

New taxa of lichens and lichenicolous fungi from the Ozark Ecoregion

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ABSTRACT. – Three genera and species of lichens from the Ozark region of midcontinental North America are described as new to science and illustrated. *Pachyphysis ozarkana* (Porpidiaceae *s. lat.*) is widely distributed on exposed carbonate rocks, *Phoebus hydrophobius* (Roccellaceae) occurs on sheltered areas of massive carbonate bluffs, and *Xyleborus sporodochifer* (Stereocaulaceae) occurs on lightly shaded decorticate hardwoods logs and stumps in wooded uplands. A lichenicolous fungus, *Opegrapha diffracticola* (Roccellaceae), occurring on *Bacidia diffracta*, is also described and illustrated.

INTRODUCTION

The Ozark Highlands of interior North America occupy significant portions of Arkansas, Missouri and Oklahoma, and smaller areas of southeastern Kansas and southwestern Illinois. This ancient highland is characterized by rugged topography, high geologic diversity, and diverse habitats. Parts of the region have been continuously exposed for more than 225 million years, and have served as refugia during periods when other portions of interior North America were variously inundated by shallow seas or covered with glacial ice. The combination of antiquity, high habitat diversity, and influxes of biota from diverse realms has produced a diverse biota with a relatively high level of endemism among both plants and animals (The Nature Conservancy 2003, Zollner et al. 2005).

Although lichens are an abundant and pervasive component of Ozark biota, little was known about the composition and ecology of Ozark lichens until the authors and their colleagues began intensive systematic field work in the region in the early 1980's. These studies revealed an unexpectedly high diversity of lichens in the Ozarks, including numerous undescribed taxa. The taxa described here are part of an ongoing process of documenting the undescribed lichens and lichenicolous fungi from the Ozark Ecoregion. Other recently described species first noted in the Ozarks include *Hertelidea pseudobotryosa* R. C. Harris, Ladd & Printzen (Printzen & Kantvilas 2004), *Sphinctrina benmargana* Selva (2004), and *Punctelia missouriensis* Wilhelm & Ladd (1992). Part of the motivation for this publication is the imminent distribution of type material of two of these taxa (*Opegrapha diffracticola* and *Xyleborus sporodochifer*) in Lendemer, *Lichens of Eastern North America Exsiccati*.

The most striking characteristic about these three new genera is that each is somewhat anomalous in lacking closely related species and in some cases having characters previously unrecorded in their families. Although all were initially discovered in the Ozarks, and most of the known occurrences are Ozarkian, all occur outside of the Ozarks as well, usually occurring west and south of the region in a biogeographic pattern represented by other taxa, such as *Geocarpon minimum* and *Geococcyx californianus*. As is the case with most lichen taxa, knowledge of the distribution, abundance, and conservation status of these species is greatly hampered by the lack of adequate field work, especially in the Midwest and Great Plains.

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MATERIALS & METHODS

Representative specimens were analyzed with thin layer chromatography (TLC) using solvent A (Culberson and Kristinsson 1970). The morphology of specimens was examined using an Olympus BX51 microscope equipped with differential interference contrast. Measurements were obtained from hand-cut sections of the thallus mounted in water. Reagents are the standard ones routinely used and indicated with the usual abbreviations. Illustrations were prepared using an Olympus DP20 digital camera or MTI video setup and composed with Adobe Photoshop.

TAXONOMIC SECTION

1. *Opegrapha diffracticola* R. C. Harris & Ladd, sp. nov.

Plate 1.

Opegrapha lichenicola in *Bacidia diffracticolae* thallo atque apotheciis crescens ascomatis saepe arcte aggregatis et ascosporis 3-septatis, 13–15 x 4–4.5 μm .

TYPE: USA. MISSOURI. MARIES CO.: Spring Creek Gap Conservation Area E of CR 340 (Old Hwy 63), ca. ½ mi N of US 63, 38°08'14"N, 91°48'08"W, 240–320m; floodplain forest, on *Bacidia diffracta* S. Ekman on bole of *Juniperus virginiana*, 4.xi.2002, Harris 46555 (NY, holotype; isotypes to be distributed as Lendemer, *Lichens of Eastern North America Exsiccati V*: 241).

DESCRIPTION. – **Ascomata** (Figs 1,2) lirelliform, growing on thallus and apothecia of *Bacidia diffracta* S. Ekman without visible damage to the host thallus but \pm deforming and darkening apothecia, sessile or slightly immersed, fusiform to \pm oblong, undivided to once branched, 0.2–0.5 \times 0.1–0.2 mm, solitary and scattered or aggregated into irregular clusters to 3 \times 2 mm; disk concealed by appressed lips. **Exciple** (Fig 3) brown-black, greenish black in K, entire, thickened below, upper part to 50–60 μm thick. **Hypothecium** thin, colorless. **Epihymenium** yellow-brown (K–). **Hymenium** colorless, I+ patchily blue-green becoming orangish. **Asci** (Fig 4) clavate, with 8 \pm biserially arranged spores. **Ascospores** (Fig 5) remaining colorless, 3-septate, with thin halo, 13–15(–16) \times 4.5–5.5 μm .

Pycnidia brown, \pm globose, 50–100 μm across. **Conidia** (Fig 6) rod-shaped, 4.5–5.5 \times 1.0–1.2 μm .

DISTRIBUTION & ECOLOGY. – *Bacidia diffracta* is widespread throughout the Ozarks in mesic woodlands, often associated with streams, and occasionally in drier woodland habitats. Substrates include lightly shaded boles of a variety of hardwoods, as well as commonly occurring on shaded boles of *Juniperus virginiana*. *Opegrapha diffracticola* probably occurs throughout the range of *Bacidia diffracta*, in the full range of habitats and substrates as the host. While most of the collections seen are from the Ozark region where *Bacidia diffracta* is common, *Opegrapha diffracticola* also occurs in Vermont and Wisconsin. While we have not borrowed the specimens of *Bacidia diffracta* cited by Ekman (1996), we assume such a search would locate additional records of the *Opegrapha*. As far as we know *Opegrapha diffracticola* is confined to *B. diffracta* and, interestingly, does not occur on the presumably closely related *B. polychroa* (Th. Fr.) Körber, even when the two taxa are adjacent on a single piece of bark [Harris 44745-C as *B. polychroa* (NY)].

DISCUSSION. – Knowledge of many groups of lichenicolous fungi is largely inaccessible to non-specialists. We thought that there were no previous records of lichenicolous *Opegrapha* on *Bacidia* until Jana Kocourková in her review pointed out the existence of *Opegrapha bacidiae* R. Sant. nom. inval. (1952) on foliicolous *Bacidia brasiliensis* (Müll. Arg.) Zahlbr. It was included in a key without subsequent English or Latin description. Matzer (1996) could find no material. It differs from *O. diffracticola* in having 5-septate ascospores. When the ascomata are closely aggregated, *Opegrapha diffracticola* is somewhat similar to older, multilocular ascomata of the lichenicolous *O. anomea* Nyl. group. It differs in that the ascomata are lirelliform from the beginning and not subspherical.

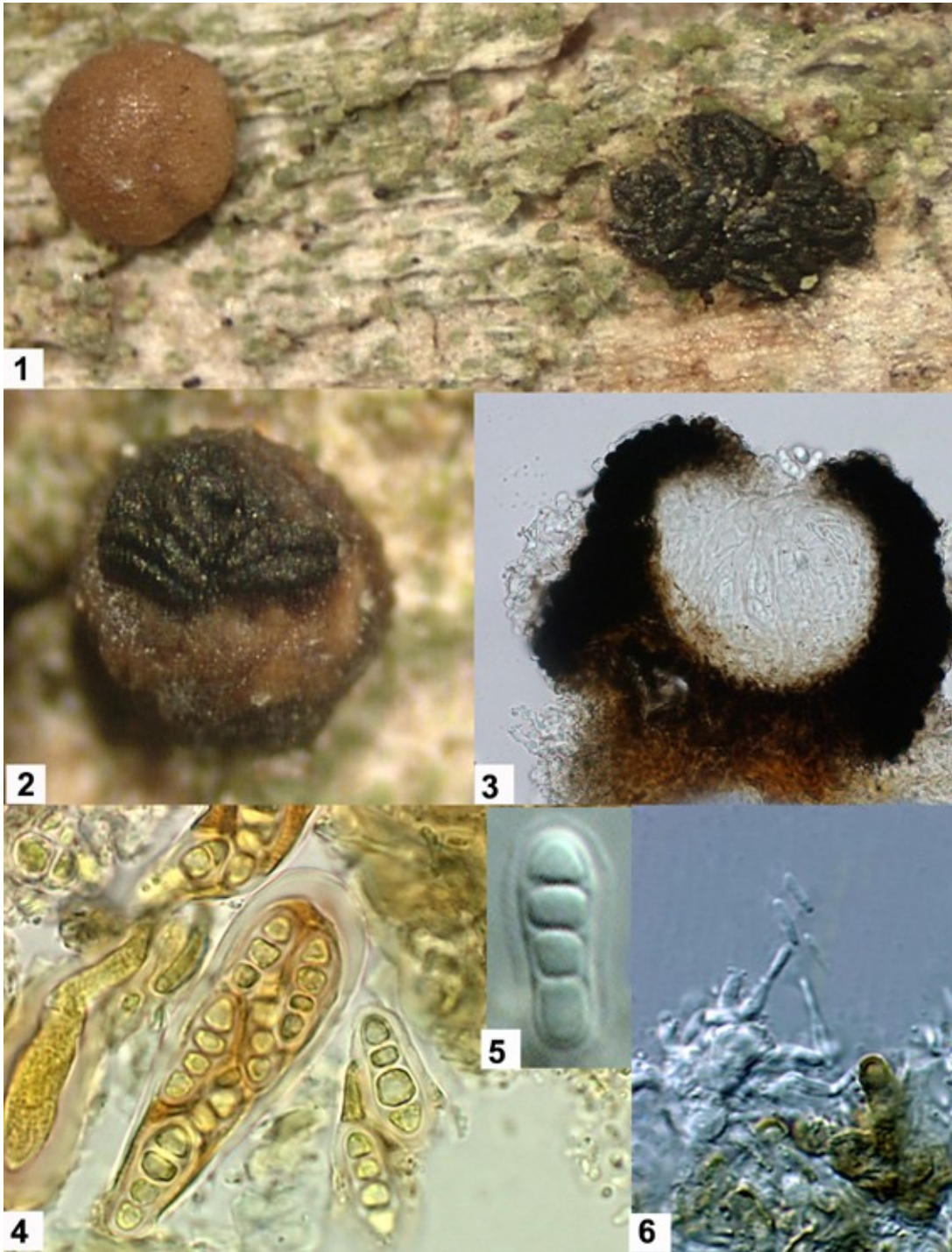


Plate 1. *Opegrapha diffracticola*. Figure 1. Ascomata on thallus of *Bacidia diffracta* (x 50). Figure 2. Ascomata on apothecium of *Bacidia diffracta* (x 70). Figure 3. Cross section of ascoma (x 650). Figure 4. Ascus and ascospores in IKI (x 1500). Figure 5. Ascospore (X2500). Figure 6. Conidiophores and conidia DIC (x 1500). All *Harris 46555*, Missouri, Maries Co., holotype, NY.

ADDITIONAL SPECIMENS EXAMINED³. – ARKANSAS. MADISON CO.: Madison County Wildlife Management Area, *Harris 44679* (NY); NEWTON CO.: Ozark National Forest, Upper Buffalo River Wilderness Area, *Wetmore 84861* (MIN, NY); SEARCY CO.: Buffalo National River, SE of Maumee South Campground, *Harris 51115-A* (NY); STONE CO.: Ozark National Forest, Gunner Pool Recreation Area, *Harris 21592-A* (NY). MISSOURI. BARRY CO.: Roaring River State Park, *Harris 44745-B, 44753* (NY); CRAWFORD CO.: Onondaga Cave State Park, *Buck 42707* (NY); CHRISTIAN CO.: Mark Twain National Forest, S of Chadwick Rd. at jct. of Monarch Road, *Harris 47619-A* (NY); GASCONADE CO.: Canaan Conservation Area, *Harris 52020* (NY); MARIES CO.: Spring Creek Gap Conservation Area, *Harris 46527, 46566* (NY); MORGAN CO.: Frank E. Carpenter Memorial Conservation Area, *Buck 48590, 48604A* (NY); OREGON CO.: Mark Twain National Forest, Falling Spring, *Harris 40523-A* (NY). OKLAHOMA. CHEROKEE CO.: Cookson Wildlife Management Area, *Harris 48909-A* (NY), J. T. Nickel Family Nature and Wildlife Preserve (J5 Ranch), *Harris 44238-B, 44273-A* (NY). VERMONT. ADDISON CO.: Monkton, 10.xii.1879, *Farlow s.n.* (NY). WISCONSIN. VILAS CO.: Northern Highland State Forest, Trout Lake Conifer Swamp Natural Area, *Buck 41783A, Harris 45945-A* (NY).

2. *Pachyphysis ozarkana* R. C. Harris & Ladd, *gen. et sp. nov.*

Plate 2.

Genus et species Porpidiacearum affinis super saxa calcarea crescens, singularis imprimis paraphysibus crassisimis, ad 10 µm diam. et ascosporis non halonatis globosis vel late ellipsoideis, 10–12 µm diam. vel 10–13 × 8–10 µm, etiam notabilis hymenio supero infuscato vel atrovirenti subtu violaceo suffuso, excipulo atque hypothecio atrovioleaceo.

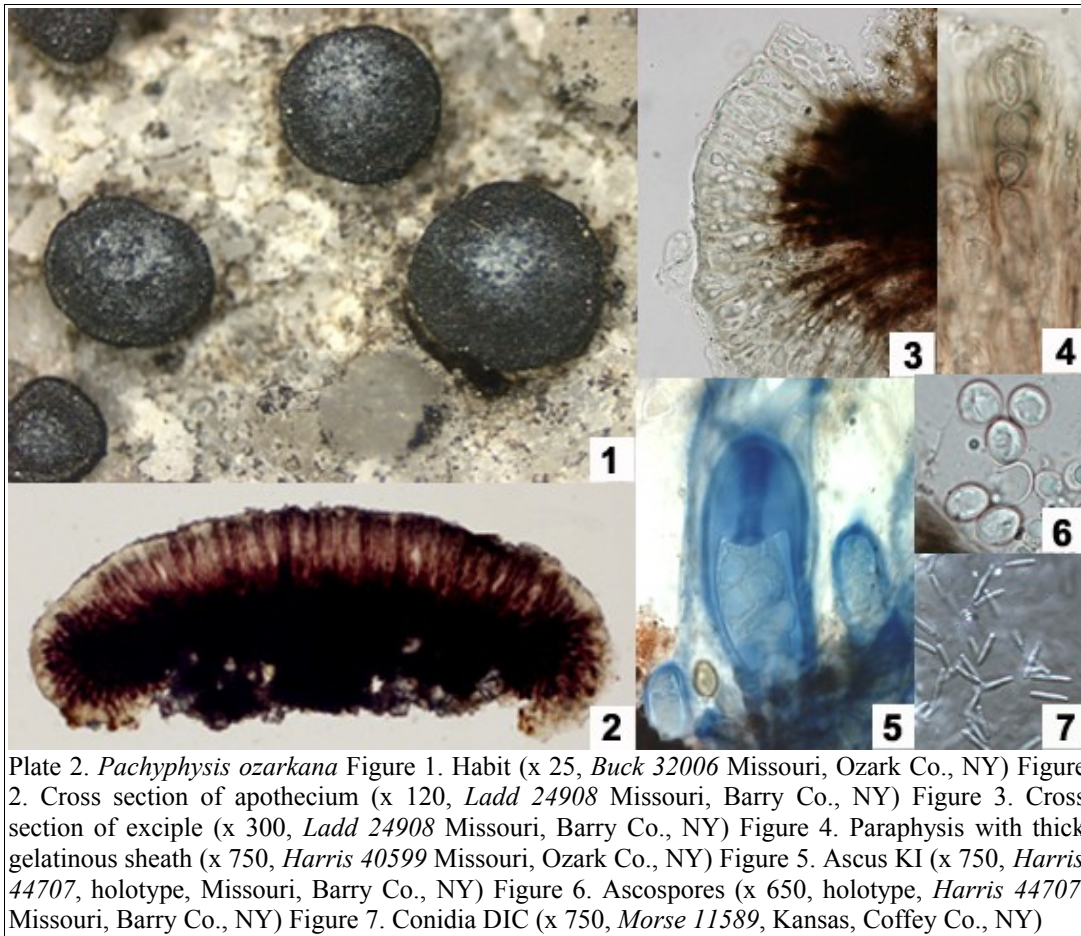
TYPE: USA. MISSOURI. BARRY CO.: Roaring River State Park, Roaring River Hills Wild Area along state highway F, 36°34'50"N, 93°50'00"W, dolomite glade with *Juniperus*, 3.xi.2000, *Harris 44707* (NY, holotype).

DESCRIPTION. – **Thallus** endolithic, not visible when on fine-grained dolomite/limestone (Ozarks), or traces of whitish epilithic thallus when on more pervious sandstone (Wisconsin); no substances detected by TLC. **Photobiont** chlorococcoid, not abundant, in a ± discontinuous layer; cells globose, 7–13 µm.

Apothecia (Fig 1) black, 0.5–1.2 mm across, usually with patches of diffuse white pruina, sessile (or in some Kansas specimens ± immersed, forming shallow pits in limestone), slightly to strongly constricted at the base, initially ± flat becoming swollen and hemispherical, initially with thick, slightly raised margin which is usually excluded with age; apothecial initials in pits in dolomite. **Exciple** (Fig 3) of radiating hyphae with large lumina embedded in well developed gelatinous matrix, ± colorless streaked with purple or with purple-black pigment masses or entirely purple, K+ red-purple; inner part often continuous with hypothecium and sometimes scarcely distinguishable from hypothecium. **Hypothecium** very gelatinous, dark brown to blackish purple, purple coloration more intense in K, red in HNO₃. **Epihymenium** grayish to olive or greenish (K–, N+ red) with numerous small colorless crystals on surface. **Hymenium** brownish (K– or K+ weakly purplish, N+ red-orange) in upper part, shading into and sometimes obscured by red-purple pigment (K+ intensely red-purple, N+ purple) in lower part (subhymenium?). **Paraphyses** of two kinds, some clavate, to ca. 10 µm thick (including thick gelatinous sheath); lumen toward base ca. 2 µm across, at top to ca. 7 µm across, others not or little expanded at tips with lumen 3–4 µm across, both types branched and anastomosed, sometimes so gelatinized as to be indistinguishable. **Ascus** (Fig 5) *Porpidia*-type, ± clavate, with eight, irregularly arranged spores. **Ascospores** (Fig 6) broadly ellipsoid to globose, not halonate, 10–13 × 8–10 µm or 10–12 µm across.

Pycnidia with blue-green wall, ca. 0.1 mm diameter, mostly immersed. **Conidia** (Fig 7) ± bacilliform although sometimes tapered at one or both ends, 6–8 × 1–1.5 µm.

³ Complete specimen citation data can be accessed at <http://sciweb.nybg.org/science2/VirtualHerbarium.asp>.



ETYMOLOGY. – *Pachyphysis* from pachys = thick and -physis from paraphysis, in reference to the distinctive thick paraphyses, *ozarkana* from region of the taxon's discovery and source of the majority of known collections.

DISTRIBUTION & ECOLOGY. – Frequent on exposed limestone and dolomite throughout the range of these substrates in the Ozarks, growing on both small pebbles and cobbles and on massive outcrops and boulders, usually on horizontal surfaces. The most typical habitat for this species in the Ozarks is dolomite glade. This species is known from carbonate bedrock regions of the Interior Low Plateau of Kentucky and Tennessee, westward through the Ozarks and into the Tallgrass and mixed grass regions of the central Great Plains of Kansas and Oklahoma, southwest into Texas. It is also known from the driftless area of southwestern Wisconsin, where it occurs on calcareous sandstone. It is interesting that all known sites for this species are in landscapes that remained unglaciated during the last glacial interval.

DISCUSSION. – *Pachyphysis* is distinctive in the very thick paraphyses and the often globose ascospores. We have been unable to assign *Pachyphysis ozarkana* to any known genus of Porpidiaceae or match it with any known species of *Lecidea s. lat.* The ascus after KI treatment shows a definite dark staining 'tube' in the tholus (sometimes seen as a stack of rings), which seems to fit the *Porpidia* type ascus. It is primarily on this basis that *Pachyphysis* is assigned to the Porpidiaceae *s. lat.* Buschbom (2004) found that *Pachyphysis* was not included within a narrow Lecideaceae/Porpidiaceae clade but was in a clade with *Farnoldia* and *Melanolecia*, differing from them in paraphyses and apothecial pigmentation. This is interesting as both are strong calciphiles. One collection (*Buck 32057*) hosts a lichenicolous fungus tentatively identified as *Muellerella pygmaea* (Körber) D. Hawksw. var. *athallina* (Müll. Arg.) Triebel. Unfortunately this taxon has a wide host range and is not informative as to the familial position of the host.

In the field *Pachyphysis ozarkana* closely resembles *Lecidella stigmataea* (Ach.) Hertel & Leuckert but can be distinguished by the large apothecia with patchy white pruina. It can also be mistaken for less pruinose forms of *Sarcogyne regularis* Körber which lacks the highly colored tissues of *Pachyphysis* and has polysporous asci. Species of *Clauzadea* are rare in the Ozarks and lack pruina on the apothecia as well as lacking a grayish to olive or greenish epihymenium. Despite the paucity of lichen work in middle portions of North America, *Pachyphysis* is sufficiently common and widely distributed that it must have been collected earlier but it remains something of a puzzle as to what it might have been named. Alan Fryday in his review suggested misidentified specimens of *Lecidea phylliscina* Nyl. (= *Porpidia macrocarpa* (DC.) Hertel & Knoph) as a possibility to be investigated.

ADDITIONAL SPECIMENS EXAMINED. – **ARKANSAS.** CARROLL CO.: Along US 62 just NE of the White River, *Buck 38731* (NY); overgrown dolomite glade north of state highway 187, 1.0 mi. E of BM 1261, *Ladd 14754* (HB. LADD); MARION CO.: Jones Point Wild Life Management Area, *Harris 50957* (NY); SHARP CO.: Strawberry River Preserve, *Buck 40498* (NY). **KANSAS.** CHASE CO.: 6.5 mi N, 2.5 mi W Strong City, Tallgrass Prairie National Preserve, N part, *Morse 12335* (KANU); CLARK CO.: 3 mi N, 12 mi W Ashland, Big Basin Preserve, *Morse 13472b* (KANU); COFFEY CO.: 0.5 mi N, 1 mi E Waverly, SE corner of intersection of 26th & Underwood Rds., *Morse 11589* (KANU, NY, HB. LADD); GEARY CO.: 4.25 mi S, 0.75 mi W Wreford, E side of Geary Co State Fishing Lake, *Morse 13923* (KANU, NY); LOGAN CO.: 16 mi S, 7 mi W Oakley, Smoky Valley Ranch (TNC preserve), *Morse 12399* (KANU, NY); MONTGOMERY CO.: ca 1 mi S, 7 mi E Elk City, N side of Elk City Lake, *Morse 14444* (KANU, NY); RILEY CO.: Konza Prairie Biological Station units 13E, 13F, & 14F in vicinity of Nature Trail, *Morse 12608* (KANU), Konza Prairie Biological Station units 14D, E & F, *Morse 11041* (KANU); ROOKS CO.: 0.75 mi S, 5.5 mi E Codell, "Devil's Den" area, *Morse 12215b* (KANU), Codell, *Morse 12256* (KANU); RUSSELL CO.: 6 mi SW of Russell, *McGregor 475* (KANU); Wilson Wildlife Area, *Morse 12264* (KANU), 2 mi S, 2 mi E Fairport, *Morse 12238* (KANU); TREGO CO.: 15 mi S, 4 mi W Ogallah, Cedar Bluff Reservoir, *Morse 12516* (KANU, NY). **KENTUCKY.** BULLITT CO.: Bernheim Arboretum and Research Forest, *Ladd 24033* (NY). **MISSOURI.** CARTER CO.: Chilton Creek Preserve, *Ladd 18680* (HB. LADD); CHRISTIAN CO.: Mark Twain National Forest, N of Turkey Creek Road, 0.75 mi W of MO UU, *Harris 47711*, *Ladd 24908* (NY); DENT CO.: Indian Trail Conservation Area, *Buck 47446* (NY); FRANKLIN CO.: Meramec State Park, Copper Hollow Natural Area, *Ladd 15911* (HB. LADD); GREENE CO.: Wilson's Creek National Battlefield, *Buck 38341*(NY); JEFFERSON CO.: W-facing dolomite glade, E of Mammoth Creek Rd., *Harris 25408* (NY), Valley View Glades Natural Area, *Buck 45155*, *Harris 48177-B* (NY); Victoria Glade Preserve, *Harris 40394* (NY), *Ladd 12753* (HB. LADD); MARIES CO.: Spring Creek Gap Conservation and Spring Creek Gap Glades Natural Area, *Buck 42755* (NY); MONTGOMERY CO.: NW corner of Danville Conservation Area, *Buck 40587*, *Harris 45691*(NY); OZARK CO.: Mark Twain National Forest, Smoke Tree Scenic Lookout, *Buck 32006*, *32008*, *32787*, *Harris 40599*, *40618*, *41383*, *41412* (NY), *Ladd 20200*, *20208* (HB. LADD), N of Forest Service Road 147 (Glade Top Trail) in vicinity of parking area, *Harris 47468*, *47473* (NY), along ridge E of Waterhole Hollow, *Amtoft 1026* (NY); PHELPS CO.: Mark Twain National Forest, Bradford Branch Woodland Restoration Area, *Ladd 17588*, (HB. LADD); ST. LOUIS CO.: Rockwoods Reservation, *Harris 45641* (NY); STONE CO.: Ashe Juniper Natural Area, *Buck 49448* (NY), *Morse 11897a*, *11914* (KANU), Pilot Knob Conservation Area, *Morse 11959* (KANU); TANEY CO.: Along W side of MO 125 ca. 0.9 mi N of Hercules Tower Rd., *Buck 32057*, *32065*, *Harris 40673* (NY), *Ladd 20181* (HB. LADD); Hercules Glade Wilderness, Blair Ridge Trail, *Buck 44633* (NY), 3 mi NNE of US 160 9n Cross Timbers Road (CO Rd. 160/200), along trail to Coy Bald, *Harris 47586* (NY), *Ladd 20845* (HB. LADD); Hercules Glades Wilderness Area. SE corner of Coy Bald, *Wetmore 84160* (MIN), *84187* (MIN, NY), Ruth and Paul Henning Conservation Area, Dewey Bald, *Buck 42930* (NY). **TEXAS.** CO.: Gist Ranch Conservation Area, *Buck 47559*, *Harris 50259*, *50286* (NY). **OKLAHOMA.** OSAGE CO.: Tallgrass Prairie Preserve, *Ladd 19872* (HB. LADD). **TENNESSEE.** WILSON CO.: Cedars of Lebanon State Park, *Harris 1294* (NY). **TEXAS.** UVALDE CO.: Sabinal, *Loring s.n.*, *Morse 9204B* (KANU). **WISCONSIN.** SAUK CO.: Baraboo Hills, Spring Green Reserve State Natural Area, *Harris 42181* (NY).

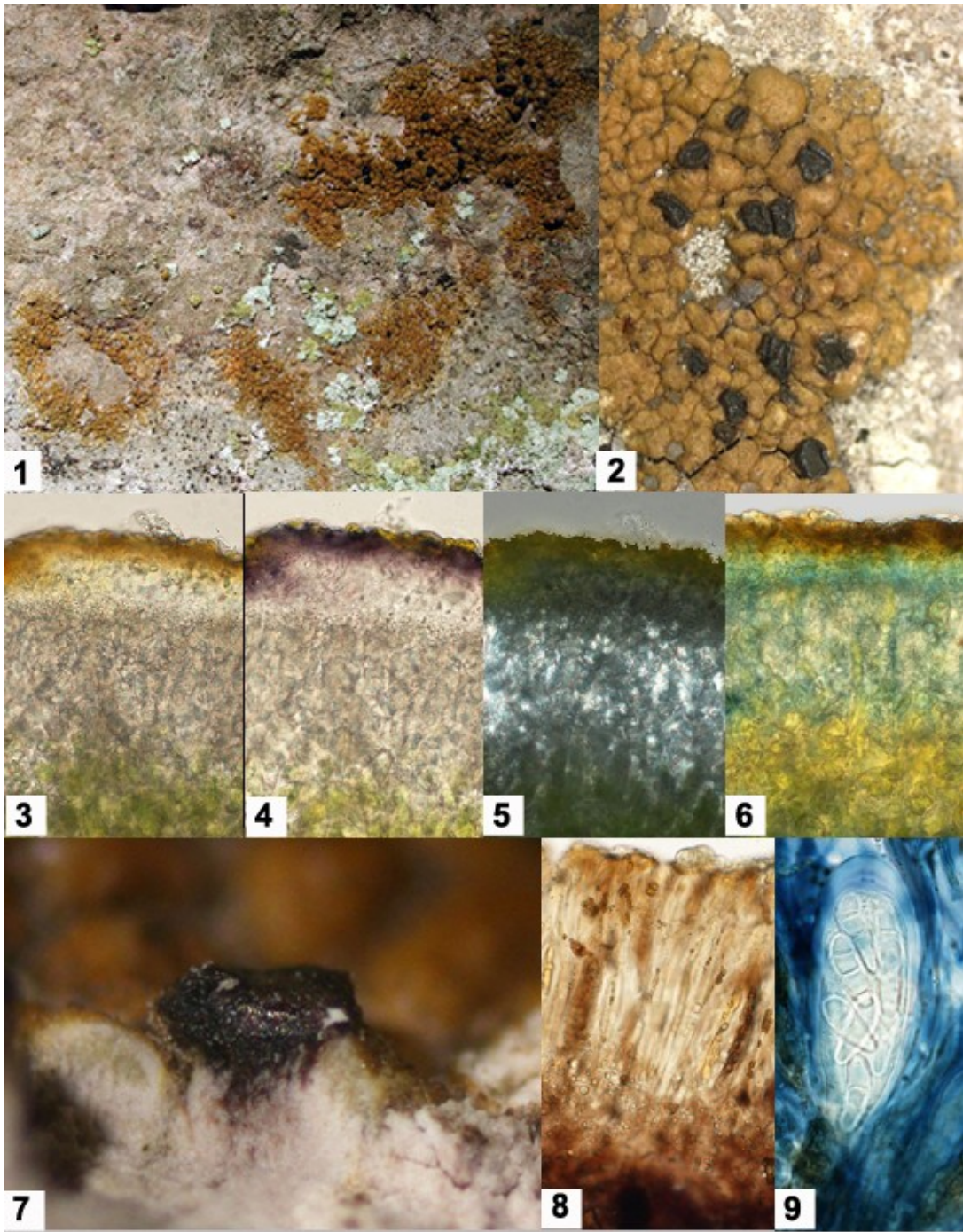


Plate 3. *Phoebe hydrophobius*. Figure 1. Habit, Oklahoma, Cherokee Co., *Buck 46537*, NY, photo Tony Kirchgessner). Figure 2. Habit (x 0.9, Arkansas, Izard Co., *Harris 45383*, NY). Figure 3. Cross section of thallus, in water (x360, Arkansas, Searcy Co., *Buck 48756*, holotype, NY). Figure 4. As fig. 3, in K. Figure 5. As fig. 3, polarized light. Figure 6. As in fig. 3, in I. Figure 7. Ascoma sectioned to show weak extension of base into thick medulla (x 60, Kansas, Cherokee Co., *Kramer 408*, NY). Figure 8. Cross section of hymenium (x 360, Arkansas, Searcy Co., *Buck 48756*, holotype, NY). Figure 9. (x 660, Arkansas, Searcy Co., *Buck 48756*, holotype, NY).

3. *Phoebus hydrophobius* R. C. Harris & Ladd, *gen. et sp. nov.*

Plate 3.

Genus et species Roccellacearum insignis ab omnibus aliis thallo placodioido aurantiaco K+ atrovioleto, medullo supra et infra algarum stratum, corticis atque medullae hyphis I+ cyaneis et ascomatis opegraphoidibus differt.

TYPE: USA. ARKANSAS. SEARCY CO.: Buffalo National River, Tyler Bend along River View Trail from Collier Homestead Trailhead, 35°58'31"N, 92°45'56"W, dolomite bluffs in hardwood forest, on vertical dolomite bluff, 17.iv.2005, *Buck 48756* (NY, holotype).

DESCRIPTION. – **Thallus** (Figs 1,2) placodioid, composed of ± bullate or rugose, irregularly polyhedral or irregular areoles, light to dark or brownish orange, K+ violet-black (violet in section), not pruinose; areoles to ± 1.0 mm across and to 1.0 mm thick; prothallus absent. **Chemistry:** unknown pigments (2 yellow spots + 1 purple spot in solvent A). **Photobiont** *Trentepohlia*, cells subglobose to ellipsoid, 14–20 x 9–12 µm. **Epicortex** (Figs 3-6) gelatinous, orange pigmented above, ± colorless below, almost absent to ca. 10 µm thick, **Cortex** (Figs 3-6) cartilaginous, colorless, 20–30 µm thick, of tightly interwoven, highly gelatinized hyphae, I+ blue-green; orange pigment K+ violet, forming small deep violet granules. **Medulla** both above and below algal layer, white, filled with small colorless crystals obscuring sparse hyphae (not dissolving in K), K–, C–, KC–, PD–; upper part 40–60 µm thick, of loose, mostly anticlinal?, thick walled, I+ blue green hyphae; lower part thick, to ca. 1.0 mm high, white, I+ dark blue-green. **Algal layer** 75–100 µm thick.

Apothecia (Fig 2, 7) opegraphoid, black, sessile, on or between areoles, 0.5–1.2 mm across, initially ± rounded but often deformed, occasionally ± elongated, scattered or occasionally clustered or proliferating along margins, initially immersed in thallus; margin black, rarely orangish pruinose, raised, coarse, becoming sinuate in older ascomata; disk black, orangish pruinose. **Exciple** black, highly melanized, 45–70 µm thick. **Hypothecium** (Fig 7) dark brown, extending slightly into thallus, ca. 250 µm thick. **Epihymenium** with sparse to dense orange granules, dark brown in K. **Hymenium** (Fig 9) tinted and streaked with light brown or orange-brown, with scattered colorless or orange crystals, upper part I+ dark blue-green, lower I+ red orange, ca. 100–110 µm high. **Paraphysoids** branched and anastomosed; tips not expanded. **Asci** (Fig 10) clavate, aborted/old ones with orangish brown to orange contents, with 8 spores mostly in two rows. **Ascospores** 3-septate, colorless, halonate, becoming brown and coarsely ornamented, 16–20 x 5–6.5 µm (excluding halo).

Pycnidia not found.

ETYMOLOGY. – Phoebus = Greek sun god, suggested by the orange “sun bursts” on rock in otherwise dark places, hydrophobius = water fearing, for its ecological preference.

DISTRIBUTION & ECOLOGY. – Restricted to massive calcareous substrates, typically on vertical faces of dolomite and limestone in areas of moderately high light intensity but protected from direct runoff or wetting. A typical habitat is on the face of a large bluff where a bedding plane of less resistant limestone has weathered more rapidly than the surrounding bedrock, creating a slightly recessed zone protected by the overhanging bedrock above. It occurs on both high light exposures and moderate shade. Because of the restricted habitat, this species is known from only a few sites in the southwestern Ozarks, as well as from nearby eastern Kansas and the Edwards Plateau of Texas, where it was discovered during the 2005 ABLS Foray. Attempts to relocate the population at the site Cherokee County, Kansas documented by Kramer in 1954 have been unsuccessful.

DISCUSSION. – In the field one is likely to mistake the orange thallus of *Phoebus* for an orange species of *Caloplaca* Th. Fr. Both also react magenta to purplish in K, but *Phoebus* has a much darker color reaction. When fertile, opegraphoid ascomata and ascospores easily distinguish *Phoebus*. Sterile material can be recognized by the very dark K-reaction and *Trentepohlia* photobiont. It is possible that *Phoebus* represents a lichenicolous *Opegrapha* on another sterile species of *Roccellaceae* but there is no hint of damage or two types of hyphae associated with apothecia. Within the *Roccellaceae* the placodioid thallus suggests some of the Southern Hemisphere species of *Roccellina* Darb. However, it does not seem closely

related to that genus due to the unique thallus pigmentation and anatomy. As far as we can tell there is no other genus in the family with anthraquinone-like pigments in the thallus or a well developed medullary layer above and below the algal layer.

ADDITIONAL SPECIMENS EXAMINED. – ARKANSAS. BENTON CO.: Hobbs State Park-Conservation Area, *Buck 49531* (NY), *Ladd 27526* (HB. LADD), *Morse 11962* (KANU); CARROLL CO.: 10 mi W of Eureka Springs on U.S. Hwy. 62, *Kramer 451* (NY); massive southwest-facing dolomite bluff above White River near US highway 62, *Ladd 22612* (Ladd). IZARD CO.: NE Corner of Devil's Knob-Devil's Backbone Natural Area, *Buck 40309*, *Harris 45383* (NY). KANSAS. CHEROKEE CO.: 4 mi E of Baxter Springs on U.S. Hwy. 166, *Kramer 408* (NY). MONTGOMERY CO.: 3 mi S, 1 mi E Independence, Elk City Lake, *Morse 2366* (KANU), N side of Elk City Lake, *Morse 14350* (KANU), *14465* (KANU, NY). MISSOURI. BARRY CO.: Roaring River State Park, *Buck 38836* (NY). OKLAHOMA. CHEROKEE CO.: Cookson Wildlife Management Area, Bolin Hollow, *Buck 46537* (NY), *Ladd 25684* (HB. LADD). TEXAS. TRAVIS CO.: Hamilton Pool Reserve, *Buck 49218*, *49228* (NY).

4. *Xyleborus sporodochifer* R. C. Harris & Ladd, *gen. et sp. nov.*

Plate 4.

Genus et species lecideina singularis sporodochiorum anamorpha ad familiam Stereocaulacearum pertinent. Subsimilis *Helvelleidae* sed hyphae parallelae arcte adnatae excipulo et strato externo excipuli hyalino differt.

TYPE: USA. MISSOURI. BARRY CO.: Mark Twain National Forest, Piney Creek Wilderness, north of Forest service Road #2185, 4.0 miles east of MO #39, Siloam Spring Trail, elev. 1200–1300 ft., 36°39'54"N, 93°36'23"W, oak-pine forest with chert residuum, on wood, 27.iii.2006, *Lendemmer 6519* (NY, holotype; isotypes to be distributed as *Lendemmer, Lichens of Eastern North America Exsiccati V: 228*).

DESCRIPTION. – **Thallus** (Figs 1,2) visible as paler areas on weathered decorticate logs and stumps (always *Quercus*?), patchy but often common on an individual log, superficial, scanty to abundant, pale tan to olivaceous, rough, of small (≤ 0.1 mm), areoles initially, sometimes remaining scattered but often coalescing and becoming \pm continuous when thallus well developed; prothallus not evident; photobiont chlorococcoid, cells globose, 10–14 μ m; unknown substance in low concentration or no lichen substances detected.

Apothecia (Fig 2) initially discoid, mostly becoming swollen, hemispherical to \pm turbinate, constricted at base, sometimes weakly stipitate, 0.2–0.5(–0.8) mm across, 0.1–0.3 mm high; disk brown to dark brown or nearly black but often with thin whitish pruina (dissolving in K), sometimes appearing gray when pruina "immersed"; margin not raised, concolorous or slightly darker than disk, not evident in swollen apothecia. **Exciple** (Fig 3,4) almost colorless to pale brown outward, brown inward, 50–80 μ m thick, of adnate radiating hyphae in colorless gel which forms a distinct external layer, sometimes containing \pm linear pockets of colorless crystals (dissolving in K); inner exciple adjacent to hypothecium with radiating lines of amorphous, dark brown extra-hyphal pigment to densely pigmented as in hypothecium; excipular hyphae mostly \pm expanded at tips (to 5.5 μ m). **Epihymenium** almost colorless to brownish, with numerous small colorless crystals (dissolving in K). **Hymenium** usually tinted pale to medium brown or brown streaked, 50–80 μ m high. **Paraphyses** (Fig 11) some slender, ca. 1–1.5 μ m across, unbranched or branched once in upper part, not expanded or pigmented at tips, interspersed with few to many with expanded tips to 3.5 μ m broad and with a thin brown cap. **Hypothecium** (Fig 3) dark brown, 50 μ m high in young apothecia to ca. 200 μ m in older, swollen apothecia (constituting bulk of apothecium), of very irregular and contorted hyphae, filled with dark brown extra-hyphal pigment and sometimes colorless crystals, K-intensifying. **Asci** (Fig 10) *Micarea*-type, clavate, with 8 irregularly arranged spores. **Ascospores** simple, fusiform to ovoid, colorless, 7–8.3–10.5 x 3.5–3.9–4.5 μ m, without halo.

Sporodochia (Figs 5-7) white, hemispherical to subglobose, 0.1–1.5(–2) mm across, K+ pale yellow; sterile part of colorless, irregular, tightly entwined, short-celled hyphae on a base of looser, brown hyphae/bark; conidiogenous cells (Fig 8) poorly differentiated, short, irregular. **Conidia** (Fig 9) globose, 2.5–4 μ m across, forming short, irregular chains/groups.

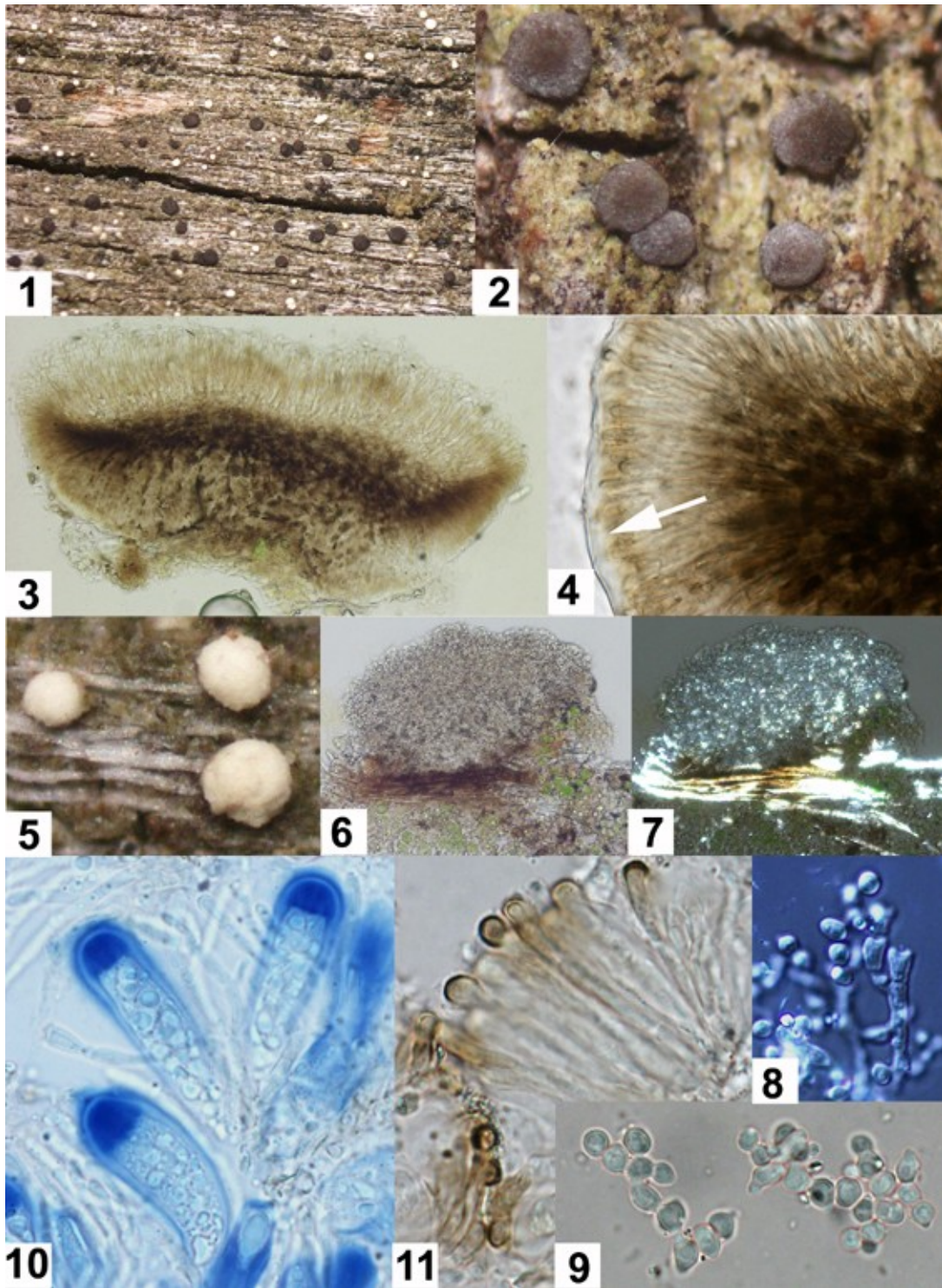


Plate 4. *Xyleborus sporodochifer*. Figure 1. Habit (x1.3) Figure 2. Pruinose apothecia (x 35) Figure 3. Cross section of apothecium (x 180) Figure 4. Detail of exciple with outer gelatinous layer (arrow) (x 670) Figure 5. Sporodochia (x 40) Figure 6. Cross section of sporodochium (x 160) Figure 7. Cross section of sporodochium polarized light (x 160) Figure 8. Conidia and conidiogenous cells? DIC (x 1200) Figure 9. Conidia DIC (x 120) Figure 10. Asci KI (x120) Figure 11. Paraphyses (x 1200). Figs. 1,3,5,6,7,8,9 (*Lendemer 6519*, Missouri, Barry Co., holotype); figs. 2,4,10 (*Buck 48942*, Oklahoma, Cherokee Co.); fig. 11 (*Ladd 20633*, Missouri, Shannon Co.)

ETYMOLOGY. – *Xyleborus* = eating wood; *sporodochifer* = bearing sporodochia.

DISTRIBUTION & ECOLOGY. – *Xyleborus* occupies an unusually narrow niche. It is confined to weathered lignum near ground level in shaded woodlands, typically in dry-mesic to dry habitats, but less commonly in mesic areas. It appears to be restricted to intact woodlands. Most, and perhaps all, of the records are from *Quercus*, usually on fallen logs but occasionally on the side of stumps. The substrate is always weathered and/or decayed to the point beings rough and abundantly fissured and cross-checked with cracks, but generally not decayed to the point of punkiness. *Xyleborus* is common in the Ozarks with a single record from eastern Kansas.

DISCUSSION. – As a consequence of the restricted circumscription of *Lecidea* Ach. *s. lat.*, all but a single Ozark species of *Lecidea* have been placed in other genera or belong to as yet undescribed genera. Since the other two unnamed lecideoid groups in our area (the *cyrtidia-plebeja* group and the *hypnorum* group) are widespread and, perhaps, controversial as to their disposition, we restrict ourselves to describing this unique, near-endemic Ozark species.

As far as we are aware lichens with sporodochial anamorphs are extremely rare (*Micarea adnata* Coppins, Coppins, 1983; *Tylophoron* Stizenb., Tibell, 1982, Harris, 1995) as are synnematal anamorphs (*Dictyocatenuolata* Finley & E. F. Morris, Lendemer & Harris, 2004). The vast majority produce pycnidia or hyphophores. While the presence of sporodochia (sometimes collected without accompanying apothecia) makes identification simple and provides additional justification for the new genus, the teleomorph is morphologically distinct. *Xyleborus* shares lignicolous substrate, apothecial coloration (external and internal) and *Micarea*-type ascus with species of *Hertelidea* Printzen & Kantvilas and "*Lecidea*" *plebeja* Nyl. The most obvious distinctions from both of the latter are found in the exciple, i.e., the colorless layer of gel on the outside and the rather narrow, closely adnate excipular hyphae with relatively unexpanded tips (differing from broader hyphae with distinctly expanded terminal cells). *Micarea adnata* differs in having the sporodochia composed of thin, cylindrical conidiogenous cells bearing small, simple conidia and in having apothecia with a poorly developed exciple.

ADDITIONAL SPECIMENS EXAMINED. – **ARKANSAS.** BAXTER CO.: Ozark National Forest, Leatherwood Wilderness, *Buck* 48888 (NY); BENTON CO.: Hobbs State Park–Conservation Area, *Buck* 46776 (NY), Ozark National Forest, Wedington Wildlife Management Area, *Buck* 46334, 46342, *Harris* 48768, 48770, 48780 (NY); FRANKLIN CO.: Ozark National Forest, Boston Mountain Ranger District, Shores Lake, *Buck* 49562 (NY), Ozark National Forest, south of FS 103 (White Ranch Mountain Road), in upper reaches of Deep Hollow, *Ladd* 25868 (HB. LADD); IZARD CO.: NE corner of Devil's Knob–Devil's Backbone Natural Area, *Buck* 40253 (NY); JOHNSON CO.: Ozark National Forest, Katie Knob, *Buck* 46735 (NY); RANDOLPH CO.: Robert L. Haskins/Mud Creek Wildlife Management Area, *Buck* 45527 (NY), *Ladd* 25347 (Ladd); SEARCY CO.: Buffalo National River, SE of Maumee South Campground, *Buck* 48856, 48866 (NY); SHARP CO.: Strawberry River Preserve, *Buck* 40467 (NY). **KANSAS.** DOUGLAS CO.: University of Kansas Ecological Reserves, Breidenthal Biological Reserve, *Morse* 14542 (KANU). **MISSOURI.** BARRY CO.: Mark Twain National Forest, Piney Creek Wilderness, *Buck* 49892 (NY); BUTLER CO.: Mark Twain National Forest, Mud Creek Natural Area, *Harris* 48491 (NY); CARTER CO.: Peck Ranch Conservation Area, MOFEP site 9, 8 mi. NW of Van Buren, *Ladd* 20484, 20491 (HB. LADD); CHRISTIAN CO.: Mark Twain National Forest, Devreaux Ridge, *Harris* 47660 (NY), S of Chadwick Road at jct of Monarch Road, 2.6 mi W of MO UU, *Buck* 44545 (NY); CRAWFORD CO.: Onondaga Cave State Park, Vilander Bluff Natural Area, *Buck* 47410 (NY); FRANKLIN CO.: Meramec State Park, *Buck* 49597 (NY); GASCONADE CO.: About 4.5 miles south of Owensville, along east side of Hwy EE, just north of Dry Fork Creek, *Wilhelm* 17649 (MOR, NY); MADISON CO.: Mark Twain National Forest, near N end of CR408/Forest Service Road 2604, *Buck* 45285 (NY); MARIES CO.: Spring Creek Gap Conservation Area and Spring Creek Gap Glades Natural Area, *Buck* 42757 (NY); McDONALD CO.: Huckleberry Ridge Conservation Area, *Buck* 43033 (NY); OZARK CO.: Mark Twain National Forest, along ridge E of Waterhole Hollow, *Buck* 44413, *Harris* 47391 (NY); STE. GENEVIEVE CO.: Magnolia Hollow Conservation Area, *Lendemer* 6747 (PH-HBL, NY); SHANNON CO.: Angeline Conservation Area, Lick Log Nature Trail, *Buck* 48942 (NY), MOFEP site 1, in Carr's Creek State Forest, in north portion of unit, *Ladd* 20633 (NY); TANEY

Co.: Mark Twain National Forest, Hercules Glade Wilderness, Blair Ridge Trail, *Buck 44624* (NY), from Hercules Tower off MO 125 to Pole Hollow, *Buck 32038* (NY); TEXAS CO.: Barn Hollow Natural Area, *Harris 50377* (NY), Gist Ranch Conservation Area, *Buck 47552* (NY), Mark Twain National Forest, Slabtown River Access, *Buck 47613* (NY); WAYNE CO.: Coldwater Conservation Area, *Buck 40075, 40083*, on side of oak stump, *Harris 45131* (NY).

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