

Pertusaria appalachensis, a new species from Eastern North America

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ABSTRACT. – *Pertusaria appalachensis* is described as new to science based on material from the southern Appalachian Mountains of eastern North America. *Pertusaria appalachensis* is the first North American species known to produce xanthonenes in the medulla of the thallus.

INTRODUCTION

The southern Appalachian Mountains of eastern North America have long been recognized as hosting a remarkable assemblage of lichens, including numerous disjunct and endemic species (Lendemer & Tripp 2008). Despite nearly continuous study for well over a century the region remains poorly explored, especially for crustose lichens and lichenicolous fungi. Recent field work by the senior author and his colleagues has resulted in the recognition of numerous new and interesting taxa (Harris & Ladd 2008; Lendemer 2007, 2007a; Lendemer & Harris 2007; Lendemer et al. 2007; Lücking et al. 2007; Lendemer & Sheard 2006; Sheard et al. 2008; Tønsberg 2007). In recent years we have collected a species of *Pertusaria* with xanthonenes restricted to the medulla, from middle to high elevations in the southern Appalachians. As medullary xanthonenes are rare elsewhere in the genus *Pertusaria* and previously unknown in any North American species, it seemed likely that the species represented another undescribed taxon endemic to the Southern Appalachians. An examination of species with a similar chemistry (i.e., containing arthothelin and related substances) revealed that in fact, arthothelin was present in the medulla rather than the cortex of those species as well. Comparison of these taxa confirmed the distinctness of the material from the southern Appalachians, and consequently we describe it here under the name *Pertusaria appalachensis*.

THE NEW SPECIES

Pertusaria appalachensis Lendemer, R.C. Harris, and Elix **sp. nov.**

MYCOBANK #511604.

TYPE: U.S.A., SOUTH CAROLINA., PICKENS CO., Dry, logged woods along Lookout Trail to Eastatoe Creek National Heritage Preserve, elev. ca. 534 m., on *Acer rubrum*, 27.ix.1989, R.C. Harris 24795 (NY, holotype; CANB, isotype).

Thallus corticola, griseus vel cinereus, hebetatus, tenuis ad crassiusculus, continuus et verruculosus; isidiis et sorediis desitutis. *Verrucae* fertiles thallo concolorae, conspicuae, dispersae et 0.8-2.0mm diam.; ostiola conspicua, alba, lutea annulata, in verrucae 1-2(-4)nae. Ascosporae 8nae, uniseriatae vel biseriatae, ellipsodeae, laeves vel exasperatae, (56.3)-68.5-(80.68)µm longae, (27.9)-33.54-(39.18)µm latae. *Medulla* arthothelin continens. *Cortex* substantiam nullam continens.

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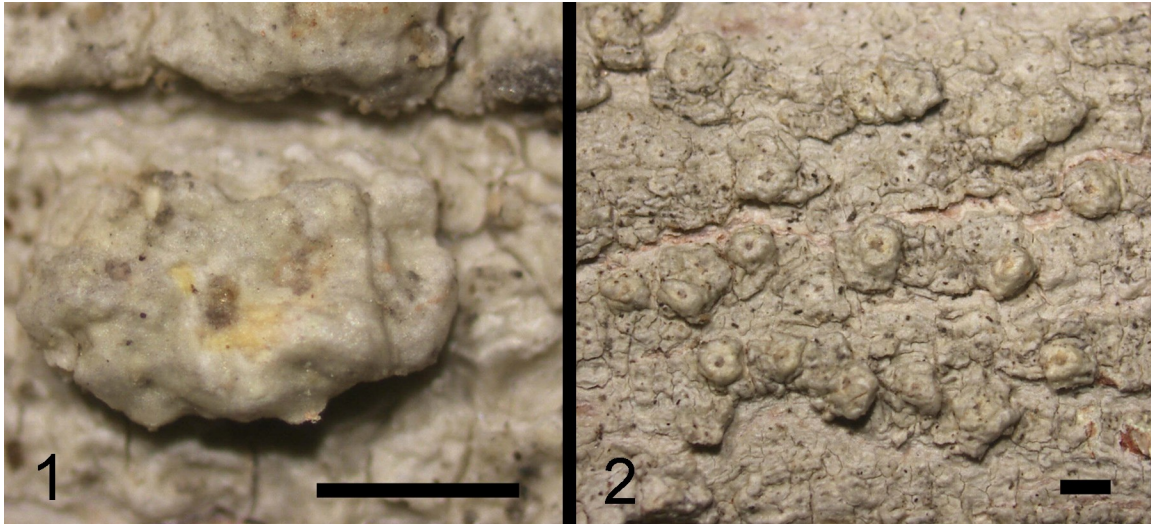


Plate 1 *Pertusaria appalachensis*. **Figure 1.** Detail of fertile wart with pale brown ostiole surrounded by yellow ring of xanthone rich medullary tissue visible due to thinning of the cortex (scale bar = 1mm). **Figure 2.** Thallus with fertile warts (scale bar = 1mm). Both figures taken from holotype (NY).

DESCRIPTION. – **Thallus** corticolous, ash-gray to yellow-gray, dull, thin to thick, continuous and becoming verruculose; **diaspores** absent; **apothecia** verruciform (pertusariate following Dibben (1980), concolorous with thallus, scattered and often becoming confluent with an irregular outline, 0.8-2.0mm diam., 0.5-0.8mm tall; **ostioles** conspicuous, pale-brown to somewhat darkened, with a conspicuous yellow ring where the medulla is visible through the thin cortex, 1-2-(3-4) per verruca; **ascospores** 8/ascus, uniseriate to weakly biseriate, smooth to moderately roughened, (56.3)-68.5-(80.68) x (27.9)-33.54-(39.18) μ m.

CHEMISTRY. – Cortex: no substances present. Medulla: arthothelin [major], 6-*O*-methylarthothelin [minor], 2,4-dichloronorlichexanthonone [minor], 2,5-dichloronorlichexanthonone [minor], 4,5-dichloronorlichexanthonone [minor]. Spot tests; cortex: K-, C-, KC-, P-, UV-; medulla: K+ yellow, KC+ orange, P-, UV+ bright orange.

ECOLOGY AND DISTRIBUTION. - The species is known only to occur on the bark of hardwoods (*Acer*, *Betula* *Fagus*, *Quercus*) at middle to high elevations (~1700-4000 ft.) in the southern Appalachian Mountains of eastern North America where several other apparently endemic lichens have been described recently (Lendemer 2007, Lendemer et al. 2007, Tønberg 2007).

DISCUSSION. - Cortical xanthonones are common in the genus *Pertusaria* (Dibben 1980), and the diverse array of secondary compounds found in the medulla of *Pertusaria* species has been widely used as a key taxonomic character for distinguishing taxa in the genus (Archer 2004; Elix & Archer 2007; Messuti et al. 2006, 2007). While Dibben (1980) did not describe any taxa with medullary xanthonones, investigation of the other species containing arthothelin revealed that it is similarly restricted to the medulla rather than the cortex in those species. Thus, *P. appalachensis* is not the only species of *Pertusaria* that produces xanthonones in the medulla, but rather is one of a group of taxa that share this chemistry and character. In view of the difficulties encountered in ascertaining the localization of arthothelin in the present work, we suggest that future studies of *Pertusaria* should examine the location of xanthonones (and other secondary compounds) and that this data should be included in revisions and descriptions as it may be taxonomically informative.

Among the known species of *Pertusaria* which produce arthothelin *P. appalachensis* is distinguished by its corticolous habit, conspicuous raised verruciform ascomata, the thallus lacking diaspores, the small hyaline ascospores (56-80 x 27-39 μ m; KOH-), and 8-spored asci. A key to the species of *Pertusaria* with 8-spored asci which occur in the southern Appalachians is included below (following the literature cited), as well as a key to the species of *Pertusaria* which produce arthothelin.

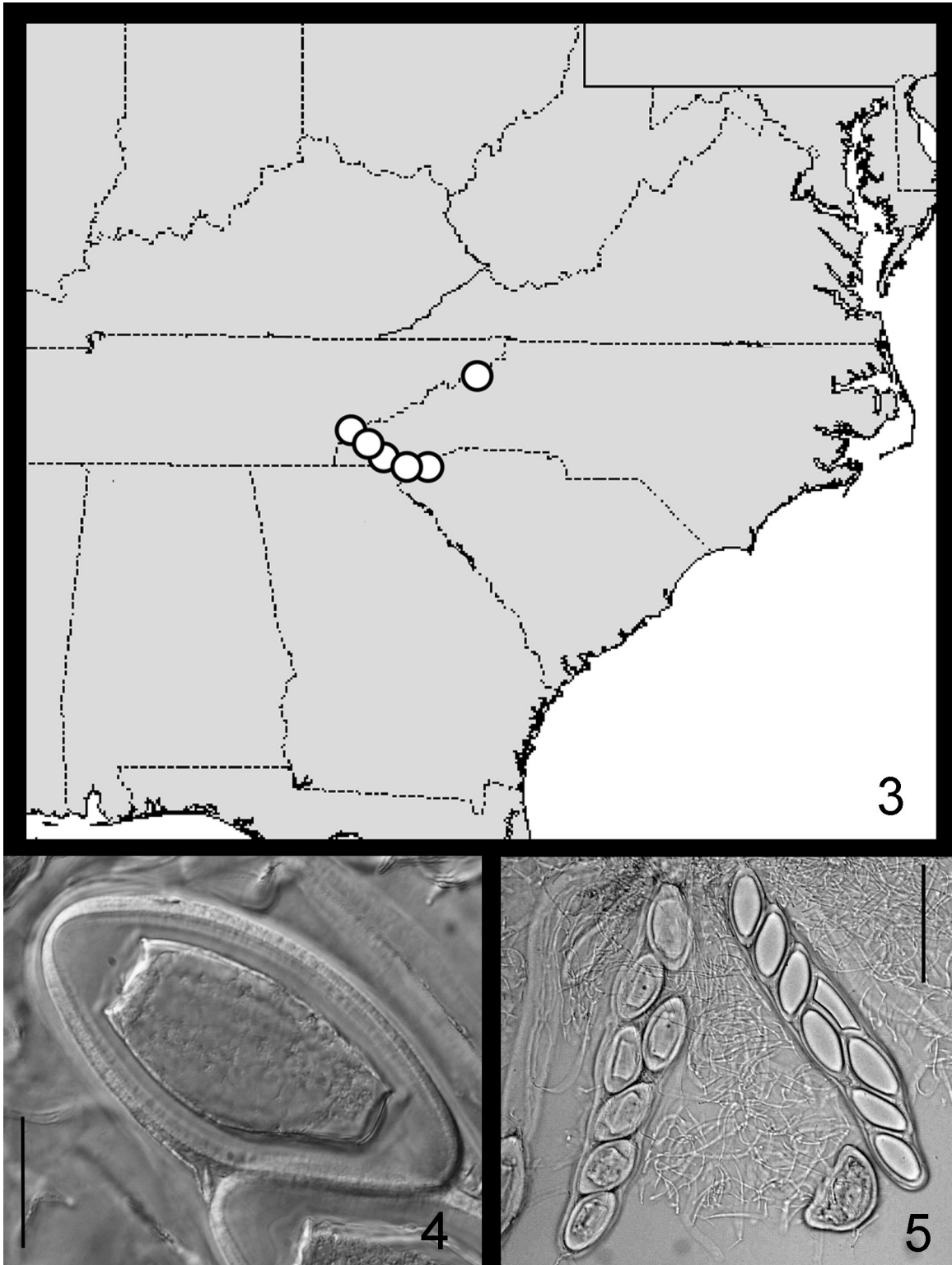


Plate 2 *Pertusaria appalachensis*. **Figure 3.** Range map. **Figure 4.** Ascospore (scale bar = 20 μ m). **Figure 5.** Asci (scale bar = 100 μ m). Both figures 4 and 5 taken from holotype.

SPECIMENS EXAMINED. – U.S.A. GEORGIA. RABUN CO.: Chattahoochee National Forest, Rabun Bald, 4.x.1997, *R.C. Harris 41276* (NY), *R.C. Harris 41281-A* (NY), *R.C. Harris 38928* (NY). NORTH CAROLINA. GRAHAM CO.: Nantahala National Forest, Cherohala Skyway [NC 143], Mudd Gap, 1.x.1997, *R.C. Harris 41048* (NY); Nantahala National Forest, Cherohala Skyway [NC 143], Stratton Ridge, 1.x.1997, *R.C. Harris 41001* (NY). MACON CO.: Nantahala National Forest, vicinity of Park Creek Trailhead, 2.x.1997, *R.C. Harris 41165* (NY). SOUTH CAROLINA. PICKENS CO.: logged woods along Lookout Trail to Eastatoe Creek National Heritage Preserve, 27.ix.1989, *R.C. Harris 24795* (NY). TENNESSEE. CARTER CO.: trail down from Carvers Gap, 6.x.1985, *R.C. Harris 18346* (NY).

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APPENDIX I.

KEY TO SPECIES OF *PERTUSARIA* IN THE SOUTHERN APPALACHIANS WITH 8-SPORED ASCI

1. Cortex UV+ bright orange or yellow.....2
 2. Cortex UV+bright yellow (lichexanthone).....*P. paratuberculifera*
 2. Cortex UV+bright orange.....3
 3. Ostiole without yellow ring or cap; medulla K+ red (norstictic acid present).....*P. rubefacta*
 3. Ostiole with yellow ring or cap; medulla K- or K+ yellow (norstictic acid absent).....4
 4. Ostiole raised, with a yellow nipple-like cap.....*P. texana*
 4. Ostiole depressed, with yellow ring..... *P. epixantha*
1. **Cortex** UV- or UV+ weak pink/orange; **medulla** UV+ or UV-.....5
 5. **Medulla** C and KC+ orange, UV+ bright orange..... *P. appalachensis*
 5. **Medulla** C-, KC various, UV-.....6
 6. Medulla K+ red (norstictic acid present); warts large; ascospores +/-uniseriate..... *P. propinqua*
 6. Medulla K- (norstictic acid absent); warts small; ascospores biseriate..... *P. ostiolata*

APPENDIX II.

KEY TO SPECIES OF *PERTUSARIA* PRODUCING ARTHOTHELIN

1. Saxicolous; ascospores 8/ascus.....*P. melanospora*
1. Corticolous; ascospores various.....2
 2. Thallus isidiate, apothecia rare; arthothelin minor accessory with thiophanic acid; Papua New Guinea.....*P. karkarensis*
 2. Thallus without isidia; apothecia common; arthothelin concentration and geographic distribution various.....3
 3. Ascospores 2-4/ascus.....4
 4. Ascospores 2/ascus; arthothelin minor accessory with thiophanic acid.....*P. saltuensis*
 4. Ascospores 4/ascus; arthothelin minor accessory with 6-*O*-methylarthothelin.....*P. inconspicua*
 3. Ascospores (6)-8/ascus.....5
 5. Ascospores $\leq 80\mu\text{m}$ long.....6
 6. Apothecia immersed in thallus; arthothelin a major substance with thiophanic acid; New Zealand.....*P. bartlettii*
 6. Apothecia raised, conspicuous; thiophanic acid absent.....7
 7. 6-*O*-Methylarthothelin major with arthothelin major or minor; ascospores 70-80 μm long.....*P. oblongata*
 7. Arthothelin major with 6-*O*-methylarthothelin minor; ascospores 60-70-(80) μm long.....*P. appalachensis*
 5. Ascospores $>(70)$ -80 μm8
 8. Ascospores 70-120 μm long; South America.....*P. papillulata*
 8. Ascospores 112-120 μm long; India.....*P. idukkiensis*

