Mycologia, 99(3), 2007, pp. 488–491.

Cercophora rubrotuberculata sp. nov., a new pyrenomycete from the Great Smoky Mountains National Park.

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Abstract: An interesting wood-inhabiting pyrenomycete was discovered while collecting for the All Taxa Biodiversity Inventory currently being conducted in the Great Smoky Mountains National Park. This species is unique in possessing superficial ascomata with reddish tubercles and ascospores that develop an apical swollen brown cell and a long, basal hyaline cell. Because these ascospore characters fit the traditional morphological circumscription of *Cercophora*, this species is described as a new species within this genus.

Key words: Ascomycota, Lasiosphaeriaceae, Sordariales, southern Appalachians, systematics, temperate forests

INTRODUCTION

A unique member of the Sordariales (Sordariomycetes, Pezizomycotina, Ascomycota) was found on decaying wood during a weeklong ''bioblitz,'' a taxon-discovery effort conducted as part of an All Taxa Biodiversity Inventory (ATBI) currently taking place in the Great Smoky Mountains National Park (GSMNP) (Miller 2006). This species is unique in possessing superficial, obpyriform ascomata with large, reddish tubercles, cylindrical asci with subapical globules and ascospores that develop an apical swollen cell and a basal cylindrical cell. Most genera within the Sordariales are distinguished by ascospore shape (Lundqvist 1972, Miller and Huhndorf 2005) and ascospore morphology suggests this taxon should be placed in the genus *Cercophora* in the Lasiosphaeriaceae (Lundqvist 1972). Although recent molecular studies have shown that many genera in the Sordariales, including *Cercophora*, are polyphyletic (Miller and Huhndorf 2005), additional study is required before generic relationships within the order can be resolved and revised circumscriptions of genera can be proposed. Therefore this species is placed within *Cercophora* based on morphological characters.

Accepted for publication 27 March 2007.

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MATERIALS AND METHODS

Morphological characterization.—Ascomata were squash-mounted in water and images of micromorphological structures were captured with a QImaging QColor 3 digital camera mounted on either a Leica MZ7.5 dissecting microscope with a Schott KL1500 fiber optics light source or an Olympus BX51 compound microscope using differential interference or phase contrast microscopy. Images were processed with Adobe Photoshop 7.0 (Adobe Systems Inc., Mountain View, California). A minimum of 30 measurements was taken for all morphological structures with NIH Image 1.63 (National Institute of Health, Bethesda, Maryland). Mean and standard deviation (shown in brackets) were calculated for ascospores. Ascomata were embedded in Tissue-Tek® O.C.T. embedding compound and sectioned with a Leica SM2000R freezing microtome at ca. 30 µm thick. Color terms are taken from Kornerup & Wanscher (1978). No attempts were made to culture this species.

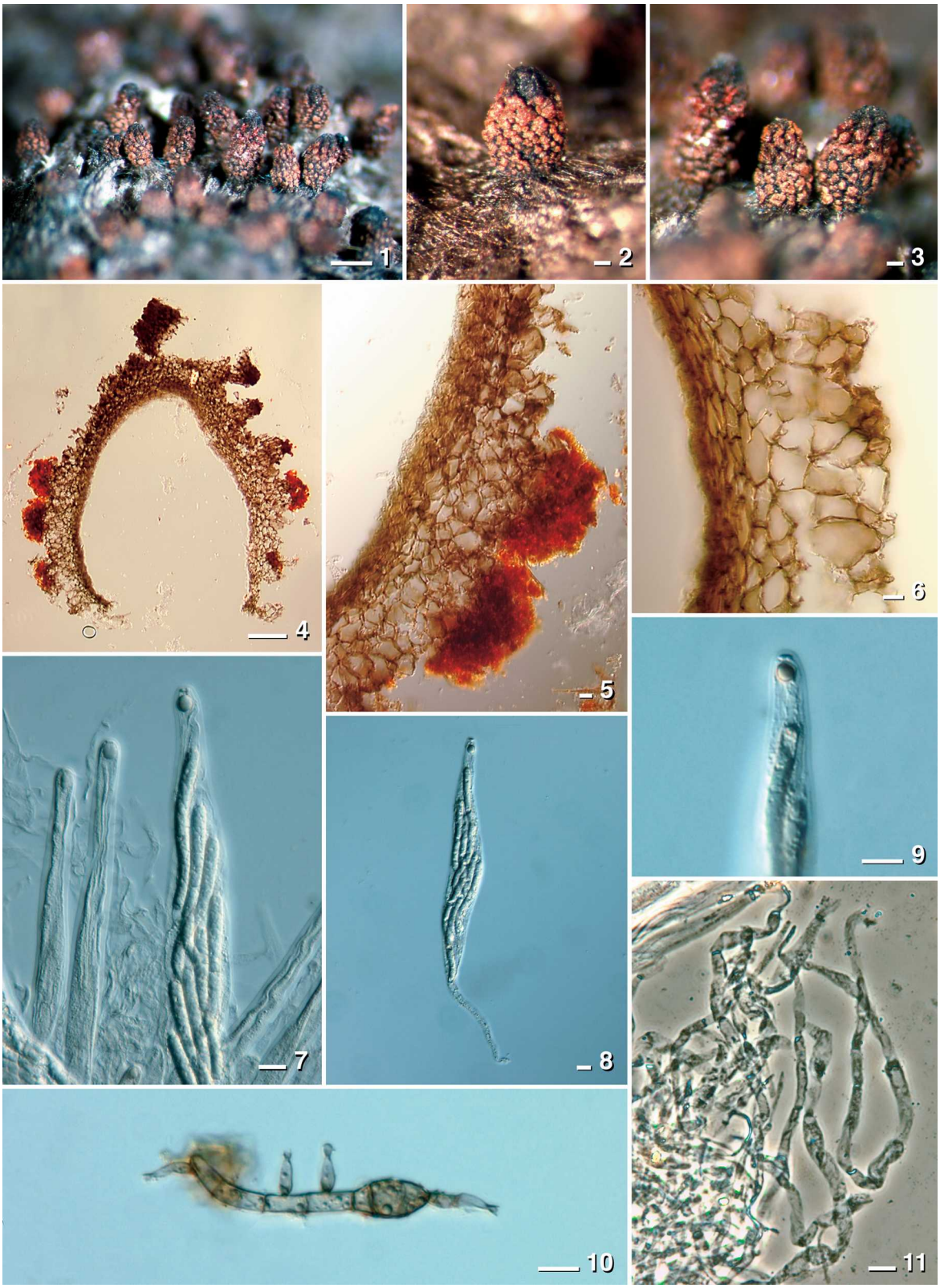
RESULTS

Cercophora rubrotuberculata A.N. Mill., Mugambi & Huhndorf, sp. nov. FIGS. 1–11

TYPE. UNITED STATES. NORTH CAROLINA: Haywood County, Great Smoky Mountains National Park, Big Creek, Big Creek Trail, 35°45′2.9″N, 83°6′34.8″W, 533 m elev., decorticated branch on ground, 4 cm diam, 9 Sep 2005, *G.K. Mugambi, ANM700.* (**HOLOTYPE designated here, ILLS 58196; ISOTYPE in F**).

Etymology. Refers to the reddish tuberculate surface of the ascomata.

Ascomata ovoidea vel obpyriformia, papillata, 300–550 µm diam, 450–900 µm alta, numerosa, dispersa vel gregaria, superficialia; superficie tuberculata subcollo, tubercula aurantiaca deinde rubella; collo conico, interdum sulcato, nigro; subiculum sparsum, 1.5–3.0 µm crassum, pilis brunneis. Paries ascomatis in sectione longitudinali bistratosus. *Paraphyses* filiformes, septatae. *Asci* cylindrici, 190–270 × 18–24 µm, longe-stipitati, stipus 50–95 × 3.5–6.5 µm, unitunicatus, cum annulo apicali et globulo sub-



FIGS. 1–11. *Cercophora rubrotuberculata* (all from Holotype). 1–3. Ascomata on substrate. 4. Longitudinal section through ascoma. 5. Longitudinal section through ascomal wall showing reddish crystalline exudate covering tubercle. 6. Longitudinal section through ascomal wall. 7, 8. Asci. 9. Ascus apex. 10. Ascospore producing phialides. 11. Paraphyses. Bars: 1 = 500 μm; 2–4 = 100 μm; 5–11 = 10 μm.

apicali, octospori. *Ascosporae* cylindricae, 54–64.5 × 4.5–6 μm, hyalinae, aseptatae; utrinque caudatis gelatinosis, 16–19 μm; deinde bicellularis, cellula superior inflata, ovoidea, 16–22.5 × 7.5–9.5 μm, cellula basis 34.5–45.5 × 4.5–5 μm, hyalina; demum ascosporae triseptatae usque ad 7-septatae.

Ascomata ovoid to obpyriform, papillate, occasionally collapsing laterally when dried, 300–550 μm diam, 450–900 μm high, numerous, scattered to gregarious, superficial; surface tuberculate below neck, tubercles large, at first orange red (8A8), becoming reddish (9B8) with age; neck conical, sometimes sulcate, black; subiculum sparse, hairs brown, 1.5–3.0 μm wide, thin-walled, septate. *Ascomatal wall* of *textura angularis* in surface view; in longitudinal section 2-layered, composed of pseudoparenchymatous cells, inner layer 15–30 μm thick, composed of 3–5 layers of elongate to flattened, brown cells, outer layer 30–80 μm thick, composed of 5–8 layers of polygonal, brown cells; tubercles 50–90 μm wide × 60–75 μm tall, composed of polygonal, brownish cells, apex encrusted with a reddish exudate that does not dissolve in water. *Ascomatal apex* with periphyses. *Centrum* hyaline. *Paraphyses* filiform, 3.0–7.0 μm wide, hyaline, numerous, septate, unbranched, persistent. *Asci* cylindrical, 190–270 × 18–24 μm, long-stipitate, stipe 50–95 × 3.5–6.5 μm, numerous, unitunicate, thin-walled, apex truncate; ring narrow, shallow, refractive; subapical globule large, 4.5–6.5 μm diam, smooth; with 8 biseriate to triseriate ascospores. *Ascospores* cylindrical, ends rounded, 54–64.5 × 4.5–6 μm (58.5 ± 2.5 × 5 ± 0.5), slightly sigmoid or geniculate, hyaline, aseptate; with bipolar appendages, 16–19 μm, gelatinous, lash-like; becoming differentiated into a swollen head and pedicel, transversely uniseptate; head ovoid, 16–22.5 × 7.5–9.5 μm, subacute to rounded at the apex, truncate at the base, hyaline to pale brown; pedicel 34.5–45.5 × 4.5–5 μm, hyaline; ascospore 3–7-septate after liberation from the ascus, occasionally producing phialides directly from the ascospore.

Habitat. Scattered to gregarious on dead, decorticated wood in mixed coniferous-deciduous forest.

Distribution. Known only from type locality.

DISCUSSION

The genus *Cercophora* Fuckel, which was established in 1870, was synonymized under *Sordaria* Ces. & De Not. (Fuckel 1873) and seldom used until it was reintroduced by Lundqvist (1972). The genus is recognized by large, membranous to coriaceous ascomata and hyaline, cylindrical ascospores, which develop an apical, swollen brown cell and a long, basal hyaline cell. *Cercophora* currently contains more than 50 species of lignicolous and coprophilous taxa that occur throughout temperate and tropical regions. Although the genus recently has been shown to be polyphyletic (Miller and Huhndorf 2005), additional work is necessary before *Cercophora* can be segregated into several distinct, well supported monophyletic groups. Thus new species, which fit the traditional morphological circumscription of *Cercophora*, should be placed within the genus until a thorough revision can be completed.

Cercophora rubrotuberculata is distinguished in having ascomata with reddish tubercles and ascospores that develop an apical swollen cell and a basal cylindrical cell. Both ascomatal characters (i.e. reddish color and tuberculate surface) are uncommon in *Cercophora*. Only two other species in the genus possess ascomata with reddish coloration, *Cercophora spirillospora* (Penz. & Sacc.) N. Lundq. and *Cercophora citrina* (Petch) N. Lundq. The ascomata of the type specimen of *C. spirillospora* presently are yellowish-brown, however they originally were described as being reddish when fresh (Penzig and Saccardo 1897). *Cercophora spirillospora* is easily distinguished from *C. rubrotuberculata* in the type of substrate (bamboo culms vs. wood), ascomatal surface (tomentose vs. tuberculate), centrum color (yellowish vs. hyaline) and ascospore size (37–45 vs. 54–64.5 μm). *Cercophora citrina* occurs on elephant dung and differs in possessing smooth ascomata with a reddish tomentum, yellow centrum contents and longer ascospores (72–89 μm).

Species with tuberculate or warty ascomata also are uncommon in *Cercophora*. *Cercophora ambigua* (Sacc.) R. Hilber and *C. arenicola* R. Hilber are described as having tuberculate ascomata (Hilber and Hilber 1979). While these two species are similar, they can be distinguished from *C. rubrotuberculata* in having dark brown to black, sparsely setose ascomata. The ascomata in *Cercophora atropurpurea* A.N. Mill. and Huhndorf also are described as being warty, primarily around the neck (Miller and Huhndorf 2001), but this species possesses dark purple ascomata and shorter ascospores (33–51 vs. 54–64.5 μm).

Although *C. rubrotuberculata* was not grown in culture, it most likely possesses a *Phialophora*-like anamorph because phialides were observed germinating directly from the ascospores (FIG. 10). This characteristic has been described in *C. ambigua* (Hilber and Hilber 1979) and more recently in *Lasiosphaeria ovina* (Pers.:Fr.) Ces. & de Not. and *L. sorbina* (Nyl.) P. Karst. (Miller and Huhndorf 2004). Several species of *Cercophora* and *Lasiosphaeria* are known to possess *Phialophora*-like anamorphs (Gams 1973, Gams and Holubová-Jechová 1976, Gams 2000, Miller and Huhndorf 2001, 2004).

ACKNOWLEDGMENTS

This species was discovered during fieldwork supported by a Discover Life in America grant (DLIA2005-11) to ANM, while the remaining research was supported by a National Science Foundation grant (DEB-0515558) to ANM. The authors thank J.L. Crane for his comments on a draft of this manuscript.

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