., Commentationes Botanicae, p. 91 (1822)
≡ *Stromatosphaeria deusta* (Hoffm.) Grev., Flora Edinensis, p. 355 (1824)
≡ *Hypoxylon deustum* (Hoffm.) Grev., Scottish Cryptogamic Flora 6:324, t. 324 (1828)
≡ *Ustulina deusta* (Hoffm.) Maire, Bulletin de la Société Botanique de France 54:CXC (1907)
= *Ustulina vulgaris* Tul. & C. Tul., Selecta Fungorum Carpologia, Tomus Secundus. Xylariei - Valsei - Sphaeriei 2:23 (1863)
Stromata are multiperitheciate, pulvinate to effused-pulvinate, with a matte brown-black to black surface, often with reticulate major cracks, spreading over large areas of the substrate and looking rather like burnt wood; stromata are 1 cm to greater than 10 cm in diameter and 1–4 mm thick, generally with crenate, sloped margins, and attached to the substrate by narrow connectives, particularly at the center; carbonaceous material immediately beneath the surface is hard and brittle; tissues below the perithecia corky to woody, starting white, becoming grey then dark brown and disintegrating, leaving older stromata generally hollow, with narrow bands or belts of tissue connecting the upper and lower surfaces within; with no discernable KOH extractable pigments. **Anamorph** (not observed) is present as greyish white to greenish colonies, 1 cm to several cm in diameter, often fusing, with distinct white margins; the teleomorph developes from the anamorph, hardening and blackening gradually. **Perithecia** are large, spherical to globose, 700–1500 µm diameter, sometimes taller than they are wide. **Ostioles** are coarsely papillate, projecting above the surface of the stromata. **Ascospores** are 27–38 µm × 7–9 µm, brown to dark brown, fusoid-inequilateral, with acute, often pinched, ends; with a straight hyaline germ slit that is much less than spore-length on the more flattened side. **Asci** stipes, 30–40 µm, are much shorter than then the fertile parts, 140–200 µm, with an apical plug taller than it is broad, ~5 µm × 3 µm, blueing in Melzer's or other iodine mount (I+), with a distinct bunge at the upper rim, urn shaped.
Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, THOMPSON ISLAND, on old rotten stump, col. Alden C. Dirks, 6

March 2017 (FH:BHI-F592); WORLD'S END, on dead stump, col. Alden C. Dirks, 26 March 2017 (FH:BHI-F712); WORLD'S END, dead corticated stump right next to Juniperus virginiana, col. Danny Haelewaters, 26 March 2017 (FH:BHI-F747).
Notes: This fungus is often encountered, particularly in the spring, in its immature conidial state, in which it is apparent as a blue-green spreading circular colony, with paler, greyish margins (Rogers and Ju 1998).

Nemania Gray
Type species: *Nemania serpens* (Pers.) Gray
Stromata are applanate to effused-pulvinate, typically multiperitheciate, lacking KOH-extractable pigments, dark or black surface color, with carbonaceous tissue beneath the stromatal surface, interior tissues at first whitish or pale grey, darkening and disintegrating in age. **Ascospores** unicellular, pale yellowish brown to dark brown, ellipsoid inequilateral, with a conspicuous or inconspicuous germ slit of variable length, typically (but not always) on the more flattened side of the spore. **Asci** 8-spored, cylindrical, usually long-stipitate, with an amyloid or dextrinoid apical apparatus taller than broad.
Additional information: Keys for the genus *Nemania* can be found in the excellent monographic treatment by Ju and Rogers (2002), with further useful descriptions and illustrations in Granmo et al. (1999).

Nemania beaumontii (Berk. & M. A. Curtis) Y.-M. Ju & J. D. Rogers (Fig. 7a–e)
≡ *Hypoxylon beaumontii* Berk. & M.A. Curtis, Grevillea 4(31):93 (1876)
≡ *Leptosphaeria beaumontii* (Berk. & M.A. Curtis) Sacc., Sylloge Fungorum 2:87 (1883)
≡ *Heptameria beaumontii* (Berk. & M.C. Curtis) Cooke, Grevillea 18(86):33 (1889)
Stromata are multiperitheciate, effused to effused-pulvinate, with a dark rusty brown to blackish brown surface roughened by conspicuous perithecial mounds, half to two-thirds exposed; are ~1 cm in diameter, but seem to be limited by the substrate, and 0.7–0.9 mm thick; carbonaceous immediately beneath the surface and between the perithecia; no substantial tissues below the perithecia, and tissues surrounding perithecia thin and brittle, black; with no discernable KOH extractable pigments. **Anamorph** is present in the deep clefts between perithecia, and is clearly geniculosporium-like. **Perithecia** are spherical to globose, 500–750 µm

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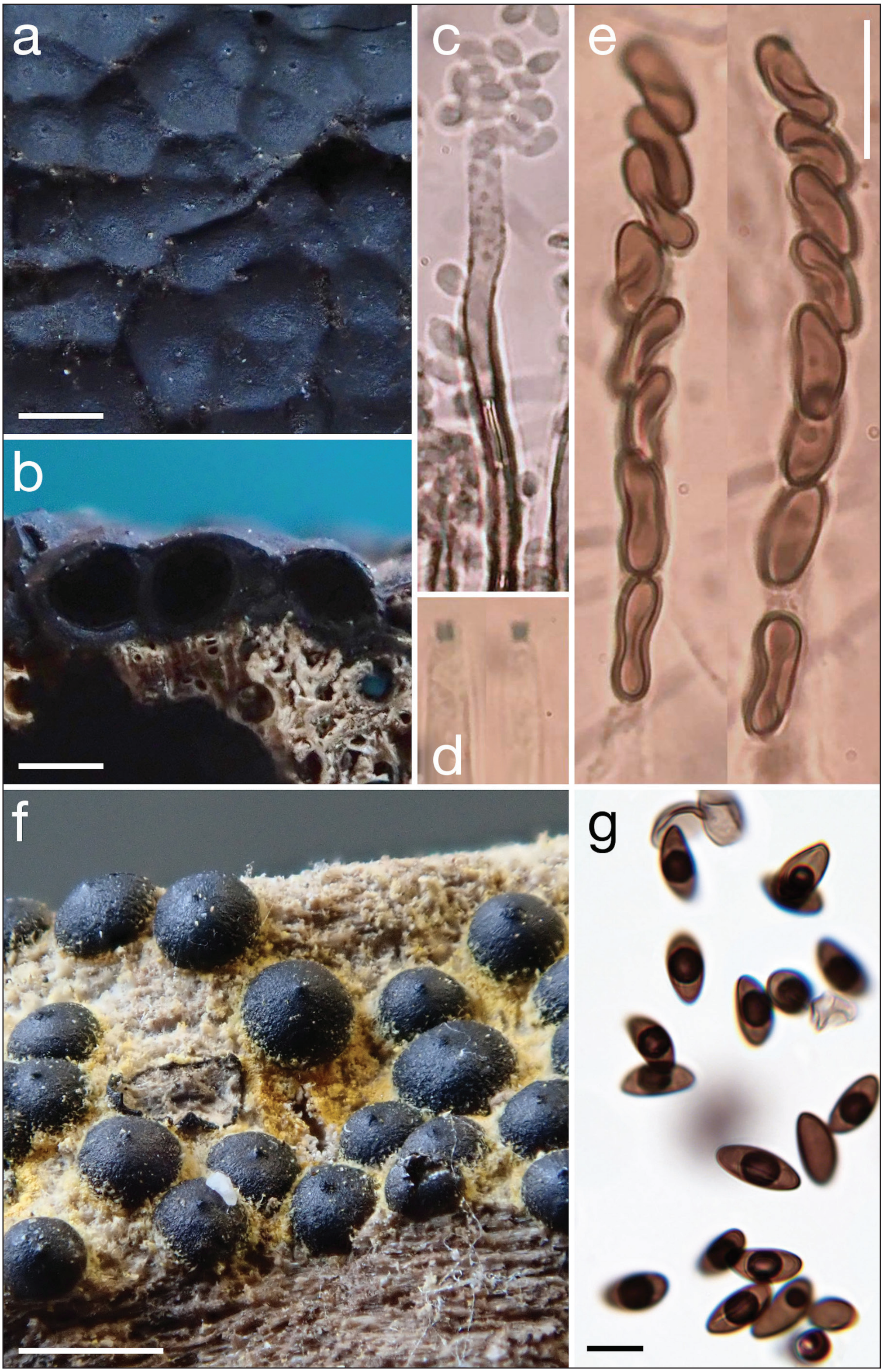
Figure 7 (following page). *Nemania beaumontii* (BHI-F307): (a) stromatal surface, showing blackish brown coloration and conspicuous perithecial mounds, as well as minutely papillate ostioles surrounded by a slightly depressed or flattened area; (b) vertical section, showing globose to slightly flattened perithecia, with little to know tissue below the level of the perithecia; (c) conidiophore of the nodulisporium-type anamorph, present within the clefts of the stromata; (d) ascospores and asci, showing the reniform shape and absence of obvious germ slits (i.e., germ slits inconspicuous); and (e) ascal tips, showing the invert-hat shaped amyloid apical apparatus. *Rosellinia subiculata* (BHI-F686): (f) uniperitheciate stromata, embedded in sulfur-yellow subiculum; and (g) ascospores showing less than spore-length germ slit. Scale bars: a–b = 500 µm; f = 1000 µm; and e, g = 10 µm. Scale bar e applies to c–d.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diameter. **Ostioles** are conic-papillate, slightly above the surface of the stromata, and sometimes surrounded by a slightly depressed or flattened area. **Ascospores** are (7–)8–10 µm × 3.5–4.5 µm, light brown, reniform, with broadly rounded ends, and an inconspicuous hyaline germ slit much less than spore-length on the more flattened side. **Asci** stipes, 55–75 µm, are nearly equal in length to the fertile parts, 65–75 µm, with an apical plug roughly as high as it is broad, ~1.5 µm × 1.5 µm, blueing in Melzer's or other iodine mount (I+), and invert hat shaped.

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on dead log of deciduous tree, col. Danny Haelewaters, Lara A. Kappler, 29 May 2015 (FH:BHI-F307a); WORLD'S END, on decorticated wood, col. Alden C. Dirks, Jasmin J. Camacho, Michal Gorczak, Danny Haelewaters, James K. Mitchell, 11 December 2016 (FH:BHI-F501); GREAT BREWSTER ISLAND, hardwood log in an advanced state of decay, col. Danny Haelewaters, James K. Mitchell, Luis Quijada, 16 October 2017 (FH:BHI-F997).

Notes: Known from only a handful of collections, this fungus has previously only been found in Brazil and the US state of Alabama (Ju and Rogers 2002); observation of this fungus at the Boston Harbor Islands extends its range significantly far to the north, and may indicate that this fungus is simply under-collected, rather than rare.

Nemania serpens (Pers. : Fr.) S.F. Gray var. Serpens
≡ *Sphaeria serpens* Pers., Synopsis Methodica Fungorum, p. 20 (1801)
≡ *Nemania serpens* var. *serpens*, A Natural Arrangement of British Plants 1:508, 516 (1821)
≡ *Gamosphaera serpens* (Pers.) Dumort., Commentationes Botanicae, p. 90 (1822)
≡ *Hypoxylon serpens* (Pers.) J. Kickx f., Flore Cryptogamique des Environs de Louvain, ou Déscription des Plantes Cryptogames et Agames qui Croissent Dans le Brabant et Dans une partie de la Province d'Anvers, p. 115 (1835)

Stromata are multiperitheciate, irregularly effused, with a dark brown to black surface, roughened by conspicuous perithecial mounds, one-quarter to one-third exposed, or smooth, with perithecial mounts not visible, and often with the remains of a thin, whitish to dark grey or silver exostromatic hyphal coating visible in the clefts between perithecia and at stromatal margins; are ~1 cm in diameter, but often fused and limited in size by available substrate, and 0.5–0.7 mm thick; carbonaceous immediately beneath the surface; tissues below and between the perithecia thin, corky, and pale brown to white; with no discernable KOH extractable pigments. **Perithecia** are spherical to globose, 400–800 µm diameter, sometimes with bases slightly immersed in the woody substrate. **Ostioles** are conic-papillate, blunt, slightly above the surface of the stromata. **Ascospores** are 10–14.5(–16.5) µm × 4–6 µm, light brown, reniform, with broadly rounded ends, or 1 broadly rounded and 1 acute, and an inconspicuous hyaline germ slit much less than spore-length on the more flattened side. **Asci** stipes, 45–120 µm, are often roughly equal in length to the fertile parts, 65–96 µm, with an apical plug higher than it is broad, ~3–5 µm × 2–3 µm, non-reactive or faintly blueing in Melzer's (but dextrinoid in Lugol's; Granmo 1999), and invert hat shaped with an diffuse upper bulge.

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, GREAT BREWSTER ISLAND, on dead decomposing log, col. Lara A. Kappler, 8 March 2017 (FH:BHI-F610); GRAPE ISLAND, on piece of dry wood, col. Alden C. Dirks, Lara A. Kappler, 21 March 2017 (FH:BHI-F650).

Notes: This circumboreal fungus is relatively common in the north temperate zone, but it is often still mis-identified as a *Hypoxylon,* the genus in which this fungus was previously placed (Kickx 1835). The pale brown to white interior flesh of this fungus, complete lack of KOH-extractable pigments, along with the taller-than-wide ascus apical plug should be sure features leading the inquisitive mycologist to the genus *Nemania*, rather than *Hypoxylon* and its allies. The ascus apical plug stains very poorly in Melzer's reagent typically, but will stain quite satisfactorily with KOH pretreatment (Ju and Rogers 2002) or in Lugol's iodine (Granmo et al. 1999).

Nemania maritima Y.-M. Ju & J.D. Rogers

Stromata are dark brown to black with a smooth surface, scattered to gregarious, and superficial to partially immersed in the substrate; they are globose to subglobose in shape, and typically uniperitheciate, though some may contain 2 to several perithecia; they are 0.5–0.6 mm in total diameter, and generally slightly taller than wide; carbonaceous immediately beneath the surface and surrounding the perithecia; no substantial tissues below the perithecia; and they are without any traces of a felty or wooly subiculum. **Perithecia** are small, generally encompassing the entire stromatal volume, and globose. **Ostioles** are obtusely conical. **Ascospores** are 9–12 µm × 5–6(–6.5) µm, brown, ellipsoid-inequilateral, with broadly rounded ends, and a hyaline germ slit much less than spore-length on the flattened side. **Asci** are short-stipitate, the fertile part 70–85 µm long, with an apical plug ~1.5 µm × 3 µm, blueing in Melzer's or other iodine mount (I+), cuneate to discoid (i.e., flattened donut shaped).

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, PEDDOCKS ISLAND, fallen Juniperus branch, col. Lara A. Kappler, James K. Mitchell, 10 May 2017 (FH:BHI-F889).

Notes: This is presumed to be *N. maritima*, based on the halophilic substrate (driftwood) and mostly uniperitheciate habit. I was unable to locate spores in this specimen, however. The diagnosis here is based on characteristics of this specimen, and is inclusive of description from the literature (Ju and Rogers 2002) for features not observed.

Rosellinia De Not.

Type species: *Rosellinia aquila* (Fr.) De Not.

Stromata uniperitheciate, but embedded in a wooly or felty subiculum composed of interviewed mycelium, often bearing the anamorph at least in places, colored white or cream, sulfur yellow, or dark to reddish brown; when present, interior stromatal tissues typically whitish; lacking KOH-extractable pigments; dark or black surface color. **Ascospores** unicellular, brown to dark brown, ellipsoid inequilateral, with a conspicuous or inconspicuous germ slit of variable length, typically (but not always) on the more flattened side of the spore. **Asci** 8-spored, cylindrical, usually long-stipitate, with an amyloid apical apparatus taller than broad.

Additional information: Petrini (2013) provides excellent keys and illustrations for *Rosellinia* in her world monograph, which neatly gathers decades of research from her and her collaborators into one convenient book.

Rosellinia subiculata (Schwein.) Sacc. (Fig. 7f–g)

≡ *Sphaeria subiculata* Schwein., Schriften der Naturforschenden Gesellschaft zu Leipzig 1:44 (1822)

≡ *Hypoxylon subiculatum* (Schwein.) Berk., Grevillea 4(30):52 (1875)

≡ *Hypoxylon subiculosum* (Schwein.) Berk., Grevillea 4(30):52 (1875)

Stromata are uniperitheciate, though they sometimes fused, giving them the appearance of containing more than 1 perithecia; they are black with a smooth surface, gregarious, often forming large groups; they are globose to cupulate in shape, often with a flattened top; they are 0.7–0.9 mm in total diameter, and generally slightly wider than they are tall; carbonaceous ectostroma, brittle and persistent, with pale cream to tan entostroma, disappearing in age. **Subiculum** is felted to wooly, appressed, and generally sulphur yellow to orange yellow, whitening with age, and may be absent in older material. **Perithecia** are small, generally encompassing the entire stromatal volume, and globose. **Ostioles** are finely papillate, slightly raised above the stromatal surface. **Ascospores** are 10–12 µm × 5–6.6 µm, light brown to brown, ellipsoid-inequilateral, with broadly rounded ends, and a straight, hyaline germ slit extending less than spore-length (half to three-quarters) on the flattened side. **Asci** are short- to long-stipitate (10–77 µm), the fertile part 70–80 µm long, with an apical plug ~1–2 µm × 2–3 µm, blueing in Melzer's or other iodine mount (I+), cuneate to discoid.

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on corticated branch, col. Danny Haelewaters, Kevin Healy, Rosanne Healy, Sarah Verhaeghen, 14 September 2013 (FH:BHI-F052); WORLD'S END, on wood, col. Danny Haelewaters, 29 September 2013 (FH:BHI-F072); THOMPSON ISLAND, on fallen decorticated wood, col. James K. Mitchell, 6 March 2017 (FH:BHI-F590); PEDDOCKS ISLAND, on dead wood, col. Zachary Chaves, 24 September 2016 (FH:BHI-F686); WEBB MEMORIAL STATE PARK, on fallen decorticated hardwood branch, col. Alden C. Dirks, James K. Mitchell, 29 March 2017 (FH:BHI-F763); SLATE ISLAND, rotten, decorticated wood, col. Alden C. Dirks, Lara A. Kappler, James K. Mitchell, 19 April 2017 (FH:BHI-F832).

Notes: This distinctive fungus can be easily identified by its yellow subiculum, a trait it shares with only one other *Rosellinia, R. pardalios* (Berk. & M.A. Curtis) Cooke, which can be distinguished by its slightly smaller ascospores and its eastern Asian distribution; currently, *R. pardalios* is only known from Japan (Petrini 2013).

Rosellinia corticium (Schwein.) Sacc.

≡ *Sphaeria corticium* Schwein., Schriften der Naturforschenden Gesellschaft zu Leipzig 1:44 (1822)

≡ *Sphaeria aquila* var. *corticium* (Schwein.) Fr., Systema Mycologicum 2:442 (1823)
≡ *Hypoxylon corticium* (Schwein.) P.M.D. Martin, South African Journal of Botany 34:156 (1968)

Stromata are uniperitheciate, though they sometimes fused, giving them the appearance of containing more than one perithecia; they are dark brown to reddish brown, trending towards black around the ostioles and turning completely black in age, with a smooth surface, and are scattered to gregarious; they are globose to subglobose in shape, often with a flattened top, with the base often constricted to a short, broad stipe; they are 1–1.6 mm in total diameter, and generally slightly wider than they are tall; with a think carbonaceous ectostroma, brittle and persistent, with pale cream to tan entostroma, disappearing in age (but more persistent in the stipe and base). **Subiculum** is densely wooly, sometimes felted in age, and generally dark brown to reddish brown, sometimes with purple tones, and reduced in older material. **Perithecia** are small, generally encompassing the entire stromatal volume save the stipe when present, and globose. **Ostioles** are finely papillate, slightly raised above the stromatal surface. **Ascospores** are 22–26.5 µm × 8.5–10 µm, dark brown, ellipsoid-inequilateral to ovoid, with broadly rounded ends and a semiglobose cellular appendage 1–3 µm in diameter on one end; completely surrounded by a slimy sheath, up to 2–4 µm thick, absent in older material; and a straight to oblique hyaline spore-length germ slit on the flattened side. **Asci** are short–stipitate, the fertile part 140–185 µm long, with an apical plug ~8–12 µm × 4–8 µm, blueing in Melzer's or other iodine mount (I+), urn-shaped, with prominent upper rim.

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, WORLD'S END, on hardwood, col. Jason M. Karakehian, 26 March 2017 (FH:BHI-F781).

Notes: This cosmopolitan *Rosellinia* species is easily confused with *R. aquila* (Fr.) De Not., another common species with a dark, woolly subiculum, but *R. corticium* can be distinguished by having larger ascomata, slightly larger ascospores, and the presence of the slimy sheath completely surrounding the ascospores (Petrini 2013).

Xylaria Hill ex Schrank

Type species: *Xylaria hypoxylon* (L.) Grev.

Stromata variable in size and shape, from erect to pulvinate, but typically stipitate or at least with a restricted base, interior stromatal tissues usually homogenous and whitish, lacking KOH-extractable pigments, with dark or black surface color, sometimes overlain by a whitish or pale ectostromatic layer of tissue. **Ascospores** unicellular, brown to dark brown, ellipsoid inequilateral, with a germ slit of variable length on the more flattened side of the spore. **Asci** 8-spored, cylindrical, usually long-stipitate, with an amyloid apical apparatus taller than broad.

Additional information: *Xylaria* is a complex genus encompassing an enormous range of morphological variation, and has been correspondingly difficult for taxonomists to clearly delineate: the genus *Xylaria* has never been monographed. The best place to begin when attempting to identify a *Xylaria* from the US is with the works of Jack Rogers, starting with his and Brenda Callan's "Provisional keys to *Xylaria* species in continental United States" (Rogers and Callan 1986) or the expanded synoptic key they published several years later (Callan and Rogers 1993). There is also a series of papers from Rogers detailing many of the major groups of *Xylaria* in the United States (Rogers 1983, 1984a, 1984b; Rogers and Callan 1986), which may prove enlightening to the interested mycologist. There is also a useful regional treatment for the Great Smoky Mountains National Park (Rogers et al. 2008).

Xylaria finismundoensis Vandegrift, sp. nov. (Fig. 8a–g)—Mycobank No. MB 836437
Types. USA, Massachusetts, Plymouth County, Hingham, Boston Harbor Islands National Recreation Area, World's End peninsula (42°15'39.72"N, 70°52'08.82"W); on decorticated stump of unknown wood; 11 Dec. 2016; col. A.C. Dirks, J.J. Camacho, M. Gorczak, D. Haelewaters, J.K. Mitchell (FH: BHI-F502, **holotype**). Ex-holotype sequences: GenBank acc. No. MT823483 (ITS-LSU), GenBank acc. no. MT823481 (α-actin), GenBank acc. no. MT823482 (β-tubulin), GenBank acc. no. MT823484 (RPB2). Ibid., 26 Mar. 2017; col. D. Haelewaters (FH: BHI-F743, **paratype**). Ex-paratype sequences: GenBank acc. No. MT823485 (ITS). Ibid., 6 Oct. 2017; col. D. Haelewaters, J.K. Mitchell, L. Quijada (FH: BHI-F949, **paratype**).
Etymology. Referring to the collecting location, meaning literally "*Xylaria* originating at the End of the World".
Stromata are minute but erect, 2–5 mm in total height above the substrate, 0.5–1.2 mm in maximum diameter, dark brownish-black to black, each with notably tomentose stromatal base, vertical striations from peeling remnants of white exostromatal coating evident on mature specimens; fertile parts 1.9–4.5 mm, with a sterile apiculate stromatal apex above. **Perithecia** are small, globose, thick-walled (>10 µm) when mature; 300–400 µm × 300–410 µm (mean = 335 µm × 345 µm, *n* = 13). **Ostioles** are large (75–130 µm; mean = 105 µm, *n* = 15), conical, papillate, and rather reflective. **Ascospores** are (9.5–)10–11.5 µm × 4.5–6 µm (mean = 10.64–5.08 µm, *n* = 25), brown to dark brown, ellipsoid inequilateral, with broadly rounded ends and a hyaline germ slit spore-length or nearly so on the flattened side. **Asci** are

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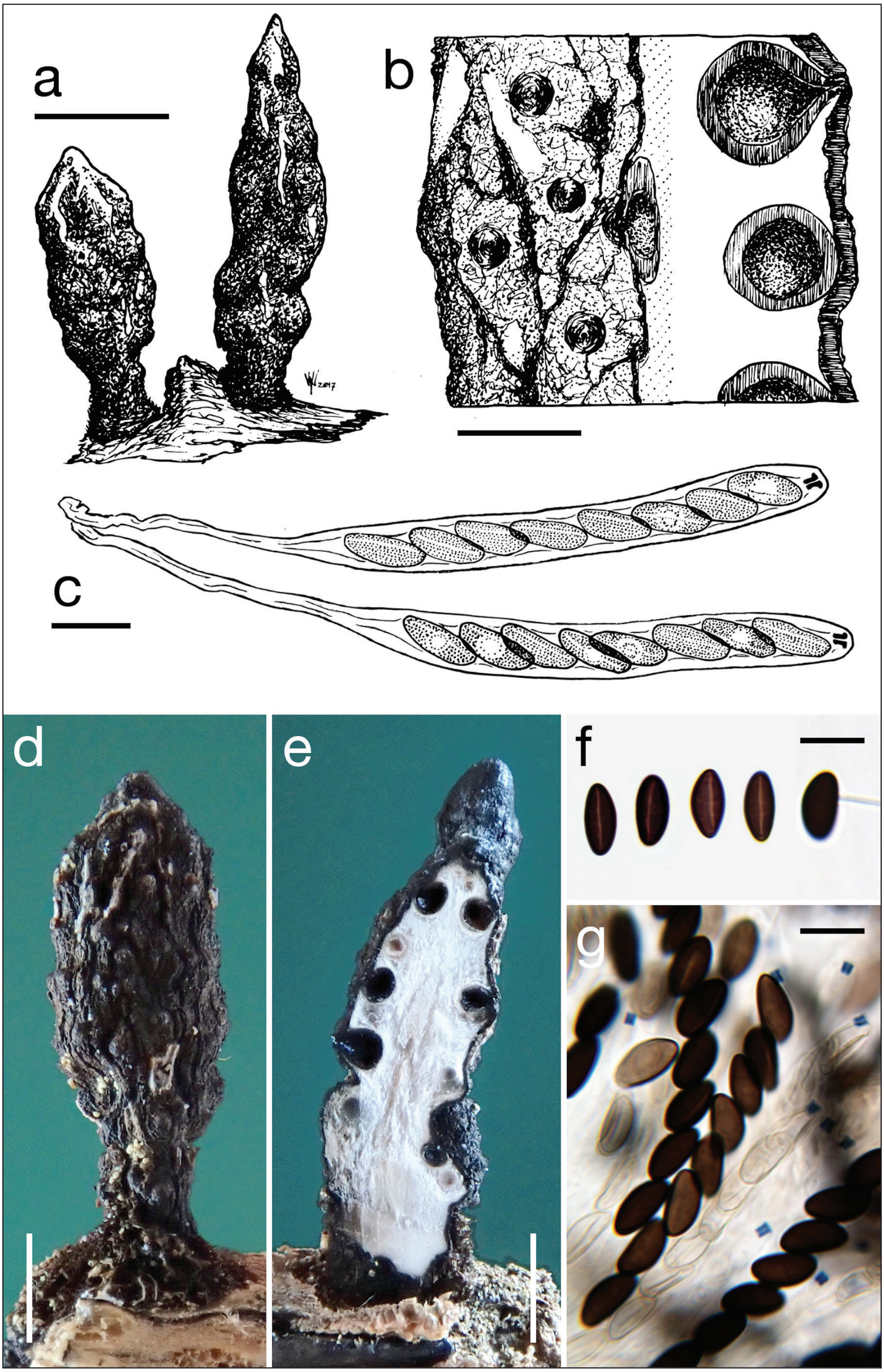
Figure 8 (following page). *Xylaria finismundoensis* sp. nov. (BHI-F502): (a) stromatal habit, illustrating erect form, tomentose base, and white vertical striping from remnants of degrading ectostromatic layer; (b) close up of stromatal surface, illustrating large, conical-papillate ostioles, and vertical section illustrating thick-walled, globose to spherical perithecia, fully embedded in stromata; (c) ascospores and asci, illustrating the narrowly to broadly rounded ends, spore-length germ slic, short-stipitate asci, and invert hat-shaped amyloid apical apparatus; (d) stromata, showing erect form, tomentose base, and white vertical striations from remnants of degrading ectostromatic layer; (e) vertical section, perithecia embedded in stromata; (f) ascospores, showing hyaline, spore-length germ slit, and germinating spore (far right); and (g) ascospores and asci, showing the amyloid apical apparatus. Scale bars: a, d, e = 1000 µm; b = 500 µm; and c, f, g = 10 µm.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short-stipitate, the fertile part about 70–100 µm long; with an apical plug slightly taller than broad, 3 µm × 2.5 µm, dark blue in Melzer's or other iodine reagent (I+), invert hat-shaped, without a central swelling.

Notes: All 3 specimens of this species were collected from the same decorticated stump on the World's End peninsula over the course of a year (Dec. 2016, Mar. 2017, Oct. 2017). This fungus is apparently a common endophyte, judging from sequence similarity to numerous endophytic isolates found by BLAST match against NCBI GenBank's standard *nr/nt* nucleotide database (https://www.ncbi.nlm.nih.gov/nucleotide). I have placed *Xylaria finismundoensis* within the previously reported E9 endophyte clade (see the Results and Discussion section, above), making this the first reported teleomorph for a group of *Xylaria*, which were previously only known as endophytes.

The ITS sequences generated from BHI-F502 and BHI-F743 are almost perfectly identical at the 5.8S and ITS2 loci, but quite divergent at the ITS1 locus; extraction and sequencing failed for the third collection (BHI-F949), so no comparison is possible. Interestingly, the sequence from BHI-F743 is nearly perfectly identical to an endophyte from North Carolina (NC0985), also a member of the E9 endophyte clade (U'Ren et al. 2016). All 3 sequenced collections are morphologically indistinguishable, and were harvested from the same substrate, a decomposing tree-stump, so it is clear that they are the same species, likely even representing fruiting bodies of the same parent mycelium. The clear evidence of recombination within the rDNA locus is interesting, and points to a need for further investigation into the sexual biology of *Xylaria* as it relates to the endophytic lifestyle, and to the need to re-evaluate the ways in which we apply ITS sequence data to identification of unknowns (Stadler et al. 2020).

This taxon may be easily confused for *Xylaria hypoxylon*, *Xylaria longiana* Rhem, *Xylaria vasconica* J. Fournier & M. Stadler, or *Xylaria apiculata* Cooke. *Xylaria hypoxylon* is probably the most commonly applied name in the genus across North America, though it would seem that the name has been constantly misapplied to collections of *Xylaria longiana* and *Xylaria vasconica* on the East Coast of the United States (Persoh et al. 2009, Fournier et al. 2011). In fact, there is some doubt as to whether *Xylaria hypoxylon* occurs on the East Coast of the US at all, with no verifiable sequenced vouchers available at all (M. Stadler, Department of Microbial Drugs, Helmholtz Center for Infection Research (HZI), and German Center for Infection Research (DZIF), Partner Site Hannover/Braunschweig, Inhoffenstraβe 7, 38124 Braunschweig, Germany, pers. comm.). *Xylaria apiculata* has been reported from the United States, but seems to have a more tropical/subtropical distribution (Dennis 1956, Rogers 1986), and is unlikely to occur in the Boston Harbor Islands.

Xylaria finismundoensis can be distinguished from *X. hypoxylon* by its smaller stature; the absence of flattened, branching, antler-like stromatal apices; and the slightly smaller ascospores. *Xylaria longiana* (sometimes referred to as the "small-spored" form of *X. hypoxylon*; Callan and Rogers 1993) is morphological similar to *X. hypoxylon*, and can be discriminated from *X. finismundoensis* in the same ways (i.e., by the flattened, antler-like sterile apex). It can likewise be distinguished from *X. vasconica* (the most likely similar taxon to be encountered in this area) by its smaller ascospores, minute stature, solitary habit, and striate stromatal surface (*X. vasconica* has a distinctly nodulose to cerebriform surface texture). Similarly, *X. finismundoensis* can be distinguished from *X. apiculata* primarily by its smaller ascospores ([9.5–]10–11.5 µm × 4.5–6 versus 17–24 µm × 7–9 µm), and its spore-length germ slit (Dennis 1956).

Xylaria polymorpha (Pers.: Fr.) Grev.
≡ *Sphaeria polymorpha* Pers., Commentatio de Fungis Clavaeformibus, p. 17 (1797)
≡ *Cordyceps polymorpha* (Pers.) Fr., Observationes Mycologicae 2:317 (cancellans) (1818)
≡ *Hypoxylon polymorphum* (Pers.) Gray, A Natural Arrangement of British Plants 1:512 (1821)
≡ *Xylosphaera polymorpha* (Pers.) Dumort., Commentationes Botanicae, p. 92 (1822)
≡ *Hypoxylon* var. *polymorphum* (Pers.) Mont., Annls Sci. Nat., Bot. sér. 2, 13:349 (1840)

Stromata large and robust, often greater than 10 cm tall and usually >1 cm in diameter, extremely variable in size and shape, cylindrical to clavate or spathulate, mostly unbranched with rounded, with fertile apices, and long or short stipes, becoming dull blackish brown or black in age, with a roughened, rugose surface texture, with obscure to discoid ostiolar papillae; interior tissues uniform and white to cream, with perithecia fully immersed beneath the stromatal surface. **Perithecia** are larger, 500–1000 µm in diameter, globose. **Ascospores** are (19–)20–28(–31) µm × (5–)6–7.5(–10) µm, brown to dark brown, ellipsoid inequilateral, with narrowly to broadly rounded ends, and a straight to slightly oblique hyaline germ slit distinctly less than spore-length on the flattened side. **Asci** are long-stipitate, the fertile part 90–145 µm long, with the stipe nearly as long as the spore bearing parts, with an apical plug taller than broad, 4.5–6.5 µm × 3–4 µm, dark blue in Melzer's or other iodine reagent (I+), rectangular to urn-shaped, with a broad central swelling.

Specimens examined: USA: Massachusetts, Boston Harbor Islands National Recreation Area, THOMPSON ISLAND, on base of dead tree trunk, col. Lara A. Kappler, 28 August 2015 (FH:BHI-F548); WORLD'S END, on dead stump, col. Alden C. Dirks, 26 March 2017 (FH:BHI-F713); GRAPE ISLAND, spalted dead wood piece, col. Lara A. Kappler, James K. Mitchell, 3 May 2017 (FH:BHI-F866).

Notes: Probably the most frequently erroneously applied name in the genus, *X. polymorpha* is one of the largest and most common *Xylaria* in the northern United States. Despite the frequency of misapplication, it is fairly easy to identify this species by its roughened, rugose surface texture, large stature (mature specimens hardly ever being <2 cm tall and <0.5 cm in diameter), and ascospores of the dimensions above, with a distinctly shorter than spore-length germ slit (Rogers and Callan 1986). Of the specimens examined here, BHI-F866 is immature but presumed to be *X. polymorpha* based on its robust stromata.

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Literature Cited

Banks, N.C., D.R. Paini, K.L. Bayliss, and M. Hodda. 2015. The role of global trade and transport network topology in the human-mediated dispersal of alien species. Ecology Letters 18:188–199.

Barr, M.E., J.D. Rogers, and Y.-M. Ju. 1993. Revisionary studies in the Calosphaeriales. Mycotaxon 48:529–535.

Bayman, P., P. Angulo-Sandoval, Z. Báez-ortiz, and D.J. Lodge. 1998. Distribution and dispersal of *Xylaria* endophytes in two tree species in Puerto Rico. Mycological Research 102:944–948.

Brunner, F., and O. Petrini. 1992. Taxonomy of some *Xylaria* species and xylariaceous endophytes by isozyme electrophoresis. Mycological Research 96:723–733.

Callan, B.E., and J.D. Rogers. 1993. A synoptic key to *Xylaria* species from continental United States and Canada based on cultural and anamorphic features. Mycotaxon 46:141–154.

Carroll, F.E., E. Muller, and B.C. Sutton. 1977. Preliminary studies on the incidence of needle endophytes in some European conifers. Sydowia 29:103.

Carroll, G.C. 1999. The foraging ascomycete. 16th International Botanical Congress, Abstracts. Vol. 309. Saint Louis, MO, USA.

Carroll, G.C., and F.E. Carroll. 1978. Studies on the incidence of coniferous needle endophytes in the Pacific Northwest. Canadian Journal of Botany. 56:3034–3043.

Chapman, D., B.V. Purse, H.E. Roy, and J.M. Bullock. 2017. Global trade networks determine the distribution of invasive non-native species. Global Ecology and Biogeography: a Journal of Macroecology 26:907–917.

Chlebicki, A. 2005. Some species of the genus *Diatrype* from the Czech Republic preserved in PRM, BRNM and KRAM. Czech Mycology 57:117–138.

Clark, A.T., J.J. Rykken, and B.D. Farrell. 2011. The effects of biogeography on ant diversity and activity on the Boston Harbor Islands, Massachusetts, USA. PloS One 6:e28045.

Daranagama, D.A., K.D. Hyde, E.B. Sir, K.M. Thambugala, Q. Tian, M.C. Samarakoon, E.H.C. McKenzie, S.C. Jayasiri, S. Tibpromma, J.D. Bhat, X. Liu, and M. Stadler. 2018. Towards a natural classification and backbone tree for Graphostromataceae, Hypoxylaceae, Lopadostomataceae, and Xylariaceae. Fungal Diversity 88:1–165.

Dennis, R.W.G. 1956. Some xylarias of tropical America. Kew Bulletin / Royal Botanic Gardens 11:401–444.

Dennis, R.W.G. 1961. Xylarioideae and thamnomycetoideae of Congo. Bulletin du Jardin Botanique de l'Etat, Bruxelles/Bulletin van den Rijksplantentuin, Brussel 109–154.

Elliman, T. 2005. Vascular flora and plant communities of the Boston Harbor Islands. Northeastern Naturalist 12(Special Issue 3):49–74.

Eriksson, O.E. 2006. Outline of Ascomycota. Myconet 12:1–82.

Eriksson, O.E., and K. Winka. 1997. Supraordinal taxa of Ascomycota. Myconet. vliz.be. Available online at http://www.vliz.be/en/imis?refid=67462. Accessed 30 November 2020.

Fournier, J., F. Flessa, D. Peršoh, and M. Stadler. 2011. Three new *Xylaria* species from southwestern Europe. Mycological Progress 10:33–52.

Glawe, D.A., and J.D. Rogers. 1984. Diatrypaceae in the Pacific Northwest. Mycotaxon 20:401–460.

Govinda Rajulu, M.B., N. Thirunavukkarasu, A.G. Babu, A. Aggarwal, T.S. Suryanarayanan, and M.S. Reddy. 2013. Endophytic Xylariaceae from the forests of Western Ghats, southern India: Distribution and biological activities. Mycology 4:29–37.

Granmo, A., T. Læssøe, and T. Schumacher. 1999. The genus *Nemania* sl (Xylariaceae) in Norway. Sommerfeltia 1–96.

Haelewaters, D., S.Y. Zhao, A. De Kesel, R.E. Handlin, I.R. Royer, B.D. Farrell, and D.H. Pfister. 2015. Laboulbeniales (Ascomycota) of the Boston Harbor Islands I: Species parasitizing Coccinellidae and Staphylinidae, with comments on typification. Northeastern Naturalist 22:459–477.

Haelewaters, D., A.C. Dirks, L.A. Kappler, J.K. Mitchell, L. Quijada, J.K. Mitchell, R. Vandegrift, B. Buyck, and D.H. Pfister. 2018. A preliminary checklist of fungi at the Boston Harbor Islands. Northeastern Naturalist 25(Special Issue 9):45–76.

Haelewaters, D., A. De Kesel, M. Gorczak, K. Bao, G. Gort, S.Y. Zhao, and D.H. Pfister. 2019. Laboulbeniales (Ascomycota) of the Boston Harbor Islands II (and other localities): Species parasitizing Carabidae, and the *Laboulbenia flagellata* species complex. Northeastern Naturalist 25(Special Issue 9):110–149.

Hsieh, H.M., Y.M. Ju, and J.D. Rogers. 2005. Molecular phylogeny of *Hypoxylon* and closely related genera. Mycologia, 97:844–865.

Huelsenbeck, J.P. and F. Ronquist. 2001. MRBAYES: Bayesian inference of phylogenetic trees. Bioinformatics, 17:754–755.

Jaklitsch, W.M., J. Fournier, J.D. Rogers, and H. Voglmayr. 2014. Phylogenetic and taxonomic revision of *Lopadostoma*. Persoonia 32:52–82.

Johnson, J.B., and J. Edward Gates. 2019. Bats of the Boston Harbor Islands. Northeastern Naturalist 25(Special Issue 9):90–109.

Ju, Y.M., and J.D. Rogers. 1996. A Revision of the Genus *Hypoxylon*. APS Press, St Paul, MN. 382 pp.

Ju, Y.M., and J.D. Rogers. 2002. The genus *Nemania* (Xylariaceae). Nova Hedwigia 74:75–120.

Ju, Y.M., J.D. Rogers, F. San Martín, and A. Granmo. 1998. The genus *Biscogniauxia*. Mycotaxon 66:1–98.

Ju, Y.M., J.D. Rogers, H.M. Hsieh, and L. Vasilyeva. 2004. *Amphirosellinia* gen. nov. and a new species of *Entoleuca*. Mycologia 96:1393–1402.

Kickx, J. 1835. Flore Cryptogamique des Environs de Louvain, ou Description des Plantes Cryptogames et Agames qui Croissent dans le Brabant et dans une Partie de la Province d'Anvers. Vandooren, Brussels, Belgium.

Kirk, P.M., P.F. Cannon, D.W. Minter, and J.A. Stalpers (Eds.). 2008. Ainsworth and Bisby's Dictionary of the Fungi (10th Edition). CABI, Wallingford, UK. 771 pp.

Laessøe, T. 1994. Index ascomycetum 1. Xylariaceae. Systema Ascomycetum 13:43–112.

Laessøe, T., and B.M. Spooner. 1994. *Rosellinia* & *Astrocystis* (Xylariaceae): new species and generic concepts. Kew Bulletin 49:1–70.

Laessøe, T., J.D. Rogers, and A.J.S. Whalley. 1989. *Camillea*, *Jongiella* and light-spored species of *Hypoxylon*. Mycological Research 93:121–155.

Lagreca, S., E. Lay, D. Greene, E. Kneiper, and M. Lincoln. 2005. The Lichens and Bryophytes of the Boston Harbor Islands. Northeastern Naturalist 12(Special Issue 3):77–98.

Lambert, C., L. Wendt, A.I. Hladki, M. Stadler, and E.B. Sir. 2019. *Hypomontagnella* (Hypoxylaceae): A new genus segregated from *Hypoxylon* by a polyphasic taxonomic approach. Mycological Progress 18:187–201.

Lu, B.S., and K.D. Hyde. 2000. A World Monograph of *Anthostomella*. Fungal Diversity Research Series 4. Fungal Diversity Press, Hong Kong.

Miller, J.H. 1961. A Monograph of the World Species of *Hypoxylon*. University of Georgia Press, Athens, GA. 158 pp.

MyCoPortal. 2020. Available online at http://mycoportal.org/portal/collections/index.php. Accessed 31 July 2020.

Nannfeldt, A.J. 1932. Studien uber die morphologie und systematik der nicht-lichenisierten inoperculaten discomyceten. Nova Acta Regiae Regiae Scientiarum Upsaliensis Ser. IV 8:1–368.

Nelson, A., R. Vandegrift, G.C. Carroll, and B.A. Roy. 2020. Double lives: transfer of fungal endophytes from leaves to woody substrates. PeerJ 8:e9341.

Nolfo-Clements, L. 2018. Mammals of the Boston Harbor Islands: Permanent and ephemeral residents. Northeastern Naturalist 25(Special Issue 9):77–89.

Okane, I., P. Srikitikulchai, K. Toyama, T. Læssøe, S. Sivichai, N. Hywel-Jones, A. Nakagiri, W. Potacharoen, and K.-I. Suzuki. 2008. Study of endophytic Xylariaceae in Thailand: diversity and taxonomy inferred from rDNA sequence analyses with saprobes forming fruit bodies in the field. Mycoscience 49:359–372.

Osono, T. 2007. Ecology of ligninolytic fungi associated with leaf-litter decomposition. Ecological Research 22:955–974.

Osono, T., and H. Takeda. 1999. Decomposing ability of interior and surface fungal colonizers of beech leaves with reference to lignin decomposition. European Journal of Soil Biology 35:51–56.

Osono, T., and H. Takeda. 2002. Comparison of litter decomposing ability among diverse fungi in a cool temperate deciduous forest in Japan. Mycologia 94:421–427.

Paton, P.W.C., R.J. Harris, and C.L. Trocki. 2005. Distribution and abundance of breeding birds in Boston Harbor. Northeastern Naturalist 12(Special Issue 3):145–168.

Persoh, D., M. Melcher, K. Graf, J. Fournier, M. Stadler, and G. Rambold. 2009. Molecular and morphological evidence for the delimitation of *Xylaria hypoxylon*. Mycologia 101:256–268.

Petrini, L.E. 2013. *Rosellinia*—A World Monograph. Bibliotheca Mycologica 205, Stuttgart, Germany. 410 pp.

Petrini, L.E., and E. Müller. 1986. Teleomorphs and anamorphs of European species of *Hypoxylon* (Xylariaceae, Sphaeriales) and allied genera. Mycologia Helvetica 1:501–627.

Pirozynski, K.A. 1974. *Xenotypa* Petrak and *Graphostroma* gen. nov., segregates from Diatrypaceae. Canadian Journal of Botany. 52:2129–2135.

Rappaz, F. 1987. Taxonomy and nomenclature of Diatrypaceae with eight-spored asci. Mycologia Helvetica 2:285–648.

Rappaz, F. 1995. *Anthostomella* and related xylariaceous fungi on hard wood from Europe and North America. Mycologia Helvetica 7:99–168.

Rodrigues, K.F., A. Leuchtmann, O. Petrini, and Others. 1993. Endophytic species of *Xylaria*: Cultural and isozymic studies. Sydowia 45:116–138.

Rodriguez, R.J., J.F. White Jr, A.E. Arnold, and R.S. Redman. 2009. Fungal endophytes: Diversity and functional roles. The New Phytologist 182:314–330.

Rogers, J.D. 1979. The Xylariaceae: Systematic, biological, and evolutionary aspects. Mycologia 71:1–42.

Rogers, J.D. 1983. *Xylaria bulbosa*, *Xylaria curta*, and *Xylaria longipes* in continental United States. Mycologia 75:457–467.

Rogers, J.D. 1984a. *Xylaria acuta*, *Xylaria cornu-damae*, and *Xylaria mali* in continental United States. Mycologia 76:23–33.

Rogers, J.D. 1984b. *Xylaria cubensis* and its anamorph *Xylocoremium flabelliforme*, *Xylaria allantoidea*, and *Xylaria poitei* in continental United States. Mycologia 76:912–923.

Rogers, J.D. 1986. Provisional keys to *Xylaria* species in continental United States. Mycotaxon 26:85–97.

Rogers, J.D. 2000. Thoughts and musings on tropical Xylariaceae. Mycological Research 104:1412–1420.

Rogers, J.D., and B.E. Callan. 1986. *Xylaria polymorpha* and its allies in the continental United States. Mycologia 78:391–400.

Rogers, J.D., and Y.M. Ju. 1996. *Entoleuca mammata* comb. nov. for *Hypoxylon mammatum* and the genus *Entoleuca*. Mycotaxon 59:441.

Rogers, J.D., and Y.-M. Ju. 2012. The Xylariaceae of the Hawaiian Islands. North American Fungi 7:1–35.

Rogers, J.D., A.N. Miller, and L.N. Vasilyeva. 2008. Pyrenomycetes of the Great Smoky Mountains National Park. VI. *Kretzschmaria*, *Nemania*, *Rosellinia*, and *Xylaria* (Xylariaceae). Fungal Diversity 29:107–116.

Rogers, J.D., and Ju, Y.M. 1998. The genus *Kretzschmaria*. Mycotaxon 68:345–393.

Rykken, J.J., and B.D. Farrell. 2013. Boston Harbor Islands all taxa biodiversity inventory: Discovering the "microwilderness" of an urban island park. Natural Resource Technical Report. NPS/BOHA/NRTR—2013/746. National Park Service, Fort Collins, CO. 182 pp.

Rykken, J.J., and B.D. Farrell. 2018a. Exploring the microwilderness of Boston Harbor Islands National Recreation Area: Terrestrial invertebrate all taxa biodiversity inventory. Northeastern Naturalist 25(Special Issue 9):23–44.

Rykken, J.J., and B.D. Farrell. 2018b. Six-legged colonists: The establishment and distribution of non-native beetles in Boston Harbor Islands NRA. Northeastern Naturalist 25(Special Issue 9):1–22.

Senanayake, I.C., S.S.N. Maharachchikumbura, K.D. Hyde, J.D. Bhat, E.B.G. Jones, E.H.C. McKenzie, D.Q. Dai, D.A. Daranagama, et al. 2015. Towards unraveling relationships in Xylariomycetidae (Sordariomycetes). Fungal Diversity 73:73–144.

Sir, E.B., T.C. Perera, A.I. Romero, and A.I. Hladki. 2012. Provisional dichotomic keys for the genera and species of Xylariaceae (Ascomycota) from Tucumán, Argentina. Lilloa 49:126–134.

Stadler, M. 2011. Importance of secondary metabolites in the Xylariaceae as parameters for assessment of their taxonomy, phylogeny, and functional biodiversity. Current Research in Environmenatl and Applied Mycology 1:75–133.

Stadler, M., E. Kuhnert, D. Peršoh, and J. Fournier. 2013. The Xylariaceae as model example for a unified nomenclature following the "One Fungus-One Name" (1F1N) concept. Mycology 4:5–21.

Stadler, M., D.L. Hawksworth, and J. Fournier. 2014a. The application of the name *Xylaria hypoxylon*, based on *Clavaria hypoxylon* of Linnaeus. IMA Fungus 5:57–66.

Stadler, M., T. Læssøe, J. Fournier, C. Decock, B. Schmieschek, H.-V. Tichy, and D. Peršoh. 2014b. A polyphasic taxonomy of *Daldinia* (Xylariaceae). Studies in mycology 77:1–143.

Stadler, M., C. Lambert, D. Wibberg, J. Kalinowski, R.J. Cox, M. Kolařík, andE. Kuhnert. 2020. Intragenomic polymorphisms in the ITS region of high-quality genomes of the Hypoxylaceae (Xylariales, Ascomycota). Mycological Progress 19:235–245.

Stamatakis, A. 2014. RAxML version 8: a tool for phylogenetic analysis and post-analysis of large phylogenies. Bioinformatics 30:1312–1313.

Stone, J.K., C.W. Bacon, and J.F. White Jr. 2000. An overview of endophytic microbes: endophytism defined. Pp. 17–44, *In* C.W. Bacon and J. White (Eds.). Microbial Endophytes. CRC Press, Boca Raton, FL. 500 pp.

Thomas, D.C., R. Vandegrift, A. Ludden, G.C. Carroll, and B.A. Roy. 2016. Spatial ecology of the fungal genus *Xylaria* in a tropical cloud forest. Biotropica 48:381–393.

U'Ren, J.M., J. Miadlikowska, N.B. Zimmerman, F. Lutzoni, J.E. Stajich, and A.E. Arnold. 2016. Contributions of North American endophytes to the phylogeny, ecology, and taxonomy of Xylariaceae (Sordariomycetes, Ascomycota). Molecular Phylogenetics and Evolution 98:210–232.

Vasilyeva, L.N., and S.L. Stephenson. 2004. Pyrenomycetes of the Great Smoky Mountains National Park. I. *Diatrype* Fr. (Diatrypaceae). Fungal Diversity 17:191–201.

Vasilyeva, L.N., and S.L. Stephenson. 2006. Pyrenomycetes of the Great Smoky Mountains National Park. III. *Cryptosphaeria*, *Eutypa*, and *Eutypella* (Diatrypaceae). Fungal Diversity 22:243–254.

Vasilyeva, L.N., J.D. Rogers, and A.N. Miller. 2007. Pyrenomycetes of the Great Smoky Mountains National Park. V. *Annulohypoxylon* and *Hypoxylon* (Xylariaceae). Fungal Diversity 27:231–245.

Voglmayr, H., G. Friebes, A. Gardiennet, and W.M. Jaklitsch. 2018. *Barrmaelia* and *Entosordaria* in Barrmaeliaceae (fam. nov., Xylariales) and critical notes on *Anthostomella* -like genera based on multigene phylogenies. Mycological Progress 17:155–177.

Voglmayr, H., M.B. Aguirre-Hudson, H.G. Wagner, S. Tello, and W.M. Jaklitsch. 2019. Lichens or endophytes? The enigmatic genus *Leptosillia* in the Leptosilliaceae fam. nov. (Xylariales), and *Furfurella* gen. nov. (Delonicicolaceae). Persoonia 42:228–260.

Wendt, L., E.B. Sir, E. Kuhnert, S. Heitkämper, C. Lambert, A.I. Hladki, A.I. Romero, J.J. Luangsa-ard, P. Srikitikulchai, D. Peršoh, and M. Stadler. 2018. Resurrection and emendation of the Hypoxylaceae, recognised from a multigene phylogeny of the Xylariales. Mycological Progress 17:115–154.

Whalley, A.J.S. 1996. The xylariaceous way of life. Mycological Research 100:897–922.

Wijayawardene, N.N., K.D. Hyde, L.K.T. Al-Ani, L. Tedersoo, D. Haelewaters, K.C. Rajeshkumar, R.L. Zhao, A. Aptroot, et al. 2020. Outline of Fungi and fungus-like taxa. Mycosphere, Journal of Fungal Biology 11:1060–1456.