

Studies in Lichens and Lichenicolous Fungi – No. 23: Notes on Appalachian taxa including newly reported disjunctions and multiple species new to North America

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ABSTRACT. – *Arthonia ligniariella* is reported for the first time from eastern North America based on a collection growing on lignum in North Carolina, U.S.A. *Biatora appalachensis*, an Appalachian endemic, is shown to be widespread throughout the Appalachian Mountains, primarily at high elevations. The only report of *Fellhanera parvula* from North America (Tennessee, U.S.A.) is considered to be *F. bouteillei*. *Fellhanera subtilis*, previously reported in North America from the Pacific Northwest, is reported for the first time from eastern North America (southern Appalachian Mountains). *Gyalideopsis mexicana*, previously reported in North America from the Yukon, Canada and New Mexico, U.S.A. is newly reported from eastern North America (southern Appalachian Mountains, North Carolina, U.S.A.). *Lepra ouahensis*, a sorediate species with lichexanthone and stictic acid, is reported from disjunct areas of the southern Appalachian Mountains and the Southeastern Coastal Plain. Its distribution is compared to the lichexanthone producing chemotypes of *L. trachythallina* and *Varicellaria velata*. *Rockefellerella crossophylla*, a rare species considered extinct in Pennsylvania, U.S.A. is reported to be extant in that state. *Psoronactis dilleniana* is newly reported from North America from high elevations of the central and southern Appalachian Mountains (North Carolina and Virginia U.S.A.). *Xenonectriella streimannii* is newly reported for North America based on a collection found growing on *Anaptychia palmulata* in Georgia, U.S.A.

KEYWORDS. – Biodiversity hotspot, biodiversity inventory, biogeography, floristics, natural history collections.

INTRODUCTION

Routine fieldwork and revision of herbarium specimens often results in the discovery of significant range extensions, occurrences of rare species, and revisions to existing published records. That is even the case for lichens and lichenicolous fungi in relatively well-studied and well-explored areas such as the Appalachian Mountains of eastern North America, where previously undescribed or undocumented species continue to be found at a remarkable rate (e.g., Tripp & Lendemer 2019). The present contribution details six noteworthy range extensions of lichens (*Arthonia ligniariella*, *Biatora appalachensis*, *Fellhanera subtilis*, *Gyalideopsis mexicana*, *Lepra ouahuensis*, *Psoronactis dilleniana*) and one lichenicolous fungus (*Xenonectriella streimannii*) from the Appalachian Mountains of eastern North America. The name *Lepra ouahuensis* is validated and the rediscovery of *Rockefellerella crossophylla* in the northern Appalachians, after more than a century, is documented.

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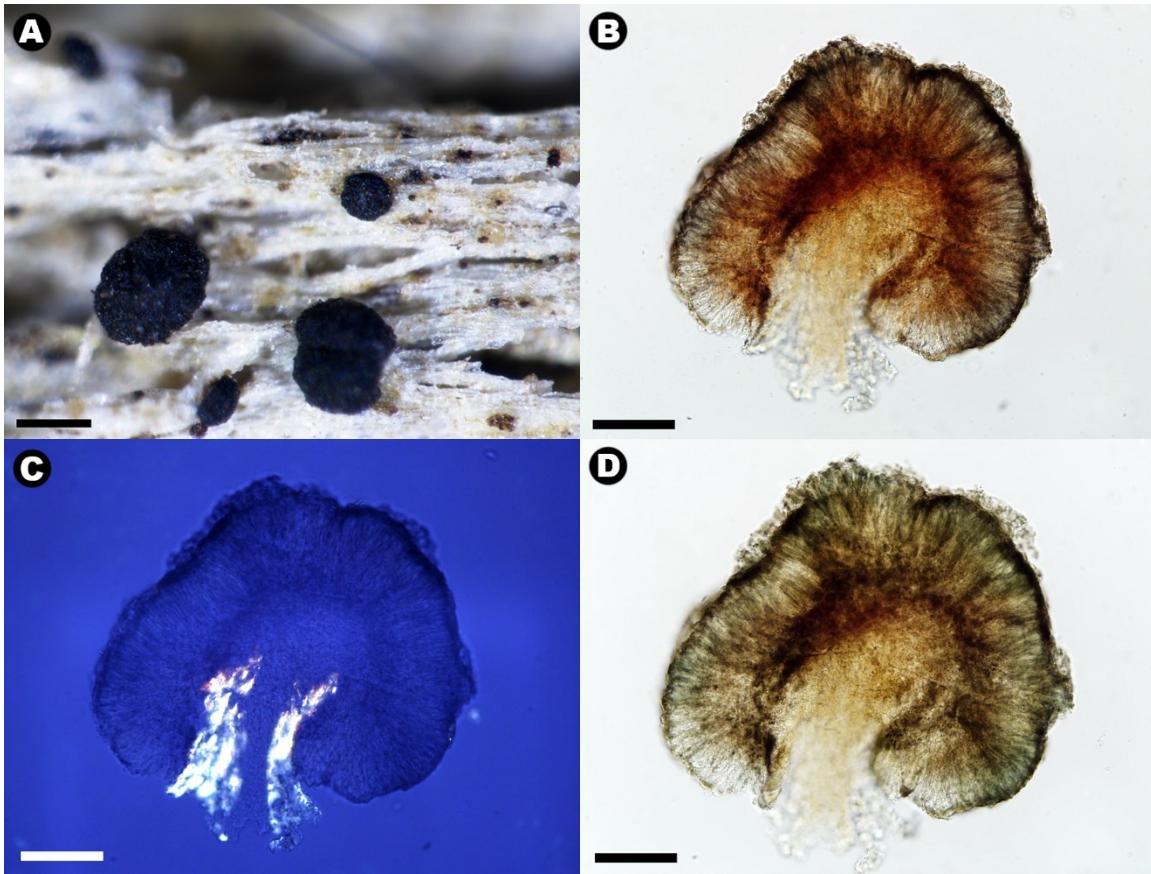


Figure 1. *Arthonia lignariella* (all from Lendemer *et al.* 43492). **A**, morphology of the apothecia illustrating variation from young apothecia with distinct margin to convex with the margin excluded. **B–D**, transverse section of apothecium mounted in water (**B**), in water viewed with polarizing light (**C**) and after treatment with KOH (**D**). Scales = 0.2 mm in **A**, 100 μ m in **B–D**.

MATERIALS AND METHODS

This study was based on specimens deposited in the herbarium of the New York Botanical Garden (NY). Georeferenced voucher data for all specimens examined can be accessed through the C.V. Virtual Herbarium at NY (<http://sweetgum.nybg.org/science/vh/>). All specimens were initially studied dry using an Olympus SZ-STB dissecting microscope. Microscopic morphology and anatomy were then studied using an Olympus BX53 compound microscope and sections prepared by hand with a razor blade and mounted in water or iodine. The presence of crystals in the apothecia and thalli were studied using polarizing (POL) filters. Chemistry was studied using standard tests (K, C, KC, P, UV) following Brodo *et al.* (2001) and supplemented by Thin Layer Chromatography (TLC) using Solvents A and C following Culberson and Kristinsson (1970) but as modified for the peanut butter jar by Lendemer (2011a) with Solvent C using the ratio of 200:30 toluene:glacial acetic acid.

I – ARTHONIA LIGNARIELLA REPORTED FROM TO EASTERN NORTH AMERICA

Arthonia Ach. is a highly diverse, heterogenous assemblage of crustose lichens and allied fungi that includes 158 species which have been reported from North America (Esslinger 2021). Despite the extraordinary diversity, there are still numerous poorly understood and apparently undescribed species known from the region (e.g., Harris & Ladd 2005). Recently Weber *et al.* (2022) drew attention to the discovery of *A. lignariella* Coppins in Finland, and highlighted the occurrence of the species in mature, old-growth forest habitats. The illustrations provided in that publication led to the connection with a

voucher collected in the southern Appalachian Mountains nearly a decade ago. Subsequent study confirmed that the material represents *A. ligniariella* and is the first report of the species from eastern North America.

Arthonia ligniariella was described by Coppins (1989) from Scotland based on material collected on a variety of wood substrates, including both hardwoods (*Fagus*, the type; *Quercus*; unidentified hardwoods) and *Pinus*, as well as on bryophytes. It was then reported from the bark of *Thuja* in old growth forests from British Columbia, Canada in western North America (Houde et al. 2007, Spribille & Björk 2008). Thor and Søchting (2018) reported it from Denmark based on records from the branches of *Sambucus*, and from a mature European beech (*Fagus sylvatica*). The mixture of records from old, stable substrates in mature forests, and those from less stable and more frequently disturbed habitats requires further study. The occurrence reported here is from a relatively mature high elevation northern hardwood forest on the wood of an old yellow birch (*Betula alleghaniensis*).

The lignicolous habit, initially plane and eventually convex, black apothecia, reddish-brown pigmented hypothecium, I- hymenium and hyaline, 2-celled ascospores distinguish *A. ligniariella* from most similar species (Coppins 1989; see Figure 1 herein). As was the case for the material reported by Weber et al. (2021) the specimen from North Carolina has ascospores smaller than those reported in the protologue $[(7.0)-(7.9)-8.7-(9.6)-[10.6] \times [2.1)-(2.3)-2.8-(3.2)-[3.5]$, $n=22$ vs. $10.5-14 \times 3-3.5 \mu\text{m}$ reported by Coppins 1989). Despite extensive fieldwork in similar habitats, the species has not been located elsewhere in eastern North America to date.

Specimen examined. – U.S.A. NORTH CAROLINA. YANCEY CO.: North Carolina. Pisgah National Forest, Deep Gap just S of camping area, Black Mountain Crest Trail 4.2 mi N of Mount Mitchell, 31 May 2014, on *Betula alleghaniensis* wood, J.C. Lendemer et al. 43492 (NY).

II – BIATORA APPALACHENSIS OCCURS THROUGHOUT THE APPALACHIAN MOUNTAINS

Biatora appalachensis Printzen and Tønsberg was described from high elevations of the southern Appalachian Mountains nearly two decades ago (Printzen & Tønsberg 2004). It is a highly distinctive sorediate crustose lichen that can be recognized by its large, typically convex soralia, bright greenish-yellow soredia (Figure 2), and the presence of only gyrophoric acid (spot tests K-, C+ pink, KC+ pink, P-, UV-; Printzen & Tønsberg 2004). The species has subsequently been found to occur commonly in spruce-fir and northern hardwood forests throughout the southern Appalachian Mountains where it grows on the bark, branches and lignum of both conifers and hardwoods (Tripp & Lendemer 2020). It has also been reported from coastal Maine in New England (Seaward et al. 2017).

Recently the author and several others (Tomas Curtis, Dennis Waters) collected material of this species in areas of its range between Maine and Virginia, U.S.A., especially in the central Appalachians. This led to the review of the holdings of sterile sorediate crustose lichens at NY and to the discovery of many additional occurrences. Here an updated distribution map for *Biatora appalachensis* is provided and specimens that document its extended distribution throughout the Appalachian Mountains are cited (Figure 3). Based on the specimens examined, the species is mostly restricted to high elevations, and is frequently associated with the occurrence of red spruce (*Picea rubens*) and yellow birch (*Betula alleghaniensis*), although it may occur on other substrates in stands that include those species. In Pennsylvania there are a number of collections from eastern hemlock (*Tsuga canadensis*) roots and shaded sandstone outcrops.

Selected specimens examined. – U.S.A. GEORGIA. RABUN CO.: Chattahoochee National Forest, S-slopes of Wolf Knob, 23.iv.2019, on *Acer*, J.C. Lendemer 59733 & M.F. Hodges (NY). UNION CO.: Chattahoochee National Forest, slopes above W shore of tributary to Cooper Creek, 9.i.2019, on *Betula*, J.C. Lendemer 57924 & E. Tripp (NY). KENTUCKY. HARLAN CO.: E-slopes of Pine Mountain, Kentenia State Forest, S of Little Shepherd Trail/SR1679 between Mill Cliff Branch and Hi Lewis Branch, 12.iv.2022, on *Quercus* base, J.C. Lendemer et al. 72751 (NY). PERRY CO.: Daniel Boone National Forest, Old Field Branch of Leatherwood Creek, 6.x.2001, on rock, R.C. Harris 44691 (NY). NEW JERSEY. SUSSEX CO.: High Point State Park, Dryden Kuser Natural Area, 1.v.2022, on *Betula*, D.P. Waters 6976 (NY). NORTH CAROLINA. AVERY CO.: Grandfather Mountain State Park, Grandfather Mountain, N-slopes N of Profile Trail, ~0.3 mi W of jct w/ Grandfather Trail, 13.vii.2020, on *Picea* branch, J.L. Allen 5686 (NY). BUNCOMBE CO.: Blue Ridge Parkway, S face of Potato Knob, 2.x.2014, on *Abies* branch, J.C. Lendemer 44236 & J.L. Allen (NY). BURKE CO.: Pisgah National Forest, Linville Gorge Wilderness Area, Jonas Ridge, summit of Gingercake Mountain, 30.vi.2020, on *Kalmia*, J.C. Lendemer 65-

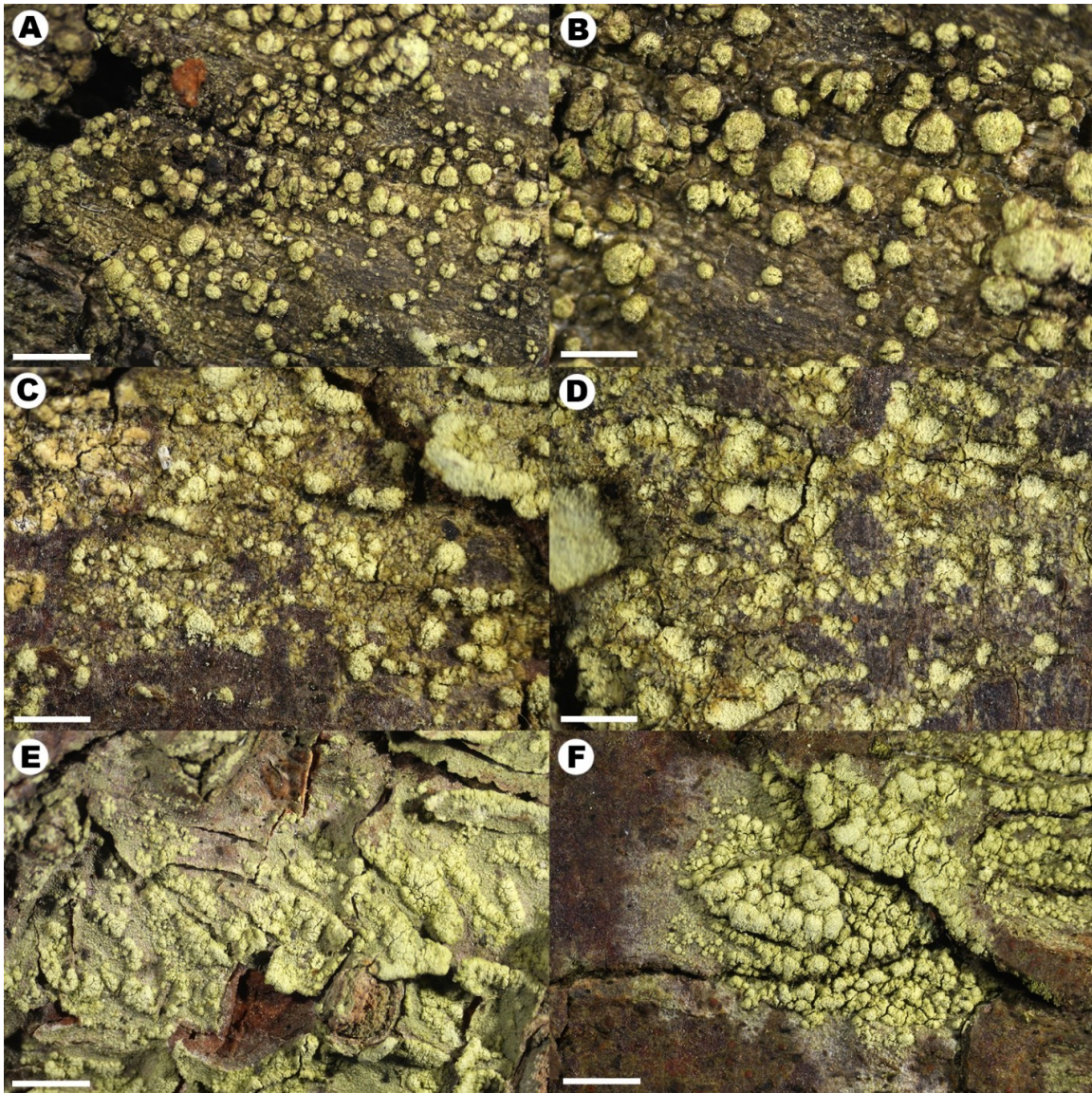


Figure 2. Morphology of *Biatora appalachensis* (A & B from *Lendemer* 7715, C & D from *Lendemer* 24548, E & F from *Lendemer* 25124). **A**, gross morphology of typical southern Appalachian individual. **B**, detail of thallus and soralia in southern Appalachian individual. **C and D**, thallus and soralia in central Appalachian individual illustrating circular but less distinctively convex soralia. **E**, central Appalachian individual with soralia becoming contiguous. **F**, central Appalachian individual with closely spaced, convex soralia. Scales = 2.0 mm in A, E and F; 1.0 mm in B–D.

-709 (NY). GRAHAM CO.: Nantahala National Forest, Joyce Kilmer-Slickrock Wilderness Area, Stratton Bald Trail 0–0.25 mi SW of Naked Ground, 19.vi.2015, on large *Betula*, *J.C. Lendemer* 45832 & *J.L. Allen* (NY). HAYWOOD CO.: Great Smoky Mountains National Park, Balsam Mountain, Beech Gap, N of Ledge Bald, 18.vi.2019, on *Picea* branch, *J.C. Lendemer et al.* 60327 (NY). JACKSON CO.: Blue Ridge Parkway, Richland Balsam, ~0.25 mi NW of Haywood Jackson Overlook, 4.vi.2014, on *Prunus*, *J.L. Allen* 2943 (NY). MACON CO.: Nantahala National Forest, Southern Nantahala Wilderness, ~3 mi N of Tate City, 17.ix.2006, on *Betula*, *J.C. Lendemer et al.* 7715 (NY). MADISON CO.: Pisgah National Forest, Bald Mountains, S-slopes of Spring Mountain, 17 Aug. 2020, on log, *J.C. Lendemer* 69241 (NY). MITCHELL CO.: Pisgah National Forest, Roan Mountain, Grassy Ridge Bald above Chimney End Ridge, 28.vii.2020, on *Abies*, *J.C. Lendemer* 67706 (NY). SWAIN CO.: Great Smoky Mountains National Park, N-facing slopes of High Rocks, High Rock Ridge, 29.v.2019, on large *Betula*, *J.C. Lendemer* 62992 & *R. Walston*

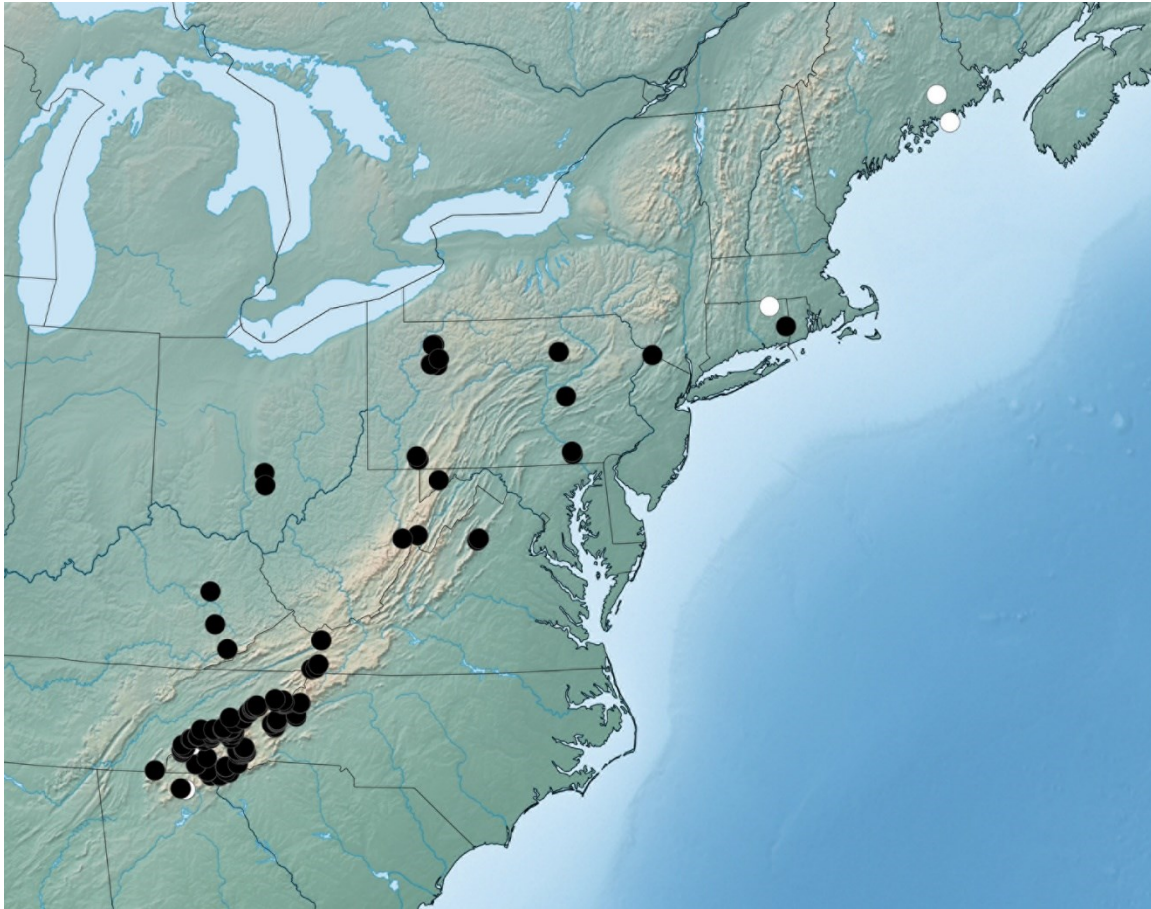


Figure 3. Known geographic distribution of *Biatora appalachensis* based on specimens examined for this study including those from collaborators T. Curtis and D.P. Waters (black dots), and records in the Consortium of North American Lichen Herbaria (CNALH, white dots, downloaded 25 November 2022).

(NY). WATAUGA CO.: Grandfather Mountain State Park, Grandfather Mountain, S slopes of Calloway Peak, 13.vii.2020, on *Abies* branch, J.C. Lendemer et al. 66660 (NY). YANCEY CO.: Pisgah National Forest, Craggy Mountains, W-slopes of Big Butt, Brush Fence Ridge, 5.vii.2020, on fallen *Picea* branch, J.C. Lendemer 66345 (NY). PENNSYLVANIA. CLARION CO.: Cook Forest State Park, Rhododendron/Indian Trail Loop, 6.ix.2010, on *Tsuga* root, J.C. Lendemer 24548 (NY). ELK CO.: Allegheny National Forest, FR131 1.25 mi SW of jct w/ FS228, 9.ix.2010, on *Tsuga* root, J.C. Lendemer 25124 (NY). FAYETTE CO.: Ohiopyle State Park. Cucumber Falls/Great Gorge Trail, 30.iv.2018, on *Betula*, D.P. Waters 3264 (NY). JEFFERSON CO.: Clear Creek State Park, Phyllis Run 0.25–0.75 mi N of confluence w/ Clear Creek, 8.ix.2010, on *Picea* root, J.C. Lendemer 24782-A (NY). NORTHUMBERLAND CO.: Wildlife Preserve, ca. 2.5 mi W of Alaska, S of PA 901, 20.v.2009, on *Acer*, J.C. Lendemer 17665 & R.C. Harris (NY). SULLIVAN CO.: Worlds End State Park, along Mineral Spring Rd. ~0.25 mi from int. w/ PA154, 18.iv.2004, on sandstone, J.C. Lendemer 2196 & J.A. Macklin (NY). YORK CO.: Apollo County Park, N section via Boyd Road Access, 9.viii.2009, on *Betula* root, J.C. Lendemer 19425 (NY), on rock, J.C. Lendemer 19452 (NY); State Game Lands No. 83, S shore of Sawmill Run, 9.viii.2009, on rock, J.C. Lendemer 19379 (NY). TENNESSEE. BLOUNT CO.: Great Smoky Mountains National Park, ridge E of Little River Gorge Rd., ~3.7 mi NE of jct w/ TN73, 9.xii.2017, on *Amelanchier*, J.C. Lendemer et al. 53802 (NY). CARTER CO.: Cherokee National Forest, N-slopes of Roan Mountain, Round Bald, 19.iii.2018, on *Picea*, J.C. Lendemer 56121 & E. Tripp (NY). COCKE CO.: Cherokee National Forest, Stone Mountain, W-facing slopes of Hall Top, 19.x.2018, on *Acer* root, J.C. Lendemer 56789 (NY). MONROE CO.: Cherokee National Forest, Unicoi Mountains, Bob Bald, Benton MacKeye Trail/Bob Bald Connector/Trail54A, 18.xii.2017, on *Betula*, J.C. Lendemer 54753 & E. Tripp (NY). POLK CO.: Cherokee National Forest, Big Frog Wilderness Area, E-slopes of Bark Logging Lead of

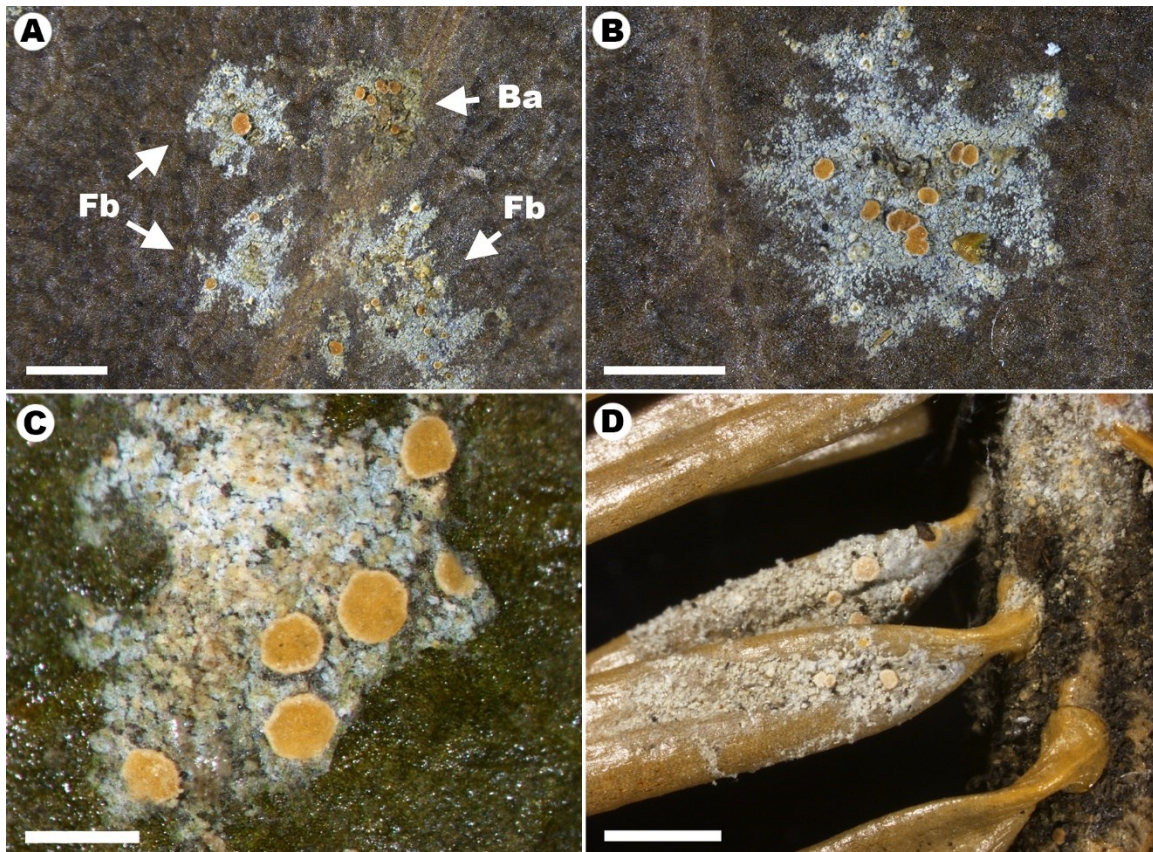


Figure 4. Comparison of voucher cited as *Fellhanera parvula* (A and B, Pursell 3399) to reference specimens of *F. bouteillei* from Central America (C, Lücking 92-9205, NY) and Europe (D, Lettau 207, NY). Note admixture of *F. bouteillei* (“Fb”) and *Bacidia apiahica* (“Ba”) in A. Scales = 2mm in D, 1.0 mm in A and B, 0.5 mm in C.

Big Frog Mountain, 16.xii.2017, on *Betula*, J.C. Lendemer 54462 & E. Tripp (NY). SEVIER CO.: Great Smoky Mountains National Park, Mount LeConte, N-facing slopes above Trillium Gap Trail, 24.x.2018, on *Sorbus*, J.C. Lendemer 57108 (NY). UNICOI CO.: Cherokee National Forest, Unaka Mountain, areas just N of Unaka Mountain Wilderness, Dark Hollow Trail/Trail #32, 8.iii.2018, on *Tsuga* root, J.C. Lendemer 55152 & E. Tripp (NY). VIRGINIA. GRAYSON CO.: Jefferson National Forest, 0.5 mi SW of VA 16 on VA 741/Homestead Rd., 5.iv.2008, on *Acer*, R.C. Harris 54023 (NY). MADISON CO.: Shenandoah National Park, Central District, Hemlock Springs talus, 24.iv.2021, on large *Betula* root, J.C. Lendemer 70467 (NY). PAGE CO.: Shenandoah National Park, Central District, W slopes of The Pinnacle, 15.x.2020, on *Kalmia*, J.C. Lendemer 70271 (NY). SMYTH CO.: Jefferson National Forest, Whitetop Mountain, 6.iv.2008, on *Picea* branch, R.C. Harris 54084 (NY).

III – FELLHANERA PARVULA EXCLUDED FROM NORTH AMERICA

The majority of *Fellhanera* species that have been reported from North America are corticolous, lignicolous or saxicolous (Harris & Lendemer 2009). While many foliicolous species are known to exist (Lücking 2009), only *F. bouteillei* (Desm.) Vězda and *F. subtilis* (Vězda) Diederich & Sérus. are currently included on the North American lichen checklist (Esslinger 2021). The former is widespread in humid subtropical and temperate areas of North America, where it grows on the leaves of evergreen shrubs and trees, as well as on conifer needles and branches (McCune 2017, Tripp & Lendemer 2020). The latter species has been reported from the Pacific Northwest (Goward et. al. 1996) and is newly reported from eastern North America below.

While keying out foliicolous lichens from the southern Appalachian Mountains using Lücking (2009), the first author noticed a cited specimen of *F. parvula* (Vězda) Vězda from eastern Tennessee, USA

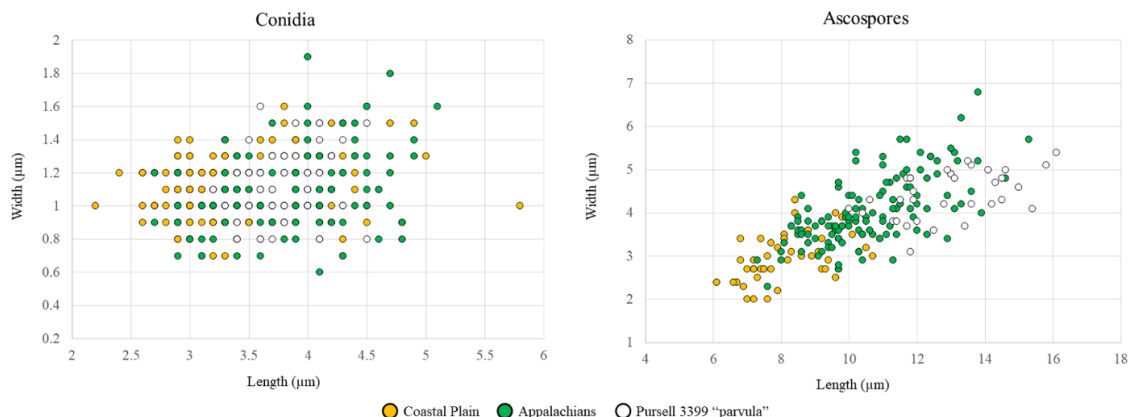


Figure 5. Graphical comparison conidium (left) and ascospore (right) size in material of *Fellhanera boutellei* from the Coastal Plain of southeastern North America (orange points), southern Appalachian Mountains (green points) and specimen cited as *F. parvula* (Pursell 3399, white points).

(*R.A. Pursell 3399*, NY; Lücking 2009: 649). Evidently the report had been overlooked, as *F. parvula* does not appear in Esslinger (2021). This led to the question of whether *F. parvula* was present and widespread in the southern Appalachians, having been previously confused with *F. boutellei*. The two species are similar in having pallid to slightly yellowish apothecia, and differ slightly in the size of the conidia ($3\text{--}4 \times 1\text{--}1.5\text{ }\mu\text{m}$ in *F. parvula* vs. $4\text{--}5 \times 1.5\text{--}2\text{ }\mu\text{m}$ in *F. boutellei*), apothecia ($0.1\text{--}0.4\text{ mm}$ in diameter $\times 70\text{--}120\text{ }\mu\text{m}$ high in *F. parvula* according to description on p. 649 but $0.08\text{--}0.2\text{ mm}$ in diameter according to the key on p. 629) vs. $0.2\text{--}0.4\text{ mm} \times 100\text{--}150\text{ }\mu\text{m}$ high in *F. boutellei*) and ascospores ($6\text{--}14 \times 2\text{--}4\text{ }\mu\text{m}$ in *F. parvula* vs. $10\text{--}17 \times 3\text{--}6\text{ }\mu\text{m}$ in *F. boutellei*) (all *fide* Lücking 2009: 648 and 649). According to Lücking (2009: 249), in addition to the slight size differences outlined above, *F. parvula* has a green thallus that should lack usnic acid, while that of *F. boutellei* is blue-gray and produces usnic acid together with zeorin (Figure 4).

The voucher cited as *Fellhanera parvula* by Lücking (2009) was filed at NY as *F. boutellei* and had not been annotated as *F. parvula*. The specimen includes multiple thalli of a *Fellhanera* that resemble *F. boutellei*, as well as fewer, scattered thalli that differ in having minute, dark yellow-orange biatorine apothecia and a poorly-developed, dark green thallus. Initially it seemed that the latter could be *F. parvula*, but microscopic examination revealed hyaline, acicular ascospores and that the thalli belong to *Bacidia apiahica* (Müll. Arg.) Zahlbr. (see Lücking 2009; $\equiv$ *Bacidina apiahica* (Müll. Arg.) Vězda). The thalli of *Fellhanera* from Pursell 3399 were compared to collections of *F. boutellei* from the southern Appalachians, the Coastal Plain of southeastern North America, and Europe. The size ranges for the morphological characters of Pursell 3399, as well as the eastern North American specimens of *F. boutellei* examined, match those reported for the latter species and not for *F. parvula* (Figure 5). The size ranges of the eastern North American material also match that of European reference specimens of *F. boutellei*. In addition, the thalli in Pursell 3399 produce usnic acid and zeorin, which was confirmed with comparative TLC using other vouchers of *F. boutellei* from Tennessee. Based on the above, I conclude that the voucher cited by Lücking (2009) corresponds to *F. boutellei* and that *F. parvula* should not be included in the North American checklist at present.

Selected specimens examined. – **LITHUANIA.** TELŠIAI: Zemaitija National Park, Plunge district, Polkstone, 1.vii.2003, on *Picea* twigs and needles, *J. Montiejunaite 6876* (NY). **U.S.A. GEORGIA.** CHATHAM CO.: Wormsloe State Historic Site, 4.xi.2011, on *Sabal* leaf, *M.F. Hodges 7686* (NY). MISSISSIPPI. FORREST CO.: Ragland Hills, S of the Leaf River, 17.iii.2022, on *Sabal* frond, *J.C. Lendemer 72538* (NY). GEORGE CO.: Harvell & Pellerree Jackson Sandhills TNC Preserve, 15.iii.2022, on *Serenoa* frond, *J.C. Lendemer 72440* (NY). WAYNE CO.: De Soto National Forest, Brewertown Sandhill, 14.iii.2022, on *Ilex vomitoria* leaves, *J.C. Lendemer 72006* (NY). NORTH CAROLINA. CRAVEN CO.: Croatan National Forest, Still Gut 0–0.5 mi SW of FS3046/Hope Rd., 6.iii.2013, on *Sabal* leaf, *J.C. Lendemer et al. 35404* (NY). DARE CO.: Buxton Woods Coastal Reserve, SE of jct of Great

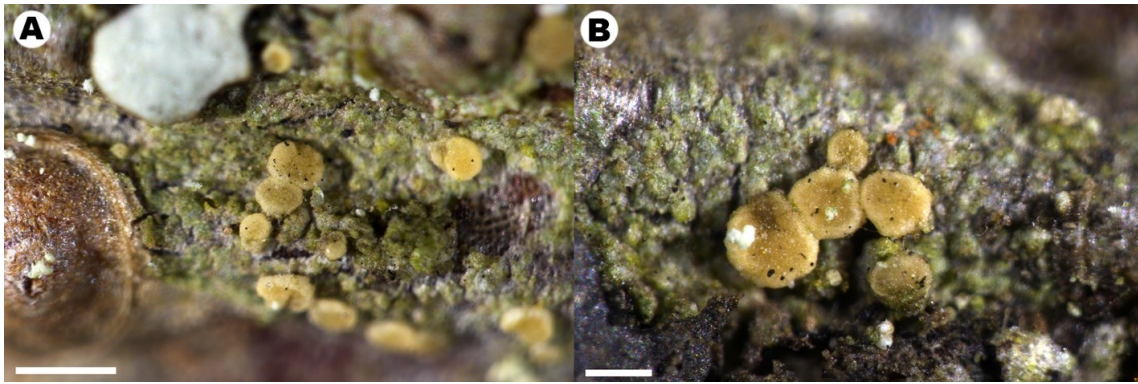


Figure 6. Thallus and apothecia *Fellhanera subtilis* from the southern Appalachian Mountains, U.S.A. (both from *Lendemer 66462*). Scales = 0.5 mm in A, 0.2 mm in B.

Ridge Rd. and Water Association Rd., E of West Trail, 18.viii.2013, on *Sabal* leaf, *J.C. Lendemer 35965* (NY). HAYWOOD CO.: Great Smoky Mountains National Park, Cataloochee, vicinity of Caldwell House, 20.x.2012, on *Rhododendron* leaves, *J.C. Lendemer 33327* & *A. Moroz* (NY). JACKSON CO.: Nantahala National Forest, Ellicott Rock Wilderness, E shore of Chattooga River downstream of confluence with Fowler Creek, 5.vi.2018, on *Leucothoe* leaves, *J.C. Lendemer 56511* (NY). MACON CO.: Nantahala National Forest, E side of Chattooga River 0.25–0.75 mi N of FSR1178/Bull Pen Rd., 25.vi.2016, on *Rhododendron* leaves, *J.C. Lendemer 47310* (NY). MADISON CO.: Pisgah National Forest, Shelton Laurel, along Big Creek Road near Fork Ridge Trailhead, 7.viii.2020, on *Rhododendron* leaves, *J.P. Hollinger et al. 24132* (NY). SWAIN CO.: Great Smoky Mountains National Park, Forney Creek Trail, between crossing over Bear Creek and jct with Lakeshore Trail, 29.vi.2010, on *Rhododendron* leaves, *J.C. Lendemer et al. 23553* (NY). SOUTH CAROLINA. BEAUFORT CO.: Spring Island, NW side, 0–0.25 mi S of Shrimp Pond Rd., 21.xii.2013, on *Sabal* leaf, *J.C. Lendemer et al. 42437* (NY). OCONEE CO.: Sumter National Forest, Ellicott Rock Wilderness, low S-facing slopes of Fork Mountain, 18.iv.2019, on *Rhododendron* leaf, *J.C. Lendemer 58944* (NY). TENNESSEE. CARTER CO.: Cherokee National Forest, N-slopes of Roan Mountain, Round Bald, 19.iii.2018, on *Abies* branch, *J.C. Lendemer 56136* & *E. Tripp* (NY). GREENE CO.: Cherokee National Forest, Gravel Knob, 7.viii.2020, on *Rhododendron* leaves, *J.P. Hollinger et al. 24136* (NY). SEVIER CO.: Great Smoky Mountains National Park, Alum Cave Parking Area, ca. 6 mi S.E. of Gatlinburg, 14.ix.1958, on *Rhododendron* leaves, *R.A. Pursell 3399* (NY, cited as *Fellhanera parvula* by Lücking 2009). UNICOI CO.: Cherokee National Forest, Unaka Mountain, W-facing slopes above Red Fork Rd./FSR230, 17.iii.2018, on *Rhododendron* leaves, *J.C. Lendemer 55910* & *E. Tripp* (NY).

IV – FELLHANERA SUBTILIS REPORTED FROM EASTERN NORTH AMERICA

Fellhanera subtilis was originally described from the Czech Republic as *Bacidia subtilis* (Vězda 1961) and transferred to *Fellhanera* by Sérusiaux (1990). It is a corticolous and foliicolous crustose lichen that has been reported from many areas of Europe (Belgium: Sérusiaux 1990; Belarus: Yatsyna & Motiejūnaitė 2015; Denmark: Søchting et al. 1992; Estonia: Marmor et al. 2013; Finland: Harmaja 1995; Greece: Christensen 2018; Italy: Tretiach 1992; Lithuania: Motiejūnaitė 1995; Poland: Miadlikowska 1997, Węgrzyn 2002; Romania: Vondrák & Liska 2013; Sweden: Zhurbenko & Nordin 2020; The Netherlands: Spier 1994). It has also been reported from central Asia (Davydov & Printzen 2012) and eastern Asia (Aptroot & Moon 2014, Kondratyuk et al. 2015). In North America it has been reported only from the Pacific Northwest in Canada (Goward et al. 1996).

During fieldwork in the southern Appalachian Mountains, *Fellhanera subtilis* was found at several sites in mature, high elevation spruce-fir forests where it grew on the young branches of Fraser Fir (*Abies fraseri*) in close association with *F. bouteillei*. While the latter species is superficially similar to *F. subtilis*, it differs in having a granular (vs. smooth) thallus, usually yellowish (vs. pallid) apothecia, and 2-celled (vs. 4-celled) ascospores (Figure 6 herein; Lücking 2009, Vězda 1961). Interestingly, in the southern Appalachians, *F. bouteillei* is primarily foliicolous (Tripp & Lendemer 2020) and when growing with *F. subtilis* was largely restricted to the needles of the phorophyte, rather than the adjacent bark of the

branches. The reports of *F. subtilis* published here extend its range a considerable distance into southeastern North America where it likely belongs to a suite of species with oceanic distributions in Europe and northern North America, but which are disjunct to high elevations of the southern Appalachian (see Tripp & Lendemer 2019).

Specimens examined. – **GERMANY.** BAVARIA. BAYERN: Niederbayern, Lkr. Freyung-Grafenau, National Park Bayerischer Wald, 0.3–0.4 km SW of lake Rachel-See, 13.x.1999, on *Vaccinium*, *T. Tønsberg* 28199 (NY). **LITHUANIA.** UTENA: Aukštaitija National Park, Ignalina district, ca. 4 km S of Ginučiai village, 28.vi.1995, *J. Montiejunaite* 2674 (NY). **POLAND.** Pojezierze Kaszubskie, Stanisławskie Bloto Nature Reserve, 20.ix.1998, on *Vaccinium*, *W. Faltynowicz s.n.* (NY). **U.S.A.** NORTH CAROLINA. HAYWOOD CO.: Great Smoky Mountains National Park, S slopes of Big Cataloochee Mountain, between Balsam Corner and Big Butt, 6.vii.2020, on *Picea* branch, *J.C. Lendemer* 66462 & *J. Hollinger* (NY). MITCHELL CO.: Pisgah National Forest, Roan Mountain, Grassy Ridge Bald above Chimney End Ridge, 28.vii.2020, on *Abies* branch, *J.C. Lendemer* 67732 (NY). TENNESSEE. SEVIER CO.: Great Smoky Mountains National Park, Mount LeConte, N-facing slopes above Trillium Gap Trail, 24.x.2018, on *Abies* branch, *J.C. Lendemer* 57088 (NY).

V – GYALIDEOPSIS MEXICANA NEW TO EASTERN NORTH AMERICA

Gyalideopsis mexicana Tretiach, Giralt & Vězda was originally described from montane central Mexico in South America (Hafellner 2016, Tretiach et al. 1996). It is a very distinctive species with large, pale, stalked hyphophores and diahyphae aggregated in a conspicuous globose mass at the apex (Tretiach et al. 1996; Figure 7 herein). The distribution of this unusual species is poorly understood, and it has subsequently been reported growing over mosses in the Yukon, Canada (Lendemer 2011b) and on organic matter or soil at high elevations of New Mexico in the United States (Lendemer & Tripp 2014). During recent fieldwork in Great Smoky Mountains National Park, the species was found growing abundantly over mosses on one large boulder at a remote site in Swain County, North Carolina. The southern Appalachian Mountains of eastern North America are widely recognized as a biodiversity hotspot for lichens, including many disjunct species (Sheard et al. 2012, Tripp & Lendemer 2019). Nonetheless the discovery of *G. mexicana* was quite unexpected, and this is the first report of the species from eastern North America.

Specimen examined. – **U.S.A.** NORTH CAROLINA. SWAIN CO.: Great Smoky Mountains National Park, N-facing slopes of High Rocks, High Rock Ridge, 29.x.2019, on rock, *J.C. Lendemer* 63027 & *R. Walston* (NY).

VI – LEPR A OUAHUENSIS NEW TO NORTH AMERICA

Recently, Paul Diederich contacted the author regarding the identity of a sterile sorediate crustose lichen that hosted an undescribed lichenicolous basidiomycete, now described as *Tremella leprae* Diederich (Diederich et al. 2022). The lichen produced lichexathone and stictic acid, two substances that are rarely found together in North American lichens (Lendemer, unpublished data). The specimen was collected in the southern Appalachian Mountains of Georgia, U.S.A. at a high elevation site that had been visited by the author. It also matched an unidentified voucher at NY that had been collected elsewhere in northern Georgia (*Tripp* 9112-A). Review of the literature led to *Lepra ouahuensis* H. Magn. ex Bungartz, A.W. Archer & Elix, a species described from Hawaii, U.S.A. and not apparently yet reported from outside of that region. Material with the same chemistry was reported from Florida, U.S.A. by Harris (1995: 51) as *Pertusaria* “sp. Buck 16889” and has been found at scattered locations throughout the Mid-Atlantic Coastal Plain of southeastern North America (Figure 8). It appears all the North American collections represent one species that is distributed in the Coastal Plain with a disjunct population at high elevations in the southern Appalachian Mountains (Figure 8). Although on the surface this disjunction may seem unusual, the lichexanthone producing variants of *Lepra trachythallina* (Erichsen) Lendemer & R.C. Harris and *Varicellaria velata* (Turner) I. Schmitt & Lumbsch also have similar distribution patterns (Figure 9). *Lepra ouahuensis* is here reported for the first time from North America, the presence in this region suggests that it may be more widespread in tropical and subtropical regions than has previously been recognized.

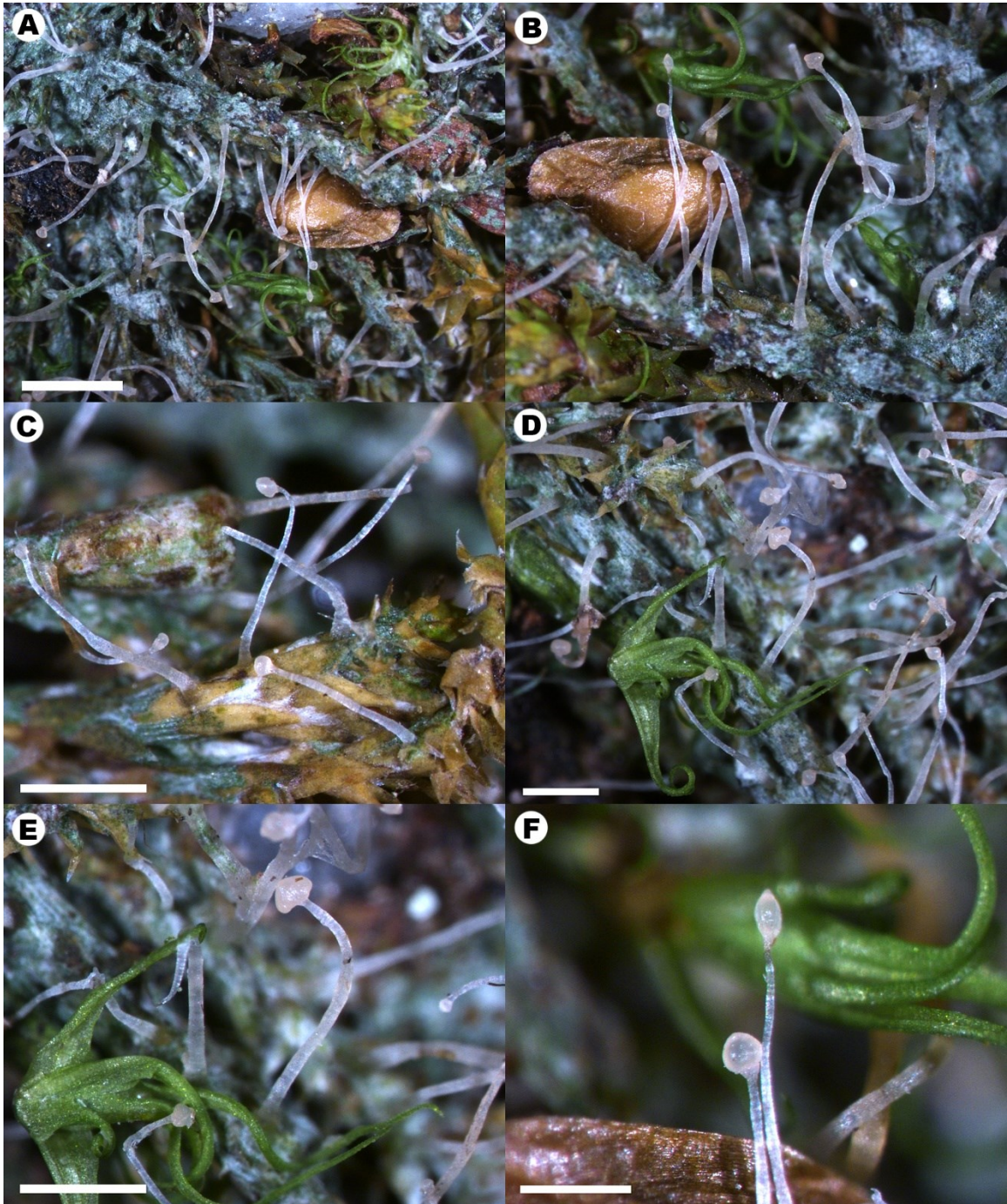


Figure 7. *Gyalideopsis mexicana* (all from *Lendemer 63027*, NY). **A**, gross morphology of the thallus and hyphophores. **B–D**, detail of the hyphophores. **E** and **F**, detail of the apical mass of diahyphae. Scales = 2.0 mm in **A**, 1.0 mm in **B–E** and 0.5 mm in **F**.

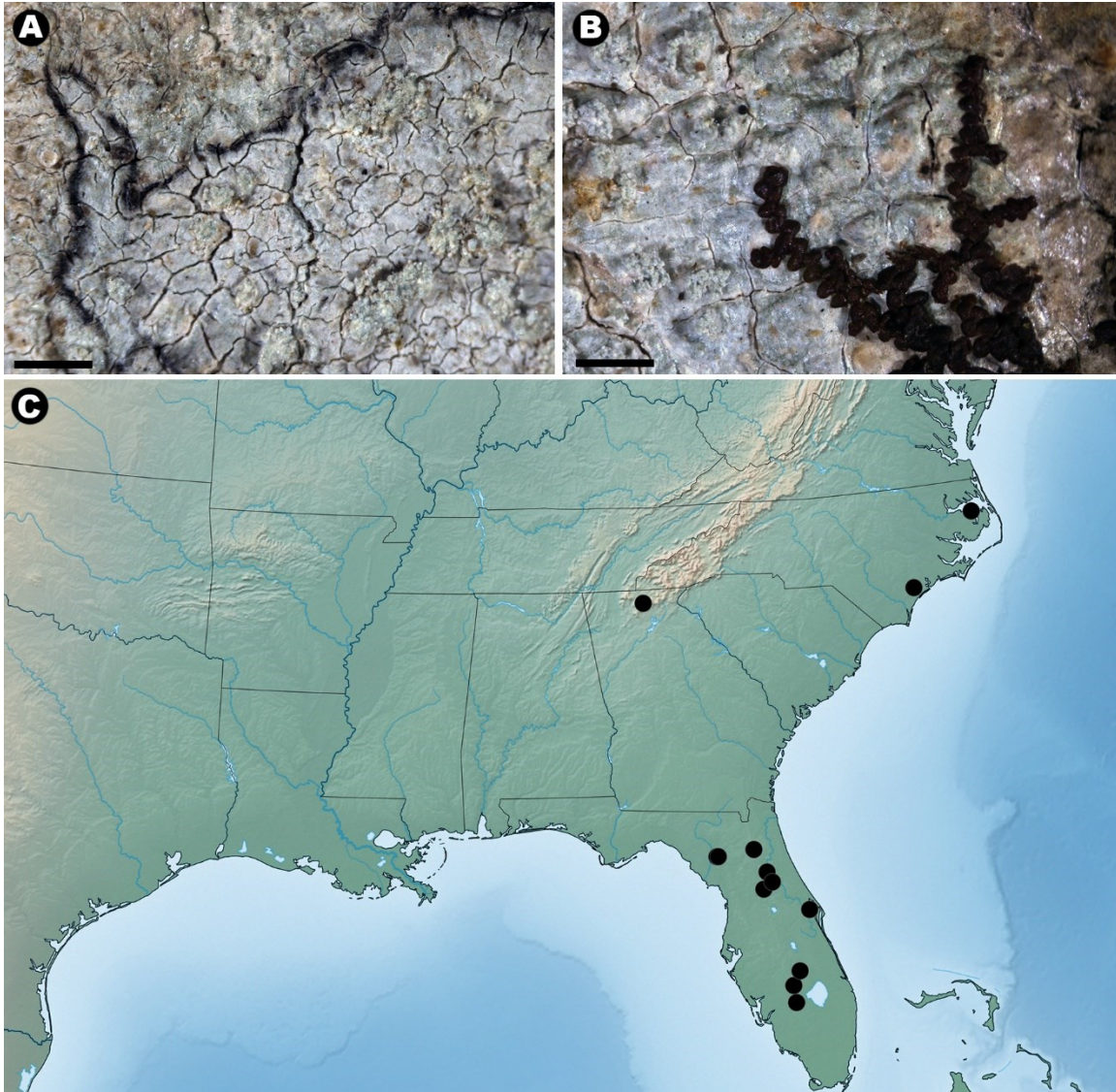


Figure 8. North American *Lepra oahuensis*. **A**, gross morphology of the thallus and soralia (Lendemer 43039, NY). **B**, detail of thallus and soralia (Lendemer 38869, NY). **C**, distribution of *L. oahuensis* in North America based on specimens examined for this study at NY. Scales = 1.0.

Additional specimens examined. – **U.S.A.** FLORIDA. BREVARD CO.: Corner of Fox Lake Road and South Carpenter Road, just W of St. Rd. 405 and I-95, 7.i.1996, on *Lyonia*, R.C.Harris 37841 (NY). CLAY CO.: Gold Head Branch State Park, 28.xi.1992, on Ericaceae, R.C. Harris 29153 (NY). GILCHRIST CO.: Waccasassa Flats, along Co. Rd. 232 ca. 1 mi W of St. Rd. 47, 5.xii.1993, on *Prunus*, R.C. Harris 31730 (NY). GLADES CO.: Ortona Cemetery, along SR 78, 1 mi E of CR 78A, 30.iii.1998, on *Lyonia*, R.C. Harris 42100 (NY). HIGHLANDS CO.: Hickory Hammock, 28.iii.1998, on *Ilex*, R.C. Harris 41923 (NY); Archbold Biological Station, on Old SR 8, W boundary fire lane of SE Tract, 26.iii.1998, on *Quercus*, R.C. Harris 41795 (NY). MARION CO.: Ocala National Forest, along FL40, 2 mi E of FL19, 2.i.1996, on bark, E. Lay 96-0020 (NY). GEORGIA. FANNIN CO.: Chattahoochee National Forest, ravine of tributary to Toccoa River, Toccoa River Rd./FSR333 0.7 mi NW of jct w/ Rocky Creek Rd./FSR69, 5.i.2019, on *Betula*, E. Tripp 9112-A & J.C. Lendemer (NY). NORTH CAROLINA. PENDER CO.: Holly Shelter Game Land, S portion of Shaken Creek floodplain, 27.x.2013, on *Magnolia*, J.C. Lendemer et al. 38869 (NY). TYRRELL CO.: Alligator River Game Land, Middle Rd. 0–0.25 mi NE of US64, 22.iii.2014, on *Acer*, J.C. Lendemer 43039 (NY).

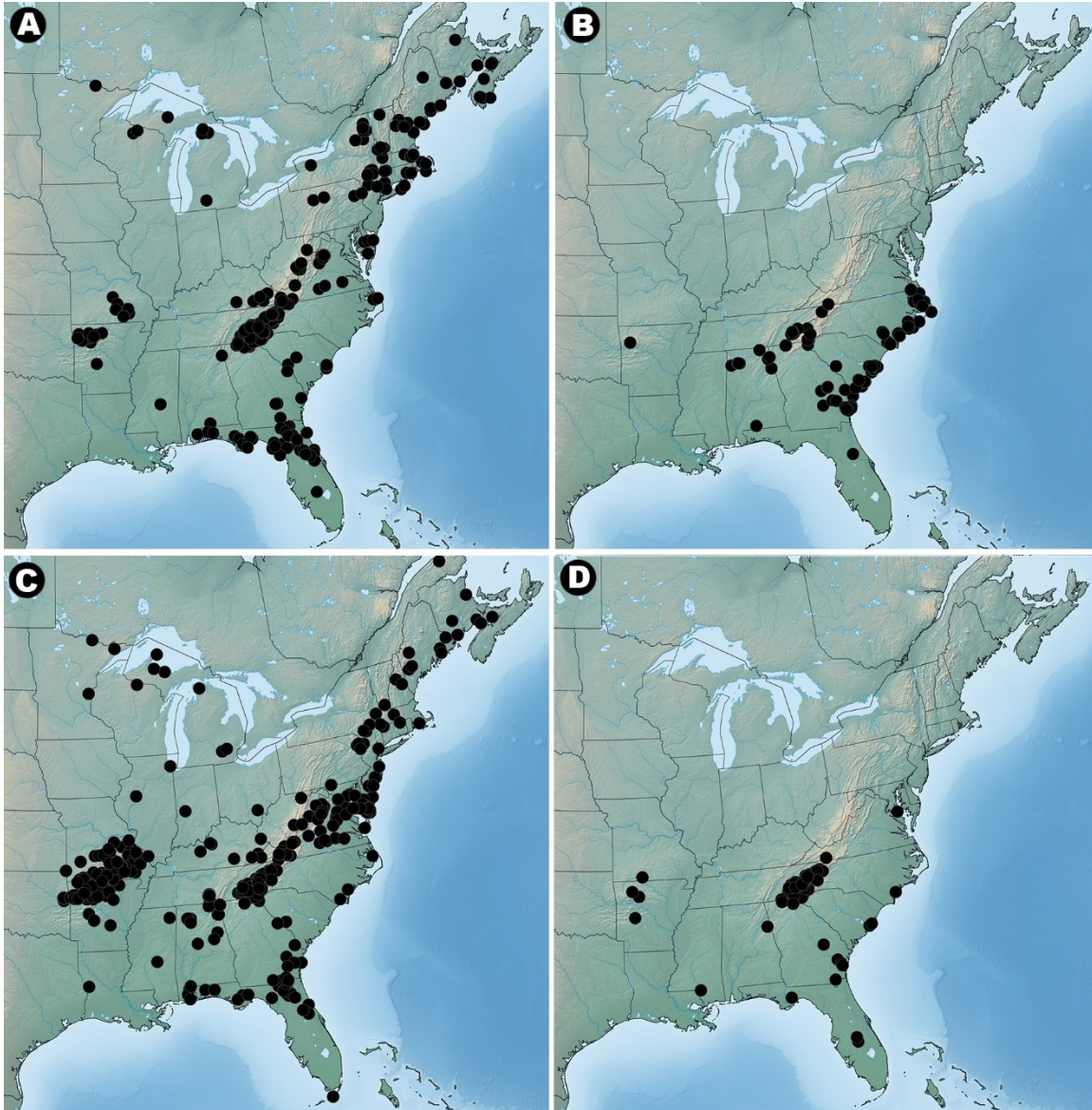


Figure 9. Comparative distributions of lichexanthone producing and deficient chemotypes of *Lepra trachythallina* and *Varicellaria velata* in eastern North America based on specimens examined for this study at NY, illustrating the restricted and disjunct distributions of the lichexanthone producing chemotypes compared to the chemotypes without that substance. **A**, *L. trachythallina* without lichexanthone. **B**, *L. trachythallina* with lichexanthone. **C**, *V. velata* without lichexanthone. **D**, *V. velata* with lichexanthone.

VII – PSORONACTIS DILLENIANA NEW TO EASTERN NORTH AMERICA

Opegrapha moroziana Lendemer is a sorediate crustose lichen that occurs on non-calcareous rocks in sheltered or protected microhabitats in the southern Appalachian Mountains of eastern North America (Lendemer 2009). It is unusual among species that grow in such habitats in the region because of the combination of soredia and the production of psoromic acid (Lendemer 2009). During recent fieldwork on high elevation rock outcrops in the central and southern Appalachians, a crustose lichen with a scurfy thallus that vaguely resembled *O. moroziana* was repeatedly encountered. Initially it was thought to be a poorly developed form of *O. moroziana* since it produced psoromic acid. However, discovery of abundant-

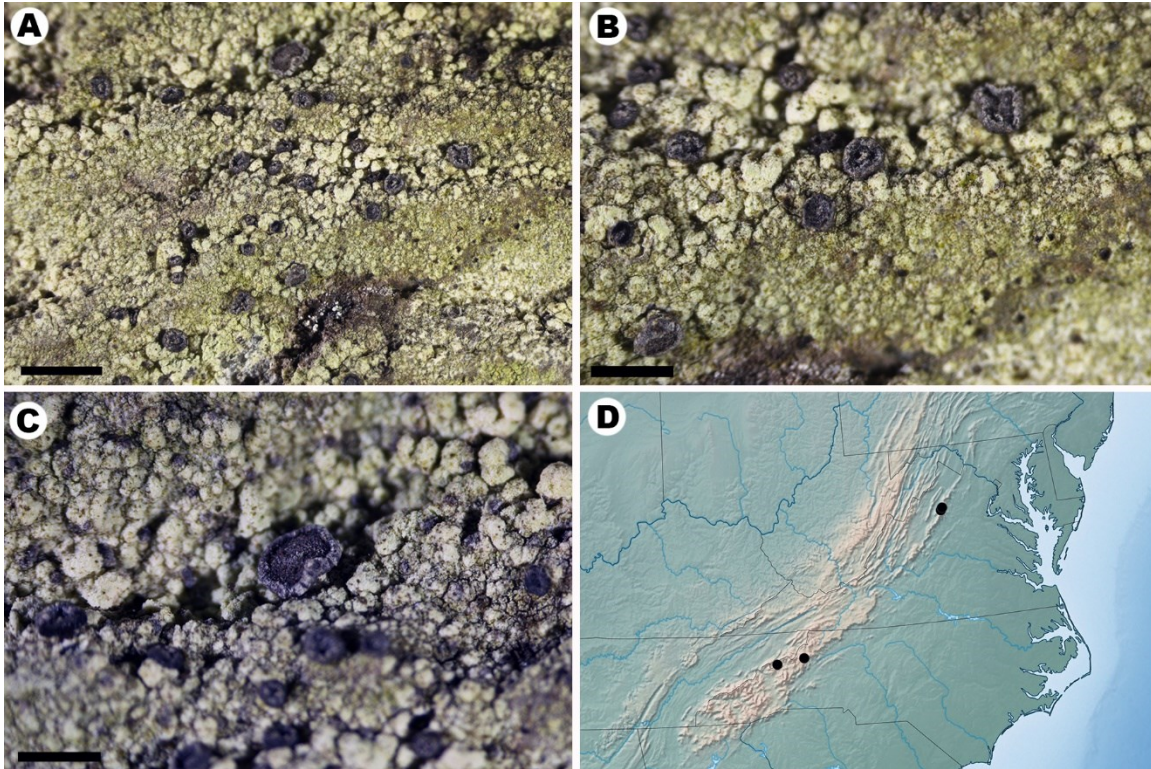


Figure 10. Morphology and geographic distribution of *Psoronactis dilleniana* (photographs from *Lendemer 66961*). **A**, gross morphology of the thallus and apothecia. **B**, detail of thallus and young apothecia. **C**, detail of mature apothecium. **D**, geographic distribution in North America based on specimens examined for this study. Scales = 2.0 mm in A, 1.0 mm in B and C.

-ly fertile material and comparison with reference material of *O. moroziana* revealed that a very different taxon was involved.

Damien Ertz examined digital images of the material and suggested *Psoronactis dilleniana* (Ach.) Ertz & Tehler as an identification. This was subsequently confirmed by comparison with reference specimens and published descriptions (Cannon et al. 2021, Ertz et al. 2015). The species can be recognized by its scurfy, rough and superficially granular thallus that is dingy pinkish to brownish-gray and when fertile by the rounded, black lecideine apothecia with gray pruina, 4-celled hyaline ascospores that are fusiform or slightly curved, measuring $18\text{--}32\text{--}(40) \times 4\text{--}5\text{ }\mu\text{m}$, and production of psoromic acid (Cannon et al. 2021; see Figure 10 herein). *Psoronactis dilleniana* does not appear to have been previously reported from North America and is here reported from scattered high elevation sites in the Appalachian Mountains (Figure 10D). The species appears to be infrequent but widespread in humid, shaded, overhangs of large non-calcareous rock outcrops and sheltered rock faces between boulders on shaded talus slopes.

Specimens examined. – U.S.A. NORTH CAROLINA. AVERY CO.: Grandfather Mountain State Park, Grandfather Mountain, Raven Rocks, 14.vi.2020, on rock in overhang, *J.C. Lendemer 66961* (NY). NORTH CAROLINA. YANCEY CO.: Pisgah National Forest, Bald Mountains, High Rocks, 3.vii.2020, on rock in overhang, *J.C. Lendemer 66256* & *B. Nelson* (NY). VIRGINIA. MADISON CO.: Shenandoah National Park, Central District, SW slopes of Hawksbill Mountain, 9.x.2020, on rock in overhang, *J.C. Lendemer 70120* (NY); Shenandoah National Park, Central District, Hemlock Springs, 24.iv.2021, on rock in overhang, *J.C. Lendemer 70587* (NY).

VIII – ROCKEFELLERA CROSSOPHYLLA REDISCOVERED IN PENNSYLVANIA

Rockefellerella crossophylla (Tuck.) Lendemer & E. Tripp is a morphologically and ecologically distinctive member of the lichen family Pannariaceae and is endemic to eastern North America (Lendemer

et al. 2017). Although it was thought to be extinct (Jørgensen 2000), individuals of the species were subsequently found at scattered locations in the Ozarks, Appalachian Mountains and Canadian Maritimes (Lendemer & Anderson 2008; note the last is no longer extant). The species is now assessed as Endangered by the IUCN Red List (Randlane et al. 2019). In Pennsylvania, *R. crossophylla* has long been known from a single historical collection made at Glen Onoko along the Lehigh River (Lendemer & Anderson 2008). Efforts by the author to find the species at Glen Onoko failed to relocate it, and led to the conclusion that it was extirpated from the state. During a hike in 2018, the author discovered a single colony of the species. Thus *R. crossophylla* is extant in Pennsylvania, and this occurrence is of high conservation concern given the absence of additional extant occurrences in the central and northern Appalachian Mountains (Randlane et al. 2019).

Specimens examined. – **U.S.A. PENNSYLVANIA.** CARBON CO.: Glen Onoko, v.1875, on rocks, *E.A. Rau s.n.* (NY). SULLIVAN CO.: Worlds End State Park, 1.i.2018, on sheltered rock face, *J.C. Lendemer 55102* (NY).

IX – XENONECTRIELLA STREIMANNII DISCOVERED IN NORTH AMERICA

While inventorying lichens as part of a large-scale project to study biodiversity gradients in the southern Appalachian Mountains (Tripp et al. 2019) a thallus of *Sticta beauvoisii* Delise that was strongly infected with a lichenicolous fungus was found (Figure 11). This discovery was noteworthy because *Sticta* thalli in the region appear to be infrequently infected with lichenicolous fungi, at least to the degree that they are rarely readily visible in the field with the naked eye (Lendemer, unpublished data). Subsequent study of the material revealed that it represents *Xenonectriella streimannii* (S.Y. Kondr., Coppins & D.J. Galloway) Rossman, which is not presently included on the North American checklist (Esslinger 2021).

Xenonectriella streimannii can be recognized by its conspicuous reddish-brown perithecia that erupt out of surface of the thallus of the host, ellipsoid to broadly ellipsoid, uniseriate ascospores that turn reddish-brown and become verruculose when mature (Kondratyuk 1996). Reports of the ascospore size vary and ours measure $13.9\text{--}17.1 \times 7.2\text{--}13.4 \mu\text{m}$, which is within the range given in the protologue albeit slightly wider ($(10\text{--})12.7\text{--}16.2 \times (7.0)8.1\text{--}10.1 \mu\text{m}$ *vide* Kondratyuk 1996) but smaller than the range given for material from Russia ($(9.6\text{--})11.1\text{--}13.7\text{--}(15.2) \times (6.6\text{--})7.0\text{--}8.0\text{--}(8.9) \mu\text{m}$, *vide* Zhurbenko et al. 2020). The species was originally described from Queensland, Australia, as *Pronectria streimannii* S.Y. Kondr., Coppins & D.J. Galloway by Kondratyuk (1996) based on material growing on *Sticta cyphellulata* (Müll. Arg.) Hue. Subsequently it has been reported from Asia, Europe and South America (see Zhurbenko et al. 2020) and multiple morphotypes have been described by Etayo (2017).

Specimen examined. – **U.S.A. GEORGIA.** RABUN CO.: Chattahoochee National Forest, S-slopes of Wolf Knob, 0.5 mi S of Patterson Gap Rd. at Patterson Gap, 23.iv.2019, on *Sticta beauvoisii* on rock, *J.C. Lendemer 59844 & M. Hodges* (NY).

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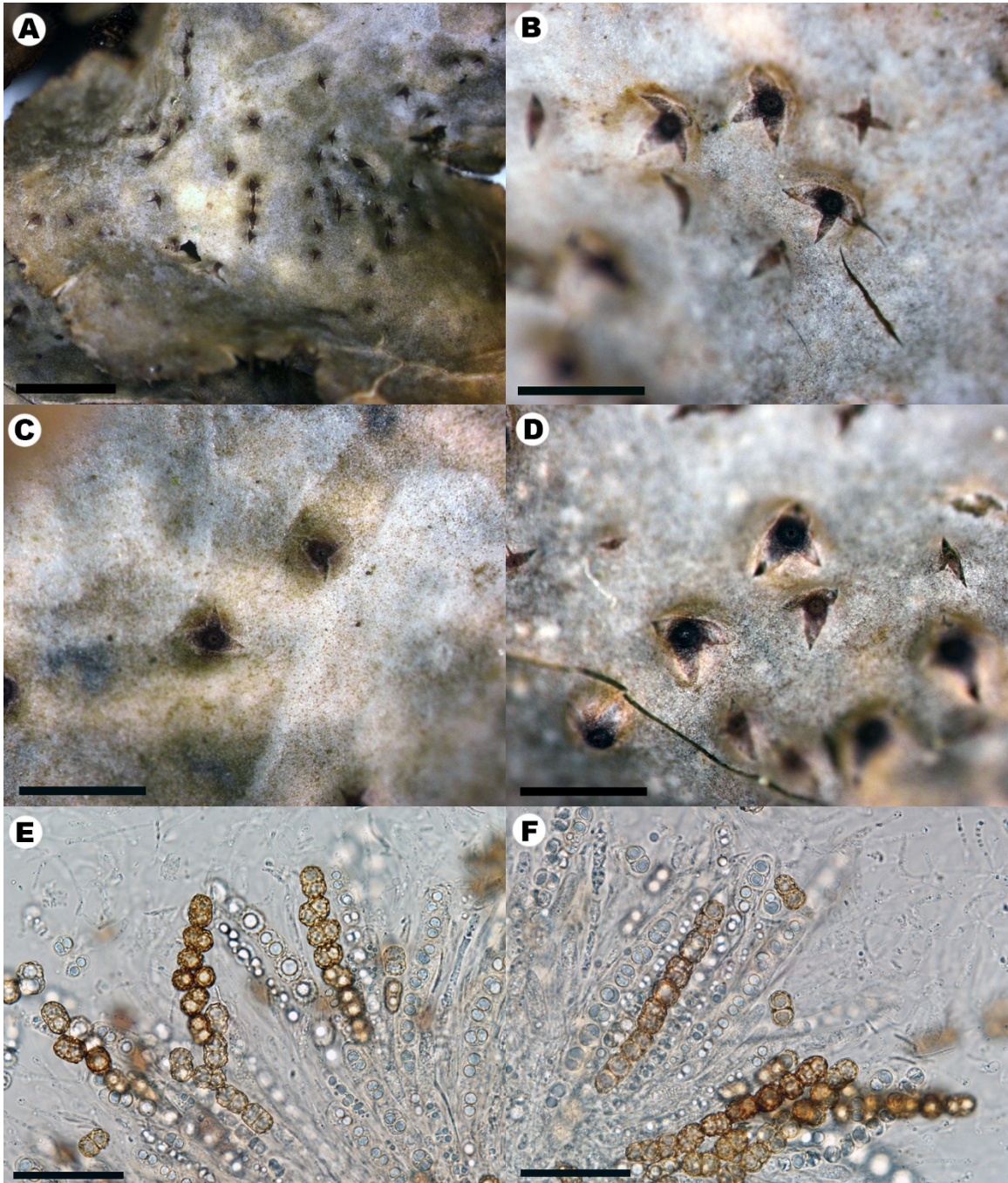


Figure 11. *Xenonectriella streimannii* (all from Lendemer 59844, NY). **A**, gross morphology of the infection on thallus of *Sticta beauvoisii*. **B–D**, detail of perithecia erupting from thallus of host. **E and F**, asci and ascospores mounted in water. Scales = 2.0 in A, 1.0 mm in B–D, 50 μ m in E and F.

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