PRELIMINARY DRAFT:
OZARK LICHENS

Enumerating the lichens of the Ozark Highlands of
Arkansas, Illinois, Kansas, Missouri, and Oklahoma

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INTRODUCTION

Well known as a biologically unique region North America, the Ozarks were long neglected from a lichenological standpoint. Systematic surveys and collecting work were initiated in the Missouri portion of the Ozarks in the early1980's, and were subsequently expanded to encompass the entire Ozark ecoregion, including small portions of Kansas and Illinois, and significant portions of Arkansas, Missouri and Oklahoma. These efforts have revealed a surprisingly rich diversity of lichens in the region, including a significant number of undescribed taxa. Despite considerable field work in every county in the region, new records continue to be found at a distressing rate, and we cannot yet state the total diversity of Ozark lichen biota.

This draft is a tentative first attempt to provide a comprehensive treatment of the lichens of the Ozarks. Included here are general keys, brief synopses of genera, key to species within each genus with more than one Ozark taxon, and summaries of the Ozark distribution and ecology of each species, sometimes accompanied by more detailed taxonomic descriptions and other comments.

As will be immediately evident to the reader, this draft is being rushed into preliminary distribution to be available for testing at the 2005 Tuckerman Lichen Workshop in the Ozarks. Hence a few disclaimers are stressed: this is an uneven treatment, in that some genera have been carefully studied, with detailed species descriptions and ecological profiles, while other groups are still problematical, with more cursory and provisional treatments. This project is an evolving work, and the user will note inconsistencies in style and approach from genus to genus. We have not included all unidentified species. Those we do include are treated inconsistently. Some are treated as new species, others as provisional (*sp. provis.*), both as to their distinctness and as to the name supplied, and many known from only a single collection are distinguished simply by a collection number. In some cases, the keys will prove frustrating and require modification - it is with hope of meaningful criticism and input from users that this draft was rushed into production.

Eventually, this draft will evolve into a unified comprehensive account of the lichen diversity of the Ozark highlands, complete with detailed distributional information, species descriptions and illustrations, and ecological information.

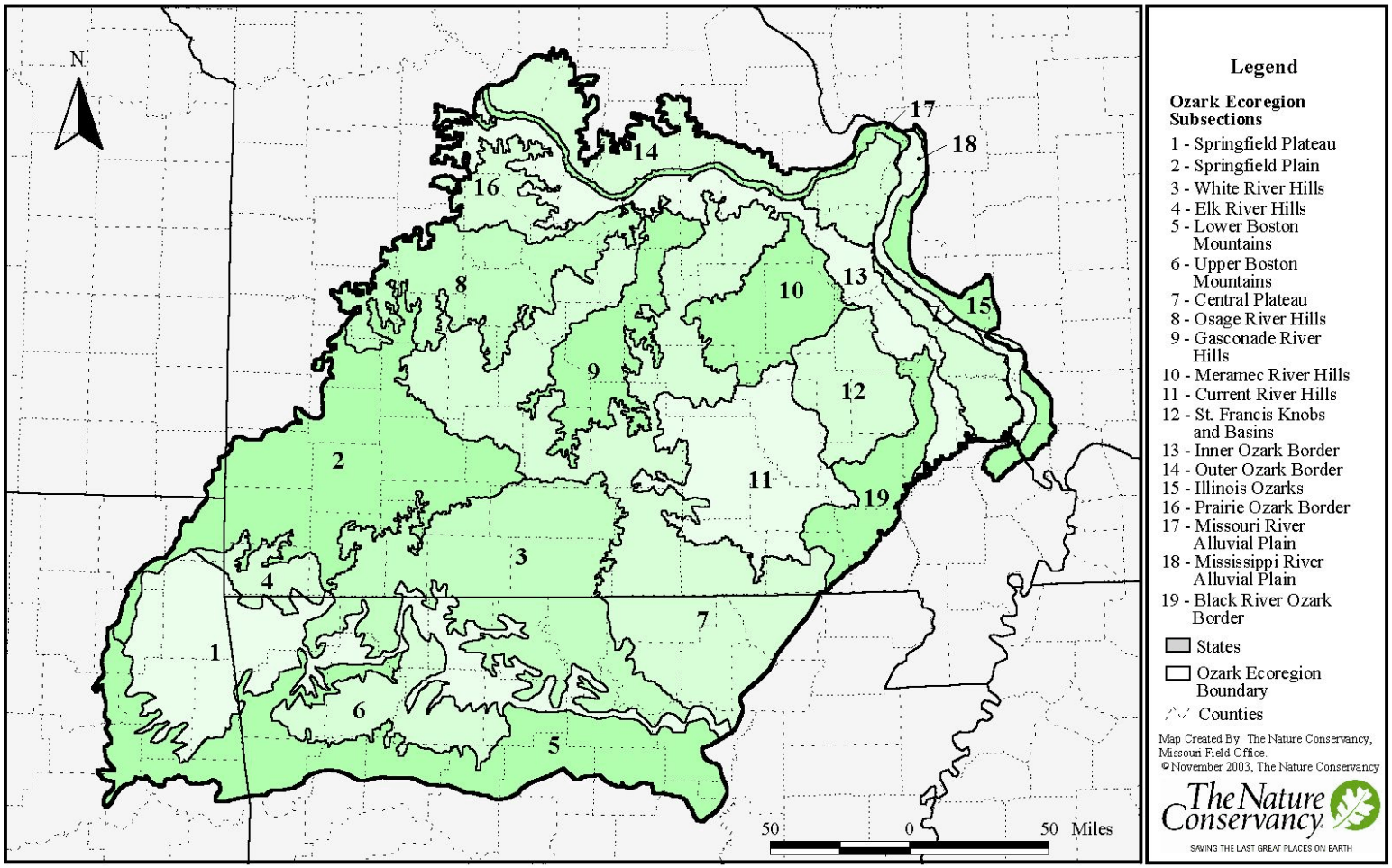
ECOLOGICAL OVERVIEW OF THE OZARKS

The Ozark region has long been recognized as a geologically, physiographically, ecologically, and culturally distinct area of North America (Figure 2). In conjunction with the Ouachita region to the south, the Ozarks comprise the only significant highland in midcontinental North America, and the only notable topographic relief between the Appalachians and the Rocky Mountains.

This region is characterized by a diversity of terrestrial, aquatic, and karst habitats, ranging from extensive glades and tallgrass prairies to both coniferous and deciduous woodlands and cypress swamps, as well as fens, sinkholes, sloughs, and a suite of clear-flowing streams and rivers fed by an abundance of springs of all magnitudes, including some of the largest freshwater springs in North America.

Encompassing 13.7 million hectares (34.3 million acres), the Ozarks includes portions of five states, with the majority of the region occurring within Missouri (67%) and Arkansas (24%) and smaller portions in Oklahoma (7%), Illinois (2%) and Kansas (0.1%). The Ozarks span a maximum of 270 miles (450 km) of north/south extent, and a maximum east/west extent

Figure 2. Ozark Ecoregion Terrestrial Subsections



wide range of habitat types. This is a region of rugged uplands with copious exposed rocks and variable soil depths. The landscape in various terrestrial subsections of the Ozarks ranges from extensive areas of karst terrain on irregular plains, to highly dissected regions with steep hills and deeply entrenched valleys, as well as limited areas of ancient low mountains with elevations up to 925 meters (3000 feet). There are also smaller, linear areas of alluvial terrain and major riparian features.

Bedrock geology of the Ozarks includes exposures of Precambrian igneous rocks in the eastern part of the Missouri Ozarks surrounded by alternating zones of Paleozoic sandstone and carbonate sedimentary rocks. Structurally, the Ozarks consist of a dome that has been slowly uplifted and eroded, resulting in a distinct landscape pattern. The oldest igneous rocks are exposed at the center of the uplift in southeast Missouri and surrounded by regions of Cambrian- and Ordovician-aged shallow water carbonates and beach sandstone strata. Further from the center are areas of younger Mississippian sedimentary rocks, including limestones and limited areas of riparian-derived freshwater sandstones (Nigh and Schroeder 2002).

Dominant soils consist of Alfisols and Ultisols. The Alfisols, predominant in the less dissected terrestrial subsections, are thin loams with a clay component in the subsurface, and are generally thought to have formed under timber and some prairie vegetation types. Ultisols, predominant in the more rugged and dissected terrestrial subsections of the Ozarks, can in many ways be considered a more leached, weathered version of alfisols, with a much lower component of basic cations. Average precipitation in the Ozarks ranges from 39-52 inches (99-132 cm), with mean annual temperatures ranging from 54-63 °F (12-17 °C). The average frost free growing season ranges from 180-208 days.

A major contributing factor to the region's extreme biological diversity is that parts of the Ozarks have been continuously available for plant and animal life since the late Paleozoic some 230 million years ago, constituting perhaps the oldest continuously exposed land mass in North America, and one of the oldest on earth. Plants have presumably inhabited these rugged uplands since the origin of the modern angiosperms some 100 million years ago. Because of their central location within the continent, the Ozarks have on multiple occasions served as a refugium for organisms buffeted by climatic shifts associated with glacial and geologic events. The high levels of microhabitat diversity, influx of biota from divergent regions, and extreme antiquity of the landscape have combined to both sustain relictual populations and allow the development of new species, making the Ozarks a center of endemism in North America (i.e. Zollner et al. 2005).

None of the four major continental glaciation events of the past two million years extended into the Ozarks. At the maximal extent of Wisconsin glaciation some 15,000 years ago, the climatic effects of a massive ice lobe extending into what is now central Iowa resulted in a boreal climate through much of midcontinental North America. At that time, the vegetation of the Ozarks was a combination of spruce-fir forests and jack pine parklands (Delcourt et al. 1986).

Coincident with or preceding the glacial retreat, there has been a more or less continuous inhabitancy of the region by human cultures. These people had to secure all the necessities of survival from the local environment on a year round basis without significant trade or resource input from areas outside the Ozarks. The fact that such cultures not merely survived, but developed art, mythology, ceremony, religion, and other accoutrements of highly developed societies, testifies to their superb abilities to manage and interact with the Ozark environment.

One of the most pervasive and effective tools available to early human populations in the region was wildland fire. An irrefutable body of evidence exists that the biological landscape of the Ozarks reflects the effects of millennia of frequent, low intensity, dormant season fires set by humans (e.g., Ladd 1991, Guyette & Cutter 1991). At the initiation of European settlement of the region,

predominate Native Americans in the Ozarks were the Osage. Parts of the eastern and southeastern Ozarks were home to the Quapaw.

Thus, the pre-Eurosettlement vegetation in the Ozarks had been influenced since the end of the glacial period by an ongoing aboriginal fire regime. This vegetation consisted of a mosaic of matrix communities dominated by open woodland types, with various combinations of oaks and shortleaf pine as the principle overstory dominants in the uplands. Although Ozark woodlands differ significantly from the extensive deciduous woodlands extending eastward to the Atlantic coast, the Ozarks represent the westernmost extension of this eastern deciduous woodland formation that dominated much of eastern North America prior to European settlement. Extensive areas of tallgrass prairie occurred in the Ozarks, especially in the western terrestrial subsections (Schroeder 1981). Embedded within these matrix vegetation types was a diverse assemblage of small and large patch natural communities, including various types of fens, forests, wetlands, fluvial features and both carbonate and siliceous glades. The Ozarks ecoregion contains the largest extent of glade communities in North America (Nelson and Ladd 1980), and the extensive landscape of dolomite glades in the White River Hills section of the Ozarks in southwestern Missouri is globally unique.

As a direct result of all these factors, the Ozarks support a diversity of natural communities and associated biota unlike anywhere else on earth. Many plants and animals in the Ozarks are relict populations of organisms whose modern ranges are otherwise remote from the region. A combination of habitat diversity, landscape position, and glacial history has resulted in a large number of species with diverse biogeographic affinities attaining the limits of their ranges within the Ozarks. For example, an evaluation of the Lower Ozark region of southeastern Missouri and northeastern Arkansas (predominately in the Central Plateau and Current River Hills terrestrial subsections) revealed that an astounding 17% of the area's vascular flora attained their global range limits in the Ozarks (TNC 1993).

The Ozarks also constitute a center of endemism for temperate biota in divergent organismal groups including vascular plants, lichens, fish, mollusks, and crayfish. Although not attaining levels of endemism associated with certain tropical systems, at least 200 taxa of plants and animals are known to be endemic to the Ozarks and/or Ouachitas (Allen 1990), despite a lack of disciplined biological inventory through most of the region, especially among more cryptic organismal groups. For these reasons, the area has long been recognized by conservation practitioners for its biodiversity and conservation significance.

The region has been significantly impacted by anthropogenic activities associated with modern society. This trend is accelerating, as intensive residential and recreational development, woodland clearing for pasture, and confined animal operations become ever more prevalent in the landscape. The Ozarks currently hosts a human population of more than three million. Despite this, large areas of the Ozarks remain in native vegetation cover. Timber, tourism, and agriculture are major economic factors in the region, with a rapidly increasing influx of retirees in recent years. Overall population trends are upward in the region. Average education and income levels throughout the Ozarks are generally lower than national averages, and 29 Ozark counties are classified as "persistent poverty" counties by the USDA. Critical threats to biodiversity across the region include altered fire regimes, altered hydrological regimes, habitat conversion and associated exotic species invasion, habitat fragmentation, and non-point-source pollution.

With its diverse geology, topography, and microhabitat spectrum, the Ozarks support a surprisingly rich diversify of lichens. Lichens are a prominent component of every intact landscape, including the prairie regions of the western Ozarks. Lichen diversity and abundance are impacted in the urban, suburban, and densely agricultural districts of the Ozarks. However, even in the most urban portions of St. Louis, the largest city in the Ozarks, one can consistently observe disturbance-tolerant lichens such as *Arthonia caesia, Caloplaca feracissima, Candelaria concolor, Endocarpon pallidulum* and *Physcia millegrana*.

The prevailing matrix natural community through most of the Ozarks is some phase of a variable deciduous wooded upland complex on leached acidic soils with abundant chert residuum. These woodlands are dominated by various species of oaks, such as *Quercus alba*, Q. coccinea, Q. marilandica, Q. stellata, and *Q. velutina*. Associated with these oaks are a consistent subcomponent of hickories such as *Carya glabra, C. texana* and *C. tomentosa*, as well as a diversity of other trees, notably *Cornus florida* and *Nyssa sylvatica*. The corticolous lichen biota of these woodlands is dominated by a mixture of foliose and crustose taxa, with *Pertusaria, Phaeophyscia* and *Physcia* being among the most diverse and abundant genera. Canopy lichens in intact wooded uplands can be extremely diverse, with a number of fruticose taxa such as *Ramalina culbersoniorum, Teloschistes chrysophthalmus*, and *Usnea* spp., as well as *Buellia stillingiana, Flavoparmelia caperta, Hypotrachyna livida*, and *Myelochroa galbina.* Pioneer lichens on young canopy branches include *Amandinea polyspora, Arthonia quinteria, Lecanora strobilina* and *Physcia stellaris*. The leached, acidic soils in the woodlands support a diverse suite of *Cladonia* species, while the chert cobbles and boulders provide habitat for a diversity of saxicolous lichens, including Buellia spuria, Fellhanera silicis, Flavoparmelia baltimorensis, Myelochroa aurulenta, *M. obsessa*, and *Physcia subtilis*.

In the southern half of the Ozarks are extensive regions that were dominated or codominated by shortleaf pine (*Pinus echinata*). These extensive pineries were the basis for an intensive logging boom at the turn of the last century, and for a brief interval in the early 1900's the largest sawmill in the world was located in the southeastern Missouri town of Grandin. Although the extensive pineries (and much of their sensitive biota, such as red-cockaded woodpeckers) are gone, considerable pine remains in this part of the Ozarks, and pines in remnant woodlands host a unique association of lichens, including *Canoparmelia caroliniana, C. texana, Chaenothecopsis nana, Cladonia ravenelii, Hypotrachyna pustulifera, Lecanora minutella , Tuckermanella fendleri* and *Tuckermanopsis ciliaris*.
Older cones of these pines are invariable, colonized by *Amandinea punctata* and *Lecanora strobilina*.

Limited areas of wet to mesic woodland, and even actual forest habitat, occur along streams and in deeper ravines. Prominent canopy trees in these habitats include *Carya cordiformis, Fraxinus americana, Quercus rubra, Q. shumardii* and *Tilia americana*, with understory species such as *Carpinus caroliniana*. Larger rivers, with significant silt deposition associated with flood events, have floodplains and margins with Acer saccharinum, Betula nigra, Fraxinus pennsylvanica subintegerrima, Platanus occidentalis, *Populus deltoides* and *Salix nigra*. Lichen development in these habitats ranges from depauperate in areas with excessive flooding to among the richest in the Ozarks in stable, intact sites with perennially high humidity levels. Some of the region's rarest lichens, such as *Graphis sophisticascens*, are associated with these habitats.

The St. Francois Mountains region of the Ozarks in southeastern Missouri consists of the exposed roots of an ancient eroded mountain range. This area, including a small region to the southwest of the main knobs area, is the only area of the Ozarks with exposed igneous substrates. Soils here tend to be thin and nutirent poor, with stunted xeric woodlands and abundant ignous glade and talus slope expanses. Streams in this region tend to be high gradient, rocky, and flashy. When a stream encounters a narrow between two igneous knobs, it often forms a feature known as a "shut-ins", where the stream width narrows and forms rapids through resistant igneous rocks. These habitats support several unusual lichens, including *Halecania rheophila.*

Glades are predominately open natural communities with bedrock at or near the surface. Glades are usually located on west and south aspects, because of the increased solar dessication associated with these aspects, and its consequent inhibition of woodland development. Two general classes of glades occur in the Ozarks: carbonate glade, developed on dolomite and limestone; and siliceous glades, developed on sandstone, igneous rocks, and chert. The world's only chert glades occur on the massive chert exposures near Joplin in southwestern Missouri. Siliceous and carbonate glades

support very different assemblages of both vascular plants and cryptogams. Differences among the lichen biota in glades of specific rock types within major glade classes are minor but evident.

The most prominent feature of siliceous glades is the abundance of various species of *Xanthoparmelia*, which provide the main color feature on many siliceous glades. Intact examples of siliceous glades support a high diversity of lichens, including several species that are rare or unusual in the Ozarks, such as *Psora icterica* and *Pycnothelia papillaria*. The saxicolous lichen component of carbonate glades is less prominent, consisting mostly of relatively inconspicuous crustose taxa. Nonetheless, it is at least as diverse, and perhaps more significant, with a number of new species whose global distribution is uncertain, some of which may prove to be Ozark endemics.

ACKNOWLEDGMENTS

Many people have contributed to this project over the past two decades, only a few of whom can be mentioned here. Bill Buck has been an unfailingly zealous field companion whose incredible field abilities have resulted in the discovery of many tiny or cryptic lichens that would otherwise be overlooked. In recent years, Anja Amtoft has been on several collecting trips with us; she contributed the treatment of *Dermatocarpon* used here, as well as several other insights. Much of the earliest systematic collecting in the Ozarks was done in conjunction with Gerould Wilhelm. James Lendemer played a major role in developing the treatment of *Usnea*. Tony Kirchgessner developed and populated the database of Ozark lichens. A few of the other people who have provided significant contributions, assistance, specimens and insight include Irwin Brodo, Carl Darigo, Robert Egan, Alan Fryday, Sam Hammer, Larry Nolan, Cindy Pessoni, Mike Skinner, Clifford Wetmore, Michelle Wilson and Douglas Zollner.

GENERAL KEYS TO LICHENS OF THE OZARK REGION OF ARKANSAS, ILLINOIS, KANSAS, MISSOURI, AND OKLAHOMA

Synopsis

Key to sections

1. Thallus fruticose, in form resembling an erect to pendent shrub, rope, stalk, or strap, with round to flattened branches, generally lacking a distinct lower cortex that is differentiated from the upper cortex . . . . . **KEY A fruticose lichens**

1. Thallus crustose, foliose, or squamulose, usually flattened, either closely attached to the substrate or with a distinct lower cortex, or flattened, lobe-like, and ± adnate to the substrate 2

2. Thallus foliose to squamulose, of ± flattened, typically horizontally spreading, distinct lobes, often with a distinct lower cortex; upper lower surfaces usually different in color and/or structure; rhizines or tomentum often present 3

3. Thallus foliose, typically of branched, radiating lobes or rosettes . . . . . **KEY B foliose lichens**

3. Thallus squamulose, of numerous scattered to contiguous, discrete, often unlobed, squamules . . . . . **KEY C squamulose lichens**

2. Thallus crustose, usually closely adherent to the substrate and often nearly inseparable from it; lower cortex lacking; rhizines and tomentum absent 4

4. Thallus routinely sterile, even in well developed specimens . . . . . KEY D sterile crusts

4. Thallus fertile, producing ascomata with asci and, usually, ascospores 5

5. Ascomata on distinct stalks, or slender, stalk-like structures (hyphophores) present . . . . . **KEY E Calicialian lichens**

5. Ascomata sessile to immersed; hyphophores lacking 6

6. Ascomata perithecia or perithecia-like, ± globose and opening by a typically apical pore, the perithecia sometimes closely aggregated . . . . . **KEY F peritheciate crusts**

6. Ascomata clearly apothecia, the disk circular to elongate or branched 7

7. Apothecia elongate or branched, lirelliform to stellate, typically at least twice as long as wide . . . . . **KEY G lirelliform crusts**

7. Apothecia ± circular, sometimes slightly irregular in outline, but prevailingly isodiametric to less than twice as long as wide . . . . . **KEY H crusts with round apothecia**

KEY A: FRUTICOSE LICHENS (including submacroscopic filamentous taxa)

1. Thallus flattened to terete, not filamentous, the main branches ≥ 0.2 mm broad. 2

2. Thallus greenish gray to blue-gray, green, or grayish orange, not gelatinous, stratified with a distinct algal layer; largest branches >0.5 mm wide; photobiont *Trebouxia* 3

3. Thallus branches flattened, not terete 4

4. Thallus grayish to orange, at least locally K+ magenta (parietin); usnic acid absent . . . . . *Teloschistes chrysophthalmus*

4. Thallus greenish, K-, usnic acid present . . . . . *Ramalina*

3. Thallus branches thicker, subterete to terete 5

5. Thallus branches solid, not hollow 6

6. Thallus branches angular; medulla loose and cottony; fibrils absent . . . . . *Evernia mesomorpha*

6. Thallus branches terete, with a distinct central cord; fibrils present . . . . . *Usnea*

5. Thallus branches hollow 7

7. Squamules often present; persistent granular primary thallus lacking; podetia and substrate various . . . . . *Cladonia*

7. Squamules absent; persistent granular primary thallus evident; podetia gray, to 7 mm tall, dark-tipped; on exposed sandstone . . . . . *Pycnothelia papillaria*

2. Thallus black to dark olive brown, becoming gelatinous when wet, or threadlike and 0.2 mm wide, not stratified with a distinct algal layer; photobiont cyanobacteria or *Trentepohlia* . . . 8

8. Isidiate; main thallus branches >2 mm wide, black, sometimes pruinose, flattened, umbilicate to straplike 9

9. Thallus black, not pruinose, typically subumbilicate . . . . . *Lichinella*

9. Thallus grayish pruinose, typically of suberect straplike lobes . . . . . *Thyrea confusa*

8. Isidia absent; main branches <2 mm wide, brownish to black, never pruinose, ± terete 10

10. On exposed carbonate rocks; thallus branches swollen; photobiont *Gleocapsa* . . . . . *Synalissa symphorea*

10. On or near bases of mature hardwoods in woodlands; thallus branches ± slender; photobiont *Nostoc* . . . . . *Dendriscocaulon intricatulum*

1. Thallus filamentous, the main branches < 0.2 mm broad 11

11. Thallus pale green, the branches < 0.02 mm thick; known only from low light conditions inside a dolomite cave (extinct?) . . . . . *Coenogonium missouriense*

11. Thallus black, some branches > 0.02 mm thick; widespread on siliceous substrates . . . 12

12. Thallus a felty mat of elongate, remotely branched, terete filaments <0.03 mm diameter, some branches >1 mm long; thallus of fungal hyphae closely enveloping filaments of *Trentepohlia* . . . . . *Cystocoleus ebeneus*

12. Thallus squat, subfruticose, branched, > 0.05 mm diameter, branches < 0.5 mm long; photobiont a cyanobacterium (*Gleocapsa*, *Nostoc*, or *cf. Scytonema*); on exposed siliceous substrates, typically associated with *Psorula rufonigra* . . . . . *Spilonema revertens*

KEY B: FOLIOSE LICHENS

1. Thallus gelatinous when wet, black to dark slate gray or brown, lacking a distinct algal layer, upper and lower surfaces similar; photobiont cyanobacterial 2

2. Thallus distinctly foliose, attached to the substrate at multiple locations, ± horizontally spreading and appressed to substrate 3

3. Lobes extremely narrow, < 0.2 mm broad . . . . . *Placynthium*

3. Lobes > 0.2 mm broad 4

4. Thallus dull above, black to brownish or olive; upper surface composed of loosely aggregated hyphae 5

5. Thallus distinctly foliose; ascospores 1+ septate; asci with IKI+ blue apical dome . . . . . *Collema*

5. Thallus subcrustose, thin and membranaceous; ascospores simple; asci IKI- . . . . . *Lempholemma polyanthes*

4. Thallus sublustrous above, slate gray to rich brown, upper surface composed of a layer of ± isodiametric cells . . . . . *Leptogium*

2. Thallus subfruticose to squamulose, typically attached to the substrate at a single point, ascending to umbilicate 6

6. Thallus of small subterete branches < 0.6 mm wide . . . . . *Synalissa symphorea*

6. Thallus of flattened straplike to umbilicate lobes mostly > 1 mm wide 7

7. Thallus of grayish pruinose ± straplike lobes . . . . . *Thyrea confusa*

7. Thallus epruinose, umbilicate to broadly squamulose . . . . . *Lichinella nigritella*

1. Thallus not gelatinous, variously colored, with a distinct algal layer, upper and lower surfaces usually different colors; photobiont various 8

8. Upper cortex tinted with orange or yellow, ranging from yellow green or sea green to lemon yellow or orange 9

9. Upper cortex golden yellow to orange, K+ magenta (parietin) 10

10. Thallus esorediate, closely adnate; rhizines lacking (simple hapters sometimes present) 11

11. Thallus bright orange, distinctly foliose; pruina, if present, inconspicuous; lower cortex present . . . . . *Xanthoria elegans*

11. Thallus bright to pinkish or yellowish orange; often whitish pruinose; lower cortex absent . . . . . *Caloplaca*

10. Thallus sorediate, appressed to suberect; rhizines present . . . . . *Xanthomendoza*

9. Upper cortex lemon yellow to yellowish green or sea green, K- 12

12. Upper cortex lemon yellow (sometimes greenish yellow in extremely shaded populations); lower cortex pale, rhizinate; thallus lobes < 0.4 mm wide . . *Candelaria*

12. Upper cortex yellowish green; lower cortex various, but if thallus lobes < 0.5 mm wide then thallus subcrustose and lower cortex lacking rhizines 13

13. Thallus subcrustose to squamulose-umbilicate, either of discrete, bullate, subumbilicate areoles < 5 mm diameter or with areolate central portions and closely appressed marginal lobes; rhizines lacking 14

14. Thallus of suberect, swollen, bullate, subumbilicate areoles; lower surface pale brown, corticate . . . . . *Rhizoplaca chrysoleuca*

14. Thallus subcrustose, centrally areolate, with appressed lobate margins; lower cortex lacking 15

15. On siliceous rock; apothecia black; ascospores brownish, 2-celled . . . . . *Dimelaena oreina*

15. Substrate various, typically calciferous; apothecia tan to brown; ascospores hyaline, simple . . . . . *Lecanora*

13. Thallus foliose, with a distinct rhizinate lower cortex; thallus not areolate . . 16

16. Thallus loosely adnate and convoluted; medulla bright yellow; lower cortex yellowish . . . . . *Vulpicida viridis*

16. Thallus closely adnate, ± flat; medulla white; lower cortex whitish to tan, brown, or black 17

17. Lobes broad, apically rounded, some > 3.5 mm wide; upper cortex dull to lustrous 18

18. Isidiate or sorediate; apothecia rare 19

19. Isidiate, the isidia sometimes breaking to appear apically sorediate 20

20. Isidia fine, cylindrical; thallus margins ciliate . . . . . *Parmotrema madagascariaceum*

20. Isidia coarse, pustular, appearing apically sorediate with age; marginal cilia absent . . . . . *Flavoparmelia*

18. Diaspores absent; apothecia common . . . . . *Flavoparmelia rutidota*

17. Lobes narrower and typically more elongate, prevailingly < 3.5 mm wide; upper cortex ± lustrous . . . . . *Xanthoparmelia*

8. Upper cortex brown, gray, or bluish or greenish gray, without yellowish tints (some species may have yellow soredia or medullary tissue) 21

21. Upper cortex brown to brownish gray, K- 22

22. Lower surface tomentose, often felt-like 23

23. Lower surface with distinct raised or darkened veins . . . . . *Peltigera*

23. Lower surface lacking raised or darkened veins 24

24. Lower surface with abundant small pores 25

25. Thallus with marginal yellow soredia (often also marginally squamulose); lower surface with shallow, irregular punctations (pseudocyphellae) . . . . . *Pseudocyphellaria aurata*

25. Thallus with abundant fimbriate-dissected marginal lobules; lower surface uniformly tan, with deep, circular pores (cyphellae) . . . . *Sticta carolinensis*

24. Lower surface lacking pores; soredia, if present, not yellow 26

26. Thallus lustrous, deep brown, with laminal, flattened, isidia-like lobules; apothecia on underside of lobe tips . . . . . *Nephroma helveticum*

26. Thallus dull, gray brown, lobules, if present, marginal and not strongly flattened; apothecia on upper surface 27

27. Apothecia without a thalline margin . . . *Santessoniella crossophylla*

27. Apothecia with a distinct thalline margin 28

28. Thallus squamulose to subfoliose, grayish, with abundant whitish marginal zones; hymenium ultimately IKI+ reddish brown (sometime initially blue green); ascospores with attenuate apiculus and smooth sheaths . . . . . *Fuscopannaria*

28. Thallus foliose, brown, essentially without whitish marginal zones; hymenium persistently IKI+ blue (only around asci); ascospores with ± short apiculus and rough sheaths . . . . . *Pannaria*

22. Lower surface bare or rhizinate, lacking tomentum 29

29. Thallus umbilicate and centrally attached or of aggregated, subumbilicate thalli; well-defined branching lobes absent or abortive; diaspores absent 30

30. Thallus typically > 5 cm broad; lower surface rhizinate; perithecia absent . . . . . *Umbilicaria mammulata*

30. Thallus rarely > 5 cm broad; lower surface various; perithecia present and typically abundant . . . . . *Dermatocarpon*

29. Thallus characteristically foliose, with branched lobes; diaspores present or absent 31

31. Sorediate 32

32. Upper cortex densely pruinose, at least near lobe tips . . . . . *Physconia*

32. Upper cortex not pruinose 33

33. Lower cortex black . . . . . *Phaeophyscia*

33. Lower cortex pale 34

34. Thallus lobes minute, < 0.5 mm wide and tightly appressed; well-developed rhizines lacking . . . . . *Hyperphyscia*

34. Thallus lobes > 0.5 mm wide, adnate but not tightly appressed; well-developed rhizines present . . . . . *Physciella*

31. Not sorediate 35

35. Lobes subterete, tough, always < 0.4 mm wide; rhizines absent; ascospores 2-celled, hyaline . . . . . *Speerschneidera euploca*

35. Lobes ± flattened, not tough, prevailingly > 0.5 mm broad; rhizines present; ascospores brownish, or if hyaline, then simple 36

36. Upper cortex lustrous, not lobulate; marginal dark pycnidia usually common; apothecia marginal to submarginal; ascospores simple, hyaline 37

37. Lobes prevailingly < 0.8 mm broad, with elongate marginal pseudocyphellae; apothecia common . . . . . *Tuckermanella*

37. Main lobes ≥ 1 mm broad, marginal pseudocyphellae lacking; apothecia very rare . . . . . *Tuckermanopsis*

36. Upper cortex dull, typically with abundant lobules; pycnidia, if present, strictly laminal; apothecia laminal; ascospores 2-celled, brown 38

38. Apothecia common; lower surface pale throughout; thallus lobes elongate and uniformly narrow, the margins dissected into linear, ± appressed lobules . . . . . *Anaptychia palmulata*

38. Apothecia very rare; lower surface dark at center; thallus lobes short and apically broadened, with irregularly dissected, erect lobules . . . . . *Phaeophyscia squarrosa*

21. Upper cortex various shades of gray or blue gray, mostly without brown tints; K- or K+ yellow 39

39. Upper cortex with numerous small white pores . . . . . *Punctelia*

39. Upper cortex lacking small white pores (sometimes white angular markings or reticulations present) 40

40. Lobes broad, suborbicular, apically broadened and rounded, usually > 5 mm wide; thallus typically loosely adnate . . . . . *Parmotrema*

40. Lobes narrow, linear to slightly expanded, prevailingly <5 mm wide; thallus typically closely appressed 41

41. Upper cortex K- (atranorin and thamnolic acid lacking) 42

42. Medulla pigmented yellow or red 43

43. Medulla red; upper cortex epruinose . . *Phaeophyscia rubropulchra*

43. Medulla yellow; upper cortex pruinose, at least near lobe tips . . . . . *Pyxine*

42. Medulla white 44

44. Thallus shiny dark lead gray, laminally isidiate; lower surface with black tomentum . . . . . *Coccocarpia palmicola*

44. Thallus lighter gray to brownish, isidia absent (isidia-like lobules sometimes present); lower surface not tomentose 45

45. Upper cortex abundantly pruinose . . . . . *Physconia*

45. Upper cortex essentially epruinose 46

46. Lower cortex black, at least centrally . . . . . *Phaeophyscia*

46. Lower cortex pale throughout 47

47. Thallus uniformly appressed and tightly adnate to substrate; rhizines not evident . . . . . *Hyperphyscia*

47. Thallus appressed, but not inseparably adnate to substrate; rhizines evident 48

48. Lobes to 0.3 mm wide; soralia laminal and often wider than the lobes; lower cortex paraplectenchymatous . . . . . *Phaeophyscia insignis*

48. Lobes 0.5 mm or more wide; soralia marginal, apical, or, if laminal, narrower than the lobes; lower cortex prosoplectenchymatous . . . . . *Physciella*

41. Upper cortex K+ yellow (atranorin or thamnolic acid present) 49

49. Lower surface white to pale tan or yellow-orange 50

50. Thallus isidiate, or lower surface fibrous and cottony, or both 51

51. Isidia thin, cylindrical; upper cortex K+ instantly deep yellow (thamnolic acid) . . . . . *Imshaugia aleurites*

51. Sorediate, without diaspores, or if isidiate, isidia granular and subsorediate; upper cortex K+ pale yellow (atranorin) *Heterodermia*

50. Thallus not isidiate; lower surface corticate 52

52. Lobes ca. 1 mm broad; upper cortex of parallel, elongate hyphae . . . . . *Heterodermia*

52. Lobes < 1 mm broad; upper cortex of ± isodiametric cells . . . . . *Physcia*

49. Lower surface black or purplish, sometimes with a pale marginal zone 53

53. Lower surface tomentose; lobes appearing thickened and inflated . . . . . *Anzia colpodes*

53. Lower surface rhizinate; lobes flattened 54

54. Thallus without diaspores (sometimes with granulose squamules) 55

55. Lower surface mostly pale, with a dark purplish center; abundant granular squamules present on lobe margins; upper cortex of parallel elongate hyphae . . . . . [*Heterodermia squamulosa*]

55. Lower surface dark brown to black throughout; thallus not notably squamulose; upper cortex of ± isodiametric cells . . 56

56. Medulla white throughout, K-; at least some rhizines with dichotomous branches; upper cortex ± smooth . . . . . *Hypotrachyna livida*

56. Medulla locally pale yellow, at least under apothecia, K+ yellow to sordid reddish (galbinic acid); rhizines simple or with furcate tips; upper cortex often slightly rugose . . . . . *Myelochroa galbina*

54. Thallus isidiate or sorediate 57

57. Thallus isidiate 58

58. Lobe tips with abundant angular white markings and reticulations 59

59. Medulla K+ yellow turning red, KC- (salazinic acid); lower cortex predominately black; rhizines with squarrose branches . . . . . *Parmelia squarrosa*

59. Medulla K-, KC+ faint purplish (perlatolic acid); lower cortex predominately dark brown; rhizines simple to sparsely branched . . . . . *Canoparmelia caroliniana*

58. Lobe tips without well-defined white markings 60

60. Medulla, at least in part, pale yellow, KC+ yellow (galbinic acid) . . . . . *Myelochroa obsessa*

60. Medulla white throughout, KC+ reddish (gyrophoric acid or hiasic acid agg.) . . . . . *Parmelinopsis*

57. Thallus sorediate, the soredia sometimes arising from coarse, isidia-like pustules 61

61. Lobe tips pruinose; medulla yellow . . . . . *Pyxine*

61. Lobe tips epruinose; medulla white (patchily yellow in *Myelochroa*) 62

62. Thallus closely appressed to and appearing almost confluent with sheltered siliceous rocks; rhizines lacking . . . . . *Dirinaria frostii*

62. Thallus ± adnate on, but not tightly appressed to, various substrates; rhizines abundant 63

63. Lower surface ecorticate and fibrous, marginally white to yellow, becoming dull purplish black towards center . . . . . *Heterodermia casarettiana*

63. Lower surface corticate, uniformly brown to black, ± lustrous 64

64. Larger rhizines with frequent dichotomous branches; thallus with coarse, inflated, hollow pustules . . . . . *Hypotrachyna pustulifera*

64. Larger rhizines simple to sparsely furcate; thallus without pustules 64

65. Soredia in diffuse laminal patches; medulla often pale yellow, at least locally; white portions of medulla K-, KC- . . . . . *Myelochroa aurulenta*

65. Soredia in small, laminal soralia or occurring along thallus ridges; medulla uniformly white, K+ yellow (stictic acid) or KC+ briefly faint purple (divaricatic acid) . . . . . *Canoparmelia*

KEY C: SQUAMULOSE LICHENS

1. Perithecia present; thallus brown or gray 2

2. Ascospores muriform, becoming brownish; photobiont present in hymenium . . . . . *Endocarpon pallidulum*

2. Ascospores simple or 1-septate, hyaline; hymenium lacking photobiont 3

3. Squamules gray, < 1 mm wide; ascospores 1-septate . . . . . *Placidiopsis minor*

3. Squamules brown, > 3 mm wide; ascospores simple . . . . . *Placidium*

1. Perithecia absent; thallus apotheciate or sterile, variously colored 4

4. Thallus of small, convex, gray green squamules with pale, minute, spiculate cortical hairs, resembling miniature cactus pads . . . . . *Agonimia opuntiella*

4. Thallus variously shaped, glabrous 5

5. Thallus sorediate, or lignicolous/corticolous, or both 6

6. Thallus of delicate blue-gray, ± appressed squamules with upturned edges; soredia laminal and marginal . . . . . *Normandina pulchella*

6. Thallus greenish or bluish to brownish, of ± ascending squamules; soredia marginal 7

7. Photobiont a cyanobacterium (*cf. Anacystis*) . . . . . *Peltula*

7. Photobiont chlorophycean (*Trebouxia* or chlorococcoid) 8

8. Squamules to 1.5 mm wide, lustrous, brown above, slightly ascending to loosely appressed, ± entire . . . . . *Hypocenomyce*

8. Squamules often > 1.5 mm wide, not notably lustrous, predominately bluish to greenish gray above, strongly ascending, often incised or lobed . . . . . *Cladonia*

5. Thallus lacking diaspores; substrate various 9

9. Squamules greenish or bluish gray, sometimes brownish tinged, ascending 10

10. Squamules corticate, with a distinct medulla 11

11. Squamules > 0.5 mm broad, thick and decidedly squamulose; isidia and prothallus absent . . . . . *Cladonia*

11. Squamules < 0.5 mm broad, thin and subcrustose, usually isidiate; pale prothallus present . . . . . *Phyllopsora*

10. Squamules undifferentiated internally, lacking a distinct medulla; restricted to sheltered shaded sites under bluff overhangs . . . . . *Flakea papillata*

9. Thallus (when dry) brown or grayish, lacking bluish or greenish tones, usually ± appressed to substrate 12

12. Photobiont a cyanobacterium 13

13. On calciferous soils; apothecia immersed; photobiont *cf. Scytonema* . . . . . *Heppia*

13. Saxicolous; apothecia sessile; photobiont *Nostoc* . . . . . *Fuscopannaria*

12. Photobiont chlorophycean 14

14. Squamules ca. 1 mm wide, brownish gray with dark thickened margins; on siliceous rocks or silty soil pockets over siliceous rocks . . . . *Psorula rufonigra*

14. Squamules mostly > 1 mm wide, brown to reddish brown, margins, if thickened, pale; on calciferous rocks or soil 15

15. Terricolous . . . . . *Psora*

15. Saxicolous 16

16. Squamules with ± thickened, whitish margins, pale beneath; apothecia reddish brown; hymenium IKI- . . . . . *Psora*

16. Squamules with thin, brown to dark margins, dark to brown beneath; apothecia gray to black; hymenium IKI+ blue 17

17. Ascospores simple; epithecium green; lower cortex absent . . . . . *Lecidea lurida*

17. Ascospores 4-celled; epithecium gray; lower cortex at least partially present . . . . . *Toninia submexicana*

KEY D: STERILE CRUSTOSE LICHENS

1. Coal black stains on acidic rock . . . . . *Lichenothelia*

1. Variously colored but not coal black; on a variety of substrates 2

2. Thallus leprose, of undifferentiated powdery masses of fungal hyphae loosely enveloping algal cells, lacking any vestige of cortex or morphological organization (occasionally appearing indistinctly lobed along margin) 3

3. Thallus yellow or with distinct yellow tints (if greenish yellow, see # 2 below) 4

4. Thallus bright lemon yellow . . . . . *Chrysothrix*

4. Thallus dull to grayish or brownish yellow 5

5. Thallus K+ deep grape purple (pannaric acid derivatives); on siliceous rocks or tree bases . . . . . *Lepraria vouauxii*

5. Thallus K+ reddish magenta (parietin); on dry sheltered carbonate faces . . . . . *Caloplaca chrysodeta*

3. Thallus greenish to bluish or gray 6

6. Usnic acid present . . . . . *Lecanora*

6. Usnic acid absent 7

7. Thallus thin, uniformly grayish green; on protected microhabitats of shaded carbonate rocks; containing only terpenes . . . . . *Botryolepraria lesdainii*

7. Thallus and substrates various; containing various lichen substances, but no terpenes other than zeorin present . . . . . *Lepraria*

2. Thallus not totally leprose, at least partially corticate and/or morphologically organized and differentiated 8

8. Thallus yellow to orange 9

9. Upper cortex K+ deep magenta (parietin) . . . . . *Caloplaca*

9. Upper cortex K- or K+ weakly reddish (calycin) 10

10. Thallus of discrete, corticate or sorediate granules . . . . . *Candelariella*

10. Thallus of diffuse masses of soredia intermingled with occasional corticate fragments . . . . . *Candelaria concolor*

8. Thallus greenish or bluish to gray, without yellowish tints 11

11. Medulla C+ reddish and/or KC+ reddish (gyrophoric acid or erythrin) 12

12. Saxicolous 13

13. Erythrin present, gyrophoric acid absent; on sandstone; photobiont *Trentepohlia* . . . . . *Dirina massiliensis* var. *sorediata*

13. Erythrin absent, gyrophoric acid present; usually on chert; photobiont chlorococcoid . . . . . *Trapelia placodioides*

12. Corticolous or lignicolous 14

14. UV+ yellow (lichexanthone) . . . . . *Ochrolechia arborea*

14. UV- 15

15. Thallus isidiate, brownish . . . . . *Placynthiella icmalea*

15. Thallus sorediate

16. Lignicolous; soralia blue green gray . . . . . *Trapeliopsis flexuosa*

16. Corticolous; soralia brownish . . . . . *Opegrapha sp.* 49437

11. Medulla C-, KC- 17

17. Thallus K+ yellow or red (atranorin, norstictic, stictic, or thamnolic acids) . . 18

18. Distinct fibrous white prothallus evident; soredia diffuse and granular . . . . . *Lecanora thysanophora*

18. Prothallus lacking or obscure, not fibrous; soredia pustular and/or in distinct soralia 19

19. Thallus K+ yellow turning red (norstictic acid); saxicolous . . . . . *Phlyctis "petraea"*

19. Thallus K+ yellow (atranorin, stictic or thamnolic acids); corticolous or saxicolous 20

20. Thallus thin, pale gray, with soralia containing farinose to finely granular soredia 21

21. Soralia punctiform; stictic acid present, atranorin lacking . . . . . *Nadvornikia sorediata*

21. Soralia larger, ± round; stictic acid lacking, atranorin present . . . . . *Lecanora impudens*

20. Thallus thicker, bluish gray, with diffuse patches of hollow pustules which sometimes disintegrate into a granular sorediate appearance . . . . . *Loxospora pustulata*

17. Thallus K- (psoromic acid or no lichen substances) 22

22. Muscicolous or humicolous; with minute, pale, shallowly lacerate hyphophores . . . . . *Gyalideopsis* sp. #2

22. Substrate various; hyphophores lacking 23

23. Thallus UV+ pinkish, KC+ orange (xanthones); muscicolous or rarely saxicolous . . . . . *Pertusaria globularis*

23. Thallus UV-, KC-; substrate various 24

24. Thallus isidiate 25

25. Corticolous; thallus of gray areoles . . . . . *Rinodina papillata*

25. Terricolous on siliceous soils; thallus of dark brown granules . . . . . *Placynthiella knudsenii*

24. Thallus not isidiate 26

26. Thallus pale gray, ± scurfy; psoromic acid present . . . . . *Phlyctis ludoviciensis*

26. Thallus greenish gray to dark gray; no lichen substances present 27

27. Thallus thin, orbicular soralia with small soredia . . . . . Opegrapha corticola

27. Thallus distinctly areolate to subsquamulose 28

28. Thallus of minute, rounded, strongly convex squamules . . . . . *Agonimia* sp. #1

28. Thallus ± continuous, of fimbriate-dissected, isidiate, plane to convex squamules . . . . . *Phyllopsora*

KEY E: CRUSTOSE LICHENS WITH STALKED APOTHECIA OR STIPITATE STRUCTURES

1. Stalked or stipitate structures hyphophores (producing conidiospores); ascospores, if present, hyaline, multiseptate to muriform, from sessile apothecia 2

2. Hyphophores black or brown, with labriform, lacerate apices . . . . . *Gyalideopsis*

2. Hyphophores pale, apically expanded and capped with a peltate, radially stellate apical plate . . . . . *Gomphillus americanus*

1. Stalked structures terminating in apothecia; ascospores usually present, greenish to brown, simple to 1-septate 3

3. Ascospores prevailingly 1-or more septate 4

4. On *Alnus*; stipes often branched; at maturity some ascospores 2-3-septate . . . . . *Stenocybe pullatula*

4. Not on *Alnus*; stipes usually unbranched; ascospores consistently 1-septate 5

5. On thalli of the polyporous fungus *Trichaptum biforme* . . . . . *Phaeocalicium polyporaeum*

5. Corticolous or lignicolous 6

6. Asci disintegrating early and forming a mazaedium . . . . . *Calicium*

6. Spores maturing within mature asci, mazaedium lacking . . . . . *Chaenothecopsis pusilla*

3. Ascospores simple 7

7. Asci disintegrating early and forming a mazaedium; spores maturing outside the asci . 8

8. On thalli of *Pertusaria*; stipes < 2 × longer than apothecia; mazaedium blackish . . . . . *Sphinctrina*

8. Corticolous or lignicolous; stipes usually > 2 × longer than apothecia; mazaedium pale brownish . . . . . *Chaenotheca*

7. Asci persistent; spores maturing within asci 9

9. Lichenicolous; ascospores ≥4.5 µm broad . . . . . *Sphinctrina*

9. Substrate various, rarely lichenicolous; ascospores < 4 mm broad 10

10. Apex of ascus uniformly thickened . . . . . *Mycocalicium*

10. Apex of ascus unevenly thickened, eventually becoming penetrated by a canal . . . . . *Chaenothecopsis*

KEY F: CRUSTOSE LICHENS WITH PERITHECIA OR PERITHECIA-LIKE ASCOMATA

Some advice based on experience — if you have problems, recheck spore color. In *Pyrenula* pale brown spores may be seen as hyaline but they will have thickened endospore. Old spores of hyaline spored species may become slightly brownish. If this seems possible, rekey as hyaline. Highly refractive hyaline spores may be interpreted as dark. If this seems possible, rekey as hyaline. Also recheck septation. Fresh spores usually have oil drops which often give appearance of additional cross walls. Clear spores with KOH or by heating briefly.

1. Ascospores simple, hyaline 2

2. Asci with 32 to > 100 spores 3

3. In algal slime over bryophytes; ascomata tiny; asci with ca. 32 spores . . . . . *Epigloea pleiospora*

3. On bark, wood, rock or soil; spores ofen > 32/ascus 4

4. Ascomata bright yellow, superficial on wood or rock . . . . . *Thelocarpon laureri*

4. Ascomata pale, dull yellowish, immersed and on bark or soil, or brown and superficial on rock 5

5. Saxicolous; ascomata superficial, brown . . . . . *Acarospora*

5. Corticolous or terricolous; ascomata immersed, yellowish 6

6. Terricolous . . . . . *Thelocarpon*

6. Corticolous 7

7. Ascomata with small, pore-like disk unadorned by teeth . . . . . *Thelopsis flaveola*

7. Ascomata opening by radiate cracking to form raised toothed exciple . . . . . *Ramonia microspora*

2. Asci with 8 or fewer spores 8

8. Terricolous; thallus filmy and indistinct or obsolete . . . . . *Thrombium epigaeum*

8. Corticolous or saxicolous; thallus obvious, usually not filmy 9

9. Saxicolous; photobiont cyanobacterial . . . . . Lichinaceae (*Cryptothele* and some species of *Pyrenopsis*)

9. Saxicolous or corticolous; photobiont a green alga 10

10. Apothecia immersed in corticate verrucae and with pore-like disks; ascospores double-walled, > 40 µm long . . . . . *Pertusaria* (rare fertile specimens of *Loxospora pustulata* will key here)

10. Peritheciate; ascospores < 30 µm long 11

11. Paraphyses present; hymenial gel I−; ascospores strongly ornamented . . . . . *Monoblastia*

11. Paraphyses absent; hymenial gel I+ bluish or orangish; ascospores not ornamented . . . . . *Verrucaria*

1. Ascospores 1-septate to muriform, hyaline or colored 12

12. Ascospores muriform to submuriform, with at least 1 cell longitudinally divided 13

13. Muscicolous . . . . . *Thelenella muscorum*

13. Corticolous or saxicolous 14

14. Thallus brown to grayish brown, rimose-areolate to minutely squamulose; hymenial algae present 15

15. Spores 2/ascus; thallus of ± dispersed subsquamulose areoles . . . . . *Endocarpon pallidulum*

15. Spores (1-)2-8/ascus; thallus continuous, areolate to rimose . . . . . *Staurothele*

14. Thallus variously colored, ± continuous; hymenial algae absent 16

16. Ascospores brown, at least at maturity; photobiont always present 17

17. Saxicolous; apothecia sunken with a pore-like mouth surrounded by radially cracked margin; thallus C+ . . . . . *Diploschistes actinostomus*

17. Corticolous; peritheciate; thallus C− 18

18. Thallus dull, brownish gray, with dark rounded ascomata composed of several perithecia-like locules; ascospore walls not thickened, the lumina conformable with the outer spore wall . . . . . *Mycoporum*

18. Thallus sublustrous, brown tinged with olive greenish, with corticate verrucae containing embedded perithecia; ascospore walls thickened, the lumina not conformable to the outer spore wall . . . . . *Pyrenula*

16. Ascospores persistently hyaline; photobiont present or absent 19

19. Photobiont *Trentepohlia* 20

20. Spores muriform; ascoma wall orangish to dark brown . . . . . *Topelia aperiens*

20. Spores submuriform with only a few cells divided lengthwise; ascoma wall black . . . . . *Strigula submuriformis*

19. Photobiont chlorococcoid or absent 21

21. Photobiont chlorococcoid 22

22. Paraphyses present; hymenium I− . . . . . *Thelenella*

22. Paraphyses absent; hymenial gel I+ blue-green becoming orangish 23

23. Perithecia black; on various substrates

23A. Thallus areolate to squamulose; cortex papillose . . . . . *Agonimia*

23A. Thallus continuous, smooth; cortex not papillose . . . . . *Polyblastia*

23. Perithecia pale orangish; on humus . . *Psoroglaena dictyospora*

21. Photobiont absent 24

24. Thallus smooth, pale silvery gray; ascomata walls blue green; on young, smooth bark in high light intensities . *Mycoglaena meridionalis*

24. Thallus indistinct, whitish; ascomata walls brown to black; on shaded lower boles of hardwoods . . . . . *Julella fallaciosa*

12. Ascospores with transverse septa only 25

25. Ascospores 1-septate 26

26. Ascospores hyaline 27

27. Paraphyses absent; photobiont chlorococcoid; on rock 28

28. Thallus immersed in substrate . . . . . *Thelidium*

28. Thallus minute, grayish, areole-like squamules . . . . . *Placidiopsis minor*

27. Paraphyses present; photobiont *Trentepohlia*, cyanobacterial or absent or if chlorococcoid, then ascomata laterally fused in small groups; on bark or rock . . 29

29. Photobiont *Trentepohlia* 30

30. Ascospores at least 35 µm long . . . . . *Acrocordia megalospora*

30. Ascospores to 25 µm long 31

31. Paraphyses abundantly branched and anastomosed; macroconidia simple . . . . . *Anisomeridium*

31. Paraphyses unbranched to sparingly and remotely branched; macroconidia septate . . . . . *Strigula*

29. Photobiont absent or cyanobacterial 32

32. Ascomata compound, several laterally fused . . *Mycoporum sparsellum*

32. Ascomata not compound 33

33. Saxicolous; photobiont cyanobacterial . . . . . *Pyrenocollema*

33. Corticolous; photobiont absent 34

34. Ascospores <15 µm long; asci ± cylindrical; paraphyses slender . . . . . [*Arthopyrenia minor*]

34. Ascospores >25 µm; asci pear-shaped; paraphyses thicker, ± parenchymatous . . . . . [*Naetrocymbe megalospora*]

26. Ascospores some shade of brown; photobiont absent; non-lichenized fungi often encountered 35

35. Thallus forming extensive black patches on moist siliceous rock; photobiont absent . . . . . *Lichenothelia*

35. Thallus on bark 36

36. Ascospores with one or both ends ± acute; on various trees but mostly on *Acer* . . . . . [*Kirschsteiniothelia*]
This nonlichenized fungus is often mistaken for a lichen. The thin, indistinct, undifferentiated grayish thallus has scattered, sessile, convex black perithecia with 2-celled, greenish to brown, often slightly asymmetrical, ascospores each less than 25 µm long.

36. Ascospores with both ends rounded; on *Quercus alba* or *Carya* 37

37. Ascospores 22-28 x 9-12 µm; very common on *Quercus alba* . . . . . [*Amphisphaeria bufonia*]

37. Ascospores 13-19 x 5-7 µm, weakly striate at high magnification; common on plates of *Carya sp.* . . . . . [*Didymosphaeria oblitescens*]

25. Ascospores 2+ septate 38

38. Saxicolous 39

39. Paraphyses absent; photobiont chlorococcoid . . . . . *Thelidium*

39. Paraphyses present; photobiont *Trentepohlia* 40

40. Ascoma with a least apex reddish or orangish; wall reddish or orangish in section; ascospores 4-celled 41

41. Hymenium I- . . . . . *Segestria*

41. Hymenium I+ bluish becoming orangish . . . . . *Thelopsis rubella*

40. Ascoma blackish; wall blackish in section 42

42. Ascus tip thickened; ascospores to 4-celled paraphyses branched and anastomosed . . . . . *Anisomeridium distans*

42. Ascus tip thin; ascospores 7+ celled; paraphyses unbranched . . . . . *Pseudosagedia guentheri*

38. Corticolous 43

43. Ascospore walls thickened, the lumina lenticular to subspherical 44

44. Ascospores hyaline 45

45. Ascospores 3-septate; thallus whitish, matt . . . . . *Lithothelium*

45. Ascospores mostly 7-9-septate; thallus green to brownish, shiny . . . . . *Trypethelium virens*

44. Ascospores brown 46

46. Ascomata with apical ostioles; ostioles sessile to immersed and not projecting; ascospores greenish to lighter brown (tea brown), 3-septate, [post-mature ascospores sometimes darkening — these often appear shriveled and misshapen]; endospore conspicuous . . . . . *Pyrenula*

46. Ascomata with ostioles off center to lateral, usually at end of neck-like projections; ascospores dark brown (cola brown), 3-7-septate; endospore not conspicuous . . . . . *Lithothelium*

43. Ascospore walls not thickened, the lumina cylindrical 47

47. Ascospores brown, 5-6-septate; photobiont *Trentepohlia* . . . . . *Eopyrenula intermedia*

47. Ascospores hyaline 48

48. Photobiont absent; ascocarp walls blue green . . . . . [*Mycoglaena*]

48. Photobiont present; ascocarp walls pale to dark, but not blue green . . 49

49. Ascospores narrow, worm-like, 20+ septate, > 80 µm long ; photobiont *Trebouxia* or absent 50

50. Photobiont *Trebouxia*; ascomata urceolate with very broad apical pore . . . . . *Conotrema urceolatum*

50. Photobiont absent; ascomata recumbent with ostiole lateral, slit-like in a round plate (resembles an eye) . . . . [*Robergea pupula*]

49. Ascospores broader in proportion to length, fusiform to dactyliform, to ca. 12- septate; photobiont *Trentepohlia* 51

51. Ascospores 7-12+ septate, > 32 µm long, attenuate at one end or not 52

52. Ascospores I+ violet; ascomata with broad pore-like disk . . . . . *Thelotrema subtile*

52. Ascospores I–; ascomata with tiny ostiole 53

53. Ascomata blackish; wall without crystals *Pseudosagedia*

53. Ascomata reddish or orangish; wall with crystals . . . . . *Porina heterospora*

50. Ascospores 3-7- septate, < 32 µm long, not apically attenuate . 54

54. Ascomatal wall reddish; ascospores 3(-4)-septate . . . . . *Thelopsis rubella*

54. Ascomatal wall black 55

55. Ascospores thin-walled, fusiform or attenuate at one end . . . . . *Strigula*

55. Ascospores thick-walled, ovoid . . . . . *Lithothelium*

KEY G: CRUSTOSE LICHENS WITH LIRELLIFORM, BRANCHED, OR STELLATE APOTHECIA

1. Ascospores muriform 2

2. Exciple absent; asci globose to pyriform; apothecia obscurely elongate and aggregated into substellate arrays . . . . . *Arthothelium*

2. Exciple black, opaque; asci elongate; apothecia lirelliform . . . . . *Graphis sophisticascens*

1. Ascospores 1-several septate, but never longitudinally divided; apothecia lirelliform, branched, or stellate 3

3. Apothecia reddish or brown to black, never pruinose; asci globose to pyriform; exciple undeveloped . . . . . *Arthonia*

3. Apothecia black, sometimes pruinose; asci elongate; exciple well developed 4

4. Ascospores 1- septate . . . . . *Melaspilea arthonioides*

4. Ascospores 3+ septate 5

5. Ascospores with lenticular to oval lumina, IKI+ violet; paraphyses unbranched; hymenium IKI- . . . . . *Graphis scripta*

5. Ascospores with cylindrical lumina, IKI-; paraphyses branched and anastomosing; hymenium IKI+ bluish to orangish 6

6. Exciple black, opaque, friable; thallus lacking crystals . . . . . *Opegrapha*

6. Exciple brown to pale, ± translucent, thin and flexuous; thallus with abundant minute crystals . . . . . *Enterographa hutchinsae*

KEY H: CRUSTOSE LICHENS WITH ROUND APOTHECIA

1. Thallus yellow to orange or apothecia orange to brownish andKOH+ magenta (parietin) 2

2. Thallus greenish yellow, with immersed black apothecia; spores brown . . . . . *Cyphelium tigillare*

2. Thallus not greenish yellow, apothecia yellow or orange to brown, or, if dark, the apothecia sessile and not immersed; spores hyaline 3

3. Thallus yellow,KOH- 4

4. Saxicolous; Thallus of flattened, isodiametric, ± contiguous areoles with immersed apothecia; ascospores > 100/ascus . . . . . *Acarospora*

4. On various substrates; thallus of small granules or tiny ± elongate squamules; apothecia superficial; ascospores 32 or less per ascus . . . . . *Candelariella*

3. Thallus color various, if yellow, then thallusKOH+ magenta (parietin) 5

5. Spores simple; on carbonate rocks; thallus thin, grayish . . . *Protoblastenia rupestris*

5. Spores 2+ celled (immature spores sometimes simple); substrate and thallus color various 6

6. Thallus various, but not thick and lobate; spores polarilocular; apothecia various, but not dark if thallus is orange . . . . . *Caloplaca*

6. Thallus deep orange, thick, placodioid-lobate;, spores 4- celled; apothecia purplish black . . . . . *Phoebus hydrophobius*

1. Thallus not yellow or orange; apotheciaKOH- 7

7. Photobiont absent 8

8. Spores simple; apothecia sessile, reddish to darkening . . . . . *Agyrium rufum*

8. Spores septate to muriform; apothecia ± immersed, dark 9

9. Thallus pale to silvery gray; spores hyaline 10

10. Ascocarp walls pale to brownish; asci globose to pyriform 11

11. Ascospores muriform . . . . . *Arthothelium*

11. Ascospores septate or chronically absent . . . . . *Arthonia*

10. Ascocarp walls blue green; ascospores 3-5- septate to submuriform, usually present . . . . . *Mycoglaena*

9. Thallus brown to dark gray; spores often brownish . . . . . *Mycoporum*

7. Photobiont present 12

12. Ascospores submuriform to muriform, with at least one cell longitudinally divided . 13

13. Thallus gelatinous, dark greenish brown to black; photobiont *Nostoc* 14

14. Cortex of elongate parallel hyphae; spores globose to cuboid, to 22µm long . . . . . *Collema occultatum*

14. Cortex of ± isodiametric cells; spores ellipsoid, ≥24 µm long . . . . . *Leptogium byssinum*

13. Thallus not gelatinous, brown to gray; photobiont chlorophycean 15

15. Corticolous 16

16. Thallus brownish; ascomata of several aggregated perithecia-like locules with separate ostioles, each aggregation resembling a flattened bunch of grapes; weakly if at all associated with a photobiont . . . . . *Mycoporum*

16. Thallus pale gray; apothecia separate, rounded to substellate 17

17. Thallus sorediate . . . . . *Phlyctis*

17. Thallus esorediate 17A

17A. Ascomata yellow to pale brown, immersed 18

18. Ascomata perithecioid . . . . . *Topelia aperiens*

18. Ascomata apothecioid . . . . . *Gyalecta*

17A. Ascomata dark, apothecioid, sessile . . . . . *Arthothelium*

15. Saxicolous 19

19. Apothecia pale 20

20. Photobiont *Trentepohlia*; on carbonate rocks; apothecia pinkish or yellowish, immersed . . . . . *Gyalecta*

20. Photobiont chlorococcoid; on siliceous rock; apothecia superficial with thin, blackish margin . . . . . *Gyalidea sp.*

19. Apothecia dark, immersed to superficial; photobiont *Trebouxia;* on siliceous rocks, mosses, or lichens 21

21. Apothecia superficial; paraphyses branched and anastomosing; thallus brownish to dark gray, areolate . . . . . *Rhizocarpon*

21. Apothecia immersed and sunken; paraphyses simple to sparsely furcate; thallus pale gray, ± continuous . . . . . *Diploschistes*

12. Ascospores simple to transversely septate 22

22. Ascospores greenish to brown 23

23. Thallus placodioid, distinctly lobate at the margins, yellowish green (usnic acid); on siliceous rocks . . . . . *Dimelaena oreina*

23. Thallus crustose to areolate, not marginally lobed, color various (usnic acid absent); substrate various 24

24. Asci disintegrating forming a mazaedium, with masses of brown 2-celled spores . . . . . *Cyphelium tigillare*

24. Asci persistent 25

25. Ascospores with thickened walls, the lumina angular or subspherical; well-developed thalline margin mostly present; . . . . . *Rinodina*

25. Ascospores with thin, uniform walls, the lumina conformable to the outer spore wall; thalline margin inconspicuous or absent at maturity; 26

26. Photobiont *Trentepohlia*; ascospores pale brown; hymenium and asci IKI- . . . . . *Melaspilea arthonioides*

26. Photobiont *Trebouxia*; ascospores green to brown; hymenium and asci IKI+ blue 27

27. Thallus areolate; apothecia marginal . . . . . *Rhizocarpon*

27.Thallus continuous to rimose or obscure; apothecia laminal . . . 28

28. ThallusKOH+ yellow or red (stictic or norstictic acid) or C+ orange (xanthones), or else thallus a well-developed, ± thick, areolate saxicolous crust; conidia ellipsoid to bacilliform . . . . . *Buellia*

28. ThallusKOH-, C- (no lichen substances), thin and ± continuous to obsolete; substrate various; conidia acicular to filiform . . . . . *Amandinea*

22. Ascospores hyaline 29

29. Asci each with more than 20 spores 30

30. Corticolous 31

31. Photobiont *Trentepohlia*; apothecia immersed or urceolate 32

32. Thallus esorediate, dark, obscure; apothecia pinkish, urceolate; spores simple, hyaline . . . . . *Ramonia microspora*

32. Thallus with punctiform soredia, pale gray; apothecia obscured by pale soredia; spores 2-celled, brown . . . . . *Nadvornikia sorediata*

31. Photobiont *Trebouxia* or chlorococcoid; apothecia superficial 33

33. Apothecia with well developed thalline margin; thallus dark green, thick, ± verrucose . . . . . *Maronea polyphaea*

33. Apothecia lacking a thalline margin; thallus grayish, thin, granular . . . . . *Strangospora*

30. Saxicolous 34

34. Apothecia immersed, variously colored; thallus areolate 35

35. On calcareous rock; apothecial disks with pale green pruina; areoles to 0.5 mm broad . . . . . *Myriospora immersa*

35. Apothecial disks not pruinose; areoles typically >0.5 mm broad . . . . . *Acarospora*

34. Apothecia superficial, dark; thallus thin and continuous or inconspicuous 36

36. Spores >50/ascus, each spore ≤ 5 µm long 37

37. Apothecia with irregularly ridged and lumpy disks; paraphyses branched and anastomosing . . . . . *Polysporina*

37. Apothecia with smooth disks; paraphyses unbranched *Sarcogyne*

36. Spores 12-16/ascus, each spore > 9 µm long . *Catinaria neuschildii*

29. Asci each with 8 or fewer spores 38

37. Ascospores 1+ septate 39

39. Photobiont a cyanobacterium; thallus blackish . . . . . *Placynthium*

39. Photobiont chlorophycean; thallus not black 40

40. Spores 1/ascus; psoromic acid present . . . . . *Phlyctis ludoviciensis*

40. Spores 8/ascus; psoromic acid absent 41

41. Ascospores 2+ septate 42

42. Spores narrow and elongate, > 5 × longer than wide 43

43. Conspicuous thalline margin present; apothecia reddish; epithecium KOH+ bright magenta-red . . . . . *Haematomma fenzlianum*

43. Thalline margin absent; apothecia not red; epithecium KOH- or KOH+ yellowish to darkening 44

44. Ascospores > 100 µm long 45

45. Muscicolous; apothecia substipitate; pale, stipitate hyphophores present . . . . . *Gomphillus americanus*

45. Corticolous; apothecia ± immersed, perithecioid; hyphophores absent . . . . . *Conotrema urceolatum*

44. Ascospores <70 µm long 46

46. Photobiont *Trentepohlia* . . . . . *Schismatomma*

46. Photobiont *Trebouxia* or chlorococcoid 47

47. Muscicolous . . . . . *Bilimbia sabuletorum*

47. Saxicolous, corticolous, or lignicolous 48

48. Paraphyses richly branched; spores twisted in the ascus and/or more irregularly curved . . . . . *Scoliciosporum*

48. Paraphyses simple to sparsely branched towards tips; spores straight to slightly arcuate 49

49. Spores delicate, thin walled, often ≤ 2µm broad and <40 µm long; exciple with thin-walled, rounded cells; in humid, shaded sites . . . . . Bacidina

49. Spores slightly stouter, often > 40 × 2 µm; exciple with ± thick-walled, elongate cells; habitat various . . . . . *Bacidia*

41. Spores ellipsoid or fusiform to elongate bacilliform, prevailingly < 5× longer than wide 50

50. Saxicolous 51

51. Photobiont *Trentepohlia* 52

52. Sorediate; spores curved . . . . . *Dirina*

52. Esorediate; spores ± straight; apothecia dark, surficial; exciple carbonaceous . . . . . *Cresponea premnea saxicola*

51. Photobiont chlorococcoid 53

53. Hypothecium and exciple brown; usually on carbonate rocks . . . . . *Bacidia coprodes*

53. On siliceous rocks; hypothecium pale or, if brown, exciple greenish 54

54. Paraphyses mostly unbranched; hypothecium pale; thallus dark greenish gray . . . . . *Fellhanera*

54. Paraphyses much branched; hypothecium pigmented; thallus pale to dark grayish or greenish . . . . . *Micarea*

50. Corticolous, muscicolous, or lignicolous . . . . . 55.

55. Photobiont *Trentepohlia* 56

56. Apothecia covered with whitish pruina; thallus brown . . . . . *Schismatomma glaucescens*

56. Apothecia dark, or if bluish pruinose, then thallus yellowish green . . . . . *Arthonia*

55. Photobiont chlorococcoid 57

57. Muscicolous 58

58. Some spores usually 5+ celled, usually > 28 × 5 µm; hypothecium reddish brown (except in pigment deficient forms with pale apothecia); paraphyses mostly simple or apically furcate, 2-3 µm broad, the tips expanded to ≥3.5 µm broad . . . . . *Bilimbia*

58. Spores prevailingly 4-celled, usually < 22× 5 µm; hypothecium pale; paraphyses branched, 1-1.5 µm broad, the tips expanded to ≤ 3 µm broad . . . . . *Micarea*

57. Corticolous or lignicolous 59

59. Apothecia ± immersed 60

60. Ascomata mostly dark, ± irregular; asci pyriform; thallus smooth . . . . . *Arthonia*

60. Epithecium pale; paraphyses mostly simple or with sparse apical branching; lignicolous . . . . . *Absconditella lignicola*

59. Apothecia superficial; epithecium greenish; paraphyses much branched; substrate various . . . . . *Micarea*

40. Ascospores 1-septate 61

61. Ascospores strongly polarilocular, with thickened septum . . . . . *Caloplaca*

61. Ascospores not polarilocular, septum not thickened . . . 62

62. Well-developed thalline margin evident 63

63. On carbonate rocks; spores without perispore . . . . . *Lecania*

63. Corticolous or on siliceous rocks; spores with an evident, ± gelatinous perispore . . . . . *Halecania*

62. Thalline margin absent (or rudimentary on young apothecia) 64

64. Apical cells of paraphyses distinctly swollen, with a dark brown apical cap . . . . . *Catillaria*

64. Apical cells of paraphyses narrow or swollen, but lacking a dark brown internal apical cap 65

65. Asci globose to pyriform; spores frequently macrocephalic . . . . . *Arthonia*

65. Asci more elongate, clavate to cylindrical; spores usually ± symmetrical 66

66. Apothecia pallid, yellowish to golden or orange 67

67. Photobiont *Trentepohlia*; apothecia round, plane . . . . . *Dimerella*

67. Photobiont *Leptosira*; apothecia short stipitate, taller than broad . . . . . *Vezdaea leprosa*

66. Apothecia grayish to dark 68

68. Photobiont *Trentepohlia* . . . . . *Melaspilea arthonioides*

68. Photobiont chlorococcoid 69

69. Thallus rimose areolate; hypothecium dark; exciple with crystals . . . . . *Rhizocarpon*

69. Thallus granular to thin or obscure; hypothecium pale to greenish; exciple lacking crystals . . . . . *Micarea*

37. Ascospores simple 70

70. Photobiont chlorophycean; thallus pale to gray or brown, never gelatinous 71

71. Apothecia not immersed, with a well-developed thalline margin . 72

72. Ascospore large, rotund, > 30 µm long . . . . . *Ochrolechia*

72. Ascospores various, < 20 µm long 73

73. Hymenium purplish red; apothecia black . . *Tephromela atra*

73. Hymenium hyaline below the epithecium; apothecia brown to blackish . . . . . *Lecanora*

71. Apothecia superficial and lacking a thalline margin, or immersed 74

74. Ascospores large, >40 µm long, single or double walled 75

75. Apothecia either immersed in thalline warts, with perithecia-like ostioles, or forming pale sorediate or pruinose verrucae . . . . . *Pertusaria*

75. Apothecia black, plane . . . . . *Megaspora*

74. Ascospores smaller, to 30µm long, single walled 76

76. Apothecia immersed in a well-developed thallus 77

77. Apothecial disks pale, pinkish to tan; thallus thin, with poorly differentiated or undifferentiated cortex . . . . . *Ionaspis*

77. Apothecial disks dark gray to black; thallus with well-defined cortex 78

78. Epithecium bright blue green; paraphyses of uniform width throughout; ascus tip IKI+ blue . . . . . *Lecanora*

78. Epithecium brown to olive; paraphyses moniliform; ascus tip IKI- . . . . . *Aspicilia*

76. Apothecia sessile and superficial (occasionally forming pits in carbonate rock, but if so, lacking a well developed thallus) . . . 79

79. On carbonate rocks, usually in exposed sites 80

80. Epithecium green 81

81. Hypothecium pale; apothecia epruinose; atranorin usually present; spores ellipsoid . . . . . *Lecidella*

81. Hypothecium dark purplish; apothecia usually pruinose; atranorin absent; spores subglobose . . . . . *Pachyphysis ozarkana*

80. Epithecium purplish or brown; sometimes with green zones 82

82. Thallus immersed to thin and scurfy; spores 16-20 × 8-10 µm; medulla P- . . . . . *Clauzadea*

82. Thallus thick, areolate; spores 12-16 × 5.5-7.5 µm; medulla P+ orange (pannarin) *Kozarus thelommopsis*

79. Substrate various, but not carbonate rocks; exposure various 83

83. Soredia, isidia, or isidia-like fimbriations present . . 84

84. Sorediate 85

85. Saxicolous . . . . . *Fuscidea recensa*

85. Corticolous or lignicolous 86

86. Thallus dark grayish green, UV-, KC+ reddish (gyrophoric acid) . . . . . *Trapeliopsis flexuosa*

86. Thallus pale grayish with brown or green tints, UV+ white, KC- (perlatolic acid) . . . . . *Hertelidea pseudobotryosa*

84. Isidiate or fimbriate-dissected 87

87. Corticolous; thallus grayish green, sublobate, with isidia or marginal fimbriations . . *Phyllopsora*

87. Terricolous or lignicolous; thallus dark brown, crustose, isidiate . . . . . *Placynthiella*

83. Diaspores absent 88

88. Apothecia red or pink to yellowish or golden, without gray overtones 89

89. Saxicolous; apothecia pink, rotund, >0.5 mm broad; thallus a grayish green film . . . . . *Dibaeis absoluta*

89. On organic substrates; apothecia red or pale to golden 90

90. Corticolous; apothecia bright red, >0.5 mm broad; thallus pale gray . . *Pyrrhospora russula*

90. Usually muscicolous or humicolous; apothecia pale to golden, mostly <0.4 mm broad; thallus greenish . . . . . *Vezdaea leprosa*

88. Apothecia brown to black, or if paler, with distinct gray overtones 91

91. Thallus pale gray, areolate to continuous; apothecia brown 92

92. Corticolous; thallus continuous, usually UV+ pinkish, KC+ orange (xanthone) . . . . . *Pyrrhospora varians*

92. Saxicolous; thallus areolate, UV-, KC+ red (gyrophoric acid) . . . . . *Trapelia glebulosa*

91. Thallus darker gray or brownish to greenish; KC−; apothecia usually gray to black 93

93. Pale, rounded sporodochia common; thallus lignicolous, greenish gray . . . . . *Lecidea sp.*

93. Sporodochia absent; thallus and substrate various 94

94. Paraphyses richly branched, often anastomosing 95

95. Hypothecium pale or, if reddish brown, then epithecium blue-green; apothecia prevailingly < 0.4 mm broad; substrate various . . . . . *Micarea*

95. Hypothecium dark; epithecium never blue-green; apothecia >0.5 mm broad; on siliceous rocks . . . . . *Porpidia*

94. Paraphyses simple to slight branched above, rarely anastomosing 96

96. Thallus brownish; epithecium brown; spores often curved; asci with 2 IKI+ blue bands arcing across the apex . *Fuscidea*

96. Thallus gray; epithecium greenish or brownish; asci with IKI+ blue internal apical structures not as above; spores straight 97

97. Tip of ascus IKI+ blue except for an apical core (*Lecanora*-type) . . . . . *Lecidella*

97. Tip of ascus otherwise . . . . . *Lecidea s. lat.*

[MARGINS SHIFTED TO LEFT]

70. Photobiont cyanobacterial; thallus black to dark brown, frequently gelatinous when wet . . 98

98. Terricolous; some apothecia >1 mm broad; photobiont *Scytonema*, sheathed filaments of cuboid cells . . . . . *Heppia*

98. Saxicolous; apothecia <0.6 mm broad; photobiont *Nostoc* (rounded cells in sheathed rounded chains or chroococcoid (loose clusters of few-several cells in a gelatinous sheath) . . . . . 99 Lichinaceae

[Note: this difficult and poorly understood family includes a plethora of diminutive black crustose species primarily occurring on carbonate rock. Probably because of their antiquity and the abundance and diversity of carbonate rock microhabitats, the family is well represented in the region, forming a bewildering polygeneric complex. The taxonomy and ecology of most Ozark material is largely unknown, and the reader is referred to Schultz & Büdel (2002) for further information. Generic concepts as currently applied in the Lichinaceae are morphologically abstruse and seem all but useless from a field perspective, especially since Ozark material is frequently sterile. Extensive further study will eventually clarify the situation, but the few species keyed below are merely representative.]

99. On mosses over carbonate rock; thallus membranaceous to marginally sublobate; photobiont *Nostoc* . . . . . *Lempholemma polyanthes*

99. On carbonate rock; thallus granular to areolate; photobiont chroococcoid 100

100. Thallus densely beset with minute vertical lobules, creating a patterned appearance under magnification . . . . . *Stromatella bermudiana*

100. Thallus plane to granular or with scattered, prevailingly marginal, granular isidia 101

101. Granular isidia usually present; thallus of ± adnate areoles . . . . . *Psorotichia schaereri*

101. Isidia absent; thallus of suberect areoles . . . . . *Peccania*

ABSCONDITELLA Vězda (Stictidaceae)

Inconspicuous crustose lichens on moist rotting wood, with indistinct, shiny, filmy thalli appearing slightly gelatinous when wet; photobiont chlorococcoid; apothecia pale, concave, minute, asci somewhat evocative of *Bacidia*-type asci, but I-, with 8 hyaline, bacilliform, 4-celled spores; conidiomata unknown; 1 species in the Ozarks.

Absconditella lignicola Vězda & Pisút
Apparently very rare, but minute, cryptic, and easily overlooked. Known only from two Missouri sites: a wet, well-rotted log in heavy shade along the border of a fen in Shannon County, and a rotting log in a wooded upland in Christian County. The tiny pale apothecia, typically less than 0.2 mm broad, are difficult to see on moist wood, virtually impossible to see when dry.

ACAROSPORA A. Massal. (Acarosporaceae)
Ric. auton. lich. 27. 1852. Type species: *A. schleicheri* (Ach.) A. Massal.

Saxicolous crustose lichens with well-developed, often subsquamulose, areolate thalli and usually immersed, rarely sessile apothecia; photobiont chlorococcoid; asci clavate with a distinct I− apical dome, with >100 small, colorless, globose to oblong spores; pycnidia pyriform, immersed; conidia ellipsoid (*Acarospora* s. str.) or bacilliform (*Thelocarpella*?); gyrophoric acid in cortex or medulla of several species, norstictic acid in medulla of one species;14 species in the Ozarks. References: Clauzade et al. (1981), Harris & Knudsen (2005).

This treatment is very tentative with 50% of the species which cannot be comfortably accommodated in any known species and several of them currently known from a single collection. It owes much to many helpful suggestions from Kerry Knudsen (UCR). However, any misconceptions or errors are ours alone. *Acarospora* is currently so poorly understood that we cannot provide any realistic information on distribution outside the Ozarks. *Acarospora immersa* J. Hedrick with fertile areoles scattered on whitish, immersed thallus and asci with I+ apical structures in the ascus tip is treated below as *Myriospora* Hue. Three Ozark species with small pore-like disks and bacilliform conidia may be more comfortably accommodated in *Thelocarpella* Nav.-Ros. & Cl. Roux. (In addition to the morphological differences preliminary casual observations suggest that apothecia either develop from or supplant pycnidia, a character not reported for *Acarospora* s. str.).

Gyrophoric acid is often difficult to detect with only a C test. Consequently the more sensitive KC reaction is used in the keys and descriptions. Paraphyses rarely provide useful information and are mentioned only when they deviate from the typical type (weakly expanded tips lacking a dark apical cap). Pycnidia are immersed and hard to find. Conidia in *Acarospora* s. str. seem to be consistently ± elliptical and small, ca. 3-4 µm long. Therefore conidia are mentioned only in those species where they diverge from this form and size. For specimens with apothecia without much/any obvious thallus see *Polysporina* and *Sarcogyne.*

1. Thallus yellow (color sometimes obscured by whitish pruina).

2. Cortex and medulla KOH+ red (norstictic acid); areoles contiguous, entirely white pruinose or pruinose only around brown apothecial disk; on dolomite or non-calcareous rock in calcareous habitats . . . . . *A. heufleriana*

2. Cortex KOH−, KC− or KC+ red (gyrophoric acid?); medulla KOH−, KC−; thallus ± bright yellow, pruinose or not; on non-calcareous rock.

3. Medulla KC+ red; thallus pruinose or not . . . . . *A. "rubescens"*

3. Medulla KC−; thallus not pruinose.

4. Areoles contiguous separated by deep fissures forming a substantial patch with effigurate margins . . . . . *A. novomexicana*

4. Areoles scattered . . . . . *A. chrysops*

1. Thallus some shade of brown or gray.

5. Apothecia ± perithecioid, subspherical with a pore-like disk; cortex surrounding disk or ostiole of pycnidium darkening, often forming a brown to blackish ring at apex of areole (*Thelocarpella*?).

6. Ascospores broadly ellipsoid to spherical, 7-9 x 5-7 µm or 7-10(-11.5) µm diam . . . . . *A. "sphaerosperma"*

6. Ascospores ellipsoid, 4.5-5.5 x 2-2.5 µm.

7. Apothecia initially immersed in dolomite and remaining basally immersed . . . . *A. "sepulta"*

7. Apothecia not immersed; on non-calcareous rock; common . . . . . *A. dispersa*

5. Apothecia discoid, not surrounded by broad area of darkened cortex.

8. Cortex KC+ pink to red (dense gyrophoric acid crystals obscuring cross section).

9. Surface of thallus with minute, rounded to irregular, paler depressions (occasionally not conspicuous); areoles mostly scattered, rounded to irregular, flat to weekly convex, with 1(-few) apothecia; disk dark brown, slightly sunken; common . . . . . *A. "punctata'*

9. Surface of thallus lacking minute, rounded to irregular, pale depressions.

10. Thallus not pruinose, light to dark brown, shiny; areoles thick, irregular, flaring from narrower base; lower side black, ± easily visible; apothecia flush or sunken, without raised rim; common . . . . . *A. fuscata*

10. Thallus white pruinose, tan; areoles thin, flat, aggregated, broadly attached; mature apothecia with raised rim; rare . . . . . *A. umbilicata*

8. Cortex KC−.

11. Disk pale greenish pruinose; on dolomite or limestone; areoles small, < 0.5 mm, usually with a single apothecium (± lecanoroid); ascospores 3.5-5 x 1.7-2 µm . . . . . *Myriospora immersa*

11. Disk not pruinose (thallus pruinose or not); on non-calcareous rock (sometimes in calcareous habitats).

12. Areoles or sessile apothecia without slightly raised, shiny, black rim.

13. Thallus pale, variably pruinose, cellular cortex absent; apothecia1(-few)/areole, *Lecanora*-like; disk red brown, epruinose . . . . . *A."decorticata"*

13. Thallus never pruinose, brown, shiny, thin, tightly adnate; cellular cortex present; apothecia1-several/areole, slightly sunken, never *Lecanora*-like . . . . . *A. veronensis*

12. Areoles **or** sessile apothecia with a slightly raised, shiny, black rim.

14. Areoles scattered or in small groups, thin, closely adnate, light olive brown with black margin; apothecia immersed; apothecial disk red brown . . *A.“atromarginata”*

14. Areoles aggregated into extensive sheet, orange brown, without black margin; apothecia becoming sessile, with distinct, shiny, black margin; disk red brown . . . . . *A. “spadicea”*

Acarospora “atromarginata” *sp. provis*.
Thallus of scattered areoles; areoles tan with a slightly raised shiny, black margin, epruinose, rounded or irregular, broadly attached; cortexKOH−, KC−; medullaKOH−, KC−; underside black. Apothecia not present. Conidia ellipsoid or lemon-shaped, 3-3.3 x 1.4-1.6 µm. [no lichen substances ?, not tested]

The sole collection is on exposed rhyolite from the Johnson Shut-Ins, Reynolds County, Missouri. *Acarospora “atromarginata”* resembles some forms of *A. dispersa* but differs in shape of conidia and in the raised, black, areole margin. It differs from *A. fuscata* in having dispersed areoles lacking gyrophoric acid. More precise disposition awaits more collections.

Acarospora chrysops (Tuck.) H. Magn.
Thallus forming small patches of ± contiguous areoles, initially scattered; areoles bright greenish yellow, epruinose, irregularly rounded or angular where crowded, attached by narrowed base, becoming subsquamulose in age; cortexKOH−, KC−; medullaKOH−, KC−; underside pale. Apothecia 1-several/areole, rounded or ± irregular, slightly sunken; disk brown, epruinose. Paraphyses expanded at tips with a dark cap. Ascospores broadly ellipsoid, 3.5-4.2 x 2.5-2.7 µm. [rhizocarpic acid]

Known from two sites on exposed sandstone flats on a bluff top from Pope and Stone counties, Arkansas. Our usage of the name *Acarospora chrysops* is based on a presumed isosyntype from South Carolina. *Acarospora novomexicana*, also KC−, forms larger colonies and the paraphyses lack apical caps and epruinose forms of *A. “rubescens”* have KC+ red medulla. The material from Pope County also contains the lichenicolous fungus *Stigmidium epixanthum* Hafellner.

Acarospora “decorticata” *sp. provis*.
Thallus forming loose groups of ± contiguous areoles; areoles pale greenish gray or pale tan, epruinose, pruinose only around apothecia or densely white pruinose, initially irregular with a few young apothecia, dividing as apothecia develop so that older areoles become rounded, reduced to a lecanoroid rim around the apothecium, tightly adnate; cellular cortex absent; uppersideKOH−, KC−; medullaKOH−, KC−; underside pale. Apothecia 1/areole when mature, mostly rounded but angular when crowded, filling most of *Lecanora*-like areole; disk brown, shiny, epruinose. Ascospores 5-6 x 2-2.4 µm. [no lichen substances?, not tested]

Acarospora “decorticata” is known from only three collections from the western Ozarks, two on chert residuum in calcareous glades, one in an old siltstone quarry. The aspect of a member of the *Lecanora dispersa* group and the absence of a cellular cortex are diagnostic. *Acarospora “decorticata”* has some similarity to some forms of the notoriously variable *Acarospora glaucocarpa* (Ach.) Körber but that group has a well developed cellular cortex.

Acarospora dispersa H. Magn.
Thallus often of scattered areoles, or loose groups of ± contiguous areoles on non-calcareous rock; areoles pale tan or grayish to brown, rarely very dark brown, often with a distinct black margin, with cortex darkening (± bright orange brown in pale forms) at apex around apothecial disk or pycnidial ostiole, epruinose, flattened to almost hemispherical, mostly rounded, more irregular when aggregated, with dark area around disk sometimes slightly raised or sunken, rather broadly attached;

cortexKOH−, KC−; medullaKOH−, KC−; underside black. Algal layer and medulla filled with KOH− crystals. Apothecia mostly 1/areole, subglobose or subpyriform with a pore-like disk; disk brown to dark brown, often concolorous with darkened cortex and nearly invisible, epruinose. Ascospores cylindrical, 5-5.5 x 2-2.2(-2.5) µm. Pycnidia often only 1/areole in center of areole, immersed, pyriform, darkened around ostiole, with pale walls. Conidia bacilliform, 4-6 x 0.8-1.3 µm. [no lichen substances?, not tested].

Common throughout the Ozark region on both exposed and shaded, hard, acidic rock, occasionally on small stones and rarely on pebbles in temporary pools in acidic glades. Collections are often mixed with *A. "punctata"*. *Acarospora dispersa* belongs to a small subgroup of *Acarospora* distinguished by ± perithecioid apothecia (*Thelocarpella*?). The other two species grow on dolomite or chert in calcareous habitats: *A. "sphaerosperma"* with larger, ± spherical ascospores, *A. "sepulta"* with apothecia and pycnidia initially immersed in the substrate. The name *Acarospora dispersa* has not been applied since Magnusson described it in 1930 but will probably prove to be more widespread in eastern North America.

Acarospora fuscata (Schrader) Th. Fr.
Thallus forming discrete, small to extensive, patches of contiguous areoles; areoles pale gray brown(shade) to dark brown (sun), epruinose, usually shiny, often roughened, irregular in shape, flattened to subsquamulose and weakly lobed (especially at edge of thallus), with interior ones subdivided and often sharply angular with black margins and ± vertical sides, broadly attached; cortexKOH−, KC+ red; medullaKOH−, KC−; underside black. Apothecia 1-few, or occasionally many, per areole, rarely one per areole expanding to fill most of areole, immersed, irregular or less commonly rounded; disk red brown or darker, flush with thallus or slightly depressed, epruinose. Ascospores 4-6 x 1-1.5 µm (Brodo et al. 2001). [gyrophoric acid]. Illustrations: Brodo et al. 2001, f. 92; Wirth 1995 1: 105.

Relatively common on both shaded and exposed, hard, acidic rocks. *Acarospora fuscata* as treated here is variable in color and thallus development held together by KC+ cortex and mixture of subsquamulose and angular/irregular, often black margined, crowded areoles. Among the species with KC+ cortex, *A. fuscata* is most likely to be confused with *A. "punctata"* which is distinguished by areoles which are more rounded in outline, usually with distinct, irregular indentations in the upperside and by larger apothecia with a raised margin. *Acarospora umbilicata* is white pruinose. The ascospore size is quoted since no mature spores have been seen in Ozark material. The lichenicolous fungi *Pyrenidium actinellum* Nyl. and *Stigmidium fuscatae* (Arnold) R. Sant. have been collected on *A. fuscata* in the Ozarks.

Acarospora heufleriana Körber
Thallus mostly forming small to extensive patches of contiguous areoles (rarely to 3-4 cm across), occasionally more dispersed; areoles yellow white (yellow obscured by white pruina), rarely brighter yellow when pruina poorly developed, irregular and weakly effigurate at margins, smaller and polygonal in center, broadly attached; cortexKOH+ red; medullaKOH+ red; underside pale or darkening. Apothecia immersed, irregular or ± rounded, sunken or becoming flush, sometimes with weakly raised rim, to ca. 1 mm across; disk white pruinose, rarely brown when pruina rubbed off. Ascospores broadly ellipsoid, 4-4.5 x 2.5-3 µm. [rhizocarpic acid, norstictic acid]. Illustration: Clauzade et. al. 1981, f. 7

Uncommon in dolomite glades on exposed dolomite or less commonly on sandstone or chert residuum over carbonate bedrock. *Acarospora "rubescens"* is also sometimes pruinose but it is chemically distinct (gyrophoric acid). The North American distribution of *A. heufleriana* is unclear. The only other material seen is from the alvars of western New York.

Acarospora novomexicana H. Magn.
Thallus forming extensive patches of contiguous areoles weakly lobed at margin; areoles bright greenish yellow, epruinose, subsquamulose marginally, angular inward, ± elevated but rather broadly attached; cortexKOH−, KC−; medullaKOH−, KC−; underside pale. Apothecia several/areole, tan to light brown, epruinose, irregular, sometimes with sterile thalline areas. Paraphyses without dark cap. Ascospores 5-6 x 2.5-3 µm. [rhizocarpic acid]

Known from two sites in Missouri and one in Oklahoma on exposed acid rock (chert, rhyolite and sandstone). *Acarospora novomexicana* differs from the other KC− yellow species in the Ozarks in forming extensive patches and in the pale apothecia.

Acarospora "punctata" *sp. provis*.
Thallus of dispersed areoles or forming small groups of contiguous areoles, rarely forming larger patches; areoles tan to dark brown, mat to slightly shiny, small, irregular indentations usually detectable, epruinose, ± rounded or less commonly irregular, often weakly lobed, rather broadly adnate, to 1 mm across; cortexKOH−, KC+ red; medullaKOH−, KC−; underside black. Apothecia mostly 1/areole, central, rounded or occasionally irregular due to crowding, sunken, typically with a raised "thalline margin" giving a somewhat *Lecanora*-like aspect, to 0.5 mm across; margin occasionally darker than thallus; disk red brown to dark brown, epruinose. Paraphyses in fresh specimens with row of droplets. Ascospores elliptical to ± cylindrical, 4-5.5 x 2-2.5 µm. [gyrophoric acid].

Acarospora "punctata" is apparently common in our region in exposed situations, on rhyolite, hard sandstones and rarely chert, rather often on pebbles and small rocks in temporary pools associated with *Polysporina simplex* and *A. dispersa*. Total distribution unknown but two specimens from South Carolina seem to be *A. "punctata"*. As far as we can tell from the literature *A. "punctata"* is unique in having small, irregular indentations in the upperside. Due to its brown upperside, black underside and KC+ cortex it is likely to be confused with *A. fuscata* which has subsquamulose marginal areoles, central areoles more angular and smaller, more irregular, sunken apothecia without a raised margin. The other brown, epruinose species with dispersed areoles in our region have a KC− cortex and pore-like disks or small sunken apothecia.

Acarospora "rubescens" *sp. provis*.
Thallus of scattered areoles or forming small patches of ± contiguous areoles, sometimes weakly lobed; areoles bright greenish yellow, patchily white pruinose or epruinose, subsquamulose marginally, angular inward, broadly attached to ± narrowed at base; cortexKOH−, KC−; medullaKOH−, KC−; underside black. Apothecia (1-)several/areole, rounded to irregular, slightly sunken; disk light to medium brown, epruinose. Paraphyses without apical cap. Ascospores 4-5(-6) x 2-2.4 µm. [rhizocarpic acid, gyrophoric acid].

The most common yellow *Acarospora*, known from Missouri and Oklahoma on exposed acid rock, often rhyolite but also chert in calcareous sites and once on granite. *Acarospora "rubescens"* is separated from the other yellow Ozark species in containing gyrophoric acid (KC+). No published name seems to be available.

Acarospora "sepulta" *sp. provis*.
Thallus of crowded areoles; areoles initially immersed in dolomite, consisting of apothecium and margin composed mostly of rock crystals, becoming emergent, developing more typical structure (cortex, medulla, etc.), tan with central area of darkened cortex forming a brown to blackish ring (often raised at maturity) around apothecial disk or pycnidial ostiole, epruinose, in age broadly attached or even ± raised; cortexKOH−, KC−; medullaKOH−, KC−; underside pale. Apothecia subglobose/subpyriform with a pore-like disk; disk nearly invisible, concolorous with surrounding cortex. Ascospores ellipsoid, 4.5-5.5 x 2-2.3 µm. Pycnidia immersed in dolomite, visible as brown dots surrounded by slightly raised ring of rock. Conidia bacilliform, 5-6 x 1-1.2 µm.

Acarospora "sepulta" is known from a single collection on exposed Cotter dolomite from Ozark County, Missouri. *Acarospora "sepulta"* is the most *Thelocarpella*-like of the three Ozark species with pore-like apothecial disk and bacilliform conidia as its apothecia and pycnidia are, at least initially, immersed in carbonate rock. The other two differ in being superficial in all stages of growth.

Acarospora "spadicea" *sp. provis*.
Thallus forming patches of contiguous areoles; areoles chestnut brown, epruinose, angular, broadly attached; cortexKOH−, KC−; medullaKOH−, KC−; underside pale. Apothecia initially 1-several/areole, 1/areole at maturity, initially immersed with "margin" concolorous with thallus, becoming sessile in appearance with areole essentially reduced to a raised shiny black margin (lecideine in aspect), large, to 1.0 mm across; margin with a sharply demarcated black outer layer and a colorless inner layer of ± radiating hyphae above and a medullary layer below which contains a few clumps of algae; disk red brown, epruinose. Paraphyses broad, 3-4 µm below, with tips swollen to ca. 5-6 µm. Ascospores 4-5.5 x 2.3-2.5 µm. [no substances?, not tested]

Acarospora "spadicea" is known from a single collection from St. Clair County, Missouri on exposed sandstone. This specimen may prove to fall within the variability of *A. badiofusca* (Nyl.) Th. Fr. with similarly sessile apothecia but adequate comparative material has been available. Descriptions of *A badiofusca* do not mention the margin becoming black. The structure and aspect of the margin are reminiscent of *Sarcogyne*. The extensive chestnut thallus and lecideine apothecia with black margin and red brown disk are diagnostic.

Acarospora "sphaerosperma" *sp. provis*.
Thallus of dispersed areoles, occasionally weakly aggregated; areoles gray, soon developing a variably sized area of brown coloration of the cortex in the center surrounding pycnidial ostiole or apothecial disk, rounded, or ± irregular, especially when young, flattened to ± hemispherical, broadly attached; cortexKOH−, KC−; medullaKOH−, KC−; underside pale. Apothecia mostly 1/areole, subglobose or subpyriform with a pore-like disk; disk brown to dark brown, often concolorous with darkened cortex and nearly invisible, epruinose. Ascospores broadly ovate to spherical, 7-9 x 5-7 µm or 7-10(-11.5) µm across. Conidia bacilliform, 5-6 x 1-1.2 µm. [no lichen substances?, not tested]

Acarospora "sphaerosperma" is known from seven collections from Arkansas and Missouri on dolomite or on chert in calcareous glades. *Acarospora "sphaerosperma"* is superficially identical to forms of *A. dispersa* with scattered areoles which occurs on non-calcareous substrates and has smaller, "typical" *Acarospora* ascospores, 5-5.5 x 2-2.2(-2.5) µm. The large ascospores suggest comparison with *A. oligospora* (Nyl.) Arnold. It differs in having broad discoid apothecia (not perithecioid) and has ellipsoid conidia (not bacilliform).

Acarospora umbilicata Bagl.
Thallus forming patches of contiguous areoles, to 6 cm across; areoles pale tan, mat, variably white pruinose (sometimes confined to apothecial rim), larger and irregularly lobed at margin, subdivided and polygonal toward center, ± entirely adnate; cortexKOH−, KC+ red; medullaKOH−, KC−; underside pale. Apothecia 1-few per areole (areoles mostly subdividing with age to leave one apothecium per areole), mostly rounded, sunken with raised thalline rim in age; disk orange brown to dark brown, epruinose; Ascospores cylindrical, 5-5.5 x 2-2.5 µm. [gyrophoric acid]. Illustration: Clauzade et al. 1981, f. 15.

Rare in the Ozark region, known from only two sites, on mine spoil and on chert in a seepy dolomite glade. *Acarospora umbilicata* has not previously been reported from North America. Ozark material compares well with European specimens, distinctive in its stark white pruina and KC+ cortex.

Acarospora veronensis A. Massal.
Thallus forming loose aggregations of areoles separated by ± broad "cracks" or of scattered areoles; areoles brown, shiny, thin (± 100 µm), angular, tightly adnate; cortexKOH−, KC− red, not distinct but with outer layer of swollen, brown cells and sometimes with colorless epinecral layer; medullaKOH−, KC−; underside pale. Apothecia 1-few/areole, sunken, rounded or irregular; disk brown, epruinose. Ascospores ellipsoid to long ellipsoid, 3.5-4.5 x 1.8-2.2(-2.4) µm. [no lichen substances?, not tested]. Illustration: Clauzade et al. 1981, f. 34.

Uncommon on chert and hard sandstones, usually in calcareous situations. *Acarospora veronensis* has the thinnest thallus of any Ozark species and is also distinct in aggregated areoles which are not truly contiguous but are quite well separated. A collection on rhyolite from Washington County, Missouri (*Amtoft 320*) is similar in general aspect to *A veronensis* but has thicker, less adnate areoles with dark margins and the apothecium fills the areole. Its disposition awaits more material.

ACROCORDIA A. Massal. (Monoblastiaceae)
Geneac. lich. 17. 1854. Lectotype (Th. Fr., 1861): *Acrocordia gemmata* (Ach.) A. Massal.

Small crustose lichens, with immersed thallus, *Trentepohlia* photobiont, perithecioid ascomata, pore central or eccentric, paraphyses branched and interconnected, cylindrical fissitunicate asci with a broad apical chamber with eight spores in a single row, colorless, 1-septate ascospores, with granular ornamented wall, colorless, elliptical microconidia, lacking macroconidia. A single Ozark species. Reference: Harris (1995)

Acrocordia is close to *Anisomeridium*. Fortunately this is not a problem locally as the only Ozark species of *Acrocordia* has very large ascospores. In more northern regions where additional taxa occur with ascospore sizes overlapping those of *Anisomeridium*, *Acrocordia* is distinguished by the strictly cylindrical asci with a broader apical chamber, and uniseriate, ornamented spores.

Acrocordia megalospora (Fink) R. C. Harris
Thallus immersed, whitish to gray. Ascomata brown to blackish (where exposed), initially immersed, becoming emergent, rarely ± superficial, with the pore often at end of a short, eccentric neck, rarely (in Ozark material) central; ascomatal wall brown where exposed, otherwise ± colorless. Asci cylindrical, 150-250 x 15-25 µm. Ascospores broadly fusiform, 33-48(-60) x 15-23 µm, with cells ± equal, well-developed halo and granular ornamentation. Microconidia elliptical, 4-5 x 2 µm.

Frequent in woodlands throughout the Ozarks, ranging from floodplains to rather dry uplands; recorded from *Carya*, *Diospyros*, *Fraxinus*, *Juniperus*, *Nyssa*, *Quercus* and *Ulmus*. *Acrocordia megalospora* is endemic to eastern North America and occurs at relatively low elevations, usually in oak woods, from Maine and Minnesota to North Carolina and Arkansas. Under the dissecting microscope the immersed ascomata with largely colorless wall and off-center pore are usually enough to make the identification, which is easily confirmed by the large 2-celled ascospores in a single row in the ascus.

AGONIMIA Zahlbr. (Verrucariaceae)

Crustose lichens with rounded, greenish, pubescent to minutely tomentose, granular squamules and small, sessile, black perithecia; photobiont chlorococcoid; asci thin-walled, without an ocular chamber, with 8 hyaline to pale brownish, muriform spores; pycnidia unknown in local populations, black, with bacilliform conidia; ? species in the Ozarks but only two treated here. See also *Flakea*.

1. Squamules with pale spiculate hairs, resembling miniature prickly pear cactus pads . . . . . *A. opuntiella*

1. Squamules under 10× magnification appearing roughened but glabrous . . . . . *A.* sp. # 1

Agonimia opuntiella (Buschardt & Poelt) Vězda
Common, but often overlooked, usually growing on or among shaded pleurocarpous bryophytes on rocks and shaded tree bases. Ozark populations of this lichen are always sterile.

Agonimia sp. # 1
Thallus of rounded, microscopically pubescent (and thus appearing roughened under 10× magnification), grayish green granular squamules that are rounded to slightly elongate, 0.1-0.15 mm long, and ± bright green when wet; perithecia widely scattered, globose to subconical, to ca. 0.2 mm broad; ascospores hyaline to pale brownish, 45-60 × 18-25 µm.

Occasional, often sterile; on lightly shaded bryophytes, especially *Anomodon*, and stable humus in wooded uplands, in habitats similar to those for *Dimerella pineti* and *Bilimbia sabuletorum*. Although most often associated with calcareous habitats, this lichen also occurs in acidic environments. A collection from *Anomodon* over rhyolite in St. Francois County, Missouri has smaller spores, about 34 × 13 µm, and may represent a different species.

AGYRIUM Fr. (Agyriaceae)

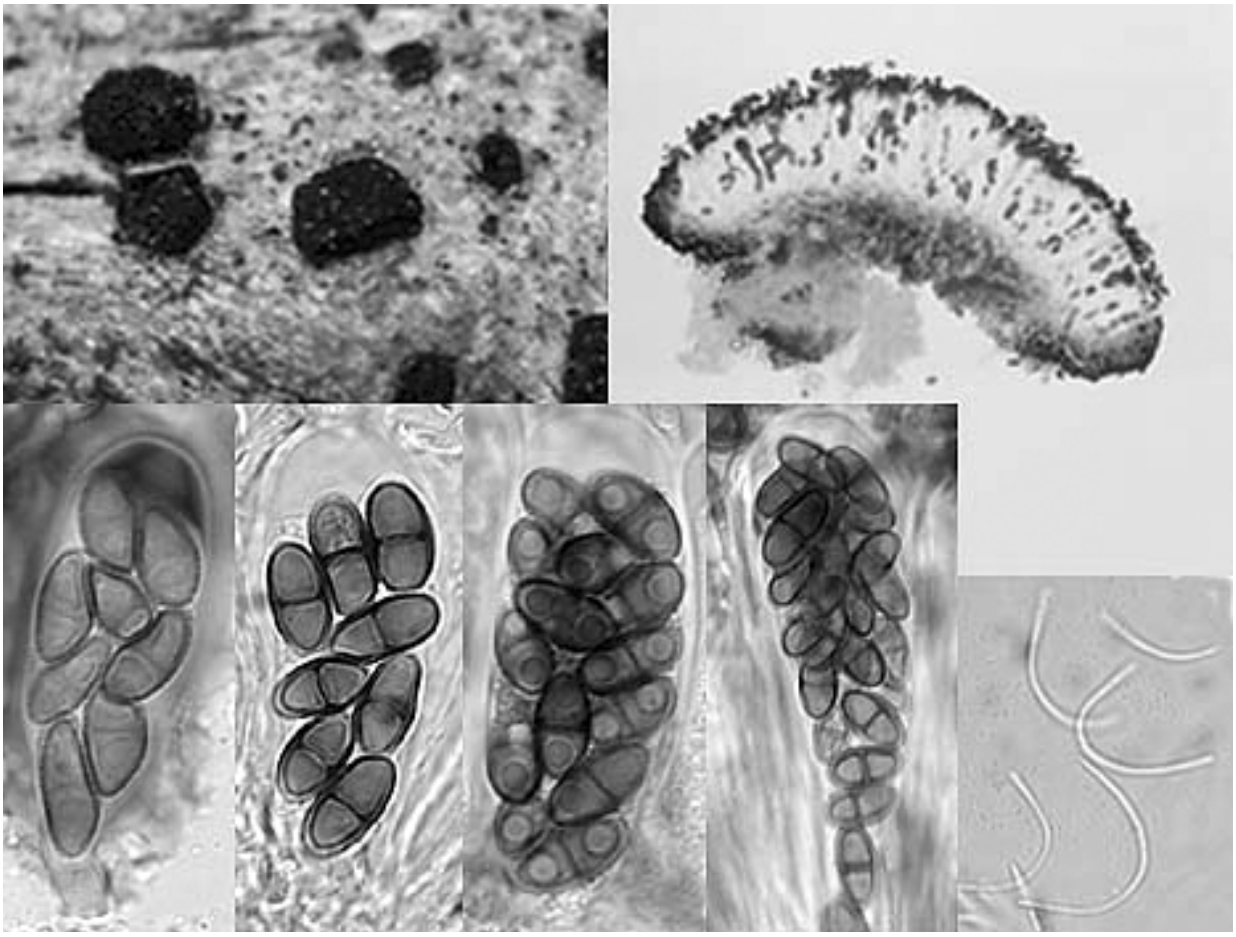
Small non-lichenized fungi with whitish continuous thalli; photobiont absent; apothecia reddish brown, swollen, emarginate, asci narrowly cylindrical, with 8 simple, colorless, ellipsoid spores; 1 species in the Ozarks.

Agyrium rufum (Pers.) Fr.
Uncommon, mostly on smooth, decorticate, rotten wood of standing *Juniperus* in woodlands, often in somewhat mesic sites. This species is also occasional on decorticate hardwoods. The continuous, whitish thallus with scattered, reddish brown apothecia is distinctive and at first glance resembles a lichen. When moist, this species looks more like a tiny jelly fungus than a lichen but current dogma (as yet untested with sequence data) associates it with taxa formerly assigned to the Trapeliaceae.

AMANDINEA Choisy ex Scheid. & H. Mayrh. (Physciaceae)

in Scheid., Lichenologist 25: 341. 1994. Type: *A. coniops* (Wahlenb. in Ach.) Choisy ex Scheid. & H. Mayrh. in Scheid.

Small crustose lichens with dark to not apparent thalli, photobiont *Trebouxia*, asci ± *Bacidia* type, with 8-32 brown, 1-septate spores, spore walls not notably thickened, conidia filiform, curved; 7 species in the region. References: Sheard & May (1997), Marbach (2000).



1. Asci with eight spores (fewer by abortion); ascospores 9-18 x 4-9.5; thallus pale, dark or not evident.

    2. Ascospores 15.5-18 x 7-9.5 µm; thallus evident, pale, areolate, ± glossy . . . . . *A. submontana*

    2. Ascospores smaller, 9-16 x 4-8 µm.

        3. Ascospores ellipsoid (length/width = 2-2.3), not notably constricted at septum, 9-16 x 4-8 µm; apothecia mostly without thalline margin (*A. punctata* s. lat.).

            4. Apothecia without thalline margin; thallus pale or not evident.

                5. Ascospores 9-15 x 4-7 µm; thallus not evident?, mostly on pine bark or cones or rock, less often *Juniperus* and *Quercus* . . . . . *A. punctata*

                5. Ascospores 12-16 x 6-8 µm, more coarsely ornamented; thallus of scattered areoles; on pine bark and decorticate juniper . . . . . *A. punctata s. lat.* 20267, 40047

            4. Apothecia with poorly developed thalline margin; thallus dark; ascospores 11-13 x 4-5.5 µm; on *Ulmus alata* . . . . . *A. punctata s. lat.* 38578

        3. Ascospores more ovoid, (length/width = ca. 1.7-1.8), constricted at septum or not.

            6. Ascospores constricted at septum, especially when old, 9-13 x 5.5-7.5 µm, not ornamented; some apothecia usually with thalline margin; thallus relatively thin, dark, matt; on hardwoods, usually on twigs or branches . . . . . *A. dakotensis*

6. Ascospores not constricted at septum; apothecia without thalline margin.

7. Ascospores 13.5-16 x 6.5-9 µm, minutely punctate; thallus relatively thick, shiny; on rough lignum, especially *Maclura* fenceposts . . . . *A. "lignicola"*

7. Ascospores 10.5-13 x 6-8.5 µm, ornamented; thallus thin, shiny; on smooth wood of *Juniperus* . . . . . *A. sp.* 48743

1. Asci with more than eight spores.

8. Ascospores ±32/ascus, 7.5-12.5 x 3.5-5.5 µm; apothecia 0.3-0.4 mm diam.; thallus dark (paler areoles on dark background); on a variety of hardwoods . . . . . *A. polyspora*

8. Ascospores ±16/ascus, 9-11.5 x 5-6 µm; apothecia ca. 0.15 mm. diam.; thallus pale; on dead stems of *Selaginella* . . . . . *A. "selaginellae"*

Amandinea dakotensis (H. Magn.) P. May & Sheard
Occasional on small, exposed, smooth-barked hardwood twigs in canopy branches, and sometimes on young branches of smaller trees in fields and along woodland edges. This species occurs in both intact natural landscapes and disturbed habitats, including suburban landscapes. Its distribution seems basically midwestern with outliers both to east and west. The critical feature for identification is the median constriction of the ascospores.

Amandinea "lignicola" *sp. provis.*
Rare, a single collection from an exposed *Maclura* fencepost in Moniteau County, Missouri. *Amandinea "lignicola"* is thus far known only from the tallgrass regions of the Midwest (Illinois, Indiana, Minnesota, northern and western Missouri). It is consistently lignicolous, on hard, rough wood, possibly confined to human modified sites, often on fenceposts, especially *Maclura*. It is distinguished from *A. punctata* by the well-developed, rough thallus and broader, more ovoid ascospores The aspect of this species, both externally and internally, is very similar to *Buellia turgescens* Tuck. differing in having filiform conidia rather than the bacilliform conidia recently described for *B. turgescens* (Bungartz & Nash 2004).

Amandinea polyspora (Willey) E. Lay & P. May
Frequent on small branches in exposed to lightly shaded habitats, including both upper twigs of canopy trees and twigs and small branches of young trees in old fields and along woodland edges. This species is part of a "pioneer cohort" of lichens that are among the first to colonize young corticolous substrates. Associated taxa with the same autecology include *Arthonia caesia, Lecanora strobilina* and *Pyrrhospora varians*.

Amandinea punctata (Hoffm.) Coppins & Scheid.
Occasional in areas of high light exposure, mostly on *Pinus* but also young twigs, old boards, exposed fenceposts and exposed siliceous rock. On *Pinus echinata* it occurs both on the bole, where it prefers the edges of large bark flakes, and on the scales of two year or older cones, where it is consistently associated with *Lecanora strobilina*. The bulk of local material is consistent with the concept in Sheard & May (1997). Two anomalous types are included in the key. Most of the material on sandstone differs in narrower ascospores, 9-13 x 4-5.5 µm (10-15 x 5-7 µm in Ozark *A. punctata*); this is perhaps worthy of further investigation.

Amandinea "selaginellae" sp. prov.
Known from a single southwestern Missouri site on *Selaginella rupestris* in a chert glade. This taxon is a variant in the *A. punctata* complex. It differs from *A. polyspora* in its 16-spored asci, tiny apothecia and odd substrate. All Ozark material of *A. polyspora* thus far examined has ± 32 spores/ascus.

Amandinea submontana Marbach
Known from a single Missouri collection on wood of *Juniperus Virginiana* on a bluff along the Eleven Point River. *Amandinea submontana* was reported by Marbach (2000) from the western United States and Louisiana. This species has the largest ascospores of any Ozark *Amandinea*. *Amandinea langloisii* Im Shaug *ex* Marbach, with similar sized ascospores, is known from Arkansas south of the Ozarks; it differs in having coarsely, irregularly ornamented ascospores.

Amandinea sp. 48743
Known from a single collection on smooth lignum of *Juniperus ashei* in open woodland. The short, broad, ornamented ascospores separate this from other Ozark *Amandinea*. The presence of a xanthone suggests *A. leucomela* (Imshaug) P. May & Sheard but this species has larger ascospores, 14-16 x 7-8 µm (Marbach 2000). [xanthone(s)]

ANAPTYCHIA Körb. (Physciaceae)

Narrow lobed, loosely adnate, brownish to greenish gray foliose lichens, thallus often lobulate, upper cortex KOH-; lower surface pale and rhizinate, with poorly developed cortex; apothecia sessile, with well-developed, often crenulate or lobulate, thalline margin; photobiont *Trebouxia*; asci *Lecanora*-type, with 8 brown, 1-septate spores; pycnidia laminal, immersed, with dark apices; conidia hyaline, simple, linear; 1 species in the Ozarks.

Anaptychia palmulata (Michx.) Vain.
Loosely adnate, narrow-lobed, brownish to greenish gray lichens to 11 cm broad, the thallus bright green when wet, with abundant, closely spaced, long, radiating linear lobes to 1 mm broad but often narrower, with abundant furcate branches in the distal half; lobe tips narrow, truncate to rounded; upper cortex somewhat dull, with flattened, irregular-margined lobules to 0.5 mm long usually abundant along the margins, these sometimes with proliferating smaller lobules along their margins; usually a few lobes with areas near the tips with widely scattered, scabrid white pruina to 0.05 mm broad; apothecia common, laminal, low, to 2 mm broad, with a well-developed margin extending above the plane brown disks, the rim often ultimately beset with lobules; lower surface pale to tan, dull, appearing indistinctly corticate, with widely and evenly scattered darkening rhizines to 1 mm long, these simple to apically furcate or coalescing; epithecium brown, hypothecium hyaline, ascospores 8, but often fewer fully developing within an ascus, greenish to ultimately brownish, 2-celled, with broadly rounded apices and slightly constricted at septum, typically 28-32 × 17-18µm, the spore wall minutely granular roughened; pycnidia frequent, small, rounded to apiculate, sessile, laminal, brown, ca. 0.1 mm broad; conidia hyaline, bacilliform, with rounded apices, ca. 4 × 0.9 µm. [reportedly containing zeorin and +/- atranorin, but all chemical spot tests negative]

Uncommon and local on shaded, often mossy, rocks and tree bases in mesic woodlands, occasionally in shaded sites in drier woodlands, growing on both carbonate and siliceous rocks, as well as a variety of hardwoods. This species is predominately distributed in the southern half of the Ozarks, and is most common in the watersheds of the Buffalo and Current rivers. This lichen typically occurs sporadically at a given locality, with a single rock or tree base having several thalli, and no other individuals occurring nearby.

A rare lichen with somewhat similar appearance, *Physconia subpallida*, has pruinose apothecia, rhizines with distinct squarrose branching, thickened spore walls, and occurs in drier, more exposed habitats. *Heterodermia* taxa have atranorin in the upper cortex and react KOH+ yellow.

ANISOMERIDIUM (Müll. Arg.) Choisy, *nom. cons.* (Monoblastiaceae)
Icon. Lich. Univ. fasc. 3 (unpaged). 1926. *Arthopyrenia* sect. *Anisomeridium* Müll. Arg., Flora 66: 290. 1883. Lectotype (Riedl, 1963): *Arthopyrenia xylogena* Müll. Arg. (= *Anisomeridium subnectendum* (Nyl.) R. C. Harris).

Minute lichens mostly on bark, less commonly on rock, with immersed thallus (sometimes containing lichexanthone) or without evident thallus, photobiont *Trentepohlia* or chlorococcoid, immersed to emergent, blackish perithecioid ascomata, branched and interwoven paraphyses (especially above level of asci), hymenial gel I-, fissitunicate asci with 8 or fewer, colorless, smooth or roughened, 1- or rarely 3-septate ascospores, pycnidia often with a short beak, ellipsoid to spherical single-celled microconidia, ellipsoid or obovoid to spherical single-celled macroconidia; 5 species in the region. Reference: Harris (1995).

Anisomeridium is a large genus and the species are often difficult to define sharply. However, most of the diversity is in Florida. It is most likely to be confused with *Strigula* which differs in having unbranched paraphyses, more fusiform ascospores, often with more than one septum, and septate macroconidia. The key below is made from Ozark material and may not cover variation found throughout the entire range of a taxon.

1. Growing on bark 2

1. Growing on sandstone; ascospores mostly 1-septate but usually a few 2-3-septate present, 18-23 x 6-8 µm . . . . . *Anisomeridium distans*

2. Ascomata remaining immersed below a broad, spreading clypeus, to 0.7 mm across; ascospores 1-septate, 13-19 x 7-9 µm . . . . . *Anisomeridium sp.* 45111

2. Ascomata at most initially immersed becoming clearly emergent with clypeus appressed the to conical to hemispherical ascoma; ascospores 11-20 ×3-7 µm 3

3. Ascospores mostly slipper-shaped (± acute at both ends but narrower and tapered at one end), 1-septate, occasionally 2-3-septate, with cells markedly unequal, 16-20 x 5-6 µm . . . . . *Anisomeridium polypori*

3. Ascospores 1-septate, shorter, 11-15 µm in length, mostly ovate, narrowly ovate, ellipsoid, narrowly ellipsoid, if slipper-shaped, then with rounded ends, with cells ± unequal or equal . 4

4. Ascospores 11-15 x 5.5-7 µm . . . . . *Anisomeridium biforme*

4. Ascospores narrower, 13-14 x (3-)4-5 µm, sometimes bent . . . . . *Anisomeridium leucochlorum*

Anisomeridium biforme (Borrer) R. C. Harris
Thallus immersed, white or not evident. Ascomata initially immersed, emergent, occasionally nearly superficial, ± globose, 0.3-0.6 mm across; ascomatal wall entire or lacking below. Asci cylindrical or ± clavate, 55-70 x 13-15 µm, with 8 (commonly fewer by abortion) biseriately arranged spores. Ascospores ovate to ellipsoid to narrowly ovate to ellipsoid, 1-septate, with cells equal to quite unequal, 11-15 x 5.5-7 µm. Pycnidia black, conical to globose, ca. 0.05-0.1 mm across. Microconidia globose, 2-3 µm across. Macroconidia ellipsoid to narrowly ellipsoid, 5-8 x 3-3.5 µm (Barry County collection).

Collected only rarely in the Ozarks. Elsewhere it is mainly on bases of hardwoods but in our area 2 of the 3 records are on *Juniperus* (the other on *Acer saccharum*). *Anisomeridium biforme* in a broad sense is cosmopolitan and probably represents a complex of species. In the Ozarks the ascospores and microconidia agree reasonably well with the type but the macroconidia are ± larger than previously recorded.

Anisomeridium distans (Willey) R. C. Harris
Thallus immersed, not evident or whitish scraps around sand grains. Ascomata black, often shiny, superficial, globose, 0.1-0.3 mm across; ascomatal wall brown-black, usually entire. Asci broadly clavate or broadly cylindrical, 70-80 x 18-22 µm, with 8 ± biseriately arranged spores. Ascospores short clavate to fusiform, 1(-3)-septate, with cells mostly markedly unequal, 18-23 x 6-8 µm. Pycnidia pyriform with a short beak to ± globose, 0.5-0.1 mm across. Microconidia oblong, ca. 4-5 x 1-2 µm (not found in Ozark material). Macroconidia mostly pyriform or obovate, occasionally ± oblong, 5-7 x 2.5-4 µm, sometimes forming a cirrus.

Frequent on rock, mostly non-calcareous sandstones, in moist habitats. It is sufficiently inconspicuous that it is often only found as an admixture in collections of more conspicuous lichens. The species is known only from eastern North America, mainly rather southern, from Massachusetts and Ohio to Georgia and Mississippi. Most of the Ozark material has only 1-septate ascospores although in occasional collections they are 2-3-septate.

Anisomeridium leucochlorum (Müll. Arg.) R. C. Harris
Thallus superficial, white, with *Trentepohlia* or ?chlorococcoid alga. Ascomata black, immersed to ca. ½ immersed, 0.2-0.3 mm across; ascomatal wall brown-black above, lacking below. Asci short-cylindrical to short-clavate, 40-65 x 11-14 µm, with 8 biseriately or ± irregularly arranged spores. Ascospores 1-septate, narrowly ellipsoid to narrowly clavate, sometimes bent, with nearly equal cells, 13-14 x (3-)4-5 µm. Pycnidia black, hemispherical, ca. 0.1 mm across. Microconidia globose, 2-2.5 µm (not found in Ozark material). Macroconidia globose, 2-3 µm across to ± ellipsoid, ca. 2 x 4 µm.

Rarely collected on branches of hardwoods in exposed situations or fallen from canopy. The species is similarly rarely collected outside our region. It is endemic to eastern North America. *Anisomeridium leucochlorum* is close to *A. biforme*, differing in smaller asci, narrower ascospores which are biseriate or irregularly arranged in the ascus. One of the Ozark collections is somewhat anomalous, associated with *Trentepohlia* and with narrower, mostly bent ascospores. Typically *A. leucochlorum* is associated with a chlorococcoid alga and has straight ascospores.

Anisomeridium polypori (Ellis & Everhart) M. E. Barr
Thallus immersed, whitish, gray or gray-green, with abundant *Trentepohlia*. Ascomata crowded to scattered, black, shiny, subconical to subglobose, initially immersed, emergent, sometimes even superficial, 0.15-0.25 mm across. Ascomatal wall usually colorless below. Asci clavate-cylindrical, 50-100 x 12-15 µm, with 8 biseriately arranged spores. Ascospores slipper-shaped to fusiform, 1-septate (septum usually markedly submedian), occasionally 2-3-septate, smooth, 16-20 x 5-6 µm. Pycnidia common, conical or sometimes with a short beak, ca. 0.1 mm across. Microconidia ovoid or oblong, ca. 3 x 1.5 µm. Macroconidia ± globose, c. 3 µm across, or broadly ellipsoid, 3-4 x 2.5-3 µm.

Frequent, mostly on the bases of oaks, less commonly on other hardwoods or *Juniperus* in mesic situations, rarely on decorticate wood. It is surely one of the most common lichens in eastern North America and is known also from Europe. *Anisomeridium polypori* in the Ozarks is something of a nuisance as it tends to lack ascospores. However, the elongate, slipper-shaped ascospores with unequal cells are sufficiently distinctive that a single spore or immature spores in the ascus are adequate for identification.

Anisomeridium sp. 45111
Thallus not evident, UV-. Photobiont not evident. Ascomata initially immersed, becoming slightly emergent, pyriform, ca. 0.3 mm across; ascomatal wall colorless. Ostiole surrounded by a broad, black-brown clypeus, ca. 0.7 mm across. Asci cylincrical, ca. 120 x 12 µm , with eight uniseriately arranged spores. Ascospores narrowly to broadly ellipsoidal, smooth, 13-19 x 7-9 µm. Microconidia not found. Macroconidia ellipsoid to broadly ellipsoid, 4-5 x 3 µm. Known from a single collection:

MISSOURI: Madison County: St. Francis River Natural Area, Mill Stream Gardens Conservation Area, Tiemann Shut-Ins along St. Francis River, mesic hardwoods along river, on bole of large, old *Fraxinus*, 22 Oct 2001, *Harris 45111* (NY).

The ascospore shape and size place this taxon close to forms of *Anisomeridium biforme* with cylindrical asci and uniseriate spores. *Anisomeridium biforme* differs in having smaller, less immersed, mostly conical ascomata with the clypeus not broadly expanded and not separated from the colorless more deeply immersed ascoma and slightly larger macroconidia.

ANZIA Stizenb. (Parmeliaceae)

Foliose lichens with thickened, narrow lobes, a thick layer of black tomentum on the lower surface, with occasional rhizines; photobiont *Trebouxia*; apothecia laminal, exceeding the lobe width, with a well-developed thalline margin; asci *Lecanora*-type, with numerous small, simple, curved spores; pycnidia laminal, with bacilliform conidia; 1 species in the Ozarks.

Anzia colpodes (Ach.) Stizenb.

Loosely adnate, narrow-lobed, blue gray foliose lichens with a regular branching pattern of elongate lobes; lobes subterete, ca. 1.5 mm broad; upper cortex rugose and white maculate, the tips dissected into short blunt fimbriations; lower cortex dark brown to black, of a thick reticulate network of tomentum, with sparse dark simple rhizines; apothecia common, substipitate, laminal, initially cupuliform, becoming plane, to 7 mm broad, with a well-developed thalline margin, the rime of which is regularly crenate at maturity; ascospores numerous, tiny, simple; pycnidia common, laminal, immersed, the ostiole to 0.17 mm broad; conidia elongate bacilliform, 6-7.5 × 1 µm, sometimes bulging on one side. [atranorin, divaricatic acid]

Rare on lower and mid boles and large branches of *Quercus* in mature woodlands; more rarely on other hardwoods in these habitats. In the Ozark region, this appears to be one of a cohort of lichens requiring older growth woodlands. Due to prevailing land use over the last century, these lichens are increasingly scarce. Other lichens with similar habitat restrictions and consequent rarity include *Pannaria subfusca*, *Pseudocyphellaria aurata*, *Usnea ceratina*, and *Usnea trichodea*. While many early records of *A. colpodes* from the Midwest are fertile, local material is now often sterile. Skorepa (1973) noted this same phenomenon with *Coccocarpia palmicola* populations in southern Illinois.

ARTHONIA Ach. (Arthoniaceae)
Neues J. Bot. 1(3): 3. Jan 1806 (*nom. cons.*). Type: *Opegrapha radiata* Persoon (= *Arthonia radiata* (Pers.) Ach.)

Small crustose lichens, thallus thin or indicated only by discoloration of bark or not apparent; photobiont *Trentepohlia*, with small immersed to sessile, often irregular or branched ascomata; chlorococcoid or absent; asci mostly pyriform to globose, with evident apical dome mostly with tiny KI+ ring, with 8 colorless or rarely brown, 1-7-septate spores; 37 species tentatively recognized for the region (including lichenicolous taxa, plus one from a nearby Missouri county). Reference: Willey (1890).

It does not seem entirely plausible that this relatively small region should have so many species, especially apparently undescribed species, but we have seen authentic material of most of the described North American species. *Arthonia*, more than any other genus, points up the futility of trying to assess lichen diversity without truly exhaustive collecting. Most of the Ozark taxa are known from only a single collection. Oddly most of the diversity seems to be in Missouri. *Arthonia* is so poorly collected and so poorly understood that it is impossible to say anything useful about

ecology or distribution for most species. Unless relatively common or very distinctive they have not been given provisional names. There seems to be some possibility that, in at least one group, the photobiont may not be constant. It is hoped additional study and material will lead to a better understanding of specific limits and a consequent reduction in the number of species.

KEY TO ARTHONIA AND ARTHOTHELIUM

1. On bark and wood; not lichenicolous 2

1. On rock or on lichens 38

2.(1) Ascomata pale, whitish, pinkish or yellowish, rounded to lobate; epihymenium with crystals ascospores 4-celled, with median cells ± larger, 12.5-15.5 x 4.5-5 µm . . . . . *Arthonia sp.* 47626-A

2. Ascomata shades of brown to black (may appear pale due to well-developed pruina; red purple pigment in margin in sp. 44592; red pigment in hymenium in sp. 48436) 3

3.(2) Photobiont chlorococcoid or photobiont absent 4

3. Photobiont *Trentepohlia* 21

4.(3) Photobiont absent (*Arthonia quintaria*, asci immature or lacking, usually without ascospores) 5

4. Photobiont chlorococcoid 15

5.(4) Ascospores transversely 2-5-septate septate 6

5. Ascospores 1-septate or submuriform 12

6.(5) Ascospores 2(-3)-septate, 9.5-10 x 3.5-4 µm . . . . . *Arthonia sp.* 50416

6. Ascospores 3-6-septate, larger, over 15 µm long 7

7.(6) Ascospores, when present, 3-6-septate with enlarged end cell 8

7. Ascospores with cell ± equal, 3-5-septate 11

8.(7) Ascospores 25-30 x 9.5-11 µm, 5-6-septate . . . . . *Arthonia sp.* 45333

8. Ascospores to 25 x 9 µm 9

9. Ascospores 21-25 x 6.5-9 µm, 5-6-septate; ascomata not “pruinose” due to residual bark; on twigs of *Quercus* . . . . . *Arthonia sp.* 50883

9. Ascospores less than 20 x 8 µm (often lacking in *A. quintaria*); ascomata “pruinose” or not 10

10.(9) Ascomata on mostly twigs, elongate, irregular, effuse, often “pruinose” due to residual bark, mostly immature; ascospores rare, 5-septate, 17.5-18.5 x 6.5-7.5 µm (*A. punctiformis* auct. Ozark) . . . . . *Arthonia quintaria*

10. Ascomata on bole of *Prunus*, raised with ± vertical sides, not “pruinose”; ascospores 5-septate, ca. 18.5 x 6-6.5 µm . . . . . [*Arthonia sp.* 47847]

11.(7) Ascospores 3-5-septate, (rarely with 1-2 cells subdivided), 19-22 x 6.5-7.5 µm; on *Rhamnus* . . . . . *Arthonia sp.* 44474

11. Ascospores 3-septate, 16-17.5 x 5.5-6.5 µm; on *Ulmus* . . . . . *Arthonia sp.* 17036

12.(5) Ascospores submuriform, transversely 5-septate with some cells longitudinally divided, with halo I+ orangish 13

12. Ascospores 1-septate 14

13.(12) Ascomata as in *A. quintaria*, narrow, elongate, irregular, occasionally branched; ascospores 18-19 x 7-8.5 µm, occasionally bent . . . . . *Arthothelium sp.* 50153

13. Ascomata emergent, ± rounded to elongate, irregular to sinuose, with whitish “pruina” of bark cells; ascospores 22-27 x 8.5-11 µm . . . . . [*Arthothelium lirellans*]

14.(12) Ascomata brown, elongate, becoming weakly branched or lobate;
ascospores 13-16.5 x 4.5-6 µm . . . . . *Arthonia sp.* 32832

14. Ascomata black, narrow, ca. 0.1 mm, lirelline, ± thread-like, weakly branched;
ascospores 11-12.5 x 4.5-5.5 µm . . . . . *Arthonia sp.* 44286

15.(4) Ascospores 1-septate 16

15. Ascospores 3-septate or muriform 18

16.(15) Hypothecium colorless; ascospores 14.5-16 x 5.5-6 µm; thallus mostly superficial,
pale to brownish (occasionally a little *Trentepohlia* present) . . . . . *Arthonia sp.* 38302

16. Hypothecium brown 17

17.(16). Ascospores 12-14 x 4.5-5 µm, ends tapered, not constricted at septum, thick-walled;
thallus immersed, whitish . . . . . *Arthonia sp.* 50266

17. Ascospores broader, 13-14 x 6-7 µm, with rounded ends and constricted at septum,
thin-walled; thallus greenish brown . . . . . *Arthonia apatetica*?

18.(15) Ascospores muriform . . . . . *Arthothelium taediosum*

18. Ascospores 3-septate 19

19.(18) Thallus superficial, greenish, ± leprose; ascomata rounded, bluish pruinose;
ascospores with ± equal cells . . . . . *Arthonia caesia*

19. Thallus immersed, not leprose; ascomata not pruinose 20

20.(19) Ascomata lirelliform, weakly branched, light brown to dark brown, not pruinose;
ascospores with end cell enlarged, 17-18.5 x 6.5-7 µm . . . . . *Arthonia sp.* 48400

20. Ascomata not pruinose, lecideoid, tiny; hymenium red pigmented, KOH + violet;
ascospores 12-15 x 4-5 µm with cells ± equal . . . . . *Arthonia sp.* 48436

21.(3) Ascospores transversely septate 22

21. Ascospores submuriform or muriform 36

22.(20) Spores becoming brown in ascus, (2-)3-septate, cells ± equal, 12-15 x 5-6 µm;
ascomata "cracked" into polygonal units, brown, whitish pruinose . . . . . *Arthonia pyrrhuliza*

22. Spores remaining colorless in ascus but may be brown postmaturity outside ascus 23

23.(22) Ascospores with end cell markedly enlarged, more than 1-septate 24

23. Ascospores with cells ± equal or with middle cells ± larger (1-septate spores key here) 29

24.(23) Ascospores (4-)5-septate, large, 32-37 x 12-16 µm . . . . . *Arthonia rubella*

24. Ascospores 2-4-septate, smaller, to 22 x 7 µm 25

25.(24) Purple red pigment present in margin (evident only in section); ascomata elongate, becoming branched and dendritic; ascospores 3?-septate, ca. 15-16 x 5.5-6 µm (material poor and immature) . . . . . *Arthonia sp.* 44592

25. Purple red pigment lacking (check cross section) 26

26.(25) Pycnidia sessile, large, abundant, pruinose; ascomata usually pruinose;
ascospores 2(-3)-septate, 10-13 x 4-5 µm . . . . . *Arthonia diffusa*

26. Pycnidia not evident; ascomata pruinose or not; ascospores (2-)3-4-septate 27

27.(26) Ascospores (2-)3-4-septate, 15-22 x 5-7 µm; ascomata elongate, becoming dendritic or stellate, brown, not pruinose; KC+ pink at edge of ascomata (gyrophoric acid) or KC- (no substances) (*A. radiata* auct. Ozark pr. p.) . . . . . Arthonia “dryadum” (*A. anglica* Coppins ??)

27. Ascospores 3-4-septate, 18-20 x 5.5-6.5 µm 28

28.(27) Thallus brown; ascomata scattered, thin, dark brown, not pruinose . . . . . *Arthonia sp.* 84959

28. Thallus whitish; ascomata thick, ascomata "cracked" into polygonal units, light brown, pruinose . . . . . *Arthonia sp.* 17128

29.(23) Ascospores 1-septate 30

29. Ascospores 3-5-septate 32

30.(29) Ascomata immersed with a jagged, white margin, white pruinose; ascospores small, 8-10 x 3 µm . . . . . *Arthonia sp.* 31940

30. Ascomata ± immersed, rounded to ± elongate and/ or ± lobed; without margin, not pruinose, dark brown; hypothecium pale to medium brown; ascospores 11-18 x 4.5-7 µm 31

31.(27) Ascospores 13-18 x 6-7 µm, becoming brown and coarsely ornamented . . . . . *Arthonia "infrafusca"*

31. Ascospores 11-13(-14) x 4.5-5.5 µm . . . . . *Arthonia sp.* 49390

32 (29). Hypothecium distinct, dark brown 33

32. Hypothecium indistinct, pale; ascospores 3-5-septate; ascomata irregularly shaped 34

33(32). Ascospores mostly 4-(5)-septate, 15-17 x 6-6.5, brown and ornamented in age; thallus whitish; ascomata large, to 1.0 mm long, slightly shiny, separating from bark at edges . . . . . *Arthonia sp.* 47563

33. Ascospores 5-(7)-septate, 17.5-20.5 x 5.5-7 µm, remaining colorless; thallus brown; ascomata small, dull, not separating from bark . . . . . *Arthonia sp.* 51102

34.(32) Ascomata light brown, pruinose; ascospores 3-septate, 15-18 x 6-7 µm . . . *Arthonia sp.* 44760

34. Ascomata dark brown to black, not pruinose; ascospores 3-5-septate, 14-18 x 5-6.5 µm . . 35

35.(34) Ascospores 3(-4)-septate, upper end ± acute 14-17 x 5-5.5 µm; ascomata irregularly to ± stellately lobed, brown to black . . . . . *Arthonia "fontana"*

35. Ascospores (4-)5-septate, upper end rounded 16-18 x 5-6.5 µm; ascomata elongate, weakly lobed, black . . . . . *Arthonia sp.* 32081

36.(21) Ascospores muriform, 26-36 x 12-15 µm (Brodo) . . . . . *Arthothelium spectabile*

36. Ascospores submuriform, mostly less than 24 x 10 µm 37

37.(36) Ascomata flat, large, dying in center; thallus usually dark; ascospores (15-)17-24(-26) x 7-9.5(-10.5) µm with sheath I- . . . . . *Arthothelium ruanum*

37. Ascomata ± raised, small, not dying in center; thallus pale; ascospores 23-24 x 9.5-10.5 µm with sheath I+ orangish . . . . . *Arthothelium sp.* 46579

38.(1) On rock 39

38. On lichens 41

39.(38) Photobiont chlorococcoid; ascospores 1-septate, 11-19 x 5-6.5 µm . . . . . *Arthonia lapidicola*

39. Photobiont *Trentepohlia*; ascospores 3-5-septate 40

40.(39) Thallus superficial, thick, ± "soft", KOH+ red (norstictic acid), with abundant large-celled *Trentepohlia*; ascomata blackish, pruinose, irregularly rounded to linear and ± sinuous, occasionally slightly branched; ascospores 3-5-septate, with ± equal cells, 15-19 x 4.5-5.5 µm; on HCl⁻ sandstone . . . . . *Arthonia "norstictica"*

40. Thallus immersed, KOH+ weakly yellowish, TLC-; ascomata blackish, pruinose, rounded to irregular and occasionally ± elongate, not branched; ascospores 3-(4)-septate, with ± equal cells, 15-16 x 4.5-5 µm; on HCl⁻ sandstone . . . . . *Arthonia "buckii"*

41.(38) Ascospores 2-septate, soon brown and coarsely ornamented, ca. 19-24 x 7.5-8 µm; ascomata immersed in thallus, brown; hypothecium colorless; on *Pertusaria propinqua* Müll. Arg. . . . . *Arthonia sp.* 46606-A

41. Ascospores 1-septate; on *Aspicilia* or *Rinodina* 42

42.(41) On *Aspicilia contorta* (Hoffm.) Kremp.; ascomata immersed in thallus; hypothecium colorless; ascospores 12-15 x 6.5-7.5 µm, with unequal cells . . . . . *Arthonia sp.* 45394

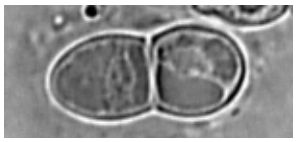
42. On *Rinodina* ; ascomata sessile, brown-black; hypothecium colorless or brown 43

43.(42) Hypothecium brown; ascospores 11-12 x 5.5-6 µm; on *Rinodina papillata* H. Magn. . . . . *Arthonia sp.* 50183

43. Hypothecium colorless 39

44.(43) Ascospores ca. 11 x 5.5 µm; on *Rinodina maculans* Müll. Arg. . . . . *Arthonia sp.* 38581

44. Ascospores 9.5-11 x 4-5 µm; on *Rinodina papillata* H. Magn.? . . . . . *Arthonia sp.* 47605

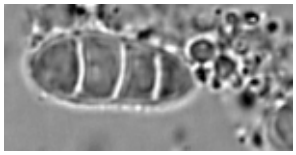


Arthonia apatetica (A. Massal.) Th. Fr. ?

Rare; known from a single Missouri, collection. This specimen has ascospores slightly smaller than in the type collection and slightly larger than the range given by Wirth (1995). There are only two other corticolous species with chlorococcoid photobiont and 1-septate ascospores, sp. 38302 differs in colorless hymenium, sp. 50266 also has a brown hypothecium but differs in ascospore shape and size.

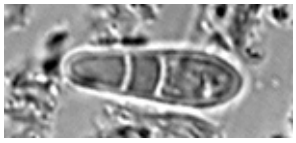
Arthonia "buckii" *sp. provis*.

Known from one site in Arkansas and one in Missouri, on shaded sandstone bluffs. One of two saxicolous species on shaded sandstone. The other, *A.* "*norstictica*", contains norstictic acid while *A.* "*buckii*" lacks detectable lichen substances. The photobiont is *Trentepohlia.*



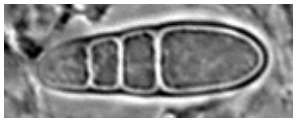
Arthonia caesia (Flotow) Körber

Common on young twigs and branches in high light intensities, as well as on boles of young trees in old fields and along glade and woodland margins. Occasionally this species occurs in low numbers on lightly shaded boles in uplands. The distinctive green color of the thallus with a chlorococcoid photobiont and blue pruinose ascomata makes it easily recognizable in the field. [usnic acid]



Arthonia diffusa Nyl.

Rare on *Quercus alba* in mesic hardwoods. The only Ozark *Arthonia* with abundant, superficial pycnidia which are usually white pruinose and often oozing conidia. Further distinctive characters are the pruinose, ± lecideoid ascomata and chlorococcoid photobiont. *Arthonia diffusa* is endemic to eastern North America, known from a scattering of collections from Missouri and North Carolina north to New England.



Arthonia "dryadum" *sp. provis.*

Common on lightly shaded hardwood boles and canopy branches, typically in mesic woodlands and along streams. The ascomata of this species are usually a rather bright shade of brown, often moniliform and irregularly branched or ± stellate, sometimes broadening in age; the spores are typically 3-4-septate with one end cell enlarged; photobiont *Trentepohlia.* It has been confused with *A. radiata* (Pers.) Ach. which has ascospores with all cells ± equal. The occurrence of gyrophoric acid in the ascomata of some specimens is unique among Ozark species. In this as well as other characters it seems close to *A. anglica* Coppins (according to the description in Purvis et al. 1992). We have seen no material for comparison but *A. anglica* is an old growth species in Europe unlikely to occur in secondary Ozark woodlands. The ephitlet "*dryadum*" "of wood nymphs" for the habitat. [gyrophoric acid]

Arthonia "fontana" *sp. provis.*

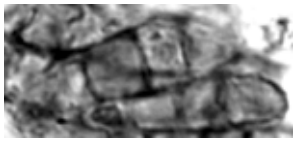
A half dozen collections widely scattered from Kansas, Missouri and Oklahoma on branches and boles of mesic hardwoods. There is a superficial resemblance to *A. radiata* but the ascospores are narrower and more pointed at the ends. It is possible that *A. radiata* s. str. does not occur in North America. "*fontana*" "of springs" as some of the specimens occur in woodlands near springs. The photobiont is *Trentepohlia*.

Arthonia "infrafusca" *sp. provis*.

Uncommon on boles of *Quercus* and *Carya* in woods. The only other taxon with *Trentepohlia* photobiont, 1-septate ascospores and brown hypothecium is sp. 49390 which has smaller ascospores. Named "*infrafusca*" "dark below" for the brown hypothecium.

Arthonia lapidicola (Taylor) Branth & Rostrup

Rare; known from one Missouri and one Illinois collection both on sandstone. The saxicolous substrate, chlorococcoid photobiont and 1-septate ascospores are diagnostic. The two collections are at the opposite ends of the spore range. The Missouri collection has ascospores 11-12.5 x 5-5.5 µm (± "typical"), the Illinois 16-19 x 6-6.5 µm and may possibly represent another taxon.



Arthonia "norstictica" *sp. provis.*

Known from a single Missouri collection on shaded, vertical sandstone face along stream. The thick, almost leprose thallus containing norstictic acid is most unusual. The possibility exists that it is a parasymbiont but we know of no lichen containing *Trentepohlia* with norstictic acid in our region. Differs from *A. "buckii"* in chemistry.

Arthonia pyrrhuliza Nyl.

Rare, known from a single collection from Arkansas in floodplain forest. The species is very distinct in having ascomata composed of closely approximated angular sections and 3-septate ascospores which become brown in the ascus.

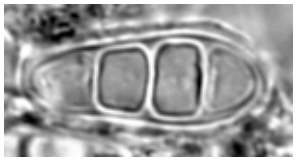
Arthonia quintaria Nyl.

Frequent, one of the most common *Arthonia* species in our region, but seldom well developed; on smooth young twigs and branches in high light exposures. The habitat, smooth, thin, silvery gray thallus with small blackish ascomata often appearing slightly pruinose due to cover of a thin layer of bark cells, and absence of a photobiont are distinctive. Ascospores can be found, with persistence, ca. 25% of the time. They are five-septate with the upper cell enlarged.


50%

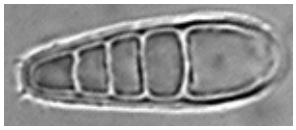
Arthonia rubella (Fée) Nyl.

Uncommon, mainly southern; on lightly shaded tree boles in woodlands along streams and in mesic ravines. The large, (4-)5-septate ascospores with enlarged terminal cell and irregular, immersed, pale reddish, lirelline ascomata are diagnostic. The photobiont is *Trentepohlia*.



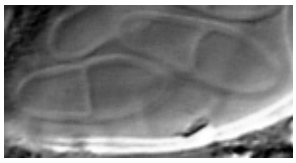
Arthonia sp. 17036

A single Missouri collection on *Ulmus* along stream in degraded woodland. Very close to sp. 44474 on *Rhamnus* but with smaller, less septate ascospores. Photobiont absent.



Arthonia sp. 17128

A single Missouri collection on *Quercus velutina* in wooded upland. Superficially identical to *A. pyrrhuliza* but ascospores remain colorless and have end cell enlarged. The photobiont is *Trentepohlia*.

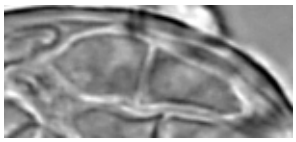


Arthonia sp. 31940

A single Missouri collection on dead *Quercus* in dry oak woods on bluff above Eleven Point River. The white, raised, jagged margin is unusual in *Arthonia* but the 1-septate spores don't suggest any other option. The photobiont is *Trentepohlia*.

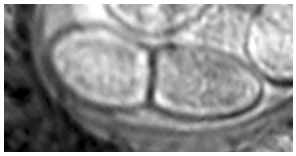
Arthonia sp. 32081

On boles of *Carya* from a single Missouri site in mesic woods. Identified by ascospores mostly 5-septate with ± equal cells, pale hypothecium and *Trentepohlia* photobiont.



Arthonia sp. 32832

Two Missouri collections, one on a twig in mesic woods, the other on bole in floodplain hardwoods. One of two species with 1-septate ascospores and lacking photobiont. The other, sp. 44286, has smaller ascospores.

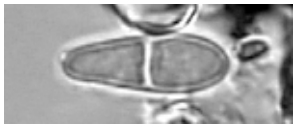


Arthonia sp. 38302

Known from six scattered Missouri specimens with no discernibly consistent ecology. Possibly a mixture, defined by chlorococcoid photobiont (sometimes a little *Trentepohlia* also?), lecideoid ascomata, pale hypothecium and 1-septate ascospores.

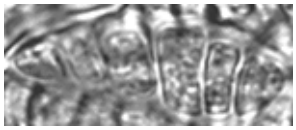
Arthonia sp. 38581*

A single Oklahoma collection lichenicolous on *Rinodina maculans* Müll. Arg. Two other species occur on *Rinodina papillata* H. Magn. differing in ascospore size or color of hypothecium.



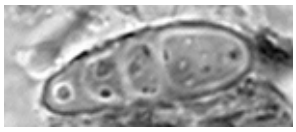
Arthonia sp. 44286

A single Missouri collection on *Carya cordiformis* in mesic woods. Differs from sp. 32832 in smaller ascospores. Photobiont absent.



Arthonia sp. 44474

A single Arkansas collection on *Rhamnus caroliniana* in oak woods. Photobiont absent. See sp. 17036.

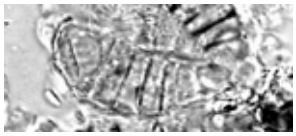


Arthonia sp. 44592

A single Missouri collection on *Quercus* in dry oak woods. This is a member of the *A. cinnabarina* (DC.) Wallr. complex, nearest *A. elegans* (Ach.) Almq.? It differs in smaller, more slender and more branched ascomata. Possibly depauperate as ascospores are not well developed. Oddly, *A. cinnabarina* itself has not been found in our region. The photobiont is *Trentepohlia*.

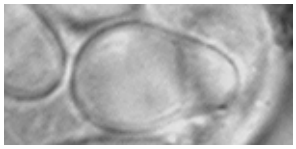
Arthonia sp. 44760

A single Missouri collection on *Carya* in oak woods. The strongly white pruinose ascomata and 3-septate ascospores with ± equal cells are diagnostic. The photobiont is *Trentepohlia*.



Arthonia sp. 45333

A single Missouri collection on dead *Acer rubrum*? in floodplain forest. This is largest spored member of a group of species with multiseptate spores with end cell enlarged and lacking a photobiont.



Arthonia sp. 45394*

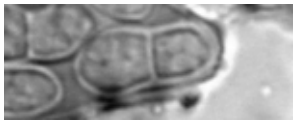
A single Arkansas collection lichenicolous on *Aspicilia contorta* in oak-juniper woods.

Arthonia sp. 46606-A*

A single Missouri collection lichenicolous on *Pertusaria propinqua* in clay-pan flatwoods.

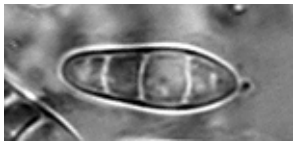
Arthonia sp. 47563

A single Missouri collection on thick bark of old oak in oak woods. The large, slightly shiny ascomata that pull away from thallus at the margin and dark brown hypothecium are diagnostic. The photobiont is *Trentepohlia*.



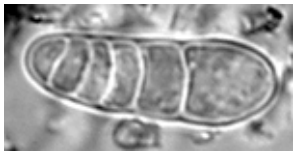
Arthonia sp. 47605

A single Missouri collection lichenicolous? on *Rinodina papillata* on *Carya* in overgrown dolomite glade. It is not completely clear that the *Arthonia* lichenicolous but it seems at least loosely associated with some rather scruffy *R. papillata*.



Arthonia sp. 47626-A

A single site in Missouri on *Carya ovata* in an overgrown glade. This is the only Ozark species with pallid ascomata, a character more common in tropical/subtropical taxa.

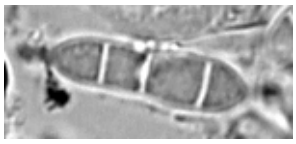


[**Arthonia** sp. 47847]

A single Missouri collection from Lincoln County just north of the Ozark region on *Prunus* in oak-hickory woods. Ascospores are 5-septate with enlarged end cell similar to *A. quintaria* but the ascomata are not effuse. Photobiont absent.

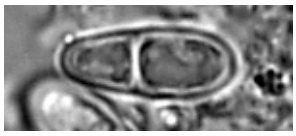
Arthonia sp. 48400

A single Missouri collection on *Carya* in oak-hickory woods. The irregularly branched, slender, light reddish ascomata and macrocephalic ascospores are reminiscent of *A. rubella* but the ascospores are much smaller and the photobiont is chlorococcoid.



Arthonia sp. 48436

A single Missouri collection from a canopy branch of a fallen *Celtis* at edge of floodplain. The chlorococcoid photobiont, tiny lecideoid ascomata and hymenium with a red pigment (KOH+ violet) are diagnostic.

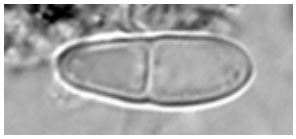


Arthonia sp. 49390

A single Arkansas collection on bole of *Celtis* in dry oak woods. See *A. "intrafusca"*. The photobiont is *Trentepohlia*.

Arthonia sp. 50183*

A single Missouri collection on *Rinodina papillata* on an exposed oak in a dolomite glade. The other species on *R. papillata* has a brown hypothecium and slightly smaller ascospores.

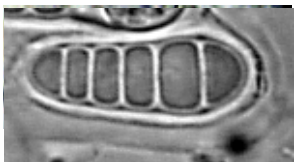


Arthonia sp. 50266

A single Missouri collection on bole of a sapling oak at edge of dolomite glade. Similar to *A. apatetica* in the chlorococcoid photobiont, brown hypothecium and 1-septate ascospores but the spores are smaller and differently shaped.

Arthonia sp. 50416

A single Missouri collection on an old *Platanus* in floodplain forest. this is the only species lacking a photobiont with mostly 2-septate ascospores.



Arthonia sp. 50883
A single Missouri collection on twigs of *Quercus* in a channel sandstone glade. This is identical to *A. quintaria* except that the ascospores are considerably larger. Photobiont absent.

Arthonia sp. 51102
A single from Arkansas on bole of *Acer rubrum* in oak-hickory woods. This is one of two species with multiseptate, ± equal celled ascospores, brown hypothecium and *Trentepohlia* photobiont. It differs form sp. 47563 in its dark thallus and larger ascospores.

Arthonia sp. 84959
A single Arkansas collection on bole of *Magnolia* in a stream valley. It is distinguished by the 3-4-septate ascospores with end cell enlarged, dark brown thallus and *Trentepohlia* photobiont.

ARTHOTHELIUM A. Massal. (Arthoniaceae)

Corticolous crustose lichens with thin, smooth, whitish gray to dark thalli; photobiont *Trentepohlia*, chlorococcoid, or absent; apothecia small, ± immersed, irregular to stellate; asci as in *Arthonia*, with 8 hyaline to pale brownish, submuriform to muriform spores; pycnidia minute, immersed, with bacilliform conidia; 5 species in the Ozarks.

Sundin & Tehler (1998), using sequence data, restrict *Arthothelium* to the type, *A. spectabile*. They place *A. ruanum* in a broad concept of *Arthonia*. The generic disposition of the remaining Ozark taxa remains to be determined.

1. Photobiont absent; spores submuriform, not all cells longitudinally divided.

    2. Apothecia narrow, irregular and elongate; ascospores < 20 µm long . . . . . *Arthothelium sp.* 50153

    2. Apothecia broader, rounded to elongate; ascospores >21 µm long . . . . . [*A. lirellans*]

1. Photobiont present; spores muriform to submuriform.

    3. Apothecia branched and elongate, typically <0.3 mm wide on their narrow axis; photobiont chlorococcoid . . . . . *A. taediosum*

    3. Apothecia larger and irregularly rounded, many typically >1 mm diameter; photobiont *Trentepohlia*.

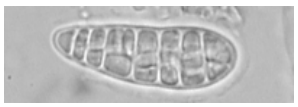
        4. Spores muriform, 26-36 × 12-15 µm . . . . . *A. spectabile*

        4. Spores muriform to submuriform, < 24 × 11 µm.

            5. Thallus dark; apothecia flat; spores with IKI- sheath . . . . . *A. ruanum*

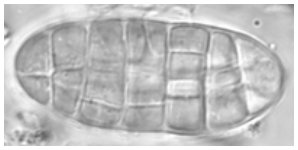
            5. Tallus pale; apothecia ± raised; spores with IKI+ orangish sheath . . . . . *Arthothelium sp.* 46579

[**Arthothelium lirellans** (Almq.) Coppins]
Known from a single collection in Lincoln County, Missouri, just north of the Ozarks, growing on *Acer saccharum* in a mesic woodland. The absence of photobiont and ascospores > 20 µm long with an I+ orangish halo are diagnostic.



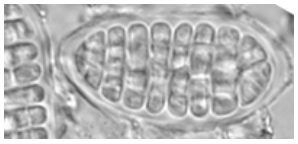
Arthothelium ruanum (A. Massal.) Körber

Uncommon on a variety of hardwoods in mesic woodlands; scattered through the region but mostly westward. The spores are slightly smaller than those of *A. spectabile*, the thallus is darker, and the ascomata are thinner, less regular, and tend to become centrally necrotic.



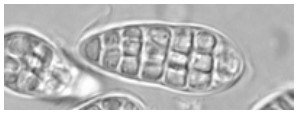
Arthothelium spectabile A. Massal.

Occasional on lower and mid boles of trees in mesic, lightly shaded areas. This species can be recognized by the well-developed, continuous, whitish gray thallus with abundant, irregularly rounded, black apothecia typically to 0.5 × 1.5 mm.



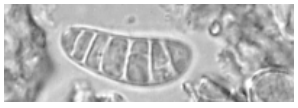
Arthothelium taediosum auct. Amer.

Frequent on a variety of smooth-barked trees in woodlands, especially on *Quercus coccinea, Q. rubra,* and *Q. velutina*. This species occurs from mid boles upward into the canopy, but is almost nonexistent at the bases of trees. It can be common on the exposed branches of small trees in open areas, but does so only in woodland landscapes, and not in extensively cleared districts. This is the only Ozark *Arthothelium* with a chlorococcoid photobiont; it forms extensive yellowish to grayish white patches small, irregularly branched, semi-immersed blackish ascomata. The apothecia are notably smaller and more stellate-branched than in *A. spectabile*, with individual clusters usually < 0.5 mm broad. Grube (1996) has pronounced North American material to be not conspecific with the type of *Arthonia taediosa* Nyl. and eventually a new description and name will have to be provided for this taxon.



Arthothelium sp. 46579

Known from a single collection in Oklahoma, on *Acer saccharum*. The spores are similar in size to those of *A. ruanum*, but the halo is IKI+ orangish and the ascomata are smaller.



Arthothelium sp. 50153

Known from a single collection from the Missouri Ozarks, growing on a small *Quercus*. This species resembles *Arthonia quinteria*, with ascospores similar to those of *Arthothelium lirellans*, but smaller.

ASPICILIA A. Massal. (Hymeneliaceae)

Saxicolous crustose lichens with gray to grayish green, continuous to areolate thalli; photobiont *Trebouxia*; apothecia usually immersed, with moniliform paraphyses; asci with a slightly thickened tip, IKI-, with (4-6-)8 large, simple, hyaline, ovoid spores; pycnidia immersed, with bacilliform to elongate conidia; 5 species in the Ozarks. The taxonomy of this genus in the Ozarks is in need of further study.

1. Thallus composed of discrete, thickened, gray areoles; apothecia immersed and sunken below level of upper cortex, pruinose, with densely pruinose thalline rim; on carbonate rocks . . . . . *A. contorta*

1. Thallus continuous to rimose; apothecia immersed but not sunken, without pruina; on siliceous rocks.

2. ThallusKOH+ red (norstictic acid) . . . . . *A. cinerea*

2. ThallusKOH- orKOH+ yellow (norstictic acid lacking or present as a trace substance).

3. Thallus light to medium gray,KOH- . . . . . *A. caesiocinerea*

3. Thallus pale to dark greenish gray,KOH+ yellow (stictic acid).

4. Thallus thin, smooth, continuous to rimose; usually near permanent water *A. laevata*

4. Thallus thick, rimose to subareolate; uplands . . . . . *A. verrucigera*

Aspicilia caesiocinerea (Nyl. *ex* Malbr.) Arnold

Occasional on shaded siliceous boulders and rock fragments in wooded uplands, occurring on chert, granite, rhyolite, and sandstone. Interestingly, this species does not occur on massive ledges, but on smaller boulders and fragments.

Aspicilia cinerea (L.) Körb.

Occasional, with habitats and substrates similar to those of *A. caesiocinerea*. This species also occurs on siliceous rocks in more moist situations along streams and seeps. [norstictic acid]

Brodo et al. (2001) suggested inclusion of morphologically similar specimens containing stictic acid under this name.

Aspicilia contorta (Hoffm.) Kremp.

Occasional on exposed dolomite boulders and ledges in glades and on bluffs, usually in full sun to light partial shade. The apothecia are typically white pruinose, and overlapped around their margins by a zone of upper cortex that is heavily pruinose and appears almost sorediate.

Aspicilia laevata (Ach.) Arnold

Apparently local, on hard, exposed siliceous rocks near permanent water, such as on massive igneous exposures of shut-ins along Ozark streams. The thallus of this species is greenish tinged, as contrasted with the light gray thalli of *A. caesiocinerea* and *A. cinerea*. [stictic acid, ± traces of norstictic acid]

Aspicilia verrucigera Hue

Rare on siliceous rocks in xeric wooded uplands. This species is similar in color and chemistry to *A. laevata*, but has a thicker, areolate thallus and typically occurs in uplands, as opposed to the typical streamside habitat of *A. laevata*. [stictic acid, ± traces of norstictic acid]

Some specimens from the eastern Ozarks also have a fatty acid with Rf values much higher than those for aspicilin.

BACIDIA De Not. (Lecanoraceae)

Giorn. Bot Ital. 2: 189. 1846. Lectotype (Fink, 1910): B. rosella (Pers.) De Not.

Crustose lichens with sessile apothecia lacking a thalline margin, photobiont chloroccoid, asci *Bacidia*-type, with 8 colorless, cylindrical to acicular, multiseptate spores, conidia filiform, curved. Reference: Ekman, 1996.

Bacidias are apparently rather gregarious in the sense that collections frequently contain more than one *Bacidia* species. If one is not careful this can lead to confusion. Further puzzlement can arise from the propensity in some species for variation in apothecial pigmentation, usually loss of pigment(s), leading to a markedly different look to the apothecia from typical forms. They are not included in Ekman's (1996) key but he notes some of them in the discussions. *Bacidia circumspecta*, *B. coprodes* and *B. schweinitzii* are the worst offenders but one should be alert for as yet unnoted instances in other species. Species of other genera are unlikely to be confused with the species of *Bacidia* with needle-like ascospores. However, *Lecania cuprea, Micarea peliocarpa, Scoliciosporum chlorococcum, S. umbrinum* and possibly *Bilimbia sabuletorum* could be confused with those species of *Bacidia* having shorter, rod- or club-shaped ascospores and for this reason are included in the key. Recent collections have turned up some additional species in *Bacidia* and *Bacidina* not included here but they are so rare that they are not likely to be encountered.

KEY TO *BACIDIA*, *BACIDINA*, *FELLHANERA*, AND SOME OTHER SPECIES WITH A SIMILAR TYPE OF ASCOSPORE

1. Growing on bark, decorticate wood or bryophytes on bark 2

2. Growing on bark 3

3. Spores 30-90 µm long; apothecia often pruinose (except *B. helicospora*) 4

4. Hypothecium yellow-brown, KOH+ rose, or red-brown and KOH- 5

5. Exciple red-brown or orange-brown, deeper purple-brown in KOH; apothecia typically with blackish disk and dull brown or blackish margin (but pigment deficient forms may be clear rust-brown or whitish), sometimes pruinose when young; epihymenium green; spores 32-88 × 2-4.3 µm; very common . . . . . *Bacidia schweinitzii*

5. Exciple, hypothecium and epihymenium partly yellowish to yellow-brown, KOH+ rose, KOH+ faintly purplish or KOH-; apothecia typically orange-brown with white pruinose margin or dull, light purplish brown without pruina 6

6. Pigmented patches of epihymenium and rim of exciple KOH+ faintly purplish, otherwise KOH- . . . . . *Bacidia schweinitzii* (apothecial pigment variant)

6. Pigmented parts distinctly KOH+ rose 7

7. Thallus granular; spores 32-69 × 2-4 µm; common . . . . . *Bacidia diffracta*

7. Thallus smooth; spores 31-74 × 2-5 µm; occasional . . .

. . . . . *Bacidia polychroa*

4. Hypothecium or central part of exciple colorless or yellowish, KOH-; rim and outer part of exciple brown or colorless 8

8. Thallus not granular, not papillose; apothecia dark 9

9. Apothecia pruinose, especially when young; spores 38-91 × 2.5-4.3 µm, not spirally twisted; common . . . . . *Bacidia suffusa*

9. Apothecia never pruinose; spores 33-81 × 2-3.7 µm, often spirally twisted; occasional . . . . . *Bacidia helicospora*

8. Thallus granular 10

10. Apothecia yellowish or pale buff, with pruinose margin; thallus granules not papillose; rare . . . . . *Bacidia diffracta* (pigment deficient form)

10. Apothecia pale orangish; thallus of isidioid granules; granules strongly papillose; only a single collection from Carter Co., Missouri . . . . . *Bacidia sp.* 32884

3. Spores 11-27(- 35) µm long; apothecia not pruinose (except *Arthonia caesia*) 11

11. Spores 2.5-5 µm wide 12

12. Apothecia ± flat with an obvious margin 13

13. Apothecial margin crenulate or denticulate; apothecia flat, black; spores narrowly cylindrical to narrowly clavate, with weakly acute ends, 3(-5)-septate, (13)-18-27 × 2-3 µm; rare *Bacidia* "*crenulata*"

13. Apothecial margin smooth 14

14. Exciple of hyphae with narrow lumina, enlarged only in outermost cells 15

15. Epihymenium lacking granules; epihymenium and exciple green or colorless in albino forms; spores narrowly clavate or narrowly cylindrical, with weakly acute ends, 3-septate, 19-28 × 2.5-3 µm; common . . . . . *Bacidia circumspecta*

15. Epihymenium with numerous to sparse blackish granules; epihymenium and exciple lacking green pigment; spores narrowly clavate to narrowly cylindrical, with weakly acute ends, 3-septate, 18-22 × 2.5-3 µm; rare . . . . . *Bacidia melanosticta*

14. Exciple of hyphae with enlarged, ellipsoid or ± isodiametric lumina 16

16. Hypothecium colorless; exciple dark inside; spores 3-septate, 14-15 × 2.5-3.5 µm; a single collection from Cherokee Co., Kansas . . . . . .

. . . . . *Bacidia sp.* 44360

16. Hypothecium dark gray; exciple colorless; spores 3-septate, 11-12 × 4-4.5 µm; a single collection from St. Francois Co., Missouri . . . . . see *Fellhanera "missouriensis"*

12. Apothecia swollen; margin absent or obscured 17

17. Thallus not leprose; thallus and apothecia C+ pink ; apothecia white to black, often mottled; spores 3-septate, 15-23 × 3-5 µm . . . . . see *Micarea peliocarpa*

17. Thallus ± leprose; thallus and apothecia C- 18

18. Thallus pale green, usually with a yellowish tint (usnic acid); apothecia usually bluish pruinose but occasionally blackish, without pruina; spores 3-septate, 15-24 × 4-6 µm . . . . . see *Arthonia caesia*

18. Thallus dark green; apothecia black, shiny, never pruinose; spores, 3-7-septate, 22-34 × 3-5 µm . . . . . see *Scoliciosporum chlorococcum*

11. Spores 1.2-2.5 µm wide, thin-walled 19

19. Apothecia brown; exciple in part brown; hymenium brown streaked; rare . . . . . *Bacidina assulata*

19. Apothecia whitish or pallid; apothecial tissues colorless; rare . . . . . *Bacidina phacodes* (also *B. delicata*?)

2. Growing on decorticate wood or on bryophytes at base of trees 20

20. On decorticate wood 21

21. Without obvious thallus; apothecia whitish, tiny; spores 3-septate, small . . . . . see *Absconditella lignicola*

21. With distinct, superficial thallus 22

22. Thallus and apothecia C+ pink, white to black, often mottled; spores 3-septate . . . . . see *Micarea peliocarpa*

22. Thallus and apothecia C-, shades of brown 23

23. Apothecia pale yellowish tan; spores broad, 3-5-septate, broad, 5-6.5 µm wide; Carter Co., Missouri . . . . . *see Bilimbia sabuletorum* (pale apothecia form)

23. Apothecia brownish black, spores narrow; 1.5-2 µm wide a single collection from Union Co., Illinois . . . . . *Bacidina sp.* 2432

20. On bryophytes 24

24. Spores fusiform, 3-5(-7)-septate, 5-8 µm wide, with punctate outer layer; apothecia usually swollen with margin mostly hidden, not pruinose . . see *Bilimbia sabuletorum*

24. Spores needle-like, multiseptate, without punctate outer layer; apothecia with persistent margin, pruinose . . . . . *Bacidia suffusa*

1. Growing on rock or bryophytes on rock or soil 25

25. Growing directly on rock 26

26. Thallus thick, composed of isidium-like granules; apothecia blackish green, slightly sunken among granules; spores 3-septate, 15-17 × 3.5-4.5 µ; on noncalcareous sandstone; known from one Illinois collection just E of Ozark region . . . . . see *Fellhanera "granulosa"*

26. Thallus ± thin, not compose of isidium-like granules or thallus not evident 27

27. Spores spirally arranged in ascus, remaining ± spiral when released from ascus; apothecia dark brown, emarginate . . . . . see *Scoliciosporum umbrinum*

27. Spores not spirally arranged in ascus and not remaining ± spiral when released from ascus 28

28. Spores short-cylindrical, 3-5-septate 29

29. With obvious superficial thallus 30

30. Thallus and apothecia C+ pink; apothecia without obvious margin . . . . . see *Micarea peliocarpa*

30. Thallus and apothecia C-; hypothecium brown; spores ± fusiform, often narrower at one end, 3-septate 31

31. Mostly on calcium rich rocks; exciple ± entirely dark merging with brown hypothecium; spores 13-18 × 2.5-3.5 µm . . . . . *Bacidia coprodes*

31. Always on siliceous rocks, especially chert; exciple dark at margin, remaining distinct from brown hypothecium; 12-14 × 4-5 µm . . . . . see *Fellhanera silicis*

29. Without obvious thallus or thallus scant, ± leprose 32

32. Apothecia black, with persistent raised margin; spores 5-7-septate, 20-27 × 5-6 µm; on sandstone; occasional . . . . . see *Cresponea premnea* var. *saxicola*

32. Apothecia pale tan or pale reddish, emarginate 33

33. Apothecia tan, convex; margin obscured; apothecial tissues colorless except exciple rim brown tinted; spores 3-septate, 16-21 × 2-3 µm; on dolomite; rare . . . . . see *Lecania cuprea*

33. Apothecia reddish, perithecium-like; spores 3(-5)-septate, 12-18(-21) × 5-6 µm; on sandstone; very rare . . . . . see *Thelopsis rubella*

28. Spores needle-like, 3-many-septate; cross walls sometimes not readily visible 34

34. Spores short and narrow, less than 2.5 µm wide 35

35. Apothecia blackish; epihymenium green; hypothecium usually brownish; rim of exciple tinted green or green mixed with brown; on carbonate rock; rather common . . . . . *Bacidina egenula*

35. Apothecia or apothecial disk pale (pinkish, brown or pale tan mottled greenish); on siliceous rock; rare 36

36. Apothecia whitish or pale pinkish orange; hypothecium colorless . . . . . see discussion of *Bacidina phacodes*

36. Apothecia darker; hypothecium brown . . . . . *Bacidina sp.* 17399

34. Spores longer and broader, 38-91 × 2.5-4.3 µm, with many cross walls; mostly on bark, very rarely on calcium-rich rock . . . . . *Bacidia suffusa*

25. Growing on bryophytes on rock or soil 37

37. Apothecia usually swollen, with margin mostly hidden, brown-black to whitish; spores broad, fusiform 5-8 µm wide, 3-5(-7)-septate, with a punctate sheath; common, over lime rocks and occasionally soil . . . . . see *Bilimbia sabuletorum*

37. Apothecia usually remaining ± flat; spores acicular, 4 µm or less wide 38

38. Rarely growing from calcium rich rock onto bryophytes; spores 38-91 × 2.5-4.3 µm, with many cross walls; apothecia pruinose; epithecium and hypothecium pale . . . . . *Bacidia suffusa*

38. On calcium rich soil; spores needle-like, tapered, 3-7-septate, 25-45 × 2-3 µm; apothecia not pruinose; epihymenium green; hypothecium brown; not known from Ozark region but might be expected as occurs in central Kansas and Northwestern Missouri . . . . . [*Bacidia bagliettoana*]

Bacidia circumspecta (Nyl. *ex* Vainio) Malme

Thallus on bark, olive-tan, grayish or rarely dark olive-brown, superficial, areolate or occasionally mostly granular, marginally with areoles dispersed, centrally with areoles appressed, forming a ± continuous thallus, occasionally ± rugose; areoles initially ± round but soon irregular, flattened to convex, 0.1 mm (young) to ca. 1.5 mm. Apothecia variable in color, black or mottled with various combinations of black, dark brown, shades of yellow-brown, green, whitish or ± colorless , rarely entirely pale tawny yellow, scattered, sessile, flat or moderately convex, rounded or sometimes irregular and even warty with age, constricted at base, 0.5-1.0 mm across,; margin usually initially evident, slightly raised, persistent or becoming obscured in more convex apothecia, with rim in paler apothecia usually black or greenish black, pale below and darker than disk; disk pigmentation discontinuous, appearing as dark dots when wetted (except in very pale apothecia). Exciple in section under dissecting scope with a distinctive glassy aspect, diffusely pigmented at rim, green (KOH-), usually mixed with purplish brown (KOH+ purplish), especially inward and/or below, colorless in center; outer part consisting of radiating hyphae with end cells enlarged, pyriform, to 5 µm across, central part (under hypothecium) of intertwined hyphae. Hypothecium colorless, loosely prosoplectenchymatous with some enlarged cells, ca. 30-40 µm thick. Epihymenium with clumped dark green pigment or in paler forms ± colorless (KOH-). Hymenium streaked with dark green

(KOH-), or ± colorless, ca. 50-60 µm thick. Paraphyses ± unbranched, some with end cells enlarged, pyriform, with a green sheath (sheath extending downward a cell or two), ca. 4-5 µm across, others little or not enlarged, without colored sheath, ca. 2 µm across. Ascospores narrowly clavate or narrowly cylindrical, with weakly acute ends, 3-septate, 19-28 × 2.5-3 µm. Pycnidia pyriform, green above, with or without brownish layer below green, colorless below, 20-30 µm across. Conidia filiform, curved, 20-25 × 0.8 µm. [no lichen substances detected] Illustrations: Ekman (1996), figs. 6C,D, 8E,F, 40G.

Occasional on shaded hardwood boles, *Juniperus* and once on bryophytes, usually associated with other species of *Bacidia*. Scattered across temperate U.S. and southern Canada with the exception of the Plains and Rockies, Europe (Ekman, 1996, fig. 21).

The common forms of *B. circumspecta* with mottled apothecia are easily recognized, those with black apothecia will require an apothecial section to see the mostly colorless exciple (glassy under dissecting scope), colorless hypothecium and short, mostly clavate, 3-septate ascospores. Although the ascospores of *B. circumspecta* specimens from outside the Ozarks can have as many as seven septa (Ekman, 1996), only 3-septate ascospores have been observed in the Ozark population. However, the ascospore length of the Ozark population ($\bar{x}$ = 23) differs little from that of the general North American population studied by Ekman ($\bar{x}$ = 24). Ekman (1996) describes three conidial types. Only one, the curved, filiform type, is found in the Ozarks. It seems possible that molecular studies may find *B. circumspecta*, as presently circumscribed, to be a species aggregate. Assuming that *Lecania naegelii* (Hepp) Diederich & v. d. Boom is correctly placed in *Lecania*, Ekman's (1996) retention of *B. circumspecta* in *Bacidia* is puzzling. They differ in ascospore size and shape but apothecial pigmentation (especially the mottling and the dotted appearance when wetted), excipular anatomy, paraphyses with a green sheath above and conidial type seem identical. Inclusion of taxa without a thalline margin in *Lecania* is relatively recent and will probably come under scrutiny again if the corticolous species are revised. We suggest that *B. circumspecta* must be included in any such revision. In a few collections a nectrioid parasymbiont is found, perhaps referable to *Nectriopsis.* [Perithecia rose-colored (KOH-), superficial, ± tomentose; hairs short, colorless, very irregular, contorted and multilobed; ascospores broadly ellipsoidal, smooth, 9-10 × 6-7.5 µm – Missouri. Greene County, *Buck 38314, 38328* , also on a sterile crust from Kentucky, *Buck 39904* (all NY)].

Bacidia coprodes (Körber) Lettau (syn. *Bacidia granosa* (Tuck.) Zahlbr.)
Thallus on carbonate rock, rarely silicate rock, tan to pale brownish gray to darker 'dirty' gray, superficial, commonly cracked or cracked-areolate, to 50 µm thick, less often of irregular, flattened areoles ± sunken between rock crystals, rarely subsquamulose or peeling from rock, granular or virtually undetectable; well-developed areoles roughened with flat warts (thallus may appear pale spotted when darker algae/cyanobacteria collect in troughs between warts). Apothecia mostly black (whitish in a rare unpigmented form in which following apothecial structures are whitish externally and ± colorless in section), not pruinose, scattered, sessile, flat to moderately convex, constricted at base, 0.3-0.8 mm diam.; young apothecia tall in proportion to width with a high proportion of margin to disk; disk black, mostly paler when wet, less commonly (in deep shade?) pale gray, pale brown-gray or medium brown, without pruina; margin black, slightly raised, mostly persistent (rarely hidden in convex apothecia or not detectable until apothecium wetted). Exciple often greenish above adjacent to hymenium (KOH-), colorless outward, dark, brown, greenish brown or purplish brown interiorly (mostly continuous under hypothecium), rarely exciple with only a little interior pigment; pigment(s) located between excipular hyphae (KOH weakly purplish); excipular hyphae radiating with end cell ± pyriform with a thick colorless sheath, 7-8 µm diam. including sheath, lumen ca. 3-4 µm. Hypothecium orange brown to brown (KOH-), rarely almost without pigment or obscured by excipular pigment. Epihymenium colorless. Hymenium often greenish and streaked with darker green (mostly around asci), occasionally colorless. Paraphyses unbranched, with end cells little expanded to pyriform, 3-4 µm diam., unpigmented. Ascospores ± fusiform, often narrower at one end, 3-septate, 13-18 × 2.5-3.5 µm, not halonate. Pycnidia usually present, globose; wall often greenish

above, brownish below. Conidia filiform, mostly semicircular curved, not septate, 13-18 × 1.0 µm. [no lichen substances]

Common on shaded, usually moist, carbonate substrates, typically shaded dolomite outcrops in mesic ravines and along streams, also on old, shaded concrete in mesic areas, very rarely on siliceous rocks in similar habitats. Widely distributed in eastern North America, New York to Florida Panhandle, Iowa to Arkansas and Mississippi (northern extent of range not clear) and also occurring in Europe.

With experience the typical form with dark, marginate apothecia on a tan, cracked thallus with low warts on the areoles growing on dolomite or limestone can be identified without microscopic study but many specimens will need to be confirmed with an apothecial cross-section to see the dark exciple continuous under the hymenium and 3-septate ascospores. On calcareous rocks difficulties arise from relatively uncommon variations in apothecial pigmentation. These include forms with ± colorless hypothecium and/or reduced excipular pigmentation. Even more problematic are two completely albino collections (Kansas: *Buck 38511*, Missouri: *Buck 38286*, in both the typical form is also present on adjacent parts of the rock). In such cases one has to depend on the ascospores and general aspect to make a determination. *Bacidia coprodes* also occurs uncommonly on siliceous rock and then distinction from *Fellhanera silicis* is a problem. Apothecial pigmentation is very similar but the *Fellhanera* has an exciple of irregularly arranged enlarged cells, *B. coprodes* of radiating hyphae with only the end cell ± enlarged and the interior of the *Fellhanera* exciple is paler greenish, clearly distinct from the brown hypothecium, not dark brownish and ± continuous with the hypothecium as in *B. coprodes*. The ascospores of *F. silicis* are broader, 4-5 µm versus 2.5-3.5 µm. The most definitive characters, if one has the skill and patience, are the ascus type (with a broad, pale axial mass in *B. coprodes*, with a dark apical tube in *F. silicis*) and conidial type (filiform, curved in *B. coprodes*, short, bacilliform to bowling pin shaped in *F. silicis*, pycnidia usually present in both). The name *Bacidia granosa*, which has been used for this species in recent years, has recently been synonymized with *B. coprodes* (Llop & Ekman 2004), a not unexpected event. One specimen from Kansas has apothecia parasitized by *Lichenoconium sp.*

Bacidia crenulata R. C. Harris & Ladd, *sp. nov.*
Thallus on bark, whitish, ± immersed, with algal layer discontinuous looking like irregular, very flat, greenish areoles or pushing through upper layer of bark forming slightly raised greenish areoles. Apothecia black, lightly shiny, scattered to ± clustered, sessile, persistently flat, strongly constricted at base, 0.3-0.6 mm across; margin black, concolorous with disk, not pruinose, usually raised, occasionally ± level with disk, persistent, variously crenulate, denticulate or weakly radiately grooved, occasionally smooth; disk black, not pruinose. Exciple brown, paling to ± colorless at edges, usually colorless in center, ca. 30-40 µm thick; pigment(s) located between excipular hyphae, dense, often in large clumps (KOH+ purplish); hyphae radiating with end cells enlarged, ± pyriform, with thick sheath, ca. 8 µm across (lumen ca. 4 µm). Hypothecium colorless, ca. 50 µm thick, of intertwined hyphae with scattered inflated cells. Epihymenium dark gray-green, KOH-, ± uneven as some paraphysis tips not pigmented. Hymenium colorless, ca. 50 µm thick. Paraphyses mostly unbranched, many with end cells enlarged, ± pyriform, ca. 5 µm across, with a gray-green sheath, others with end cells not or only a little enlarged, ca. 2 µm across, without a colored sheath. Asci clavate. Ascospores narrowly cylindrical to narrowly clavate, with weakly acute ends, mostly 3-septate, a few seen with 4-5 septa, (13-)18-27 × 2-3 µm ($\bar{x}$ = 20.5 µm). Pycnidia semi-immersed, ± globose, with brown wall above, colorless below, ca. 1.0 mm across. Conidia filiform, strongly curved, not obviously septate, ca. 15-20 × 0.8 µm, or mixed with rod-shaped conidia, ca. 7-9 × 1.0 µm (*Buck 32738*). [no lichen substances?, not tested]

Rare on *Juniperus virginiana* and *Quercus stellata* in wooded uplands.

We are not aware of any other species of *Bacidia* with a consistently crenulate or denticulate margin. Before the light dawned, *Bacidia crenulata* (named for the unique margin) was determined as either

B. circumspecta or *B. subincompta* (Nyl.) Arnold which it somewhat resembles in pigmentation (but not in the anatomy of the exciple which seems identical to that of *B. coprodes*). In addition to the crenulate exciple, *B. coprodes* differs in growing on rock, brown hypothecium and shorter and slightly broader ascospores and *B. circumspecta* (with which *B. crenulata* grows) differs in dark exciple and apothecia not pure black, often greenish or yellowish, especially the disk, with a thicker margin, often becoming convex. The co-occurrence of two types of conidia in a single pycnidium needs to be confirmed with additional material.

Bacidia diffracta S. Ekman
Thallus on bark, pale to medium green-gray, rarely pale tan (badly dried specimens?), superficial, consisting of sparse to crowded, globose to flattened and slightly irregular granules on a whitish "hypothallus" of hyphae mixed with upper cells of bark; granules 50-120 µm across, with outer layer one hypha thick. Apothecia bright to dark orange-brown (yellowish to pale buff in pigment deficient forms), pruinose or not, scattered, sessile, ± flat to strongly convex, rounded or weakly lobed in old age, constricted at base, 0.5-1.2 mm across; disk sometimes weakly white pruinose; margin concolorous with disk or slightly darker, even with disk or obscured in convex apothecia, often strongly white pruinose; young apothecia initially globose, paler, yellowish to pale orange-brown, often strongly pruinose, with marginal pruina radiately sulcate. Exciple distinctly two parted: inner, thicker part lens-shaped, pale yellowish, of dense, gelatinized, irregular hyphae with narrow lumina, to ca. 200 µm thick; outer cup-like, of radiating hyphae with broader lumina, to ca. 100 µm thick, with terminal cells only weakly expanded, sometimes containing large, colorless crystals, ± colorless outside, yellowish to yellowish brown inward; rim usually brownish; pigmented areas of both KOH+ rose. Hypothecium yellowish to yellow-brown, ca. 40-50 µm thick, KOH+ rose above, KOH- below; hyphae irregular, not gelatinized, with some cells inflated (to ca. 6 µm across or oval, 12-15 × 6-7 µm). Epihymenium colorless to pale yellow-brown (KOH+ rose). Hymenium sometimes streaked with yellow-brown above (KOH+ rose), ca. 90-100 µm thick. Paraphyses unbranched, not or slightly expanded at tips. Ascospores needle-like, 3-11-septate, 32-69 × 2-4 µm (Ekman, 1996), not spirally arranged in ascus. Pycnidia pale brown (KOH-), ± globose, ca. 150 µm across. Conidia filiform, curved, ca. 20 × 0.8 µm. [atranorin (sometimes only a trace), rarely with a trace of zeorin (Ekman, 1996)] Illustrations: Ekman (1996), figs. 40H, 43F.

Locally abundant in the Ozarks (mostly Missouri) in mesic woodlands, ravines or along streams; on shaded boles of hardwoods or *Juniperus*. *Bacidia diffracta* is endemic to eastern North America from northern Minnesota to Nova Scotia to Louisiana and northern Georgia with a morphologically and distributionally anomalous population in eastern Florida (Ekman, 1996, fig. 22).

The granular thallus in combination with the usually bright orange-brown, marginally pruinose apothecia normally allow for easy identification with just a handlens. The apothecia of *B. polychroa* are very similar but the thallus is smooth (for some additional minor differences see discussion of *B. polychroa*). The granular thallus also allows one to deal with the few specimens with pigment deficient apothecia (all tissues KOH-). One collection (Missouri, Crawford Co., *Ladd 11932*) has both typical and pigment deficient forms growing intermixed. The pigment deficient forms might be confused with *B. rubella* (Hoffm.) A. Massal. which has larger thallus granules and has not been found in the Ozark ecoregion. Pigment deficient forms of *B. schweinitzii* with orange-brown apothecia also tend to have granular thalli but the exciple/hypothecium is darker and KOH-. *Bacidia diffracta* occasionally occurs without apothecia and then can be confused with sterile *Phyllopsora spp.* or sterile *Bacidia schweinitzii*. *Phyllopsora* species in the Ozarks differ in larger, proliferating thallus granules, lacking atranorin, and more conspicuous, superficial hypothallus. *Bacidia schweinitzii* usually lacks atranorin, has ± larger thallus granules and blackish pycnidia (not pale brown). The lichenicolous *Opegrapha diffracticola* is often found on the apothecia and thallus and possibly is confined to *B. diffracta*.

Bacidia helicospora S. Ekman
Thallus on bark, shades of gray, superficial or mostly immersed, essentially smooth or with slightly raised, scattered to aggregated areoles, to 50-60 µm thick. Apothecia black in sun, paler in shade, then brown to pallid, mottled with darker browns, ± shiny, not pruinose at any stage, scattered, flat, rarely weakly convex, round or ± lobed in old apothecia, 0.5-1.5 mm across; margin raised, relatively thick, especially in young apothecia, less commonly even with disk, black to brown, usually darker than disk in paler apothecia; disk black to brown, finely dotted when wetted. Exciple dark brown to pale brown in a narrow outer zone (KOH+ more purplish), tinted yellow brown within, especially in upper part, occasionally darker just below hypothecium or most of exciple tinted yellow-brown, sometimes mostly colorless (under dissecting microscope mostly shiny and brownish), 80-100 µm thick; outer part of radiating hyphae, with end cells ± enlarged; central part denser, with hyphae more irregularly arranged. Hypothecium colorless, 40-60 µm thick. Epihymenium discontinuously dark (rarely pale) brown pigmented (KOH+ purplish, rarely KOH-); pigment mostly around ascus tips and clumps of paraphyses. Paraphyses unbranched, not or only slightly expanded at tips, ca. 2-3 µm wide, sometimes sheathed by brown pigment and then ca. 4 µm with sheath. Ascospores needle-like, often twisted (often spirally twisted in ascus and released in a single bundle, especially when ± immature), broader toward one end, gradually tapering in a long tail, 11-15-septate, 47-64 × 3.5-4.5 µm. Pycnidia globose, brownish, ca. 100 µm across. Conidia filiform, curved, 20-27 × 0.8 µm. [no lichen substances] Illustrations: Ekman (1996), figs. 7, 41B, 43G.

Uncommon on boles of hardwoods, *Juniperus* and *Pinus*. *Bacidia helicospora* is endemic to southern and central U.S. It does not seem to be a very common species. Ekman (1996, fig. 23) maps 11 localities from Maryland to southern Oklahoma and the Florida Panhandle (including one from Ozarkian Illinois). Judging from our material, it seems to occur mostly as rather small, scattered thalli, often only found as an admixture in other *Bacidia* collections.

Bacidia helicospora is the only "long-spored" Ozark *Bacidia* with dark apothecia completely lacking pruina at all stages. Thus the flat, ± shiny, black to mottled brown/black apothecia, thin, gray thallus in combination with the microscopic characters of brown epihymenium and outer exciple and long needle-like ascospores make for ready identification. In paler forms the epihymenial pigment may not be obvious but mostly still gives a KOH+ purplish reaction. However, one specimen (Missouri, Carter County, *Ladd 19511A*) lacks any pigment reacting with KOH and consequently the apothecia are a clear orange-brown, not showing any fine dots when wetted. It presumably represents another instance of the variation in pigmentation we have found throughout the genus. In aspect *B. helicospora* might be confused with large forms of *B. circumspecta* which differs in much shorter, 3-septate ascospores. Small forms of *B. schweinitzii* completely lacking pruina differ in better developed thallus, thicker, more convex apothecia, greenish epihymenium and thick brown exciple. Ekman (1996) emphasized the spores twisted in the ascus and the tendency for the spores to be ejected as a single bundle. However, in fresh material from the Ozarks, while a few asci can usually be found with twisted spores, the spores are not often seen released in bundles. This latter character may be one which is affected by the length of time in the herbarium since most of the specimens seen by Ekman were at least 15 years old.

Bacidia melanosticta R. C. Harris & Ladd, *sp. nov.*
Thallus on bark, tan, superficial, older parts cracked into irregular areoles ca. 0.3 mm across seemingly composed of smaller areoles less than 0.1 mm across, to ca. 75 µm thick, not corticate, youngest parts with dispersed, flattened, irregular areoles ca. 0.1 mm across, without evident prothallus. Apothecia uniform dark brown in sun, mottled brown and tan where shaded, not pruinose, scattered, sessile, flat to ± convex; margin concolorous with disk or slightly paler, even with disk or very slightly raised, evident from beginning, persistent but becoming less evident in older apothecia. Exciple variably colored, translucent brown, mostly toward outside, otherwise colorless (KOH slightly purplish brown), ca. 30-50 µm thick; excipular hyphae radiating, with end cells ± enlarged, ca. 4 µm across, with brown pigment located between the hyphae. Hypothecium with thin brownish

layer above, otherwise colorless, ca. 30-40 µm thick, extending downward stipe-like. Epihymenium colorless, with few to many, irregular, brown-black granules, to 5 µm across, KOH-, not dissolving, N–, dissolving. Hymenium partially or entirely diffusely brown-tinged, ca. 50 µm thick (KOH slightly purplish brown). Paraphyses unbranched, not pigmented, with end cells not enlarged (ca. 2 µm across) or enlarged, ± pyriform (ca. 4 µm across). Asci short clavate. Ascospores narrowly clavate to narrowly cylindrical, with weakly acute ends, 3-septate, 18-22 × 2.5-3 µm. Pycnidia with upper part green, lower part brown. Conidia filiform, curved, ca. 20 × 0.8 µm. [no substances?, not tested]

MISSOURI. SHANNON COUNTY: MOFEP site 4, in Cardareva State Forest, S of Banker Hollow, W of Wolf Pen Hollow, N of Current River, on *Toxicodendron radicans* along bank of Current River, Apr 1996, *Chadwell s.n.* (Ladd).

As far as we are aware there are no other species of *Bacidia* with blackish granules in the epihymenium (from which the epithet is derived). Also the total lack of greenish pigments is noteworthy as is the diffuse nature of the brown pigment and the weakness of its reactions with the usual reagents. The dull brown-black obscurely marginate apothecia of *B. melanosticta* are fairly distinctive but could confused with some forms of *B. circumspecta* which differs in the presence of greenish pigments in the apothecium and larger ascospores. It is known only from a single collection on a substrate which is usually avoided.

Bacidia polychroa (Th. Fr.) Körber
Thallus on bark, whitish to pale greenish (from a distance), superficial, with small, flat, ± dispersed areoles barely raised above bark to raised, crowded and ± constricted at base, rarely nearly continuous and cracked; areoles 0.1-0.3 mm across. Apothecia light orange-brown, buff-brown, brown or dark brown, pruinose or not, scattered, sessile, flat to rarely strongly convex, constricted at base, 0.5-1.0 mm across; disk sometimes thinly white pruinose; margin slightly darker than or concolorous with disk, even with disk or slightly raised, obscured in convex apothecia, sometimes thinly white pruinose; young apothecia paler, light orange-brown, occasionally pruinose. Exciple distinctly two parted: inner part lens-shaped, yellowish, of dense, gelatinized, irregular hyphae with narrow lumina, to 80-120 µm thick; outer cup-like, of radiating hyphae with broader lumina, to 70-120 µm thick, with terminal cells ± expanded, clavate, sometimes containing large, colorless crystals, ± colorless outside, yellowish to yellowish brown inward; pigmented areas KOH+ rose. Hypothecium yellow-brown, 40-60 µm thick (KOH+ rose); hyphae irregularly arranged, not gelatinized, with some cells inflated (ca. 6 µm across or oval, 12-6-7 µm). Epihymenium colorless to pale yellow-brown (KOH+ rose). Hymenium sometimes streaked with yellow-brown in upper part, KOH+ rose, 80-120 µm thick. Paraphyses unbranched, not or slightly expanded at tips. Ascospores needle-like, 2-15-septate, 31-74 × 2-5 µm (Ekman, 1996), not spirally arranged in ascus. Pycnidia almost colorless to pale orange-brown, ± globose, KOH-, ca. 100 µm across. Conidia filiform, curved, ca. 20-25 × 0.8 µm. [no substances detected or atranorin (Ekman, 1996)] Illustrations: Ekman (1996), fig. 41G; Wirth (1995) 1:160.

In addition to the smooth thallus *B. polychroa* seems to have some additional tendencies separating it from the very similar *B. diffracta*, at least in the Ozarks: sometimes no pruinose apothecia present, no young apothecia seen completely white pruinose or with pruina radiately sulcate, margin in older apothecia less pruinose, margin often darker than disk and thus more visible, disk more often thinly pruinose, apothecial color not as bright (tends more toward buff shades), and exciple and hypothecium more uniformly colored and KOH+ rose. We have not encountered pigment deficient forms in Ozark *B. polychroa*. Forms of *B. schweinitzii* with smooth thallus can be separated by its darker, redder, KOH– hypothecium, epruinose forms of *B. suffusa* by its ± colorless, KOH– hypothecium.

Frequent on hardwoods and *Juniperus*. *Bacidia polychroa* has an eastern American-European distribution. In North America it is known from northern Minnesota to northern Maine south to western Louisiana and central Florida (Ekman, 1996, fig. 28).

Bacidia schweinitzii (Fr. ex E. Michener) A. Schneid.
Thallus on bark, pale gray-green to dark green (shades of tan in older herbarium specimens), dull, superficial, in Ozark region most commonly ± continuous and areolate, but also coarsely granular, or rarely thallus scant with or without small granules (dry habitats?), rarely smooth and continuous (on smooth bark); areoles slightly to strongly convex, round or irregular, 0.1-0.2 mm across; when thallus coarsely granular, granules often flattened and irregular or sometimes even isidioid, when thallus scant, granules smaller, ca. 0.5-0.15 µm across; granular thalli sometimes with thin, white, arachnoid hypothallus. Apothecia most commonly entirely black or disk black and margin dull brown (pigment deficient variants described below), mostly without pruina, scattered, sessile, flat, less commonly moderately to strongly convex, rounded or slightly lobed with age (rarely old apothecia regenerating, forming a dense clump of small, deformed apothecial initials or apothecia), constricted at base; margin concolorous or dull brown, slightly raised above or even with disk, rarely ± strongly raised, occasionally thinly pruinose in young apothecia, obscured in more convex apothecia; young apothecia often pale buff-brown. Exciple two-parted but division often ± obscured by density of pigmentation: inner lens-shaped, deep red-brown (KOH+ deep purple-brown), ca. 100-150 µm thick, of irregularly intertwined, rather large hyphae; outer cup-shaped, red-brown inside, paler outwards, yellow-brown, yellowish or colorless (KOH+ purplish), ca. 80-100 µm thick; rim often green adjacent to epihymenium. Hypothecium brown(KOH-), or concolorous and indistinguishable from the inner part of the exciple, ca. 60 µm thick. Epihymenium with dense to sparse clumps of green pigment (KOH-), often extending downward into upper hymenium. Hymenium ca. 100 µm thick. Ascospores needle-like, 3-15-septate, 32-88 × 2-4 µm. Pycnidia blackish, globose, 0.15-0.2 mm across, with upper wall dark brown. Conidia filiform, curved, 20-25 × 0.8 µm . [± atranorin] Illustrations: Brodo et al. (2001), fig. 126; Ekman (1996), figs. 8A, 42D,E.

The deficiencies in apothecial pigmentation seems to fall in the following groups.

1) Apothecia orange-brown or yellow-brown, shiny or rarely dull. Exciple inner part uniformly light orangish brown, outer light orangish brown inside, with colorless layer outside; pigmented parts darkening slightly in KOH. Hypothecium concolorous with inner exciple. Epihymenium colorless (KOH-). Otherwise as in the typical form. This form lacks the pigments Bacidia Green and Schweinitzii Red (as named by Ekman, 1996). The remaining Rubella Orange, mainly in the exciple, is then responsible for the apothecial color. This is the most common pigment-deficient variant in our region and occurs occasionally throughout the range of *B. schweinitzii.*

2) Apothecia dull brown. Exciple inner part yellowish to light orangish brown, outer light orangish brown inside (KOH-), pale grayish or ± colorless outside (KOH+ faint purplish, C+ faint purplish). Hypothecium concolorous with inner exciple. Epihymenium spottily faint grayish pigmented or ± colorless (KOH+ faint purplish, C?). Otherwise as in typical *B. schweinitzii*. The apothecia of this form seem to lack the same two pigments as the first variant but contain low amounts of Sedifolia-gray [Thalloidima Green sensu Ekman] in the upper edge of the exciple and in the epihymenium. Although the concentration of Sedifolia-gray seems low, it is apparently sufficient to tone down the orange-brown color seen in the first variant to a dull brown. Sedifolia-gray has not been reported from *B. schweinitzii* and the material is included in *B. schweinitzii* with some hesitation. Perhaps may be worth recognizing at the subspecific level as an Ozark region endemic?

3) Apothecia yellowish white, slightly shiny. All tissues colorless (KOH-) except the center of the inner part of the exciple which is pale brown in section (KOH-). This would seem to be an almost completely albino form of *B. schweinitzii* with only traces of Rubella Orange. A similar form with

more pigment in the exciple is known from Alabama. Interestingly the single Ozark collection of this variant is associated with both typical *B. schweinitzii* and the first variant above.

Common in moist to dry mesic woodlands and almost all collections are from lower and middle portions of boles of hardwoods, with only two collections from decorticate *Juniperus* twigs, once on bryophytes on *Juniperus*, and once on rock. *Bacidia schweinitzii* is the most common species of *Bacidia* and one of the more common crustose lichens in eastern North America including the Ozarks. It is endemic to eastern North America from northern Minnesota to Nova Scotia south to eastern Texas and central Florida (Ekman, 1996, fig. 31).

Typical *B. schweinitzii* is unlikely to be confused with any other Ozark *Bacidia*. The entirely black or dull brown margined black apothecia with green epihymenium and bright red-brown exciple in section (seen even with a dissecting microscope) are unique. The thallus is very variable (reduced in drier situations, increasingly better developed with increasing humidity?). The forms with lighter brown, pigment deficient apothecia might be confused with *B. diffracta* or *B. polychroa* but these have the exciple and hypothecium yellowish in section, distinctively KOH+ rose. Sterile thalli can be confused with *B. diffracta* or *Phyllopsora* ssp. See discussion of *B. diffracta*. A specimen from canopy hardwood twigs (*Ladd 26084B*) has much smaller apothecia than usual.

Bacidia suffusa (Fr.) A. Schneid.
Thallus on bark or rarely rock or bryophytes, whitish or rarely gray, superficial, areolate; areoles ± dispersed to crowded and becoming ± continuous, mostly nearly flat but sometimes raised and weakly constricted at base, rarely almost bullate, 0.2-0.3 mm across, with interspaces ± arachnoid and rarely with a white, fimbriate prothallus (on hard bark of *Carya*). Apothecia shades of brown to blackish, rarely pale, scattered, sessile, rounded or weakly lobed when old, flat to moderately convex, constricted at base, 0.8-1.5 mm across; disk mostly medium brown, chocolate brown to blackish brown, often mottled with paler browns, less commonly pale orangish brown or buff-brown, rarely yellowish, often with thin white pruina; margin usually slightly darker, even with or slightly raised above disk, frequently pruinose; young apothecia very often totally white pruinose, with marginal pruina usually denser and often radiately sulcate, sometimes rather coarse (marginal pruina sometimes remaining ± sulcate in older apothecia). Exciple distinctly two parted: inner lens-shaped, colorless or very weakly yellowish, dense, of gelatinized, interwoven hyphae with narrow lumina, 80-120(170) µm thick; outer cup-shaped, with outer part chestnut brown, especially rim (KOH-), paling to colorless inward, 90-120 µm thick, of radiating hyphae with narrow lumina inward and several rows of enlarged cells outside. Hypothecium mostly yellowish (KOH-), sometimes colorless, 50-70 µm thick, of loosely intertwined hyphae with some cells enlarged. Epihymenium with clumps of chestnut brown pigment around paraphyses (KOH-) or nearly colorless. Hymenium colorless or streaked with brown above, (KOH-), 100-120 µm thick. Ascospores needle-like, 3-17-septate, 38-91 × 2.5-4 µm. Pycnidia blackish brown, globose, ca. 100 µm across, with upper wall chestnut brown. Conidia filiform, curved, ca. 20-30 × 0.8 µm. [atranorin] Illustrations: Ekman (1996), figs. 3C, 42G.

Common, mainly on the boles of hardwoods, rarely on twigs, rock or bryophytes on rock and once on bryophytes on *Juniperus*. *Bacidia suffusa* is an eastern North American endemic, known from northern Minnesota to Quebec south to eastern Texas and northern Florida (Ekman, 1996, fig. 33).

Bacidia suffusa is the most frequently pruinose of the long-spored species. Rare epruinose forms can be superficially confused with other species with brown apothecia but can be recognized by the colorless inner exciple, outer exciple with several layers of enlarged cells and lack of reactions with KOH. The young apothecia are often completely white pruinose and older ones seem to discolor readily and become very dark brown or blackish and these combined with “normal” brown apothecia give a distinctive “tricolor” aspect not seen in the other brown-fruited Bacidias.

Bacidia sp. 32884
Thallus on bark, pale greenish, superficial, consisting of ± spherical to irregular, isidioid granules, ca. 50 µm across to ca. 100 × 50 µm, loosely attached, weakly dispersed to crowded, without evident hypothallus; granules with coarse, bluntly conical papillae, 10-15 µm long (visible under dissecting microscope), thick-walled with small lumina. Apothecia pale orangish, not pruinose, flat to weakly concave, rounded or weakly lobed in old age, constricted at base; margin concolorous with disk, raised and ± thick in young apothecia, remaining ± raised or even with the disk in older apothecia. Exciple colorless, outer part cup-shaped, colorless, ca. 100 µm thick, of indistinct, radiating hyphae with thick walls and narrow lumina, with end cells slightly enlarged, inner part, colorless, ca. 40 µm thick, of interwoven hyphae, with thick wall and narrow lumina. Hypothecium pale yellowish (KOH-), ca. 30 µm thick, of ± loose hyphae, with some cells enlarged. Hymenium colorless, ca. 100 µm thick. Asci *Bacidia*-type. Ascospores needle-like, multiseptate, 46-74 × 2.5-3 µm. Pycnidia not found. [no lichen substances]

MISSOURI. CARTER COUNTY: Mark Twain National Forest, along S side of Skyline Drive (FS 3280), ca. 2.8 mi SW of MO 103, 36° 57'N, 91° 02'W, 220-265 m, oak-pine-*Nyssa* woodland, on base of *Quercus coccinea*, 13 Oct 1997, *Buck 32884* (NY).

The strongly papillate, isidioid, granular thallus is unique as far as we can ascertain. It seems certainly new to science and as soon as more adequate material is collected, will be formally described. Superficially it might be confused with *B. rubella* (Hoffm.) A. Massal. or pale apothecial forms of *B. diffracta* both of which differ in having mostly rounded, non-papillose thalline granules and *B. diffracta* has apothecial tissues KOH+ rose.

Bacidia sp. 44360
Thallus on bark, superficial, scattered, pale green, slightly raised areoles on a white hypothallus; areoles round to ± irregular, 0.05-0.15 mm across, to 100 µm thick, with a thin cortex. Apothecia dark gray. blackish or partly tan, scattered, sessile, flat to moderately convex, 0.2-0.5 mm across; disk medium to dark gray, grayish tan, tan or mottled gray and tan, not pruinose; margin blackish, thin, even with disk, not pruinose. Exciple outer part inside green-gray (KOH-), or mixed green-gray and brown (KOH+ purplish), colorless at edge, with hyphae radiating, with large lumina, with end cells slightly larger, with lumina to 6 µm across; cental part denser, colorless, of thick-walled, intertwined hyphae. Hypothecium colorless, of ± loose hyphae with ± large lumina. Epihymenium colorless. Hymenium colorless or faintly green streaked (KOH-). Asci *Bacidia*-type. Ascospores rod-shaped, 3-septate, 13-15 × 2.5-3.5 µm. Pycnidia not found. [no lichen substances?, not tested]

KANSAS. CHEROKEE COUNTY: N of SE Bagdad Road, 0.2 mi W of Missouri state line, 1.6 mi E of jct with US 166/400, 37°01'35"N, 94°36'35"W, N-S-running ravine in oak woods, on white oak, 31 Oct 2000, *Harris 44360* (NY).

Externally this species is reminiscent of *Lecania naegelii* (Hepp) Diederich & v. d. Boom but the anatomy of the exciple does not agree with that of this group of *Lecania* as defined by Ekman (1996). We place it provisionally in *Bacidia* pending further study. It is most likely to be confused with *B. circumspecta* which differs in larger spores and more compact exciple. It could also be confused with *Fellhanera* spp. which have a dark hypothecium and different ascus type.

BACIDINA Vězda, *nom. cons.* (Lecanoraceae)
Folia Geobot. Phytotax. Praha 25: 431. 1991. Holotype: *Bacidina phacodes* (Körber) Vězda.

Crustose lichens, mostly of humid microhabitats, with small, sessile apothecia; thalline margin absent; photobiont chlorococcoid, often aggregated into discrete units (goniocysts); asci *Bacidia*-type,

with 8 colorless, needle-like, narrow (less than 2.5 µm), thin-walled, 3-7-septate spores; conidia filiform, mostly curved, rarely needle-like. Reference: Ekman, 1996.

Bacidina is a rather weak genus, held together mainly by the narrow spores and preference for humid microhabitats. It would not be surprising if *Bacidina* species have arisen several times from within *Bacidia*. The narrowness of the spores makes the cross walls very difficult to see and apparently they are late to develop so that the spores usually appear nonseptate. Since the number of septa is not relevant to identification, we have not studied Ozark material for this character. The genus seems to be species rich in the Ozarks. Unfortunately these small lichens are as yet too infrequently collected, especially on rock, to resolve all of the problems which have been added to by recent collections not yet incorporated.

See *Bacidia* above for key to species.

Bacidina assulata (Körber) S. Ekman
Thallus on bark, greenish white (darkening in herbarium?), ± continuous or of irregular, weakly raised areoles, 0.05-2.0 mm across. Apothecia brown, dark brown, rarely tan, or mottled brown and paler browns; margin concolorous, darker or lighter, often obscured (when protected from light, with disk pale buff-brown and margin pallid), scattered, sessile, ± flat to moderately convex , 0.3-0.9 mm across. Exciple brown tinted at rim (KOH-), otherwise colorless or pale outside, brownish inside, ca. 70-150 µm thick, of radiating hyphae with end cells enlarged and some inner cells also enlarged or not, with central part of intertwined, colorless hyphae with small lumina. Hypothecium colorless, ca. 50 µm thick, of intertwined hyphae with some cells enlarged. Epihymenium colorless. Hymenium streaked with yellow-brown to brown in upper part (KOH-), ca. 80 µm thick. Paraphyses unbranched, not expanded at tips, or weakly capitate, 2-4 µm across. Ascospores needle-like, 5-9-septate, 36-43 × 2-2.5 µm (Ekman, 1996). Pycnidia immersed, colorless (Ekman, 1996). Conidia filiform, curved, non-septate, ca. 10 × 0.5 µm (Ekman, 1996). [no lichen substances?, not tested]

Ekman's (1996) only North American record of this species is from the Ozark ecoregion on oak from Cherokee County, Oklahoma. The second record is on *Juniperus*, Taney Co., Missouri, *Wetmore 84042* (MIN). It is otherwise known from central and eastern Europe. A lichenicolous *Opegrapha* occurs on the Missouri collection.

Bacidina egenula (Nyl.) Vězda
Thallus on calcium rich substrates, rarely silicate rock, pale tan or pale gray, superficial, usually of small, confluent or ± dispersed granules or areoles (goniocysts), ca. 0.05 µm across, sometimes fusing and appearing continuous or forming larger, thicker (to 150 µm) areoles around an apothecium (usually seen to be composed of goniocysts in section), when on sandstones, sometimes not readily visible, reduced to a few granules among sand grains. Apothecia dark, usually black but disk and/or margin occasionally brownish or mottled black and brown, sessile, mostly flat, sometimes convex, round, constricted at base, 0.2-0.5 mm across; margin usually slightly raised, sometimes even with disk, or obscured in convex apothecia. Exciple mostly colorless, with rim dark green adjacent to hymenium, mostly brown at edge below the green (KOH+ purplish), with brown pigmented area occasionally continuous with brown of hypothecium; outer portion cup-shaped, 50-70 µm, of radiating hyphae with end cells markedly enlarged; inner portion often with a cellular appearance, thick-walled. Hypothecium mostly brown (KOH-), occasionally very pale, rarely colorless, 40 µm, of rather loose hyphae with some cells enlarged. Epihymenium and with clumps of green of green pigment (KOH-). Hymenium streaked with green (KOH-), 60 µm thick; pigment mostly associated with groups of paraphyses or with asci,. Paraphyses unbranched, some not or little expanded at tips, ca. 2.5 µm across, others expanded at tips, to 6 µm across, with a thin green sheath. Ascospores needle-like, 0-7-septate (Ekman, 1996), 23-31 × 1.5-2 µm. Pycnidia blackish, immersed, globose, ca. 100 µm across. Conidia filiform, curved or spiral, 20-27 × 1.0 µm. [no lichen substances, not tested]

Bacidina egenula is easily recognized by the narrow spores and dark green epihymenium. The color of the hypothecium is variable, brown to colorless, even within a single collection. It is very similar in external aspect to *Bacidia coprodes*, also common on carbonate rock, and, although rare on silicate rock, is likewise similar to *Fellhanera silicis*. While easily separated by spore type (rod-shaped and 3-septate in the *Bacidia* and *Fellhanera*), spores in *B. egenula* are sometimes hard to find or see. Without spores, *B. egenula* can be recognized by the mostly colorless exciple and clumps of paraphyses with expanded, green sheathed end cells. A similar species, *B. arnoldiana* Körber, differing in having a colorless epihymenium, is known from a single Missouri lignicolous collection.

Frequent on calcareous substrates, often in disturbed sites on bricks, concrete and mortar, twice on chert. Ekman (1996) cited a collection from the base of *Ulmus americana*. The distribution *Bacidina egenula* is poorly known; scattered collections at NY range from North Dakota south to Louisiana.

Bacidina phacodes (Körber) Vězda
Thallus on bark, of a few scattered, small, greenish areoles (goniocysts?). Apothecia whitish or discoloring(?) to pale buff, with disk usually slightly darker than margin, scattered, sessile, ± flat to convex, 0.2-0.3 mm across; margin even with disk or slightly raised, obscured in more convex apothecia. Exciple colorless, ca. 80 µm thick, of radiating hyphae with narrow lumina and end cell(s) enlarged and thick-walled. Hypothecium colorless, ca. 30 µm thick, of intertwined hyphae with some cells enlarged. Epihymenium colorless. Hymenium colorless, ca. 65-70 µm thick. Paraphyses unbranched, with tips not enlarged or capitate, to 5 µm across. Ascospores needle-like, 5-7-septate, 31-43 × 2 µm [3-7-septate, 29-45 × 1.5-2 µm (Purvis et al., 1992)]. Pycnidia not encountered. [no lichen substances?, not tested]

Rare; the Ozark record consists of scattered apothecia on the edges of bark plates of an oak (red oak group) from Madison County, Arkansas. There are also two records further south in Arkansas, in Jefferson and Prairie counties. *Bacidina phacodes*, an otherwise European species, was not reported for North America by Ekman (1996). It differs from the closely related *B. assulata* in paler apothecia with apothecial tissues colorless in cross-section.

There are other collections with whitish apothecia and colorless apothecial tissues or consisting only of white pycnidia occurring in more mesic situations on tree bases and on rock which may be referable to *B. delicata* (Leighton) V. Wirth & Vězda. Unfortunately we know this species only from the literature and in such a poorly understood group we prefer to await study of verified European material.

Bacidina sp. 2432
Thallus on decorticate wood, of small, tan (probably green when wet) rounded or isidioid granules (goniocysts). Apothecia dark brown, sometimes mottled with lighter brown, scattered to ± crowded, sessile, convex, with margin obscured from the beginning. Exciple washed with gray-brown in upper part (KOH+ purplish), orange-brown (KOH-) adjacent to hypothecium, otherwise colorless, outward with radiating hyphae with narrow lumina, with terminal cells not much enlarged. Hypothecium orange-brown (KOH-), of intertwined hyphae. Epihymenium colorless. Hymenium sparsely brownish streaked. Paraphyses unbranched, with tips not expanded or weakly capitate, ca. 3.5 µm across. Ascospores needle-like, 0-3-septate, 24-32 × 1.5-2 µm. Pycnidia pale to dark brown, semi-immersed, globose, ca. 100 µm across. Conidia needle-like, often broader toward one end, almost straight or slightly curved, 20-30 × 1-1.5 µm. [no lichen substances?, not tested]

ILLINOIS. UNION COUNTY: Pine Hills, edge of Otter Road, on old sycamore log, 14 Aug 1966, *Skorepa 2432* (NY).

This taxon seems very close to *Bacidina egenuloidea* S. Ekman, known from only two collection from southern Ohio, and may prove conspecific if more material is ever collected. It agrees with

Bacidina egenuloidea in having an uncommon type of conidia (Ekman, 1996, type 3) but they are longer than reported by Ekman for *B. egenuloidea*. Also the hypothecium in *B. egenuloidea* is colorless not brown but if the variation encountered in *B. egenula* is not unusual for this group in *Bacidina*, this difference may not be important. *Bacidina egenuloidea* differs in having a green epihymenium.

Bacidina sp. 17399
Thallus on silicate rock, greenish, of scattered to confluent, small, irregular areoles, occasionally becoming granular (goniocysts). Apothecia pale, ivory to pale buff, sometimes mottled with brown, or more orangish with disk buff-brown with paler orange-brown margin, scattered, sessile, ± flat to convex; margin concolorous or paler, even with disk or obscured in convex apothecia. Exciple colorless or weakly brownish tinted at rim (KOH-?), of radiating hyphae with rather large lumina and end cells enlarged. Hypothecium light yellow-brown (KOH-). Epihymenium colorless. Hymenium colorless. Paraphyses unbranched, not expanded at tips or capitate, to ca. 5 µm across. Ascospores needle-like, 0-3-septate, 21-26 × 1.5 µm. Pycnidia not found. [no lichen substances?, not tested]

MISSOURI. IRON COUNTY: St. Francis Mountains, Clark National Forest, along Co. Rd. N just N of Reynolds Co. line, 37°40 N, 90°47 W, on rhyolite pebble, 13 Oct 1993, *Harris 31167-A* (NY); PHELPS COUNTY: Mark Twain National Forest, Roluf Spring Woodland restoration area, W of Forest Service Road 1516, ca. 4 mi WSW of Newburg, on underside of chert fragment in pasture, 11 Sep 1993, *Ladd 17399* (Ladd).

This taxon does not seem to match a described species but the available material is scanty. The silicate rock substrate and pale apothecia with brown hypothecium are the diagnostic characters.

BILIMBIA De Not. (Biatoraceae?)
[formerly in **MYXOBILIMBIA** Hafellner and **MYCOBILIMBIA** Rehm]

Small muscicolous crustose lichens with thin, granular thalli; photobiont chlorococcoid; apothecia sessile, thalline margin absent; asci with 8 ellipsoid to fusiform, 3-8-septate spores; conidiomata unknown; 1 species in the Ozarks.

Bilimbia sabuletorum (Schreber) Arnold
Occasional; usually growing over pleurocarpous mosses in sparsely vegetated areas of wooded uplands. Apothecia range from nearly black to tan or even whitish, sometimes on the same thallus.

BOTRYOLEPRARIA Canals, Hernández-M., Gómez-B. & Llimona (Verrucariaceae?)

Sterile undifferentiated crust with a grayish green thallus consisting of a felty mass of powdery granules to about 0.08 mm broad, with a web of projecting hyphae creating a dull appearance; photobiont chlorococcoid; conidiomata absent; 1 species in the Ozarks. This genus is separated from *Lepraria* by its distinctive terpenoid chemistry and shrubby clusters of hyphae and algal cells, which are said to resemble microscopically a bunch of grapes.

Botryolepraria lesdainii (Hue) Canals, Hernández-M., Gómez-B. & Llimona
Occasional throughout the Ozarks; on damp, sheltered, deeply shaded, often mossy, carbonate rocks, in areas protected from direct runoff, such as in cave entrances, under overhangs and in crevices of massive bluffs. This species is easily identified by its diffuse felty (not leprose) thallus, habitat, and characteristic dark gray green color resembling *Penicillium* mold on bread. The only other leprose lichen that grows on shaded carbonate rocks, *L. lobificans*, has a thick, powdery, much lighter

greenish gray thallus, usually with areas of white. [lesdainin - a terpenoid with R_f value just above zeorin]

BUELLIA De Not. (Physciaceae)

Crustose lichens with well-developed, continuous to areolate thalli; photobiont *Trebouxia*; apothecia black, sessile, with thalline margin usually absent at maturity; asci *Lecanora*-type, with 8 brown, ellipsoid to bacilliform, 1-3- septate spores; 13 species in the Ozarks. Reference: Imshaug (1951). The following key includes several other lichens with two-celled brown ascospores that could be confused with *Buellia*.

1. Apothecia lacking a thalline margin, the rim concolorous with the disk.

    2. Thallus light gray to white,KOH+ yellow or red (stictic or norstictic acids).

        3. Thallus corticolous.

            4. Spores <15µm long, to 6 µm wide, with bluntly rounded apices . . . . *B. stillingiana*

            4. Spores >15 µm long, >7 µm wide, with +/- acute apices . . . . . *B. curtisii*

        3. Thallus saxicolous.

            5. Ascospores 3-septate . . . . . *Diplotomma venustum*

            5. Ascospores 1-septate.

                6. Thallus well developed, continuous.

                    7. Thallus of thick areoles; atranorin, norstictic and/or stictic acid present . . . . . *B. spuria*

                    7. Thallus thin, rimose but not areolate; norstictic and high concentration of connorstictic acid present . . . . . *B. maculata*?

                6. Thallus poorly developed, of small areoles among rock crystals.

                    8. Thallus KOH+ yellow to red, C− . . . . . *B. sequax*

                    8. Thallus KOH−, C+ pink.

                        9. Apothecia and areoles small, nestled among rock crystals; medulla I−; ascospores 11-12 x 6-7 µm . . *Buellia sp.* 17597

                        9. Apothecia and areoles larger; thallus bullate areolate; medulla I+ violet; ascospores 11-13(-15) x 7-8 µm . . . . . *Buellia sp.* 48927

    2. Thallus brown or dark green, rarely grayish or lacking;KOH- .

        10. Thallus corticolous or lignicolous.

11. Hypothecium brown; paraphyses capitate with conspicuous dark cap . *Amandinea*

11. Hypothecium colorless; paraphyses weakly expanded at tips with inconspicuous dark cap . . . . . *Buellia sp.* 17744

10. Thallus saxicolous.

12. Thallus not evident, or traces of thin gray thallus present . . . *Amandinea punctata*

12. Thallus well developed, gray, brown, or greenish.

13. Thallus yellow green, grayish green to dark green, with confluent, rounded, granules and no evident prothallus; spores bacilliform, 3-septate . . . . . *B. vernicoma*

13. Thallus brown; spores ellipsoid, 1-septate.

14. Thallus continuous, rimose, lustrous, shiny, angular areoles and a well-developed black prothallus . . . . . *B. tyrolensis*

14. Thallus of bullate areoles to squamulose.

15. Thallus C− . . . . . *B. badia*

15. Thallus C+ pink . . . . . *B. badia s. lat.*

1. Apothecia with a well-developed thalline margin.

16. Spores thin-walled, the locules not angular . . . . . *Amandinea dakotensis*

16. Spore walls thickened, the locules angular or rounded, well separated from the outer wall *Rinodina*

Buellia badia (Fr.) A. Massal.
Rare; from Hughes Mountain Conservation Area in the eastern Missouri Ozarks, associated with *Buellia spuria* and *Aspicilia cinerea s. lat.* on rhyolite.

Buellia badia s. lat.
Uncommon; associated with various crustose lichens on rhyolite. Apparently differs from typical *B. badia* only in containing gyrophoric acid, which has not been reported for the species previously. The status of this probable chemotype of *B. badia* needs to be more carefully studied. It is more common in the Ozarks than the TLC− chemotype (both occur at Hughes Mountain). [gyrophoric acid]

Buellia curtisii (Tuck.) Imshaug (= *Baculifera curtisii* (Tuck.) Marbach)
Occasional on exposed to lightly shaded hardwoods, often growing on upper branches of canopy trees; found once on chert. In the field this species appears identical to *B. stillingiana*. [norstictic acid]

Buellia maculata Bungartz (= *B. stigmaea* Tuck.?)
Frequent on lightly shaded siliceous rocks, especially chert fragments and boulders, in woodlands. This species has been confused with *B. spuria*, which has a thicker thallus, immersed apothecia, occurs in more exposed sites, and typically contains stictic acid (occasionally norstictic acid). Local populations, as well as specimens from elsewhere in eastern North America determined by Imshaug as *B. stigmaea*, are characterized by an unusual, high concentration of connorstictic acid. The name is used with question since Bungartz (2004) keys *B. maculata* as having atranorin in addition to norstictic acid. This will have to be resolved by re-examination of the type. The somewhat similar

B. spuria always contains atranorin in addition to stictic or norstictic acid. The lichenicolous *Polycoccum microstictum* (Leighton) Arnold? occurs on one collection.[norstictic (major) & connorstictic (major) acids]

Buellia mamillana (Tuck.) W. A. Weber
Rare, a single collection from the southern edge of the Ozarks. In the eastern United States the species has a scattered southeastern distribution. Its most distinctive feature is the slightly yellowish UV+ orange thallus. [xanthone, stictic acid agg.]

Buellia sequax (Nyl.) Zahlbr.
Thallus whitish gray, ± flat to convex , scattered areoles nestled among rock grains or well developed of ± continuous areoles, KOH+ yellow to red; medulla I−. Apothecia beside and between areoles, with slightly raised margin. Exciple and epithecium brown. Hypothecium orangish brown. Ascospores small, 9-112.5 × 4.5-5-6(-6.5) µm. [±xanthone?, norstictic acid agg.]

Rare, on dolomite? but upper layer is HCl- (calcium mostly leached out?) and once on sandstone in glades. *Buellia sequax* is known from Europe (Scheidegger 1993) and is common in southwestern and western North America (Bungartz et al. 2004). This is another species which can be confused with saxicolous forms of *Amandinea punctata* or *Buellia sp.* 17597 if KOH reaction is missed.

Buellia spuria (Schaerer) Anzi
Frequent on exposed to lightly shaded siliceous rocks in glades and wooded uplands. This species has a thick light gray thallus evocative of the thallus of *Lecanora oreinoides*. Strains with stictic acid and norstictic acid occur in the region. A few specimens from Oklahoma on sandstone will key here but differ from *B. spuria s. str.* in lacking greenish pigment in the exciple and in having larger, more irregularly shaped ascospores. They may receive taxonomic recognition at some future date. [1) atranorin, norstictic acid (minor), stictic acid agg.; 2) atranorin, norstictic acid agg.]

Buellia stillingiana J. Steiner
Common on boles and branches of a variety of hardwoods, in exposed to moderately shaded situations. This species grows on young trees in old fields and along woodland edges, as well as on older trees in mature woodlands. [atranorin and/or norstictic acid]

Buellia tyrolensis Körber (= *B. novomexicana* de Lesd.)
Infrequent on exposed, relatively small, sandstone and chert fragments in dolomite glades. This species is easily recognized by the chocolate brown thallus with a well-developed black prothallus, and the restricted habitat. The 2'-O-methylperlatoic acid chemotype is the more common in the Ozarks. *Buellia tyrolensis s. str.* applies to the norstictic acid chemotype. Scheidegger (1993) recognized the 2'-O-methylperlatoic chemotype as *B. fusca* (Anzi) Kernst. (1893) but this name is unavailable as it is a later homonym of *B. fusca* Arnold (1872). The disposition of *B. novomexicana* as to chemotype remains unresolved as it has not been typified (Bungartz 2004). [1) 2'-O-methylperlatoic acid; 2) norstictic acid agg.]

Buellia vernicoma (Tuck.) Tuck. (= *Gassicurtia vernicoma* (Tuck.) Marbach)
Local on lightly shaded sandstone or igneous rocks, on both outcrops and massive boulders, invariably associated with and often growing upon thalli of *Pertusaria plittiana* or *Phlyctis "petraea"*. [xanthone]

Buellia sp. 17597
Rare, a single Missouri collection on sandstone rubble on exposed dolomite ledge in glade. Easily mistaken for saxicolous *Amandinea punctata* or *B. sequax* if C or KC reaction overlooked. [gyrophoric acid?, not tested with TLC]

Buellia sp. 17744
Thallus of scattered granular areoles; apothecia with brown to brown black disk and paler margin; hypothecium colorless; paraphyses slightly expanded at tips with inconspicuous dark cap; ascus *Bacidia*-type; ascospores *Buellia*-type, 14-16 x 6-7 µm. [no substances?, not tested]

Rare; known from a single collection on old timbers of small bridge over a wooded creek. The pale hypothecium and epihymenium suggest the possibility of inclusion in *Rinodina*. Also the possibility that this taxon might belong in *Amandineas. lat.* cannot be ruled out as pycnidia have not been found. If the above characters are not noted, it would be named as *Amandinea punctata*.

Buellia sp. 48927
Rare; a single Arkansas specimen from exposed sandstone on bluff top. The bullate areolate thallus, I+ violet medulla, green pigment in exciple and epihymenium, rather large ascospores and gyrophoric acid make this taxon very distinctive. Unfortunately no name leaps from the avaiable literature. [atranorin? (trace), gyrophoric acid]

CALICIUM Pers. (Caliciaceae)

Corticolous or lignicolous crustose lichens with thin to obscure, grayish thalli; photobiont *Trebouxia*; apothecia stipitate, dark, small, urceolate to cylindrical; asci disintegrating early into a mazaedium with numerous small, ellipsoid, greenish, 1-septate spores; pycnidia sessile to immersed, with broadly ellipsoid conidia; 3 species in the Ozarks. Reference: Tibell (1975).

1. Lower portion of exciple with brown pruina; spores <5 µm broad . . . . . *C. salicinum*

1. Pruina lacking or whitish and restricted to margin of exciple; spores prevailingly >5 µm broad.

    2. Pruina absent; asci often >40 µm long . . . . . *C. abietinum*

    2. Margin of exciple white pruinose; asci to 40 µm long . . . . . *C. glaucellum*

Calicium abietinum Pers.
Uncommon on shaded boles of *Pinus echinata* in open woodlands, usually growing near the base of the tree. This species has a darker, less lustrous thallus and stouter fruits than does *Chaenothecopsis nana*, which also occurs on *Pinus echinata*.

Calicium glaucellum Ach.
Apparently uncommon or overlooked; known only from decorticate, standing dead *Quercus* in wooded uplands.

Calicium salicinum Pers.
Occasional on wood and bark of *Quercus* in lightly shaded, wooded uplands.

CALOPLACA Th. Fr. (Teloschistaceae)

Crustose to subsquamulose lichens, with thalli ranging from nearly absent to continuous, areolate, subsquamulose, or lobate; photobiont *Trebouxia* (sometimes considered to be "*Pseudotrebouxia*"); apothecia sessile or immersed, thalline margin present or becoming obsolete; asci *Teloschistes*-type, with 8 ellipsoid to ovate, hyaline, polarilocular spores; pycnidia immersed, conidia ellipsoid; a poorly

understood genus badly in need of revision; 24 species currently known from the Ozarks. [orange species reactingKOH+ magenta contain anthraquinones, usually parietin] References: Wetmore (1994, 1996, 1998).

1. Thallus saxicolous.

2. Thallus leprose or granular sorediate, yellow to golden.

3. Thallus leprose, ecorticate, grayish yellow . . . . . *C. chrysodeta*

3. Thallus granular sorediate, usually with some corticate areoles, golden to lemon yellow . . . . . *C. citrina*

2. Thallus not sorediate, variously colored.

4. ApotheciaKOH+ magenta, yellow to orange, sessile; thallusKOH- orKOH+ magenta.

5. Thallus well developed, orange,KOH+ magenta.

6. Thallus lobate to placoid or subsquamulose, showy.

7. Thallus distinctly lobate, with dense white pruina creating a dull pinkish orange appearance . . . . . *C. galactophylla*

7. Thallus placoid to subsquamulose, not notably pruinose, vivid orange to reddish orange.

8. Thallus reddish orange, of thin, continuous, subsquamulose areoles; rare on massive siliceous exposures in the southern Ozarks . . . . . *C. cinnabarina*

8. Thallus orange, of discrete, thick, sublobate squamules; occasional on siliceous fragments and boulders, often in carbonate glades . . . . . *C. "squamosa"*

6. Thallus crustose, not typically showy.

9. Thallus pale yellow to grayish or brownish yellow, thin, continuous to rimose; mostly in shaded habitats; spores >12 µm long . . . . . *C. flavovirescens*

9. Thallus orange, areolate; mostly in exposed habitats; spores <12 µm long.

10. Thallus yellowish, with well-developed areoles; rims of the apothecia containing algae; rare on hard limestone in the extreme eastern Ozarks . . . . . *C. vitellinula*

10. Thallus distinctly orange, scant to areolate of incipiently sublobate; rims of the apothecia essentially without algae; common and widespread on diverse rock types . . . . . *C. subsoluta*

5. Thallus absent or thin and grayish andKOH-, or restricted to a few small yellow areoles
associated with the apothecia andKOH+ magenta.

11. Thallus evident, gray; on siliceous rocks.

12.Apothecial margins orange; thallus thin and indistinct . . . . . *C. arenaria*

12.Apothecia margins gray, often indistinct; thallus evident, areolate . . . . . *C. sideritis*

11. Thallus various; on carbonate rocks.

13. Thallus bluish gray; spore isthmus ≥3.5 µm; on sheltered, shaded, massive bluff outcrops . . . . . *C.* sp. #1

13. Thallus absent, or consisting of a few yellow areoles associated with the apothecia; spore isthmus to 3.5 µm; in exposed, often disturbed, sites . . . . . *C. feracissima*

4. ApotheciaKOH-, black, immersed; thallusKOH-

14. On siliceous rocks; ascospores up to 12 × 6.5 µm . . . . . *C. conversa*

14. On carbonate rocks; ascospores > 12 × 6.5 µm . . . . . *C. atroalba*

1. Thallus corticolous.

15. Apothecia and thallusKOH-.

16. Thallus obscurely sorediate . . . . . *C. obscurella*

16. Thallus not sorediate.

17. Apothecia yellowish, with a whitish rim . . . . . *C. ulmorum*

17. Apothecia brownish, the rim concolorous to slightly paler.

18. Apothecia dark brown, not pruinose; thallus brownish . . . . C. *brunneola*

18. Apothecia tan to brown, pruinose; thallus pale . . . . . C. *camptidia*

15. ApotheciaKOH+ magenta; thallusKOH- orKOH+ magenta

19. Thallus pale to grayish,KOH-.

20. Thallus dark gray; apothecia yellowish orange, with a gray thalline rim . *C. cerina*

20. Thallus pale to light gray; apothecia brownish to orange, the rim concolorous with the disk

21. Apothecia dark brown to blackish, the rim often indistinct . . . . *C. pollinii*

21. Apothecia orange, with a distinct orange rim . . . . . *C. holocarpa*

19. Thallus yellow to orange,KOH+ magenta.

22. Thallus not sorediate . . . . . *C. flavorubescens*

22. Thallus sorediate.

23. Thallus chrome yellow to pale grayish, thin and ± continuous; in light shade in woodlands . . . . . *C. chrysophthalma*

23. Thallus bright orange, areolate; on exposed wood and sometimes bark . . . . . *C. microphyllina*

Caloplaca arenaria (Pers.) Müll. Arg.
Rare and restricted to exposed to lightly shaded sandstone at a few sites scattered across the region; usually occurring on small boulders and fragments. The small, dark orange apothecia and thin gray thallus are diagnostic.

Caloplaca atroalba (Tuck.) Zahlbr.
Infrequent in the western Ozarks, rare eastward; on limestone, usually in shaded sites.

Caloplaca brunneola Wetmore
Occasional on boles and branches of trees in woodlands, often growing on younger branches, but not one of the earliest pioneer species. This lichen occurs on both hardwoods and *Juniperus virginiana*. It has a darker thallus than does *C. pollinii*, although the apothecia are similar except for size and theirKOH reaction:KOH+ magenta in *C. pollinii* andKOH- in *C. brunneola*.

Caloplaca camptidia (Tuck.) Zahlbr.
Common on lightly shaded boles of hardwood trees in woodlands. The spores are typically 11-12 × 6 µm, with an isthmus >5.5µm broad. This species is easily separated from other *Caloplaca* species by the tan to brownish, pruinose apothecia, but in the field care must be taken not to confuse it with species of *Bacidia* that have pruinose apothecia, such as *B. polychroa*.

Caloplaca cerina (Hedw.) Th. Fr.
Frequent on lightly shaded boles and branches of trees in woodlands. In areas of extensive woodlands, this species can be part of the early colonizer cohort on young branches, but in areas with extensive disruption of the woodlands it becomes scarce and restricted to older trees. The distinct gray thalline margin of the apothecia is characteristic, although it can become obscure on old apothecia.

Caloplaca chrysodeta (Vain. *ex* Räsänen) Dombr.
Rare; on sheltered, dry shaded lower and mid faces of massive dolomite bluffs, usually in areas of high humidity that are protected from direct wetting.

Caloplaca chrysophthalma Degel.
Frequent on lightly shaded tree boles, usually in open wooded uplands or along the edges of glades. Although it grows on a variety of hardwoods as well as *Juniperus virginiana*, *Quercus stellata* is overwhelmingly the most common substrate.

Caloplaca cinnabarina (Ach.) Zahlbr.
Rare and restricted to massive exposures of hard sandstone at a few sites in the Arkansas Ozarks, usually occurring on or just below bluff summits. The vivid orange-red thallus patches are among the most conspicuous and striking lichens in the Ozarks.

Caloplaca citrina (Hoffm.) Th. Fr.
Occasional and local, in sheltered areas on massive rock formations that are subject to relatively high light intensities. Most populations are from carbonate rocks, but it also grows on sandstone when there is overlying dolomite, and presumably, carbonate mineralization of the sandstone. This species grows on overhung vertical faces and under shallow ledges where there is little exposure to rain or

runoff. Typical forms of *C. citrina* are entirely granular sorediate, although the soredia are largely corticate and can appear to be almost isidiate. Some populations in the region have marginally sorediate areoles; these have been segregated as variety *flavocitrina* (Nyl.) A. E. Wade, but this element intergrades completely with the typical morphology.

Caloplaca conversa (Kremp.) Jatta
Rare on exposed to lightly shaded rhyolite and chert, and exposed sandstone in an extensive dolomite glade ravine. This species has immersed black apothecia and appears more like an *Aspicilia* than a *Caloplaca*.

Caloplaca feracissima H. Magn.
Locally frequent on disturbed carbonate substrates, including concrete, limestone blocks in walls and foundations, and similar habitats; more rarely on limestone and dolomite in natural habitats such as glades. This is one of the most common lichens in the few truly urban areas of the Ozarks, consistently associating with *Endocarpon pallidulum*. The correct name for this common lichen is questionable.

Caloplaca flavorubescens (Huds.) J. R. Laundon
In the Ozarks, this is an uncommon but widely distributed species of the lower boles of trees, particularly *Quercus velutina*, in open situations, such as along glade margins and on open ridgetops.

Caloplaca flavovirescens (Wulfen) Dalla Torre & Sarnth.
Very common on shaded rocks, particularly in mesic habitats, occurring on both carbonate and siliceous substrates. This species also colonizes old concrete and stone work in lightly shaded areas.

Apothecia of *C. flavovirescens* are occasionally parasitized by *Muellerella lichenicola* (Sommerf. *ex* Fr.) D. Hawksw., a peritheciate fungus with polysporous asci and septate, brown ascospores.

Caloplaca galactophylla (Tuck.) Zahlbr.
Rare and local on a few massive dolomite exposures in glades and on blufftops in the northern half of the Ozarks.

Caloplaca holocarpa (Ach.) A.E. Wade
Although this species is known to occur, albeit rarely, north and northwest of the Ozarks, the only local record is from *Asimina triloba* below a dolomite glade in the southeastern Missouri Ozarks.

Caloplaca microphyllina (Tuck.) Hasse
This is primarily a species of decorticate wood, and occasionally exposed bark, in prairie regions. Weathered, exposed decorticate fenceposts made from *Juniperus virginiana* or *Maclura pomifera* are typical substrates. Less commonly, this species occurs on bark and wood in open woodlands. This species is common in the prairie-affiliated districts or predominantly cleared ranching districts of the western Ozarks, but local and uncommon eastward, and unknown from the Illinois Ozarks.

Caloplaca obscurella (Körber) Th. Fr.
Known only from Taney County, Missouri, as reported by Wetmore (1994).

Caloplaca pollinii (A. Massal.) Jatta
Frequent on lightly shaded twigs, and occasionally on tree boles. This species occurs on a variety of hardwoods, as well as on *Juniperus virginiana*. The apothecia are typically 0.4-0.8(–1) mm broad, dark brown, sublustrous, with an entire rim. Specimens with slightly larger apothecia sometimes exceeding 1 mm broad, with a dull, orangish disk, and frequently with a crenulate rim, were previously referred to *C. ferruginea* (Huds.) Th. Fr, but are herein considered a phase of *C. pollinii*.

Caloplaca sideritis (Tuck.) Zahlbr.
Infrequent on exposed to lightly shaded siliceous rocks, growing on chert, sandstone, rhyolite, and granite.

Caloplaca "squamosa" (de Lesd.) Zahlbr.
This species is occasional on chert fragments associated with weathered dolomite exposures in glades. It usually grows in close association with other lichens, and sometimes appears to be somewhat parasitic. *Caloplaca squamosa* may not be the correct name for this distinctive, subsquamulose lichen — it also matches fairly well the description for *C. inconnexa* (Nyl.) Zahlbr. The apothecia are essentially concolorous with the thallus, with the thalline margins of the apothecia slightly lighter. The spores are relatively small, ranging to ca. 12 µm long, with a broad isthmus typically exceeding 4.5 µm.

Caloplaca subsoluta (Nyl.) Zahlbr.
Very common on exposed dolomite on glades and bluffs, and occasionally on other exposed to lightly shaded carbonate substrates and rarely on siliceous rocks. As used here, this is a variable species, ranging from a well-developed areolate thallus to scattered apothecia and scant areoles.

Caloplaca ulmorum (Fink) Fink
Uncommon on lightly shaded hardwoods at scattered sites across the northern half of the Ozarks. This species becomes more common to the north and west of the Ozarks, growing on exposed to lightly shaded boles of trees in prairie regions.

Caloplaca vitellinula (Nyl.) H. Olivier
Rare on hard limestone of massive bluff exposures in the extreme eastern Ozarks of southern Illinois.

Caloplaca sp. #1
Apparently rare, on massive carbonate bluffs in lightly shaded, sheltered areas protected from direct wetting by rainfall or runoff. This is a distinctive but inconspicuous species with an areolate, lustrous, bluish gray thallus, with the areoles typically confluent and continuous. Potions of the thallus are typically suffused with yellow, perhaps indicating incipient apothecia. The apothecia are common and tiny, ranging from 0.15-0.20 mm broad at maturity, with a well-developed, plane orange disk and a thickened, paler orange margin. The tips of the paraphyses are notably expanded, with the upper 1-3 cells 3-3.5 µm broad. The ascospores are 10-13 × 5-7 µm, with the isthmus 3.5-5 µm broad.

CANDELARIA A. Massal. (Candelariaceae)

Small, lemon yellow foliose lichens with a pale, rhizinate lower cortex; photobiont *Trebouxia*; apothecia sessile, with a well-developed thalline margin; asci *Candelaria*-type, with 16-32 hyaline, ellipsoid, simple (rarely 1-septate) spores; pycnidia protuberant, yellow, with ellipsoid conidia; 2 species in the Ozarks.

1. Thallus sorediate, individual thalli small and irregular; apothecia lacking . . . . . *C. concolor*

1. Thallus esorediate, individual thalli round and well-delimited; apothecia common . . . . . *C. fibrosa*

Candelaria concolor (Dicks.) Stein
Very common on a wide variety of corticolous substrates, as well as lignum, shaded rocks, and anthropogenic substrates such as concrete, rusted iron, asphalt shingles, and even old tires and vinyl. This species is especially common in sheltered areas and crevices of tree boles where saturation from

rainfall is infrequent. The lichen may be more common in wooded uplands than would first appear; often there are only minute, scattered, individual thalli of 2 mm or less on a tree bole, and these thalli are pervasively distributed through the woodland, although not initially apparent. Forms that are almost totally composed of masses of soredia have been referred to as var. *effusa* (Tuck.) Burnham, but there appears to be a full range of intergrading morphologies. [calycin]

Candelaria fibrosa (Fr.) Müll. Arg.
Occasional throughout the Ozarks on exposed upper branches of canopy trees in mature woodlands, and less commonly on younger trees in light shade. This species also occurs rarely on lightly shaded rocks. [calycin]

CANDELARIELLA Müll. Arg. (Candelariaceae)

Granulose to minutely subsquamulose, lemon yellow crustose lichens with small, sessile, concave, yellow apothecia with a thalline margin; photobiont *Trebouxia*; asci *Candelaria*-type, with 8-32 small, hyaline, ellipsoid, simple (occasionally 1-septate) spores; pycnidia emergent to immersed, yellow, with globose to ellipsoid conidia; 3 species in the Ozarks.

1. Thallus sorediate, sometimes consisting of discrete patches of soredia with no apparent thallus; spores 8 per ascus . . . . . *C. reflexa*

1. Thallus esorediate, although sometimes consisting of aggregations of minute, corticate, spheroid granules; spores 12-32 per ascus.

2. Thallus saxicolous, subsquamulose . . . . . *C. vitellina*

2. Thallus corticolous, of minute, corticate, spheroid granules . . . . . *C. xanthostigma*

Candelariella reflexa (Nyl.) Lettau
Frequent on exposed to lightly shaded corticolous substrates, especially twigs of small trees on glades. Sterile sorediate corticolous *Candelariella* thalli are frequent throughout the region, and vastly outnumber fertile material. Sterile material of *C. reflexa* appears identical to *C. efflorescens* R. C. Harris & Buck, an eastern species with 32 spores per ascus, but since all fertile material known from the Interior Highlands has eight spores per ascus, sterile Ozark material is defaulted to *C. reflexa*. [calycin]

Candelariella vitellina (Hoffm.) Müll. Arg.
Local on exposed, massive siliceous substrates, including sandstone and chert in glades and on bluffs; infrequently found on lightly shaded sandstone. [calycin]

Candelariella xanthostigma (Ach.) Lettau
Frequent, but seldom abundant, on exposed to lightly shaded hardwoods, typically on mid boles of larger trees in wooded uplands. This species is never dominant, but occurs as diffuse or solitary patches, typically among other lichens on furrowed or irregular, bark. A typical habitat is small exposed branches of trees and shrubs on glades and along glade margins. [calycin]

CANOPARMELIA Elix & Hale (Parmeliaceae)

Light gray to blue-gray, adnate foliose lichens with rounded lobe apices, eciliate, isidiate or sorediate; upper cortex containing atranorin, mostly without markings or pruina; lower cortex dark, lustrous, rhizinate, the rhizines prevailingly simple, occasionally furcate to coalescing, generally absent near

the lobe margins; photobiont *Trebouxia*; apothecia not seen in Ozark material, sessile, brown, with a well-developed thalline margin; epithecium brownish, hypothecium hyaline; asci *Lecanora*-type, with 8 simple, hyaline, ellipsoid spores; pycnidia not seen in Ozark material, immersed; conidia filiform to bifusiform; 3 species in the Ozarks.

1. Thallus isidiate; upper cortex smooth, with fine reticulate white marks near lobe tips; substrate almost always coniferous . . . . . *C. caroliniana*

1. Thallus sorediate; upper cortex sometimes ridged but lacking pronounced reticulate white marks; substrate various.

    2. Upper cortex smooth to locally somewhat ridged, not foveolate; medulla KOH- (divaricatic acid) . . . . . *C. texana*

    2. Upper cortex strongly reticulate ridged, creating a foveolate appearance; medulla KOH+ yellow . . . . . *C. crozalsiana*

Canoparmelia caroliniana (Nyl.) Elix & Hale
Thallus to 15 cm, deep bluish gray, the lobes typically 2-4 mm broad, closely juxtaposed and often with overlapping margins, secondary lobes short, broadening into rounded tips; upper cortex dull except near lustrous and frequently brown-tinged tips of the lobes, which are characterized by a fine reticulation of pale, slightly elevated markings, these developing into cracks or becoming obscure in older portions of the thallus; laminal isidia abundant on all but the lobe tips, cylindrical, brown-tipped, simple to furcate or occasionally coralloid, 0.06 mm thick × 0.2(-0.4) mm tall; lower cortex tan to dark brown. [atranorin, perlatolic acid]

Occasional in intact wooded uplands and along massive bluff summits in the southern half of the Ozarks, occurring on bark and decorticate wood on the boles and larger branches of lightly shaded older conifers, including *Pinus echinata* and *Juniperus virginiana*. There is a single record from a shaded sandstone boulder.

Despite the proliferation of *Juniperus* in the Ozarks over the last century, this lichen appears to be confined to sites with remnant natural integrity and a cohort of older conifers. *Punctelia rudecta* frequently has incompletely reticulate white markings near the lobe tips, but can be differentiated by the presence of pseudocyphellae, pale lower surface, and C+ red medullary reaction resulting from the presence of lecanoric acid.

Canoparmelia crozalsiana (de Lesd. *ex* Harm.) Elix & Hale
Thallus blue-gray, to 15 cm broad but usually < 10 cm broad, lobes typically 3-5 mm broad; lobe tips with a faint pattern of fine white reticulations, these developing into a ± symmetrical network of raised ridges 0.1 - 0.2 mm broad over most of the thallus, creating a distinctly foveolate appearance; soralia common, laminal, initially round and ca. 0.5 mm broad, mostly developing on the ridges of the upper cortex and eventually coalescing into linear or sometimes massed aggregations of farinose pale soredia; lower cortex brown to sometimes pale near the margins, black towards the center. Infrequently the lobe tips can have a thin layer of whitish pruina. [atranorin, stictic acid]

Occasional and scattered through the Ozarks, usually occurring as widely scattered individuals on the lightly shaded to exposed boles of hardwoods, sometimes in disturbed sites, such as along the borders of old fields. Common substrates include *Quercus, Gleditsia, Fraxinus* and *Ulmus*. It is also known from *Juniperus* and from a single collection from lightly shaded rhyolite along a stream.

See comments under *C. texana*.

Canoparmelia texana (Tuck.) Elix & Hale
Thallus pale blue-gray, to 15 cm broad, the lobes typically 3-6 mm broad and often overlapping at their margins, to 4 cm long, with broadly expanded at the apices; upper cortex smooth in younger portions of the thallus, sometimes becoming wrinkled in age, but never creating a regular pattern of reticulations and foveolate depressions; lobe tips often with a faint pattern of pale angular markings; soredia abundant, laminal, originating as minute punctiform soralia about 0.1 mm in diameter and coalescing into masses of farinose soredia, particularly along ridges and folds of the thallus; lower cortex brown at the margins, dark brown to black towards center; apothecia rare, laminal, basally constricted, with a brown disk to 5 mm broad and a usually sorediate thalline margin. [atranorin, divaricatic acid]

Locally frequent in lightly shaded uplands, such as sparsely wooded ridges and along glade margins, especially in the western and southern Ozarks. This species grows on a variety of trees, but is especially common on *Juniperus virginiana, Pinus echinata* and *Ulmus alata*; it occurs on both older boles and on branches and young trees.

Unusually ridged specimens of *C. texana* might be confused with *C. crozalsiana,* but differ in that *C. texana* has smaller initial soralia, broader lobes, a slightly lighter color, and lacks the regular network of isodiametric patches on the upper cortex separated by narrow ridges. Forms of *Myelochroa aurulenta* with a uniformly white medulla might be confused with *C. texana*, but in addition to the chemical differences, *Myelochroa* has coarser, more friable soredia, and is rhizinate to the thallus margin.

CATILLARIA A. Massal. (Catillariaceae)

Small crustose lichens with thin to obscure thalli; photobiont *Myrmecia* or *Dictyochloropsis*; apothecia small, dark, sessile, usually convex; asci *Catillaria*-type, with 8 small, hyaline, narrowly ovoid, 1-septate spores; pycnidia immersed, with ellipsoid to bacilliform conidia; 3 species in the Ozarks.

1. Corticolous; apothecia black . . . . . *C. nigroclavata*

1. Saxicolous.

    2. On calcareous rocks; apothecia brown; exciple pale except at outer edge; hymenium colorless . . . . . *C. lenticularis*

    2. On siliceous (rarely calcareous) rocks; apothecia blackish; exciple dark throughout; lower portion of hymenium usually greenish . . . . . *C. chalybeia*

Catillaria chalybeia (Borrer) A. Massal.
Rare on lightly shaded sandstone in the western Ozarks.

Catillaria lenticularis (Ach.) Th. Fr.
Occasional, and perhaps overlooked; on lightly shaded dolomite, especially in the western Ozarks. This species has small, chestnut brown, strongly convex apothecia on a thin, sordid thallus. *Lecania* species could be confused with this species and, perhaps, are best separated by having *Bacidia*-type asci.

Catillaria nigroclavata (Nyl.) Schuler
Frequent throughout the Ozarks, on exposed to lightly shaded twigs, branches, and small tree boles in thickets, occurring on a wide variety of hardwoods and *Juniperus*, often collected unintentionally as an admixture.

CATINARIA Vain. (Bacidiaceae)

Small crustose lichens with thin continuous thalli; photobiont *Dictyochloropsis*; apothecia sessile, lacking a thalline margin, epihymenium brownish, hypothecium pale; asci lacking an ocular chamber and axial mass, tholus IKI+ blue, with 12-16 (in ours)1-septate ascospores, these with an evident gelatinous halo; conidiomata unknown; 1 species in the Ozarks.

Catinaria neuschildii (Körber) P. James
Known only from an exposed *Ulmus* in a degraded limestone glade in southwestern Missouri.

CHAENOTHECA Th. Fr. (Coniocybaceae)

Crustose lichens with thin or obscure thalli; photobiont (in ours) *Stichococcus* or *Trebouxia*-like; apothecia dark, stipitate, globose to subcylindrical; asci disintegrating early into a mazaedium with numerous, minute, brown or greenish, simple, globose spores; conidiomata simple or pycnidia, with ovoid conidia; 2 species in the Ozarks.

1. Photobiont *Stichococcus*, the cells elongate, <10 µm wide; apothecia with yellow-green pruina; spores 2-3 µm diameter . . . . . *C. furfuracea*

1. Photobiont *Trebouxia*-like, the cells rounded, 10-15 µm diameter; apothecia with white pruina or pruina absent; spores 3.5-4.5 µm diameter . . . . . *C. brunneola*

Chaenotheca brunneola (Ach.) Müll. Arg.
Known from a single collection (Buck 18115, NY) from a mesic site in Carter County, Missouri, growing on hardwoods.

Chaenotheca furfuracea (L.) Tibell
Known from a few scattered sites in the southern Ozarks, growing in sheltered areas in high light intensities with little exposure to direct runoff or rainfall. Habitats and substrates include rich soil or humus under bluffs, under overhanging sandstone, among tree roots, and on rhyolite outcrops.

CHAENOTHECOPSIS Vain. (Mycocaliciaceae)

Corticolous crustose fungi with thin, whitish thalli; photobiont lacking although some species consistently associated with algae or other lichens; apothecia black, minute, stipitate, subglobose; asci narrowly cylindrical, with a broad apical dome penetrated by a central canal; asci with 8 brown, ellipsoid, simple to 1-septate spores — the asci tardily disintegrating as the spores mature; pycnidia rare, the wall with outwardly pointed cells with ellipsoid conidia; 5 species in the Ozarks.

1. Spores 1-septate.

2. Spore septum thinner and/or paler than outer spore wall; weakly associated with chlorophycean algae . . . . . *C. pusilla*

2. Spore septum as thick as and colored similarly to outer spore wall; photobiont absent . . . . *C. debilis*

1. Spores simple.

3. Thallus whitish; on *Pinus*; spores ≥3.5 µm broad . . . . . *C. nana*

3. Thallus obscure to sordid; substrate various; spores to 3 µm broad.

4. Associated with *Trentepohlia* . . . . . *C. rubescens*

4. Associated with chlorophycean algae . . . . . *C. savonica*

Chaenothecopsis debilis (Sm.) Tibell
Scattered in the northern portion of the Ozarks, from southwestern Missouri eastward; generally growing on decorticate hardwood.

Chaenothecopsis nana Tibell
Frequent on exposed to more often lightly shaded bark of *Pinus echinata*, usually growing on the lower bole and base, especially on trees with well-developed plates and furrows in the bark. Frequently the lower boles of *Pinus echinata* in wooded uplands have small sterile white patches that are presumably this species.

Chaenothecopsis pusilla (Ach.) A.F.W. Schmidt
Rare on well drained decorticate *Pinus echinata* and hardwoods in woodlands, usually in microhabitats sheltered from much direct water contact.

Chaenothecopsis rubescens Vain.
Known only from the bole of a dead standing *Quercus* in the southeastern Missouri Ozarks.

Chaenothecopsis savonica (Räsänen) Tibell
Apparently rare; known from two sites in wooded uplands - one a decorticate fallen *Pinus* log and one from *Chaenotheca furfuracea*.

CHRYSOTHRIX Mont. (Chrysothrichaceae)

Bright yellow leprose lichens with ecorticate, unstratified thalli, prothallus apparently lacking; photobiont chlorococcoid; local material always sterile, but apothecia reported to be tiny, sessile, with a thin ecorticate margin; asci with the inner wall extended into an I+ blue tube, with 8 hyaline, ellipsoid, 3-septate spores; conidiomata unknown; 2 species in the Ozarks.

1. Thallus corticolous,KOH- . . . . . *C. candelaris*

1. Thallus saxicolous,KOH+ reddish . . . . . *C. chlorina*

Chrysothrix candelaris (L.) J.R. Laundon
Occasional on boles of both hardwoods and softwoods in woodlands, usually in mesic sites such as along streams or on talus slopes. The thalli occur in zones not subject to water runoff, such as on the

underside of leaning trees. *Acer saccharum* seems to be a preferred substrate. [pinastric acid (in our region) and/or calycin]

Chrysothrix chlorina (Ach.) J.R. Laundon
Local in sheltered crevices and under overhangs of massive siliceous rock exposures on glades and bluffs. This species occurs on both igneous rocks and sandstone. Local populations usually have high concentrations of calycin and reactKOH+ reddish. [calycin, vulpinic acid]

CLADONIA P. Browne (Cladoniaceae)

Fruticose lichens with well-developed, usually persistent, basal squamules having an evident upper cortex; photobiont *Trebouxia*; apothecia convex to globose, sessile on the squamules to terminal on well-developed attenuate, blunt, or cupuliform, abundantly branched to simple podetia, these sometimes squamulose, in some species the podetia typically remaining sterile; asci with thickened I+ blue apical dome, with 8 hyaline, simple, fusiform to ellipsoid or ovoid spores; pycnidia with short-acicular, arcing conidia; 40 species in the Ozarks.

This genus is interpreted to include the Reindeer Lichens, formerly segregated as the genus *Cladina*, which have an evanescent primary thallus and characteristic multiple-branched podetia. Most species of *Cladonia* require an organic matter in the substrate to become established. References: Thomson (1967). Note that Ahti (2000) considered several esorediate taxa with large squamules to be chemical strains of a single species. In the Ozarks, this would include *C. polycarpia, C. polycarpoides,* and *C. sobolescens*, which Ahti included under *C. subcariosa*.

Key to the species groups of *Cladonia* in the Ozarks

1. Thallus, even when well developed, consisting only of squamules; commonly sterile or with sessile or subsessile apothecia; podetia absent or always <5 mm long . . . . . **Key A**

1. Thallus with well-developed sterile or fertile podetia >5 mm long, these pointed, branched, clavate, or cupuliform; sterile or fertile.

    2. Podetia forming distinct cups . . . . . **Key B**

    2. Podetia prevailingly not forming cups — occasionally a few podetia will have small, shallow, poorly developed cups.

        3. Podetia abundantly and repeatedly branched, typically >5 cm long; esorediate . . . . . **Key C**

        3. Podetia simple or forked to sparingly branched, typically <5 cm long; sorediate or esorediate . . . . . **Key D**

Key A: squamulose; podetia tiny or absent

1. Squamules C+ blue-green (strepsilin present) . . . . . *C. strepsilis*

1. Squamules C- or C+ yellowish (strepsilin absent).

    2. Apothecia present and/or minute podetia present, the apothecia sessile on squamules or on the podetia.

        3. Apothecia present, sessile or on tiny podetia.

4. Apothecia on minute, delicate podetia; thallusKOH+ deep yellow, P+ yellow (thamnolic acid present, fumarprotocetraric acid absent) . . . . . *C. parasitica*

4. Apothecia sessile; thallusKOH-, P+ red (thamnolic acid absent, fumarprotocetraric acid present) . . . . . *C. caespiticia*

3. Apothecia lacking; tiny pointed podetia present . . . . . *C. macilenta* var. *bacillaris*

2. Apothecia lacking.

5. SquamulesKOH+ yellow turning red (norstictic acid present).

6. Atranorin absent; common . . . . . *C. polycarpoides*

6. Atranorin present; rare.

7. Stictic acid present; squamules with brownish cast . . . . . *C. polycarpia*

7. Stictic acid lacking; squamules usually not brownish . . . *C. symphycarpia*

5. SquamulesKOH- orKOH+ persistently yellow (norstictic acid absent).

8. SquamulesKOH+ deep or pale yellow (atranorin or thamnolic acid present).

9. Squamules sorediate,KOH+ deep yellow (thamnolic acid present). *C. ravenelii*

9. Squamules esorediate,KOH+ pale yellow (thamnolic acid absent).

10. Squamules P+ yellow (fumarprotocetraric acid absent) *C. cariosa*

10. Squamules P+ red (fumarprotocetraric acid present).

11. Squamules long and strap-shaped, often exceeding 7 mm long; sphaerophorin absent; on exposed to lightly shaded soil . . . . . *C. apodocarpa*

11. Squamules shorter, usually <5 mm long; sphaerophorin present; on shaded siliceous rocks in mesic sites . . . . . *C. petrophila*

8. SquamulesKOH- (atranorin and thamnolic acid absent).

12. Squamules sorediate, sometimes coalescing into masses of soredia . . . . . *C. ramulosa*

12. Squamules esorediate.

13. Squamules greenish yellow, containing usnic acid.

14. Squamules large and strap-shaped, some usually 5 mm or more long; barbatic acid present (underside KC+orangish) . . . . . *C. robbinsii*

14. Squamules small and rounded, <2.5 mm long; barbatic acid absent . . . . . *C. piedmontensis*

13. Squamules brown to green or gray-green, usnic acid absent.

15. Grayanic acid present; terricolous, saxicolous, corticolous or lignicolous.

16. Squamules to ca. 1 mm long and usually about as broad, often marginally sorediate; on lignum . . . . . *C. cylindrica*

16. Larger squamules usually at least 2 mm long and notably longer than broad, marginal soredia absent; substrates various but typically terricolous or saxicolous . . . . . *C. grayi*

15. Grayanic acid absent; terricolous or saxicolous.

17. Squamules broadly expanded, brownish green above and sordid or brownish white below; on massive acidic rock exposures . . . *C. mateocyatha*

17. Squamules narrow and strap-shaped, greenish above and chalky white beneath; terricolous . . . . . *C. sobolescens*

Key B: podetia forming cups

1. Cups esorediate, sometimes with coarse greenish areoles.

2. Cups proliferating from their centers, the podetia with two or more pagoda-like tiers of cups . . . . . C. *verticillata*

2. Cups not proliferating from their centers — occasionally a few smaller cups along the margins of the main cups . . . . . *C. pyxidata*

1. Cups sorediate, the soredia farinose to granular.

3. Podetia yellow green, with usnic acid; apothecia and pycnidia red . . . . . *C. pleurota*

3. Podetia green to gray green, without usnic acid; apothecia and pycnidia brown (*C. chlorophaea* group – chromatography needed for accurate identification).

4. Grayanic acid present; terricolous, saxicolous, or corticolous, cups sometimes very irregular and marginally proliferating . . . . . *C. grayi*

4. Grayanic acid absent; terricolous; cups not marginally proliferating in local populations.

5. Cryptochlorophaeic acid present . . . . . *C. cryptochlorophaea*

5. Cryptochlorophaeic acid absent.

6. Soredia farinose; containing bourgeanic acid . . . . . *C. humilis*

6. Soredia granular; bourgeanic acid absent . . . . . *C. chlorophaea*

Key C: podetia ± abundantly branched

1. Primary squamules absent; cortex lacking, the outer surface dull and appearing cobwebby under magnification; podetia abundantly and repeatedly branched, the branches never squamulose.

2. Podetia white,KOH+ yellowish (atranorin) . . . . . *C. rangiferina*

2. Podetia green or greenish gray,KOH-.

3. Ultimate branches appearing windswept and strongly oriented in one direction, usually 4 at each terminal node . . . . . *C. arbuscula*

3. Ultimate branches not strongly oriented in one direction, often 2(-3, sometimes 4), at each terminal node . . . . . *C. subtenuis*

1. Primary squamules present; cortex present, the surface at least in part smooth and often ± lustrous, appearing smooth under magnification; podetia simple to sparsely branched, or if abundantly branched, then squamules usually present on branches.

4. Podetia gray green; usnic acid absent; podetia usually squamulose . . . . . *C. furcata*

4. Podetia yellow green; usnic acid present; podetia never squamulose.

5. Podetia leathery; cortex wrinkled; apothecia and pycnidia red . . . . . *C. leporina*

5. Podetia brittle; cortex not wrinkled; apothecia and pycnidia brown.

6. UV+ white (squamatic acid); cortex shiny and areolate; podetia uniformly thin . . . . . *C. uncialis*

6. UV- (squamatic acid absent); cortex dull, areoles not well defined; podetia irregularly thickened . . . . . *C. caroliniana*

Key D: podetia simple

1. Podetia sorediate.

2. Apothecia and pycnidia red; barbatic and/or didymic acids present.

3. Thallus instantlyKOH+ deep yellow (thamnolic acid); restricted to wood and bark of *conifers* . . . . . *C. ravenelii*

3. ThallusKOH- orKOH+ weakly yellowish (thamnolic acid lacking); substrate various, especially rotting, decorticate hardwood logs.

4. Squamules sorediate, entire to lobed; podetia with well-developed farinose soredia . . . . . *C. macilenta* var. *bacillaris*

4. Squamules esorediate, finely divided; podetia finely squamulose, with sparse soredia . . . . . *C. didyma*

2. Apothecia and pycnidia brown; barbatic acid absent.

5. Squamules prevailingly >2.5 mm long.

6. At least some podetia with corticate bases and rounded soralia; squamules incised . . . . . *C. ochrochlora*

6. Podetia farinose sorediate except near base; squamules lobed to entire . . . . . *C. coniocraea*

5. Squamules prevailingly 2 mm or less long.

7. Grayanic acid present; podetia narrowly clavate, with blunt tips, covered with coarse isidioid granules . . . . . *C. cylindrica*

7. Grayanic acid absent; podetia pointed or tipped with apothecia or small, shallow, fimbriate cups, covered with farinose soredia.

8. Podetia small and pointed, usually <10mm long; soredia farinose . . . . . *C. ramulosa*

8. Podetia stout, often tipped with apothecia or shallow cups, prevailingly >10 mm long; soredia granular isidioid to farinose.

9. Containing homosekikaic acid; soredia farinose, microsquamules absent; some podetia usually pointed or with shallow apical cups; terricolous . . . . . *C. rei*

9. Homosekikaic acid absent; soredia granular isidioid; with microsquamules toward base; podetia not apically acicular or cupped; prevailingly lignicolous . . . . . *C. subradiata*

1. Podetia lacking soredia.

10. Podetia small and delicate, <8 mm tall, isidioid granulose,KOH+ instantly deep yellow (thamnolic acid)
. . . . . *C. parasitica*

10. Podetia stouter and larger, usually >10 mm tall, corticate or ecorticate, but not isidioid squamulose,KOH-,KOH+ yellowish, orKOH+ red (thamnolic acid absent).

11. Apothecia and pycnidia red; didymic acid present . . . . . *C. cristatella*

11. Apothecia and pycnidia brown; didymic acid absent.

12. Podetia bearing squamules.

13. Podetia UV- (squamatic acid absent), P+ red (fumarprotocetraric acid present) . . . . . *C. furcata*

13. Podetia UV+ white (squamatic acid present), P- or P+ yellow (fumarprotocetraric acid absent).

14. Podetia P+ yellow (baeomycesic and/or barbatic acid present) . . . . . *C. beaumontii*

14. Podetia P- (squamatic acid only) . . . . . *C. squamosa*

12. Podetia mostly lacking squamules.

15. Podetia and squamulesKOH+ yellow turning red (norstictic acid present) . . . . . *C. polycarpoides*

15. Podetia and squamulesKOH- orKOH+ yellow (norstictic acid absent).

16. Podetia and squamules with a distinct yellowish green color (usnic acid present) . . . . . *C. piedmontensis*

16. Podetia and squamules green to gray green (usnic acid absent).

17. Podetia and squamules P+ yellow (atranorin present, fumarprotocetraric acid absent) . . . . . *C. cariosa*

17. Podetia and squamules P+ red (atranorin absent, fumarprotocetraric acid present).

18. Podetia stout, with thick walls and a small central cavity; apothecia present.

19. Apothecia flesh colored to tan; squamules <2 mm long . . . *C. peziziformis*

19. Apothecia dark brown; squamules large, mostly >2 mm long . . . . . *C. sobolescens*

18. Podetia slender, with thin walls and a large central cavity; often sterile . . . . . *C. simulata*

Cladonia apodocarpa Robbins
Common on well-drained, acidic, often rocky soil, in both full sun and light shade. The characteristic habitat for this species is sterile, acidic soils of well-drained, rocky sites on ridges and upper slopes in woodlands. The squamules are blue gray on the upper surface and chalk white beneath. This species and the yellowish green *C. robbinsii* have the largest squamules of the local *Cladonia* biota. [atranorin, fumarprotocetraric acid]

Cladonia arbuscula (Wallr.) Flotow [= *Cladina arbuscula* (Wallr.) Hale & W. L. Culb.]
Apparently rare; on cherty, well-drained ridges and upper slopes in light shade. The podetia of this species appear slightly more robust than those of *C. subtenuis*, although Ozark material may represent an extreme form of *C. subtenuis*. [fumarprotocetraric & usnic acids]

Cladonia beaumontii (Tuck.) Vain.
This is a species of massive, shaded, well-drained, usually vertical or steeply sloping siliceous rock outcrops in mesic areas, particularly in large canyon and ravine systems. It is morphologically similar to some local populations of *C. squamosa*, which have a similar ecology. Previous Ozark reports of *Cladonia atlantica* A. Evans are misidentifications and should be referred here; *C. atlantica* is prevailingly corticate and frequently has cups terminating the podetia, while *C. beaumontii* is decorticate, with acicular podetia tips. [baeomycesic & squamatic acids, ± barbatic acid]

Cladonia caespiticia (Pers.) Flörke
Uncommon or overlooked, growing on shaded rocky soil, rocks, and rotting logs in woodlands, often in somewhat mesic sites. The apothecia are sessile or subsessile on the squamules. [fumarprotocetraric acid]

Cladonia cariosa (Ach.) Spreng.
Uncommon, on exposed, well-drained acidic soil. The squamules are large, and typically form loose patches. This is the only species of *Cladonia* that contains atranorin as the sole lichen substance, although most populations east of the Ozarks also contain fumarprotocetraric acid. [atranorin]

Cladonia caroliniana Tuck.
Locally abundant in exposed, well-drained areas with massive horizontal exposures of siliceous rock, where competition from vascular vegetation is minimal. This is a characteristic lichen of both sandstone and igneous glades, forming extensive mats over large areas. In this habitat it often occurs with two similar taxa, *C. leporina* and *C. uncialis*, as well as with vascular taxa such as *Bulbostylis*

capillaris, Diodia teres, Hypericum gentianoides, Lechea tenuifolia, and *Vulpia octoflora*. When dry, it is easily damaged by trampling. Local populations have been called *C. dimorphoclada* Robbins, and may represent a distinct taxon. They are characterized by an unevenly thickened, irregular thallus. The cortex of the podetia is notably uneven, dull, and lacks conspicuous areoles. *Cladonia uncialis* has more regular, thinner podetia, with a shiny areolate-patterned cortex. *Cladonia leporina* differs in its leathery podetia with a wrinkled cortex, as opposed to the brittle, unwrinkled cortex of both *C.caroliniana* and *C. uncialis*. [usnic acid]

Cladonia chlorophaea (Flörke *ex* Sommerf.) Spreng.
Occasional in lightly shaded, well-drained, often mossy sites, growing over soil and rocks. This is the least common of the four members of the *Cladonia chlorophaea* group in the Ozarks. [fumarprotocetraric acid]

Cladonia coniocraea (Flörke) Spreng.
Apparently rare, usually occurring in habitats and substrates similar to those of *C. ochrochlora*, which see. Known only from Newton County, Arkansas and Carter and Maries counties in Missouri. [fumarprotocetraric acid]

Cladonia cristatella Tuck.
Abundant in well-drained, acidic substrates, in both exposed and lightly shaded sites. Typical substrates include well-drained decorticate logs, stumps, rocky soil, and boulders. This species is common in rocky soil on sterile ridges in wooded uplands, and also frequents sterile, well-drained soil in open abandoned fields. The red apothecia and esorediate podetia are diagnostic. Most material in the region contains usnic acid and has characteristic yellow green podetia, but there are occasional forms lacking usnic acid. These populations have ashy gray podetia, and sometimes occur mixed with typical populations. Forms with pale or orange apothecia also occur from time to time. [barbatic & didymic acids, ± usnic acid]

Cladonia cryptochlorophaea Asahina
Occasional in rocky, well-drained soil, usually in light shade. This species usually has well-defined, regular cups, with little variation or marginal proliferation. Although difficult to describe, it has a distinctive gestalt once one becomes familiar with it. It is more common than most of the cup-forming *Cladonia* in the region, but far less common, variable, or ecologically plastic than *C. grayi*. The Ozark population has a higher percentage with atranorin than most regions. [cryptochlorophaeic acid, ± atranorin, ± fumarprotocetraric acid]

Cladonia cylindrica (A. Evans) A. Evans
Occasional to frequent, usually growing on shaded, decorticate, rotting logs in dry to mesic woodlands, but occasionally found on mesic mossy rocks. The small, blunt podetia with isidioid granules at least on the lower portions are good field identification characters. [fumarprotocetraric & grayanic acids]

Cladonia didyma (Fée) Vain.
Relatively rare on well-drained, rotting, decorticate logs in wooded uplands at a few sites scattered through the Ozarks. This species is usually slightly larger than the more common *C. macilenta* var. *bacillaris*; see discussion under that species for additional differences. [barbatic & didymic acids]

Cladonia furcata (Huds.) Schrad.
Frequent in lightly shaded, well-drained soil on wooded slopes, often associated with *Cladonia subtenuis*. This species is more shade tolerant than *Cladonia subtenuis*, and sometimes forms extensive populations of scattered patches in wooded uplands, particularly where vascular

competition at the ground level is sparse, such as around old turkey-scratching areas and on sterile cherty ridges. [fumarprotocetraric acid]

Cladonia grayi G. Merr. *ex* Sandst.
Very common, with a variety of habitats and substrates. This is the most common, morphologically variable, and ecologically plastic of our cup-forming *Cladonia* species. It is nearly ubiquitous in lightly shaded rocky woodlands, occurring in open well-drained soil, on moss mats, and on siliceous boulders and rock fragments. This species also occurs on rotting logs, shaded lower faces of massive bluffs and outcrops, and even on tree boles. It also colonizes sterile acidic soil in old fields, where common associates include *Cladonia peziziformis*, *C. polycarpoides* and *Danthonia spicata*. The cups of *C. grayi* range in size from a few mm to more than 3 cm, with a bewildering array of shapes and degrees of marginal proliferation. Ozark material is about evenly divided between populations with and without fumarprotocetraric acid. [grayanic acid, ± fumarprotocetraric acid]

Cladonia humilis (With.) J.R. Laundon
Rare; known only from two sites in the south central Ozarks - one in Arkansas and one in Missouri, growing in humus over carbonate bedrock. [bourgeanic & fumarprotocetraric acids]

Cladonia leporina Fr.
Uncommon and restricted to high quality igneous or sandstone glades, where it occurs over massive rock exposures, usually among mats of *C. caroliniana*. This southeastern species is at the extreme northern limit of its interior range in the Ozarks. [baeomycic, squamatic, & usnic acids, ± bellidiflorin, ± didymic acid]

Cladonia macilenta Hoffm. var. **bacillaris** (Genth) Schaer.
Common on rotting decorticate logs and stumps in light to moderate shade in woodlands. This lichen is also a characteristic species on the bases of *Pinus echinata* in wooded uplands, and also occurs less commonly on shaded bases of large hardwood trees. This species is typically sterile, and care must be taken to note the sometimes obscure red pycnidia, which can become somewhat brownish with age. It is noteworthy that *C. macilenta* var. *macilenta* is absent from the Ozarks. [barbatic acid, ± didymic & usnic acids]

This species has obviously sorediate podetia, with the soredia and any exposed areas whitish. *Cladonia didyma* differs in having podetia that are mostly decorticate and squamulose, with the bare areas brownish and translucent.

Cladonia mateocyatha Robbins
Uncommon and local, on massive siliceous rock expanses in glades, occurring on both sandstone and igneous substrates, and sometimes growing in thin soil over bedrock expanses. This species has large, rounded, brownish squamules with a dingy, brownish white undersurface. Our populations invariably consist of sterile squamules. [fumarprotocetraric acid]

Cladonia ochrochlora Flörke
Frequent on rotting logs, stumps, and mossy boulders in mesic sites, particularly in wooded ravines and woodlands along streams. This species is closely related to *C. coniocraea*, although as applied here, *C. ochrochlora* is the more common element in the region. *Cladonia ochrochlora* has the podetia basally corticate with a few rounded soralia, and usually has larger squamules than *C. coniocraea*. [fumarprotocetraric acid]

Cladonia parasitica (Hoffm.) Hoffm.
Locally frequent on rotting decorticate logs in woodlands, including well-rotted logs near the point of disintegration. This species occurs in habitats ranging from mesic to dry, and can be recognized

by the tiny, delicate, dark green podetia, and abundant small, dark brown apothecia or when sterile by the primary squamules finely divided, appearing granular isidioid. [decarboxythamnolic & thamnolic acids, ± barbatic acid, ± bellidiflorin]

Cladonia petrophila R. C. Harris
Restricted to shaded outcrops and boulders of siliceous rocks, usually in mesic areas such as ravines and along the bases of bluffs. This species usually grows as extensive, flattened patches of somewhat widely spaced squamules, and displays a predilection for vertical or steeply sloping rock surfaces. [atranorin, sphaerophorin, fumarprotocetraric acid]

Cladonia peziziformis (With.) J. R. Laundon
Very common on well-drained soil, lignum, rocks, and tree bases in a variety of exposed to shaded habitats. This is one of the first pioneer lichens to invade abandoned fields and road cuts. It is also one of the few species of *Cladonia* to inhabit dolomite as well as siliceous rocks. The tiny, pale greenish gray squamules in small dense patches, and the tan apothecia terminating the twisted podetia are diagnostic. [fumarprotocetraric acid]

A sterile specimen collected from limestone talus below a glade in McDonald County, Missouri appears morphologically similar to *C. peziziformis*, but contains physodalic, fumarprotocetraric, and a trace of protocetraric acids. This chemistry has previously been reported only from an Australian species.

Cladonia peziziformis is frequently parasitized by *Abrothallus cladoniae* R. Sant. & D. Hawksw. This fungus is particularly common on the apothecia, which are normally pale tan but become dark brown to black when infested. The *Abrothallus* apothecia are irregularly scattered over the blackened portions of the host thallus. The apothecia are dark gray to black, plane to slightly convex, to 0.3 mm broad, with the margins concolorous with or slightly paler than the disk. The epithecium and hypothecium are dark brown, with the hymenium ca. 50 µm thick; ascospores 8, ± biseriate, 2-celled, greenish, slightly macrocephalic, 8 × 3.5 µm.

Cladonia piedmontensis G. Merr.
Occasional but seldom abundant; in sterile, acidic soils in exposed to lightly shaded sites, often occurring in areas with sparse vascular vegetation. This species forms large mats on the otherwise barren tailings from the old lead mines around Joplin and Webb City in southwestern Missouri. [usnic acid]

Cladonia pleurota (Flörke) Schaer.
Frequent in well-drained acidic soils, often growing in more exposed, acidic sites than other cup forming species of *Cladonia*. This species occurs in siliceous glades and on rocky acidic bluff summits and ridges. It is also found rarely on dry decorticate logs and stumps along glade edges. The red pycnidia on the cup margins are often obscure to darkening, but the yellowish green thallus tints are distinctive. [usnic acid, zeorin]

Cladonia polycarpia G. Merr.
Rare on sandstone glades in the western Ozarks, growing on thin soil over exposed bedrock of freshwater channel sandstones. These sandstones are known for their heavy metal content. [atranorin, norstictic & stictic acids]

Cladonia polycarpoides Nyl.
Common in sterile, well-drained, acidic soil in exposed areas. This lichen is particularly common in soil derived from cherty parent materials, growing in old fields and along road cuts. It also occurs in openings in wooded uplands. [norstictic acid]

Cladonia pyxidata (L.) Hoffm.
Occasional in rocky open woodlands, growing on rocky soil and often associated with bryophytes. This species has small, areolate granules on the cups, and care must be taken to distinguish these from the coarse soredia that characterize the other cup-forming species of *Cladonia* in the region. [fumarprotocetraric acid]

Cladonia ramulosa (With.) J. R. Laundon
Occasional, mostly on shaded decorticate logs in woodlands. This name, as it seems to be applied in the Midwest, is a general repository for farinose sorediate, small *Cladonia* containing only fumarprotocetraric acid and having pointed podetia. There may be more than one taxon included conceptually under this name, as local material ranges from well-defined, sorediate-margined squamules with podetia to general masses of squamulose soredia lacking podetia. [fumarprotocetraric acid]

Cladonia rangiferina (L.) F.H. Wigg. [= *Cladina rangiferina* (L.) Nyl.]
Local and scattered throughout the Ozarks; in acidic, well-drained areas with slight shade, such as on massive exposures of siliceous rocks or at the edges of glades. This species occurs on both sandstone and igneous sites. The ashy white thallus is distinctive. [atranorin, fumarprotocetraric acid]

Cladonia ravenelii Tuck.
Locally frequent in exposed to lightly shaded upland sites, where it grows on well-drained bark or wood of *Juniperus virginiana* and *Pinus echinata*. This species occurs on living bark, dead wood, stumps, and charred logs of the host trees. [didymic & thamnolic acids]

Cladonia rei Schaer.
This prevailingly northern species is at the southern limit of its range in the Ozarks, where it is known from a single sandstone glade in southern Missouri, growing on a mossy, lightly shaded bedrock flat. [homosekikaic acid, ± fumarprotocetraric acid]

Cladonia robbinsii A. Evans
Common on sterile, exposed to slightly shaded, rocky soil in uplands, and on massive exposures of siliceous rocks. In acidic rocky soils, particularly in light shade, it often associates with *Cladonia subtenuis* and *Cladonia apodocarpa*. In siliceous glades, *Cladonia caroliniana* and *C. strepsilis* are common associates. [barbatic & usnic acids]

Cladonia simulata Robbins
Rare; known only from a Richard Harris collection from Iron County and a Gerould Wilhelm collection from Howell County. Thomson (1967) stated that this species has a yellowish green color and resembles *C. piedmontensis*. The Iron County record, and other material from Florida archived at NY, lacks the yellowish green tint and has pointed podetia. [fumarprotocetraric acid]

Cladonia sobolescens Nyl. *ex* Vain.
Occasional in exposed to lightly shaded, acidic, well-drained soil. This species resembles *C. polycarpoides* in its ecology and morphology, but is less common in the region. [fumarprotocetraric acid]

Cladonia squamosa Hoffm.
Local in mesic shaded areas, on massive, well-drained, usually vertical or steeply sloping siliceous rock outcrops in ravines and on ledges, outcrops, and lower bluff faces. This species sometimes occurs in drier, more exposed sites along the margins of sandstone or igneous glades, or in semi-sheltered areas on rock faces in glades. See discussion under *C. beaumontii*. [squamatic acid]

Cladonia strepsilis (Ach.) Grognot
Locally frequent in exposed glades and on bluff summits and exposed ledges, growing over massive exposures of siliceous rock. In these habitats, the squamules are often partially overgrown with *Diploschistes muscorum*. Infrequently, *C. strepsilis* occurs in open xeric wooded uplands, growing in rocky soil on upper slopes and ridges, where associates include such species as *C. apodocarpa* and *C. robbinsii*. [baeomycesic acid, strepsilin]

Cladonia subradiata (Vain.) Sandst.
Through much of the Ozarks are populations of an unusual *Cladonia* with partly ecorticate podetia mostly covered with fine, partly corticate, isidioid granules; the podetia have well-developed pale to dark brown apothecia, and the basal squamules are copiously incised. Sam Hammer (personal communication) has tentatively determined this element as a somewhat anomalous form of *C. subradiata*, a species with affinities to the Gulf Coastal Plain. Our specimens resemble southeastern material in overall aspect, except that local material does not form cups, and the podetia are not squamulose. Ozark specimens are all from rotting, decorticate logs. [fumarprotocetraric acid]

Cladonia subtenuis (Abbayes) Mattick [= *Cladina subtenuis* (Abbayes) Hale & W. L. Culb.]
Frequent in well-drained acidic soils, typically in very light shade. Typical habitats include wooded upland slopes in sterile soils derived from chert, sandstone, or igneous parent materials, along roads through wooded uplands, and in upland old fields. This species also occurs on rotting decorticate logs in wooded uplands. [fumarprotocetraric & usnic acids]

Cladonia symphycarpia (Flörke) Fr.
Rare and scattered in the Ozarks. The large squamules, with a pale gray green upper surface and chalky white lower surface, resemble those of *C. apodocarpa*. [atranorin, norstictic acid]

Cladonia uncialis (L.) F. H. Wigg.
Occasional in open, well-drained sites associated with massive exposures of siliceous rock, occurring on both glades and upper portions of massive bluffs. This species is related to and frequently associated with *C. caroliniana*; see also comments under that species. [squamatic & usnic acids]

Cladonia verticillata (Hoffm.) Schaerer.
Very rare in well-drained, rocky, acidic sites. Most records from the Ozarks are based on historical specimens. The pagoda-like towers of centrally proliferating cups are unmistakable. This species has been called *Cladonia cervicornis* (Ach.) Flot. ssp. *verticillata* (Hoffm.) Ahti. [fumarprotocetraric acid]

CLAUZADEA Hafellner & Bellem. (Porpidiaceae)

Saxicolous crusts with obscure, thin or endolithic thalli; photobiont *Trebouxia*; apothecia black to dark purplish brown, plane to convex, sessile to more commonly immersed in pits in the substrate; asci *Porpidia* type, with 8 simple, hyaline, halonate, broadly oval spores; pycnidia immersed, with bacilliform conidia; 2 species in the Ozarks.

Material of a probably undescribed Porpidiaceous genus, also on dolomite, with distinctly purple upper hymenium,KOH+ violet and warted ascospores will key here. Due to press of time it is not treated further.

1. Ascospores 17-26 x 6-11 µm; apothecia without stipe immersed in thallus . . . . . *C. metzleri*

1. Ascospores 13-18 x 6-9 µm; apothecia tapering to an immersed stipe . . . . . *C. chondrodes*

Clauzadea chrondrodes (A. Massal.) Clauzade & Roux
Known only from dolomite in a ravine on a massive glade complex in Ozark County, Missouri.

Clauzadea metzleri (Körber) Clauzade & Roux *ex* D. Hawksw.
Uncommon on exposed dolomite in glades, growing on both small fragments and massive bedrock exposures; restricted to the northern half of the Ozarks.

COCCOCARPIA Pers. (Coccocarpiaceae)

Small, dark, lead-gray, isidiate foliose lichens with relatively short, broad lobes, lower surface mostly dark, with dense, rhizine-like tomentum; photobiont *Scytonema* (in our species); apothecia sessile; asci with an I+ blue apical cap, with 8 hyaline, ellipsoid, simple spores; pycnidia immersed, with bacilliform conidia; 1 species in the Ozarks. Reference: Arvidisson (1982).

Coccocarpia palmicola (Sprengel) Arv. & D. J. Galloway
Occasional on lightly shaded, often mossy, rocks, and less commonly on shaded bases of larger trees in mature woodlands, growing on both hardwoods and *Juniperus*; typically in somewhat mesic microhabitats.

COENOGONIUM Ehrenb. (Gyalectaceae)

Minute, branched, green filamentous lichens forming small tufts, branches exceedingly thin, < 25 µm broad, consisting of algal filaments enveloped in fungal hyphae; photobiont *Trentepohlia*; apothecia unknown in Ozark material, but superficial, yellowish, without a thalline margin; asci with simple or 1-septate spores; 1species in the Ozarks. Reference: Davis (1994).

Coenogonium missouriense J. Davis
Known only from an area just inside the entrance of Onyx Cave in Pulaski County, Missouri, where it was discovered in 1981-82. This location has subsequently been impacted by activities associated with attempts to develop the cave for commercial purposes. Subsequent surveys have failed to find any *Coenogonium*, and it is presumed extirpated. The assignment of this report to *Coenogonium* is somewhat questionable. The photobiont of this taxon has been called *Physolinum monile*

COLLEMA F. H. Wigg. (Collemataceae)

Gelatinous lichens with dull, brown to black, undifferentiated thallus; photobiont *Nostoc*; apothecia sessile to immersed, usually with a thalline margin sometimes becoming obscure to absent at maturity; asci with I+ blue apical dome and apical cap, with 8 hyaline, ellipsoid to acicular, 1-septate to muriform spores; pycnidia ± immersed, with bacilliform, sometime apically expanded, conidia; 15 taxa comprising 14 species in the Ozarks. The taxonomy of local taxa of *Collema* is confusing, and the following treatment is only provisional. Reference: Degelius (1974).

1. Thallus lobes large, the main lobes typically > 4.5 mm broad, flat.

    2. Thallus without diaspores.

3. Lower portion of exciple of elongate cylindrical cells . . . . . *C. nigrescens*

3. Lower portion of exciple of rounded ± isodiametric cells.

4. Apothecia disks epruinose . . . . . *C. pulcellum*

4. Apothecia disks ± densely pruinose . . . . . *C. pulcellum* var. *leucopeplum*

2. Thallus isidiate.

5. Thallus with distinct, usually longitudinally aligned, ridges (pustulate or not).

6. Apothecia common; corticolous . . . . . *C. nigrescens*

6. Apothecia lacking; substrate various.

7. Thallus pustulate and ridged; isidia globose to terete; usually corticolous . . . . . *C. furfuraceum*

7. Thallus ridged but not pustulate; isidia flattened, scale-like; saxicolous . . . . . *C. flaccidum*

5. Thallus not distinctly ridged, but often pustulate.

8. Saxicolous; isidia >0.1 mm tall . . . . . *C. fuscovirens*

8. Usually corticolous; isidia to 0.1 mm tall . . . . . *C. subflaccidum*

1. Thallus lobes small and narrow, <3(4) mm broad; variously adnate.

9. Thallus subcrustose, to 3 mm broad; spores globose to subcuboid . . . . . *C. occultatum*

9. Thallus distinctly foliose, > 3 mm broad; spores not globose or cubiod.

10. Thallus isidiate.

11. Lobe margins and tips notably thickened; on mosses or soil (even if apparently saxicolous, careful examination will reveal a thin layer of soil or aeolian silt); lobes usually > 1.5 mm broad . . . . . *C. coccophorum*

11. Lobe margins and tips not thickened; saxicolous; lobes usually < 1.5 mm broad . . . . . *C. texanum*

10. Thallus lacking diaspores.

12. Spores 2+ septate to submuriform.

13. Spores 4-celled.

14. Lobes usually > 2 mm broad, with flat margins; usually on bryophytes or soil over carbonate rock . . . . . *C. tenax*

14. Lobes usually < 2 mm broad, with upturned margins; saxicolous directly on bare carbonate rock . . . . . *C. polycarpon*

13. Spores submuriform to muriform, with at least one cell longitudinally divided.

15. Thallus black, adnate; apothecia > 1 mm broad, with crenulate rims; white hapters absent on lower surface . . . . . *C. bachmanianum*

15. Thallus brown, suberect; apothecia ≤ 0.3 mm broad, immersed; scattered clusters of white hapters on lower surface . . *C. pustulatum*

12. Spores 1-septate.

16. Lobe margins and tips notably thickened; on bryophytes or thin soil pockets over carbonate rock . . . . . *C. coccophorum*

16. Lobe margins not thickened; corticolous or saxicolous directly attached to bare rock.

17. Usually corticolous; lobes flat, brownish; apothecia abundant, substipitate and creating a pincushion appearance *C. conglomeratum*

17. Saxicolous; lobes caniculate, with downturned margins, blackish; apothecia occasional, well-spaced, sessile . . . . . *C. texanum*

Collema bachmanianum (Fink) Degel.
This is a rare lichen of shaded dolomite and limestone, mostly occurring in the extensive dolomite region of the White River and eastwards in Missouri. In the field, this species appears very similar to *C. tenax*, except for notably crenulate thalline margins of the apothecia.

Collema coccophorum Tuck.
Frequent on lower bluff faces and shaded ledges and lightly shaded outcrops - typically growing in thin soil over dolomite or on mossy dolomite or limestone.

Collema conglomeratum Hoffm.
Occasional on lightly shaded boles of trees, particularly along glade margins and bluff summits, as well as rarely on lightly shaded dolomite. This species grows most commonly on *Fraxinus americana, Juglans nigra, Quercus muehlenbergii*, and *Q. stellata*. The small thalli with abundant, closely spaced apothecia are distinctive, and resemble miniature pin cushions. Corticolous populations frequently grow with other gelatinous lichens, especially *Leptogium millegranum*. The Ozark material we have examined has 1-septate ascospores. Forms with 3-septate ascospores have been reported from the Ozarks (*e.g.* Hale 1957) as *C. conglomeratum* var. *crassiusculum* (Malme) Degel., although Schultz et al. (2004) considered variety *crassiusculum* to have 1-septate ascospores.

Collema flaccidum (Ach.) Ach.
Extremely rare on shaded sandstone in wooded uplands.

Collema furfuraceum (Arnold) Du Rietz
Uncommon on shaded lower boles and bases of trees in wooded uplands, and in mesic woods where there is sufficient light intensity. As applied here, this concept also includes material frequently found on moist shaded boulders in ravines which were previously referred to *C. flaccidum*. According to Purvis *et al.* (1992), *C. flaccidum* has isidia which become lobulate or squamulose. Local material has small, fine, globose to cylindrical isidia with no tendency to become flattened or lobulate; these isidia are identical to isidia of local corticolous populations of *C. furfuraceum*.

Collema fuscovirens (With.) J. R. Laundon
Known only from Union County, Illinois, as cited by Degelius (1974).

Collema nigrescens (Huds.) DC.
Infrequent on lightly shaded tree boles, typically on *Quercus alba* or *Q. stellata*. Although this lichen is described as occurring both with and without isidia, local material usually lacks isidia, and isidiate material is very rare. The abundant, small, substipitate apothecia, broad lobes, blackish color, and pustular surface are diagnostic.

Collema occultatum Bagl.
Known only from *Acer saccharum* in a woodland in Crawford County, Arkansas.

Collema polycarpon Hoffm.
Short, basally attached, apically suberect lobes; spores 2-celled. Rare on lightly shaded, massive dolomite; collected once on calcareous sandstone.

Collema pulcellum Ach.
Known only from shaded, mossy limestone in Newton county, Arkansas.

Collema pulcellum Ach. var. **leucopeplum** (Tuck.) Degel.
Known only from mossy sandstone in a ravine in Franklin County, Arkansas.

Collema pustulatum Ach.
Infrequent on shaded dolomite boulders, outcrops, and bluff faces, usually in higher light intensities than are favored by other species of *Collema*. This species is characterized by its suberect brown to olive brown thallus that is tough and brittle when dry. Rarely it occurs on lightly shaded sandstone.

Collema subflaccidum Degel.
Common on shaded mid to lower boles and bases of trees in wooded uplands, in habitats similar to those of *C. furfuraceum*, with which it is sometimes associated.

Collema tenax (Sw.) Ach.
Occasional on shaded, moist, often mossy dolomite, often on ledges and boulders along streams or on lower faces of bluffs and ledges. This species grows in thin soil pockets or over mosses on the rocks.

Collema texanum Tuck.
Infrequent on exposed to lightly shaded dolomite exposures, usually in dryish sites such as along glade margins and on outcrops on upper slopes in woodlands. This species grows directly on rock exposures, usually in areas with little or no moss. Previous reports of *C. polycarpon* should be referred here; all with the exception of the valid record of *C. polycarpon* discussed above, all Ozark material we have seen has consistently 1-septate spores, whereas *C. polycarpon* typically has 3-septate spores.

CONOTREMA Tuck. (Stictidaceae)

Whitish corticolous crustose lichens with a continuous to rimose thallus; photobiont *Trebouxia*; apothecia strongly concave, ± immersed in thalline tissue and appearing perithecioid; asci with a thickened apex, with 8 extremely long, acicular 25+ -septate spores with ± spherical cells; 1 species in the Ozarks.

Conotrema urceolatum (Ach.) Tuck. [= *Stictis urceolatum* (Ach.) Gilenstam]
Infrequent in lightly shaded dry mesic to mesic woodlands, growing on boles of a variety of hardwood trees, particularly *Acer rubrum, Acer saccharum*, and *Quercus coccinea*. Wedin et al. (2005) found that *C. urceolatum* is very close to the type of *Stictis* in their gene tree and have placed it in that genus. We consider the morphological differences sufficient to maintain *Conotrema* as a separate genus for now.

A non-lichenized fungus that looks much like this species, *Robergea pupula* (Nyl.) R. C. Harris, occurs on boles and branches of trees in the area, typically in more upland and exposed situations. The ascocarp of *Conotrema* opens by a gaping central pore, while the ascocarp of *Robergea pupula* is offset to the side, with a closed slit set in a white pruinose disk. Another species, *Robergea albicedrae* (Heald & Wolf) Sacc. & Trav., also has a white thallus with elongate ascocarps, forming distinctive white zones on branches of *Juniperus ashei* in the southwestern Ozarks.

CRESPONEA Egea & Torrente (Opegraphaceae)

Crustose lichens with thin or poorly developed to endosubstratal thalli; photobiont *Trentepohlia*; apothecia laminal, dark, lacking a thalline margin, typically pruinose at least initially; asci with a thick amyloid band, ring structure, and ocular chamber, with 8 hyaline, elongate, multiseptate spores; pycnidia not seen in Ozark material, dark, ± immersed, with short-bacilliform conidia; 1 taxon in the Ozarks.

Cresponea premnea (Ach.) Egea & Torrente var. **saxicola** (Leighton) Egea & Torrente
Uncommon on exposed sandstone; scattered through the southern half of the Ozarks.

CRYPTOTHELE Th. Fr. (Lichinaceae)
Minute, dark, crustose lichens with cyanobacterial photobiont with reddish sheath; apothecia perithecioid; paraphyses absent; ascus usually with pointed apex, with 8 colorless, simple ascospores; 1 species in the Ozarks.

Cryptothele permiscens (Nyl.) Th. Fr.
Known only from a rhyolite glade in southeastern Missouri, growing on exposed rhyolite.

CYPHELIUM Ach. (Caliciaceae)

Yellowish green crustose lichens with continuous, thickened areoles; photobiont *Trebouxia*; apothecia common, black, subimmersed in the thallus, mazaedial; asci disintegrating early and releasing a powdery mass of brown 1-septate spores; pycnidia, with ellipsoid conidia; 1 species in the Ozarks.

Cyphelium tigillare (Ach.) Ach.
Rare, although sometimes locally abundant; on exposed, weathered lignum of softwoods and *Maclura pomifera*, usually on fenceposts of these species in open fence rows. The colorful pale yellowish green thalli, often associated with the bright orange *Caloplaca microphyllina*, are one of the visual pleasures of old farmsteads in rural regions of the Ozarks.

CYSTOCOLEUS Thwaites (Agonomycetes: family unknown)

Minute, black filamentous lichens consisting of undulate hyphae closely enveloping filaments of *Trentepohlia*; 1 species in the Ozarks. This monospecific genus is only known in sterile condition; conidiomata unknown.

Cystocoleus ebeneus (Dillwyn) Thwaites
Thallus consisting of loose, intertangled tufts of filiform remotely branched black filaments 12-20 µm thick; filaments to 2 mm long, with the branches emerging singly at nearly right angles, the branches more than 0.1 mm, and usually more than 0.2 mm distant, with the main filaments and branches essentially isodiametric for their entire length; bases of branches minutely constricted in microscopic view; filament consisting of *Trentepohlia* closely enveloped by elongate hyphal cells ca. 15 × 4 µm, with thick, undulate cell walls.

Uncommon and local; restricted to lightly to moderately shaded conditions on sheltered faces of massive siliceous rock formations, such as under overhangs, with mesic microclimate conditions and protection from direct rainfall or runoff. Known from sandstone, granite, and rhyolite, and typically occurring as scattered patches of small tufts which sometimes coalesce.

See comments under *Spilonema revertens*.

DENDRISCOCAULON Nyl. (Lobariaceae)

Tiny, sterile, grayish, compact, densely branched subfruticose lichens, with narrow channeled to flattened branches, photobiont *Scytonema* or *Nostoc*; conidiomata unknown; 1 species in the Ozarks.

Dendriscocaulon intricatulum (Nyl.) Henssen
Uncommon on the bases of shaded trees in stable woodlands, growing in a narrow zone near the bark/soil interface on mature trees. Because of its size, habitat, and structure, this species is easily overlooked.

Genetic analysis conducted by Bernard Goffinet indicates that this is the blue-green counterpart of *L. quercizans*. The cyanobacterium of the Ozark material differs from the cyanobacteria found in cephalodia of *L. quercizans*, although it is known to occur in other cyanolichens.

DERMATOCARPON Eschw. (Verrucariaceae) by Anja Amtoft

Brown to grayish, umbilicate to subfoliose saxicolous lichens with a smooth to papillate or rugose lower cortex and one or more holdfasts, rhizines present or absent; photobiont *Trebouxia* plus *Protococcus* and/or *Hyalococcus*; perithecia immersed; asci *Verrucaria*-type, with 8 simple, hyaline, ellipsoid to subglobose spores; pycnidia immersed, plurilocular, with bacilliform conidia; 7 species in the Ozarks.

1. Thallus firmly attached to the substrate by delicate rhizohyphae, no umbilicus or holdfasts present; on soil . . . . . *Placidium chilense*

1. Thallus attached to the substrate by an umbilicus or multiple holdfasts, or with no umbilicus and holdfasts but not firmly attached to soil by rhizohyphae; on rock or soil 2

2. Lower surface with rhizinomorphs or tomentum 3

3. Rhizinomorphs present, composed of ± cylindrical aggregation of cells, dark brown to black . . . . . *D. moulinsii*

3. Tomentum present, composed of moniliform rhizohyphae, pale brown to brown . . . . . *D. tomentulosum*

2. Lower surface without rhizinomorphs or tomentum 4

4. Thallus composed of a single lobe with a main holdfast, if secondary lobes are present, these lobes without additional holdfasts 5

5. On calcareous rock 6

6. Perithecia mostly small, 162-320(-440) µm high × 130 -360(-396) µm wide; ostiole black, infrequently brown, typically sunken or flush with upper surface; upper surface very dark brown to light brown, very rarely blue green (no brown pigment), usually partly pruinose; lower surface variable but often verrucose, rarely completely smooth; thalli vagrant or not . . . *D. dolomiticum*

6. Perithecia mostly large,(335-)420-600(-810) µm high × (245-)355-565(-690) µm wide; ostiole dark to light brown, reddish brown or without pigment, often two-toned, typically raised above the upper surface or level; color of upper surface variable but not very dark brown, often pale bluish-green, infrequently pruinose; lower surface topography variable but often completely smooth, infrequently verrucose; thalli rarely vagrant . . . . . D. muhlenbergii

5. On acidic rock 7

7. Thallus not distinctly thin and flexible; single holdfast always present; lower surface tan, pale brown to black, often completely smooth, otherwise veined, wrinkled or verrucose; perithecia large,(335-)420-600(810) × (245-)355-5(690) µm . . . . . *D. muhlenbergii*

7. Thallus distinctly thin and somewhat flexible; single holdfast present or absent; lower surface light brown to golden brown,often shiny, foveolate or weakly wrinkled; perithecia small, (148-)200-300(451) × (154-)200-300(-400) µm . . . . . *D. arenosaxi*

4. Thallus composed of multiple lobes with multiple holdfasts or thallus with multiple holdfasts 8

8. Spores mostly longer than 15 µm; on acidic rock or soil 9

9. Aquatic to subaquatic, growing along permanent or ephemeral waterways or along seepage trails; spores 14.5-17.5 × 5.5-7.5 µm, frequently thin-walled . . . . . *D. luridum*

9. Not aquatic or subaquatic, growing in dry habitats directly on rock or on a thin layer of soil over rock; spores 15.4-21.5 × 5.5-7.7 µm, frequently thick-walled ≥ 1µm . . . . . *D. luridum* var. *xerophilum*

8. Spores mostly shorter than 15 µm; on acidic or calcareous rock 10

10. Substrate known 11

11. On calcareous rock, usually dolomite . . . . . *D. multifolium*

11. On acidic rock, usually sandstone . . . . . *D. arenosaxi*

10. Substrate unknown 13

13. Thallus distinctly cushion-like with erect to sub-erect lobes or thallusmat-forming with elongate ribbon-like lobes . . D. arenosaxi

13. Thallus not cushion-like, lobes adnate to sub-erect, rounded or if elongate then not mat-forming 14

14. Upper surface very dark brown to brown-black; on acidic rock . . . . . *D. arenosaxi*

14. Thallus not dark-brown to brown black but brown to light brown or grayish brown 15

15. Lobes with a conspicuous, usually slightly raised, brown margin; lower surface mostly smooth, or slightly foveolate . . . . . *D. multifolium*

15. Lobes without conspicuous, raised brown margin; lower surface smooth, wrinkled or foveolate . . . . . *D. arenosaxi*

Dermatocarpon arenosaxi Amtoft *ined.*
Common and predictably present in acidic sandstone glades, sandstone flats, or gladey areas along seepage trails. This species also grows on rhyolite, chert and on soil over rock. It is usually very abundant locally, covering large areas. At a single site (or in a single collection) it may present a wide range of morphologies despite seemingly identical ecological conditions. Thalli can be flat, cushion-like or only slightly convex, mat-forming or not, composed of either adnate small rounded lobes, small erect lobes, elongate and ribbon-like lobes or less frequently broad, undulate lobes. Vagrant thalli are common, especially in glades with soil deposits and fragmented rock. The upper surface of *D. arenosaxi* ranges from brown to very dark brown. Occasionally a thallus is broad-lobed with a single or no apparent holdfast but other thalli in the collection will likely have multiple holdfasts and a more typical morphology; the aberrant thallus is often undulate and has the golden brown foveolate or wrinkled lower surface characteristic of the most common form of the species. The spores of *D. arenosaxi* are ellipsoid to sub-globose and are often germinating or in the early stages of germination and then appear minutely mucronate at one end. This species is sometimes found at the same locality as *Dermatocarpon luridum* but not growing side-by-side. *Dermatocarpon luridum* is distinguished from *D. arenosaxi* by long spores, a most often thick, rigid thallus and stout, measurable holdfasts. *Dermatocarpon arenosaxi* normally has shorter spores, a flexible thallus and smaller, short holdfasts. *Placidium chilense* grows in close association with *Dermatocarpon arenosaxi* in glades with soil deposits. *Placidium chilense* is squamulose and tightly adhered to the soil by rhizohyphae. *Placidium chilense* is bright green when wet. Wet thalli of *Dermatocarpon arenosaxi* are sometimes distinctly bi-colored green and brown when wet but are always partly melanized and not evenly green as in *Placidium chilense*. See *Placidium chilense* for further discussion.

Dermatocarpon dolomiticum Amtoft *ined.*
Frequent and predictably present in dolomite glades. This species is restricted to calcareous rock and prefers exposed, high light areas. It occasionally grows in shaded areas along the periphery of glades, and overgrown remnant glades where it is found alongside *D. muhlenbergii*. Shade forms have less brown pigment thus deviating from the more typical dark brown glade form. The upper surface is

usually “pruinose” or with a whitish bloom especially towards the center. In pale specimens the contrast between the whitish bloom and dark pigment is lacking but on close inspection one can see that part of the upper surface has a layer of cells (the “pruina” or epinecral layer) which is easily scraped off with a razor. This layer is infrequently absent. The lower surface of *D. dolomiticum* can be veined or wrinkled but is most often verrucose and infrequently completely smooth. The medulla is often loose and somewhat glassy but can be compact. *Dermatocarpon dolomiticum* is distinguished from *D. muhlenbergii* by the very dark brown thallus (if the typical glade form) and the small perithecia which have a dark brown to black ostiole that is most often partially sunken or flush with the upper surface. The thallus of *D. dolomiticum* is frequently rosette-like appearing pinched in the center. Occasionally a thallus can be strongly convoluted, and thalli may grow crowded together. *Dermatocarpon dolomiticum* is one of two species (the other *D. arenosaxi)* with a tendency to become vagrant; this condition is rare in *D. muhlenbergii*.

Dermatocarpon luridum (With.) J. R. Laundon var. **luridum**
Rare throughout the Ozarks and restricted to acidic rock. *Dermatocarpon luridum* grows along or near flowing water where it is at least periodically submerged. It seems to prefer shaded areas and hard rocks such as rhyolite. Although it is capable of forming large mats this growth habit is rarely observed in the Ozarks where it usually forms small isolated patches. It sometimes occurs at the same site as *D. arenosaxi* but is then isolated from the large colonies of *D. arenosaxi* and not growing side by side. The following characteristics of *D. luridum* help to distinguish it in the field from *D. arenosaxi*: a very rigid thallus, a pale blue green upper surface, a pale tan lower surface, and/or stout, long holdfasts. *Dermatocarpon luridum* is highly variable with thalli composed of broad and round lobes or of small narrow, elongate lobes but long spores and specificity to acidic rock along or near flowing water are diagnostic.

Dermatocarpon luridum var. **xerophilum** Amtoft *ined.*
This variety is rare in the Ozarks and is so far found only in Pope Co, Arkansas and Ste. Genevieve Co., Missouri. *Dermatocarpon luridum* var. *xerophilum* grows in dry habitats on acidic sandstone or on soil over rock. The thallus is can be convex or cushion-like and tends to be very rigid. The margin is brown and usually slightly raised. In three of the four collections of this species the thallus is bicolored, bluish-green and brown. The spores are very long, up to 21 µm and can be thick walled (1-1.5 µm). The habitat preference distinguishes this variety from *Dermatocarpon luridum* var. *luridum* which is considered obligately hygrophilous.

Dermatocarpon moulinsii (Mont.) Zahlbr.
Rare throughout the Ozarks on dolomite. *Dermatocarpon moulinsii* is found on ledges in dolomite glades or on summit of dolomite bluffs. This species is characterized by having rhizinomorphs on the lower surface. It is sometimes found growing alongside *D. dolomiticum* which lacks rhizinomorphs.

Dermatocarpon muhlenbergii (Ach.) Müll. Arg.
Dermatocarpon muhlenbergii is the most common and widely distributed species of *Dermatocarpon* in the Ozarks. This species in the eastern United States has previously been called *D. miniatum* (L.) Mann or more recently *D. americanum* Vainio, both of which occur in North America, the former seemingly more boreal, the latter seemingly southwestern. It is a generalist in terms of habitat and substrate, occurring on dry exposed bluff faces to moist shaded bluffs, in underhangs, or submerged along streams on both calcareous and acidic rock. The morphology of the thallus is variable but more often than *D. dolomiticum* is undissected and ± flat, otherwise it can be somewhat dissected. The thalli grow individually or crowded together. In the Ozarks this is the only broad-lobed species of *Dermatocarpon* with a single holdfast that can have an upper surface entirely melanin-free, making identification of sterile blue-green thalli easy. This condition also occurs in *D. luridum* but that species has multiple holdfasts. The upper surface color of *D. muhlenbergii* ranges from blue-green to brown to pinkish-light brown, but not very dark brown as in *D. dolomiticum*. Blue-green (melanin-

free) specimens are usually growing in low light conditions. However, the degree of pigmentation is not strictly correlated with light exposure. *Dermatocarpon muhlenbergii* is occasionally "pruinose" or with a layer of cells on the upper surface which can be easily scraped off. Lower surface color ranges from pale tan to black. The lower surface is often completely smooth but it can also be veined, wrinkled, or infrequently verrucose. The tendency of perithecia to push down the lower cortex and form bulges on the lower surface should not be interpreted as verrucose. Mature perithecia are mostly large relative to *D. dolomiticum.* The ostiole is usually capped with pigmented or unpigmented cells. This "cap" is usually pigmented light brown to dark brown or pale reddish-brown and is sometimes two-toned, dark in the center and pale along the periphery or vice-versa. Occasionally this cap is not well developed on all perithecia in the thallus especially if the perithecia are immature or senesced. The neck of the ostiole is frequently long and it is not uncommon for perithecia to have two hymenia sharing the same ostiole. Spores are frequently ejected in a cirrus. Pycnidia may be inconspicuous and immersed in the thallus or conspicuous and immersed in areoles and then usually these pycnidial areoles occupy the entire thallus.

Dermatocarpon multifolium Amtoft *ined.*
Occasional in the Ozarks but often locally abundant where present. *Dermatocarpon multifolium* grows in mesic habitats on calcareous rock, on shaded boulders or bluffs with a preference for horizontal surfaces and dolomite. *Dermatocarpon multifolium* is usually present in many small colonies. Thalli are typically crowded together, difficult to separate and mostly mat forming. Individual lobes or thalli are normally ≤ 1cm in diameter, very rarely reaching 2 cm. The lobes have a brown margin that is slightly to strongly raised. Lobes are often partly convex or cup-like. The upper surface is gray to gray-brown. In the field, damp thalli often appear two-toned. The perithecia are mostly globose-pyriform, (182-) 289 - 484 µm × (181-) 266 - 473 µm. The ostiole frequently has a conspicuous wide brown cap. This cap can also be dark brown or infrequently black and sometimes not well developed (not wide, not convex). *Dermatocarpon multifolium* often grows alongside *Dermatocarpon muhlenbergii*. It is difficult to separate small or immature thalli of *D. muhlenbergii* from immature(?) *D. multifolium* which occasionally lacks or has only rudimentary secondary holdfasts. Young thalli of *D. muhlenbergii* sometimes have a brown margin thus making the problem worse. The young thalli of *Dermatocarpon muhlenbergii* are more flat and not cup-like with uplifted margins as in *D. multifolium*. The perithecia of *D. muhlenbergii* are typically elongate-pyriform not globose-pyriform as in *D. multifolium*. Small sterile thalli with no pycnidia and a single holdfast probably belong to *D. muhlenbergii* since *D. multifolium* usually produces either perithecia or pycnidia. Pycnidia in *D. multifolium* are immersed. Thalli with abundant pycnidia are not uncommon and are occasionally rosette-like rather than mat-forming.

Dermatocarpon tomentulosum Amtoft *ined.*
This species is rare in the Ozarks. It is known from a single locality on dolomite in Stone Co., Missouri. The lower Ozarks is probably the northern limit of *D. tomentulosum*. It appears to be locally rare where present. *Dermatocarpon tomentulosum* prefers calcareous rock and the habitat of Ashe juniper forests. The tomentum, composed of rhizohyphae, is very short and can be easily missed if one does not observe the lower surface carefully. The only other species in the Ozarks with cortical outgrowths covering the lower surface is *D. moulinsii*. *Dermatocarpon moulinsii* produces rhizinomorphs and not rhizohyphae.

DIBAEIS Clem. (Icmadophilaceae)

Crustose lichens with thin continuous thalli; photobiont chlorococcoid; apothecia laminal, sessile to short-stipitate, ± globose, typically pinkish; asci with an IKI+ blue apical cap, with 8 simple, ovoid spores; pycnidia unknown in Ozark material, with bacilliform conidia; 1 species in the Ozarks. This species was formerly included within *Baeomyces*.

Dibaeis absoluta (Tuck.) Kalb & Gierl
Rare and local in the Ozarks; restricted to sheltered sandstone walls and faces in mesic habitats, usually in intact natural areas, in microhabitats protected from excessive direct runoff.

DIMELAENA Norman (Physciaceae)

Yellow-green saxicolous crustose lichens with rimose to lobate thalli; photobiont *Trebouxia*; apothecia ± immersed, thalline margin absent; asci *Lecanora*-type, with 8 brown, 1-septate, ellipsoid spores; pycnidia immersed, with bacilliform conidia; 1 species in the Ozarks.

Dimelaena oreina (Ach.) Norman
Frequent on exposed to lightly shaded siliceous rocks, especially on large rock exposures in glades. Typical associates include *Acarospora fuscata, Candelariella vitellina, Lecanora oreinoides*, and *Xanthoparmelia* spp. The predominate chemotype contains gyrophoric acid but a single collection from Izard County, Arkansas belongs to the stictic acid chemotype. [1)gyrophoric & usnic acids; 2) stictic and usnic acids]

DIMERELLA Trevisan (Gyalectaceae)

Inconspicuous crustose lichens with thin or obscure, ecorticate thalli; photobiont *Trentepohlia*; apothecia sessile, plane, pale to orange; asci simple, with no apical structures or thickenings, with 8 small, ellipsoid, hyaline, 1-septate spores; pycnidia pale to yellowish, ± immersed, with bacilliform conidia; 2 species in the Ozarks. Recent genetic analyses suggest inclusion of this genus within *Coenogonium*.

1. Apothecia to 0.4 mm broad, pale to dull yellowish; mostly lignicolous, or on bryophytes, humus, or tree bases . . . . . *D. pineti*

1. Apothecia usually > 0.5 mm broad, orange; mostly corticolous . . . . . *D. lutea*

Dimerella lutea (Dicks.) Trevisan
Apparently rare; on bryophytes, humus, and shaded boles of *Acer saccharum, Populus deltoides* and *Quercus velutina*. Some local material has spores notably longer than are typical for the species, ranging to 14 µm long.

Dimerella pineti (Ach.) Vězda
Occasional in shaded sites in dry to mesic woodlands, but small and perhaps overlooked. Known from rotting stumps, and from bryophytes over stable humus.

DIPLOSCHISTES Norman (Thelotremataceae)

Crustose lichens with pale gray, continuous to rimose thalli; photobiont *Trebouxia*; apothecia immersed, urceolate; asci with internal thickening, internally I+ orange, with 4-8, greenish to brown, muriform spores; pycnidia black, emergent, with bacilliform conidia; 3 species in the Ozarks.

1. Exciple radially striate, the striations usually white to pale; thallus generally rimose or of contiguous areoles . . . . . *D. actinostomus*

1. Exciple not radially striate, sometimes marginally roughened and whitened; thallus mostly continuous.

2. Thallus saxicolous, with subtle yellowish gray tinge; spores 4-8 per ascus . . . . . D. scruposus

2. Thallus lichenicolous, muscicolous or lignicolous, pale mineral gray; spores 4 per ascus . . . . . *D. muscorum*

Diploschistes actinostomus (Ach.) Zahlbr.
Occasional on exposed to lightly shaded siliceous rocks, especially sandstone on upper slopes. [lecanoric acid]

Diploschistes muscorum (Scop.) R. Sant.
Locally frequent, usually growing over *Cladonia* squamules and mosses in extensive bedrock exposures in sandstone or igneous glades; rarely on exposed lignum. *Cladonia strepsilis* is a common substrate. [lecanoric acid]

Diploschistes scruposus (Schreber) Norman
Infrequent, on exposed, usually massive siliceous rocks, especially large sandstone boulders in openings on upland slopes, and on sandstone in glades. [lecanoric acid]

DIPLOTOMMA Flotow (Physciaceae)

Saxicolous crustose lichens with thick ± sublobate, gray thalli, the upper cortex with abundant crystals; photobiont chlorococcoid; apothecia black, plane, ± immersed, with a poorly developed or disappearing thalline margin; asci *Lecanora*-type, with 8 red-brown, 3-septate, thick-walled spores; pycnidia with ellipsoid conidia; 1 species in the Ozarks. see key to *Buellia*.

Diplotomma venustum Körber [= *Buellia venusta* (Körber) Lettau]
Rare; known from a single Kansas collection on limestone outcrops in oak-hickory woodland. The Ozark collection is at the easternmost edge of the range shown by Nordin (2000). Sequence data support separation of *Diplotomma* from *Buellia*. [no substances]

DIRINA Fr. (Roccellaceae)

Saxicolous crustose lichens with thin, sorediate thalli; photobiont *Trentepohlia*; apothecia sessile (absent in our form); asci unknown in Ozark material, with thickened apex and I+ blue internal ring, with 8 hyaline, fusiform, 3-septate spores; pycnidia, dark, immersed, with curved, filiform conidia; 1 taxon in the Ozarks.

Dirina massiliensis Durieu & Mont. f. **sorediata** (Müll. Arg.) Taylor
Occasional on shaded, moist sandstone. This species has a thin, grayish or greenish crust, with small, pale, punctiform, soralia about 0.2 mm broad. The thallus reacts C+ red. Ozark material has a much thinner thallus than most European material. However, Laurens Sparrius (in litt.) has kindly confirmed the identity of our specimens. [erythrin]

DIRINARIA (Tuck.) Clem. (Physciaceae)

Small, narrow-lobed foliose lichens with a pale gray,KOH+ yellow upper cortex and a dark lower surface, rhizines lacking; photobiont *Trebouxia*; apothecia lacking in our species; pycnidia absent in Ozark material, immersed in small thalline warts, with bacilliform conidia; 1 species in the Ozarks. Reference: Awasthi (1975).

Dirinaria frostii (Tuck.) Hale & W. L. Culb.
Restricted to exposed or lightly shaded, massive siliceous rock formations, in areas sheltered from direct rainfall and runoff, such as under overhanging ledges. The thalli tightly adnate, with nearly confluent lobes. [atranorin, divaricatic acid]

ENDOCARPON Hedw. (Verrucariaceae)

Small brown areolate to squamulose lichens; photobiont *Stichococcus*, present in the hymenium; perithecia immersed; asci thick-walled, *Verrucaria* type, with 2 hyaline to brownish, muriform spores; pycnidia immersed, conidia bacilliform; ? species in the Ozarks but only one treated here.

Endocarpon pallidulum (Nyl.) Nyl.
Occasional on shaded, often mossy dolomite and limestone in woodlands, and less commonly on shaded bases of hardwoods. This species also occurs on carbonate substrates in more exposed sites, including dolomite in glades, and even on old concrete and limestone paving blocks. *Caloplaca feracissima* is a frequent associate in disturbed areas. Local populations were previously misidentified as *E. pusillum* Hedw., a species which has rhizines on the lower surface, whereas local populations lack rhizines.

ENTEROGRAPHA Fée (Roccellaceae)

Crustose lichens with thin, ± continuous thalli; grayish to dark prothallus typically present; photobiont *Trentepohlia* or *Phycopeltis*; ascomata of aggregated, somewhat lirellate pseudothecia; asci with an apical dome containing an IKI+ dark blue ring, with 8 hyaline, elongate, multiseptate spores; pycnidia not seen in Ozark material, immersed, with bacilliform to filiform conidia; 1 species in the Ozarks.

Enterographa hutchinsiae (Leight.) A. Massal.
Rare on lightly shaded rock outcrops at a few scattered locations in Arkansas and Missouri.

EOPYRENULA R.C. Harris (Dacampiaceae)

Corticolous crustose lichens with a thin, whitish, continuous thallus; photobiont *Trentepohlia*; perithecia subimmersed, black; asci cylindrical, without structures, ocular chamber present, with 8 brown, 3+ septate spores, the apical cells sometimes paler than the rest of the spore; pycnidia black, with straight elongate, hyaline simple microconidia and brown, septate ellipsoid macroconidia; 1 species in the Ozarks.

Eopyrenula intermedia Aptroot
Rare on hardwoods in mesic woodlands, typically on neutral-barked substrates such as *Acer negundo*, *A. saccharum*, and *Ulmus americana*. The macroconidia are bacilliform, 4-celled, and bluish green.

EPIGLOEA Zukal (Epigloeaceae)

Weakly lichenized (or parasitized?) gelatinous algal mats, the thallus not evident; photobiont cf. *Coccomyxa*; with scattered, tiny, immersed, blackish perithecia; asci cylindrical, with an IKI+ blue

wall, with 32 hyaline, 1-septate spores; pycnidia not seen in Ozark material, black, with bacilliform to ellipsoid conidia; 1 species in the Ozarks. Reference: Buck & Harris (2002).

Epigloea pleiospora Döbbler
Occasional, but probably overlooked, on moist algal mats over bryophytes (*Aulacomnium, Dicranum, Fissidens*) in exposed to lightly shaded habitats, such as at the edges of thickets and along glade margins.

Unless the algae are wet, this taxon is almost invisible.

EVERNIA Ach. (Parmeliaceae)

Dull yellowish green fruticose lichens, the thallus basally attached, branched, and soft; cortex often ridged; photobiont *Trebouxia*; apothecia rare, not seen in Ozark material, stipitate, with a thalline margin and brownish disk; asci *Lecanora*-type asci, with 8 simple, ellipsoid spores; pycnidia rare, not seen in Ozark material, dark, immersed; conidia acicular; 1 species in the Ozarks.

Evernia mesomorpha Nyl.
Thallus tufted, lax to suberect, to 2 cm in Ozark material (but typically larger), ridged, angular, and irregularly branched, yellowish green, often with some dull paler yellowish zones; branches to 2 mm thick; each basally attached main branch irregularly branching into a series of progressively smaller and narrower branches; upper cortex irregularly bumpy; soredia abundant, coarse, partly corticate at first, granular, developing on ridges and bumps along the branches. [divaricatic & usnic acids]

Known only from a secondary woodland at the northeastern edge of the Ozarks, in St. Louis County, Missouri, growing on exposed dead limbs of *Gleditsia triacanthos*.

This species is readily distinguished from *Usnea* by its soft, irregular, angular branches and lack of a central cord. *Ramalina* branches are flattened, even when narrow, with a distinct upper and lower surface, and have scant medullary tissue. Ozark populations of *E. mesomorpha* may be recent introductions; Brodo (2001) mapped the nearest location as extreme northern Illinois, and Wilhelm (1995) noted that most or all the populations in the Chicago region are probably introduced.

FELLHANERA Vězda (Piloccrpaceae)
Folia Geobot. Phytotax. 21: 200. 1986.

Crustose lichens with thin thallus, sessile dark apothecia, thalline margin absent; photobiont chlorococcoid; asci with an I+ apical dome including a darker tube, with 8 hyaline, fusiform, 1-3-septate spores (only 3(-4)-septate in Ozark species) lacking a halo; pycnidia black, globose, greenish walled, often gaping widely; conidia short, fusiform or bottle-shaped; 4 species in the Ozarks.

The ± cellular exciple, ascus with a I+ dark tube in the apical dome and short, often bowling pin-shaped conidia suggest that the species below should be included in *Fellhanera*. The first putatively exclusively saxicolous species has only recently been described from Mexico (Nash et al. 2004). It differs from eastern North American taxa in having broader ascospores (4.5-6 μm vs. 3.5-4.5(-5) μm) The differences in apothecial characters (including ascospore) between the eastern taxa recognized here are trivial at best. The distinctions have been found in thallus and conidial characters.

1. Thallus without asexual propagules 2

2. Hypothecium KOH+ purplish; conidia mostly over 5 µm long; growing on rock, especially chert; common . . . . . *F. silicis*

2. Hypothecium KOH−; growing on rock and conidia mostly less than 5 µm long or growing on bark and conidia mostly over 5 µm long; rare 3

3. Growing on rock . . . . . *F. "fallax"*

3. Growing on bark . . . . . *F. "missouriensis"*

1. Thallus composed of crowded isidioid granules or thin with small blastidia 4

4. Thallus composed of crowded isidioid granules . . . . . [*F. "granulosa"*]

4. Thallus with small blastidia; conidia mostly less than 5 µm long;growing on rock (one Ozark collection) . . . . . *F. "minnisinkorum"*

Fellhanera "fallax" *sp. provis.*
Thallus on chert and HCl− sandstone, pale green gray tinted with brown, ± continuous, cracked. Apothecia scattered, sessile, constricted to ± narrow base, initially flattened, becoming convex, 0.2-0.3 mm across; disk brown to black, matt; margin pale gray or darkening to blackish and ± concolorous with or slightly darker than disk, even with disk, eventually excluded. Exciple tinted with green above at margin, ± colorless below, greener in KOH, N+ purplish red. Epihymenium patchily pigmented, KOH−, N+ purplish. Hypothecium orange brown to brown with small masses of orange brown to blackish brown pigment between hyphae, KOH−, N+ orange brown or orange red. Hymenium greenish, KOH− and N+ purplish and/or brownish streaked, KOH−. Ascospores 3(-4)-septate, (12-)14-17 x 4-5 µm. Conidia 4-5(-5.5) x 1.5-2(-2.3) µm. [no lichen substances?, not tested]

Fellhanera "fallax" occurs on chert and sandstone at one site in Illinois, two in Missouri and one in Oklahoma. It is also known from a single collection from Rowan County, Kentucky. If it were not for the consistently smaller conidia, we would have dismissed this as a pigment variant of *F. silicis* with a KOH− hypothecium. Since there is an anomalous collection (Carter County, Missouri, *Harris 48546*) tentatively placed here with a KOH+ hypothecium and short conidia, It may yet prove most expedient to submerge this putative taxon in *F. silicis*. There seems to be no distributional or substrate differences. Recognition is maintained tentatively "for the sake of argument" since pycnidia are present in over 90% of the collections of both taxa which would allow differentiation.

[**Fellhanera "granulosa"** *sp. provis.*]
Thallus on non-calcareous sandstone, olive-green, thick, composed of fused isidioid granules cracked into large polygonal areoles, to 1.0 mm across. Apothecia black, matt, scattered, sessile or slightly immersed among granules, initially flat but soon convex, 0.3-0.5 mm across; margin mostly concolorous to slightly paler, mostly obscured, even with disk or slightly raised. Exciple tinted green-black, KOH+ greener, N+ purplish red, with rim dark green but brown, KOH+, N+ purplish red, adjacent to hypothecium, of weakly radiating hyphae with ± large lumina. Hypothecium brown, with darker pigment masses between hyphae, KOH-, N+ orange red. Epihymenium patchily blackish green, KOH+ greener, N+ purplish red. Hymenium greenish streaked, KOH+ greener, N+ purplish red. Ascospores 3(-4)-septate, 15-17 × 3.5-5 µm. Conidia fusiform, 4.5-5 × 1.5 µm.

The thick thallus composed of ± isidioid granules is diagnostic. The apothecial pigmentation is very similar to *F. silicis* which has a thin thallus, longer conidia. This taxon is from Illinois (Saline County, *Buck 35950)* just outside the Ozark ecoregion and could well occur in our area.

Fellhanera "minnisinkorum" *sp. provis*.
Thallus on rock, pale gray, consisting of sparse minute areoles and more numerous, more conspicuous granular blastidia on a whitish cobwebby hypothallus. Apothecia few and poorly developed, sessile, constricted at base; disk brown; margin pale gray. Exciple cellular, greenish. Epihymenium ± colorless. Hymenium tinted orangish brown, KOH−. Hypothecium brown, with darker masses between hyphae, KOH−. Ascospores ca. 17 x 4.5 µm. Conidia not found (3.5-5 x 1.5-2 µm in extra-Ozark material). [no lichen substances?, not tested]

Known from shaded sandstone from Pomona Natural Bridge, Jackson County, Illinois.
The apothecia and ascospores of *Fellhanera "minnisinkorum"* are essentially identical to the other species treated here differing in the thallus with small granular blastidia. The small conidial size differs from all except *F. "fallax"*. *Fellhanera "minnisinkorum"* is a fairly common, mostly corticolous or lignicolous species with a northeastern distribution touching the Ozark region only in southern Illinois. A more detailed description will be published elsewhere. The sole Ozark collection is poor and is included here on the basis of the blastidiate thallus.

Fellhanera "missouriensis" *sp. provis*.
Thallus on bark, gray, thin, continuous to very weakly areolate toward center, with poorly developed whitish prothallus. Apothecia sessile, constricted at base, soon convex; disk blackish brown, matt; margin ± soon excluded, grayish. Exciple cellular, usually bicolor or tricolor, colorless outside/below, brown within, sometimes also diffuse greenish just outside brown. Epihymenium patchy brownish, KOH−, N+ orangish red. Hymenium tinted purplish brown, KOH− or KOH+ weakly purplish. Hypothecium brownish with black brown masses between hyphae, KOH− N+ orangish red. Ascospores 3-septate, ca. 11-12 × 4-4.5 µm. Pycnidia blackish, semi-immersed, globose, ca. 100 µm across. Conidia rod-shaped or weakly constricted in middle, 5.5-7 × 1.5-2 µm. [no lichen substances]

Known from only a single collection on bole of *Carya* from St. Francois County, Missouri.
Among corticolous taxa *F. "missouriensis"* is ± similar in aspect to some forms of *Bacidia circumspecta* which has a green epihymenium, hymenium often green streaked and exciple of radiating hyphae as well as a different type of ascus, spores and conidia. It is also externally very similar to saxicolous *F. 'fallax"* which has smaller conidia and *F. silicis* which has greenish exciple and epihymenium and KOH+ purplish hypothecium.

Fellhanera silicis R. C. Harris & Ladd *sp. nov.*
Thallus on silicate rock, gray-green, olive-green or greenish brown, superficial, thin (80-100 µm), initially continuous, becoming cracked, without obvious prothallus (marginal region in *Harris 31171* very thin, with a silvery cast); asexual propagules lacking; no lichen substances detected. Apothecia dark brown to black, scattered, sessile, flat to weakly convex (ca. 150 µm thick), constricted to weakly constricted at base, 0.4-0.5 mm across when mature, with thin, concolorous margin, initially weakly raised, often becoming obscured with age. Exciple usually bicolor, greenish (KOH−, N+ purplish red) inward, colorless outward, composed of weakly radiating, thick walled hyphae with large, irregular lumina (2-4 µm across). Hypothecium brown to chocolate brown, KOH+ purplish, N+ orangish brown. Epihymenium green, KOH−, N+ purplish. Hymenium colorless but appearing brownish streaked due to brownish or greenish pigment in some (moribund?) asci. Ascospores 3-septate,12-14 × 4-5 µm. Conidia bacilliform to sublageniform, 5-6 × 1.5 µm. (*Buck 31800* has larger pycnidia, opening more broadly and larger bacilliform conidia, 5-9 × 2-2.5 µm, forming short cirrhi.) [no lichen substances]

Fellhanera silicis, as far as is now known, is an eastern American endemic common in the Ozark region with a few collections from Pennsylvania and one from West Virginia. It occurs on fine grained non-calcareous rock, rhyolite, fine grained sandstone and chert or quartz inclusions in lime rich situations. As far as one can tell at this time it occurs in wooded habitats unlike *Micarea erratica* which is mainly in open habitats. It may also tolerate more lime than *M. erratica*. We have had this

species on the web for several years but it is just as well that we proceeded no further as the *Fellhanera* situation on closer examination has proved rather complex. In the field and under the dissecting microscope this lichen can pass for *Micarea erratica* which is widespread on non-calcareous rock in eastern North America. Further complicating hasty identifications, the green epithecium and brown hypothecium also mimic *M. erratica*. However, 3-septate vs. 0-septate ascospores and broad-celled, weakly radiate, thick walled excipular hyphae vs. narrow, much branched and interconnected, thin-walled excipular hyphae embedded in a well-developed gel matrix, readily separate it from *M. erratica*. *Bacidia granosa* (Tuck.) Zahlbr. with 3-septate ascospores is also quite similar but usually is confined to calcium rich rocks and has the dark exciple continuous with the dark hypothecium, less conspicuous pycnidia, filiform conidia and "*Bacidia* type" ascus.

FLAKEA O.E. Eriksson (Ascomycota)

Sterile squamulose lichens with dull, gray-green, suberect, lobate-branched thalli; lobes to 2 mm long and 0.3 mm broad, typically 40-60 µm thick, undifferentiated; photobiont chlorococcoid, the closely packed algal cells 7-10 µm in diameter; a monotypic genus of uncertain affinities. Diederich and Aptroot (1997) place this in the genus *Agonimia*, as *A. papillata* (O.E. Erikss.) Diederich & Aptroot.

Flakea papillata O.E. Eriksson
Uncommon and scattered at a few sites through the southern Ozarks; restricted to low light intensities at the back of sheltered underhangs under massive sandstone bluffs, where it occurs on surface protected from direct water flow, at light intensities lower than will support most lichens. In the Ozarks known from Arkansas, Illinois, Kansas, and Oklahoma.

FLAVOPARMELIA Hale (Parmeliaceae)

Broad-lobed, yellow-green adnate foliose lichens without marginal cilia; upper cortex sometime wrinkled, containing usnic acid; lower cortex black with a brown marginal zone, relatively sparsely beset with mostly simple rhizines typically less than 0.5 mm long, these black except occasionally pale near the thallus margins; photobiont *Trebouxia*; apothecia sessile, laminal, basally constricted, with a well-developed thalline margin, epithecium brownish, hypothecium pale; asci *Lecanora*-type, with 8 simple, hyaline, ellipsoid spores; pycnidia laminal, immersed in the upper cortex; conidia bifusiform; 3 species in the Ozarks.

1. Thallus sorediate or pustulate-isidiate; widespread on rocks and trees; apothecia and pycnidia rare.

    2. Thallus with granular soredia in diffuse patches and developing from low pustules; mostly corticolous . . . . . *F. caperata*

    2. Thallus with coarse isidia-like pustules, these friable and sometimes breaking and appearing apically sorediate, but not developing true soredia; saxicolous or rarely on shaded tree bases . . *F. baltimorensis*

1. Thallus without diaspores; mostly on old growth *Juniperus* in natural areas; apothecia and pycnidia abundant . . . . . *F. rutidota*

Flavoparmelia baltimorensis (Gyeln. & Fóriss.) Hale
Thallus with apically expanded lobes 5-10 mm broad, upper cortex sometimes with locally wrinkled areas on older portions, with hollow, corticate, irregularly bulbous isidioid pustules 0.2-0.3 mm broad at the base, but often apically expanded and irregular, 0.3(0.5) mm tall, the pustules friable and often breaking and appearing sorediate, but remaining basally corticate, and no true soredia present; apothecia not seen in Ozark material; pycnidia rare, near the lobe tips, brown to black, to 0.1 mm

broad, often surrounded by a slightly swollen zone of cortex; conidia bifusiform, 5-7 × 1-1.1 µm. [atranorin, protocetraric & usnic acids, ± gyrophoric acid]

Abundant throughout the Ozarks, on lightly to moderately shaded siliceous rocks, growing on sandstone, chert, rhyolite, and granitic rocks. On massive lightly shaded siliceous outcrops and boulders in woodlands, this species occurs with *Myelochroa obsessa* and *Pertusaria plittiana*. Associates in more deeply shaded habitats include *Myelochroa aurulenta* and *Phaeophyscia adiastola*. *Flavoparmelia baltimorensis* also occurs on shaded hardwoods, especially near the base, most commonly in areas where saxicolous populations of the lichen are abundant.

This species can be easily confused with *F. caperata*, especially when growing on corticolous substrates, and care must be taken to determine whether a specimen is truly sorediate. Isidiate species of *Xanthoparmelia* typically grow on more exposed rocks; they have small, more cylindrical isidia, a more lustrous upper cortex, and narrower, truncate lobes. Gyrophoric acid is an occasional constituent in Ozark populations of *F. baltimorensis*.

Flavoparmelia caperata (L.) Hale
Thallus with apically expanded lobes 5-12 mm broad, upper cortex sometimes with locally ridged and wrinkled areas; soredia granular to coarsely farinose, originating near the lobe tips and low laminal pustular eruptions; apothecia rare, cupuliform and strongly constricted at the base, to 6 mm broad, with a well-developed and usually sorediate thalline margin; pycnidia not seen in Ozark material. [atranorin, protocetraric & usnic acids]

Abundant on lightly shaded trees in woodlands, occurring from bases and lower boles to older canopy branches on a variety of hardwoods and conifers in upland and mesic woodlands. This species also occurs on lightly shaded decorticate stumps and logs, and rarely on lightly shaded siliceous boulders. Ladd (1996b) documented this as one of the most consistently dominant lichens in wooded upland in parts of the Mark Twain National Forest in the Missouri Ozarks.

Smaller young thalli of this species are often esorediate. See comment under *F. baltimorensis*.

Flavoparmelia rutidota (Hook. f. & Taylor) Hale
Medium-large lichens with slightly expanded lobe apices, often with the lobe tips dissected into narrow segments, the lobes to 6 mm broad; upper cortex commonly wrinkled and sometimes almost subfoveolate; apothecia abundant, to 5 mm broad, somewhat low, with a thin thalline margin forming an involute rim above the disk; pycnidia black, common to abundant and often distributed throughout the thallus, creating a speckled appearance, to 0.1 mm broad; conidia obscurely bifusiform, 6-8 × 1-1.2 µm. [atranorin, protocetraric & usnic acids]

Uncommon and local, usually in exposed habitats associated with massive bluffs, where it grows on exposed boles and branches of old-growth *Juniperus ashei* and *J. virginiana*, growing on both bark and decorticate wood. A single record from Arkansas is from *Ulmus alata* on an extensive bluff system.

This is one of a series of lichens, mostly associated with glade and bluff systems, that have phytogeographic affinities to the southwestern deserts and attain their northern range limit in the Ozarks.

FUSCIDEA V. Wirth & Vězda (Fuscideaceae)

Crustose lichens; apothecia sessile to partially immersed; photobiont chlorococcoid; asci with internal

and external I+ blue caps, with 8 hyaline, ellipsoid to elongate-reniform, simple to 1-septate spores; pycnidia immersed, ± marginal with ellipsoid to bacilliform conidia; 2 species in the Ozarks.

1. Thallus saxicolous; apothecia black (frequently sterile) . . . . . *F. recensa*

1. Thallus corticolous; apothecia brown . . . . . *F.* sp #1

Fuscidea recensa (Stirt.) Hertel, V. Wirth & Vězda
Apparently rare on massive siliceous rock outcrops; known only from Shannon County, Missouri. [divaricatic acid]

Fuscidea sp. #1
Thallus whitish, continuous; apothecia medium brown, sessile, with raised margin ranging from pale tan to concolorous with the disk; upper hymenium, outer exciple, and hypothecium brownish; paraphyses not or slightly expanded apically; ascospores simple, hyaline, ellipsoid to weakly reniform, 9-10 × 5 µm. [unknown substance with R_f value above norstictic acid]

Known only from Shannon County, Missouri, on hardwood twigs.

FUSCOPANNARIA M. Jørg. (Pannariaceae)

Small dark brown to grayish brown lichens composed of imbricate, sublobate squamules with a black tomentum on the lower surface; photobiont *Nostoc;* apothecia sessile, with a thalline margin which usually disappears towards maturity; asci with I+ blue ring-like apical structures, with 8 simple, hyaline spores with long-attenuate, curved, pointed ends; pycnidia brownish, immersed, with bacilliform conidia; 2 species in the Ozarks. Reference: Jørgensen (2001).

1. Lobe margins white pruinose; thallus strongly imbricate; perispore with evident attenuate apices . . . . . *F. leucosticta*

1. Lobe margins epruinose; thallus ± plane; perispore without conspicuous attenuate apices . . . . . *F. leucophaea*

Fuscopannaria leucophaea (Vahl) M. Jørg.
Rare on lightly shaded sandstone in the southern Ozarks, typically on wooded slopes above small streams.

Fuscopannaria leucosticta (Tuck.) M. Jørg.
Local on mossy, massive, lightly shaded igneous rocks, sandstone and dolomite in mesic areas, usually along small streams; rarely on lightly shaded boles of *Quercus*. [terpenoids]

GOMPHILLUS Essl. (Gomphillaceae)

Crustose lichens with continuous, thin, pale, shiny thalli closely conforming to the substrate; photobiont chlorococcoid; apothecia dark, globose, minutely stipitate; hyphophores usually present, these stipitate and becoming radially stellate at the summit; asci with an I- apical dome, with 8 large, hyaline, linear, multi-septate spores; pycnidia subimmersed, with minute ellipsoid conidia; 1 species in the Ozarks. Reference: Buck (1998).

Gomphillus americanus Essl.
Local, typically growing over bryophytes, particularly *Leucodon julaceus,* on lightly shaded boles

and large, horizontal branches of *Juniperus virginiana*, as well as on shaded *Leucodon* over carbonate bedrock; less commonly on other bryophytes. Typical habitats include overgrown glades, glade margins, talus slopes and bluff summits.

GRAPHIS Adans. (Graphidaceae)

Thin, pale gray to whitish corticolous crustose lichens; photobiont *Trentepohlia*; apothecia lirelliform, partially immersed, hymenium I-; asci I-, splitting apically, with 8 hyaline to pale brownish, elongate, 5+ -septate spores with lenticular lumina; pycnidia rare, with bacilliform conidia; 2 species in the Ozarks.

1. Spores with transverse septa only; common on a variety of hardwoods . . . . . *G. scripta*

1. Spores muriform; rare and restricted to *Betula nigra* . . . . . *G. sophisticascens*

Graphis scripta (L.) Ach.
Abundant on shaded, smooth, hard bark on lower and mid boles of hardwoods in woodlands, growing in both mesic and dry habitats. This species is particularly common on *Acer, Amelanchier, Carya, Quercus coccinea, Q. rubra,* and *Q. velutina*. The apothecial disks are usually white pruinose and visible as pruinose slits.

Graphis sophisticascens Nyl.
Rare and local, growing on shaded boles of older *Betula nigra* on intact floodplains and wooded terraces along small rivers. This species is apparently only known from the Ozarks, from where it was described by Nylander (1890) as growing on *Populus*, although the original label accompanying the type specimen lists the substrate as *Betula*.

Non-lichenized lirelliform fungi, *Hysterium pulicare Pers.* with brownish 3-septate spores, and *Hysterographium mori* (Schw.) Pehm with brown muriform spores, are frequent in mesic woodlands, growing on neutral-barked hardwoods such as *Acer saccharum* and *Betula nigra*. Sometimes these fungi can even appear lichenized, if there are free-living chlorococcoid algae admixed. The lirelline apothecia of *Hysterium* and *Hysterographium* tend to be more aggregated, and there is no evident thallus.

GYALECTA Ach. (Gyalectaceae)

Crustose saxicolous lichens with thin, continuous to minutely granular thalli; photobiont *Trentepohlia*; apothecia ± immersed, pale to orange or brown; asci thin-walled, lacking apical structures, I+ blue, with 8 hyaline, ellipsoid, submuriform to muriform spores; pycnidia pale to tan, immersed, with bacilliform conidia; 3 species in the Ozarks. The taxonomy of local populations is poorly understood, and probably includes additional, perhaps undescribed, taxa.

1. Thallus and apothecia orange; paraphyses with gold to orange carotenoid droplets . . . . . *G.* sp #1

1. Thallus greenish to grayish, apothecia pale; paraphyses lacking carotenoids.

    2. Thallus olive green; apothecia superficial, some > 0.5 mm broad . . . . . *G. jenensis*

    2. Thallus gray to greenish gray; apothecia immersed in pits in the rock, < 0.4 mm broad *G. foveolaris*

Gyalecta farlowii Nyl.
Frequent on shaded carbonate rocks, growing on both dolomite and limestone, and often in moist habitats, sich as on lower bluff faces. This species has been called *Petractis farlowii* (Tuck. *ex* Nyl.) Vězda.

Gyalecta jenensis (Batsch) Zahlbr.
Rare on shaded, mesic dolomite, often associated with seeping outcrops in wooded ravines and lower faces of massive bluffs bordering streams.

Gyalecta sp. #1
Uncommon, in habitats similar to those of *G. jenensis*, and apparently more common in the region than *G. jenensis*.

GYALIDEA Lettau *ex* Vězda (Gyalectaceae)
Folia Geobot. Phytotax. Bohemoslov. 1: 312. 1966. Type: *G. lecideopsis* (Massalongo) Lettau *ex* Vězda (*Gyalecta lecideopsis* Massalongo)

Tiny, very inconspicuous, saxicolous or terricolous crustose lichens with thin, smooth gray green thallus, photobiont chloroccoid; apothecia sessile, biatorine, pale, often translucent when wet; asci thin-walled, lacking apical structures, I+ blue, with 8 hyaline, ellipsoid, 1-septate to muriform spores; pycnidia dark, with bacilliform conidia; 1 species in the Ozarks.

Gyalidea sp.
Thallus small patches immediately adjacent to apothecia. Apothecia sessile with pale disk and thin, blackish margin. Ascospores muriform, 3-5 x 1-2-septate, 18-22 x 9-12 µm.

Rare, known from a single Missouri collection on chert fragment in floodplain forest along stream. The key to identifying this species are the thin-walled asci and chloroccoid photobiont. It seems to belong in the *G. lecideopsis* complex but the ascospore size is not a good match for any described species.

GYALIDEOPSIS Vězda (Gomphillaceae)

Crustose lichens with thin, lustrous, continuous gray thalli and brown or black hyphophores; photobiont *Trebouxia*; apothecia unknown in local material, sessile, irregularly rounded, asci with thickened apices, I+ wine red, with (2-)8 hyaline, muriform spores; conidiomata unknown; in addition to the 2 species below, several other unknown sterile specimens have been rarely collected in the region, occurring on substrates such as *Juglans, Juniperus* and *Pinus*.

1. On hardwood twigs; hyphophores black, acicular with a narrowly expanded, lacerate apex, >1 mm tall . . . . . *G.* sp. #1

1. On moss or humus; hyphophores brown, short and blunt, <1 mm tall . . . . . *G.* sp. #2

Gyalideopsis sp. #1
Uncommon on upper canopy twigs of *Quercus* in extensive, mature woodlands.

Gyalideopsis sp. #2
Rare, but probably overlooked, on soil and mossy humus in open rocky woodlands in river and stream valleys, such as along the Black River in Reynolds County and the Current River in Carter County. The hyphophores are pale brown, shallowly lacerate, and folded over.

HAEMATOMMA A. Massal. (Haematommaceae)

Large crustose lichens with thick, well-defined, somewhat verrucose thalli; photobiont *Trebouxia*; apothecia laminal and sessile, with a distinct thalline margin and reddish disk; asci *Haematomma* type, with 8 hyaline, multiseptate, elongate, curved spores; pycnidia not seen in Ozark material, curved, reddish, with filiform conidia.

Haematomma fenzlianum A. Massal.
Rare and local, on massive, dry, vertical exposures of sandstone in the southwestern Ozarks. The large lecanorine apothecia with deep reddish disks are distinctive.

HALECANIA M. Mayrh. (Catillariaceae)

Small saxicolous crustose lichens; apothecia sessile, with a thalline margin; photobiont chlorococcoid; asci *Catillaria*-type, with 8 small, hyaline, ellipsoid, 1-septate spores; pycnidia immersed, with bacilliform conidia; 2 species in the Ozarks.

1. Hymenium P+ red; epithecium not granular; apothecia uniformly brown; paraphyses twisted . . . . . *H. "rheophila"*

1. Hymenium P-; epithecium with scattered granules among the tips of the paraphyses, creating a dark spotted appearance in the wetted apothecial disk; paraphyses ± straight . . . . . *H. "punctata"*

Halecania rheophila *sp. provis.*
Restricted to hard, weathered siliceous rocks, usually rhyolite, near the mean water line in clear, fast-flowing high-gradient streams and seeps in the St. Francois Mountains and occasionally elsewhere in similar habitats, on orthoquartzite. This species has a dark, minutely subsquamulose thallus with a conspicuous black prothallus and tiny, pale to dark apothecia with an evident thalline margin. This species does not occur in sites where flood amplitudes, flow dynamics, or water turbidity and quality have been significantly altered by anthropogenic activity in the watershed.

Halecania punctata *sp. provis.*
Abundance and distribution unknown; occurring with the previous species and only recently recognized as distinct.

HEPPIA Nageli (Heppiaceae)

Brown squamulose terricolous lichens with closely adnate thalli; photobiont *Scytonema*; apothecia immersed; asci IKI-, with 8 hyaline, fusiform, simple spores; pycnidia immersed, with bacilliform to fusiform conidia; 2 species in the Ozarks. Reference: Henssen (1994).

1. Thallus brownish; upper surface smooth; lower hymenium IKI+ reddish . . . . . *H. adglutinata*

1. Thallus grayish pruinose; upper surface appearing rough or granular; lower hymenium IKI+ blue . . . . . *H. conchiloba*

Heppia adglutinata (Kremp.) A. Massal.
Local in exposed, thin soil pockets over dolomite in glades and on bluff summits, invariably associated with cyanobacterial or algal soil crusts, and usually growing with *Placidium squamulosum* and sometimes *Psora decipiens*.

Heppia conchiloba Zahlbr.
Known only from exposed soil in a dolomite glade in the eastern Missouri Ozarks.

HERTELIDEA Printzen & Kantvilas (Stereocaulaceae)

Sorediate crustose lichens with pale gray granular areoles; photobiont chlorococcoid; apothecia dark brown to black, superficial, sometimes proliferating from older apothecia; asci lacking an ocular chamber, with an IKI+ blue tholus and IKI+ blue darker structure, with simple (rarely 1-septate) spores; pycnidia with filiform conidia. Reference: Printzen & Kantvilas (2004).

Hertelidea pseudobotryosa R.C. Harris, Ladd, & Printzen
Apparently rare; on burned and unburned lignum of *Juniperus*, and burned hardwood lignum, in open to lightly shaded habitats in the southern Ozarks. The thallus is UV+ white, readily distinguishing it from pale forms of *Trapeliopsis flexuosa*. [perlatolic acid]

HETERODERMIA Trevisan (Physciaceae)

Narrow lobed, pale gray foliose lichens with the upper cortex of elongate cells prevailingly aligned with the lobes; lower surface pale, rhizinate, corticate or ecorticate; marginal cilia often present; photobiont *Trebouxia* (?); atranorin and zeorin always present in our taxa, some local taxa also with salazinic acid; apothecia sessile, with prominent thalline rim and dark brown disk (the disk obscured by pruina in *H. echinata*); asci *Lecanora*-type, with 8 brown, thick-walled, ellipsoid, 1-septate spores, the spores rarely with additional small locules; pycnidia dark, laminal, immersed; conidia bacilliform; 7 species in the Ozarks. Members of this genus may be confused with *Physcia*, which is always corticate on the lower surface, and has an upper cortex composed of nearly isodiametric cells.

1. Thallus lacking diaspores.

    2. Thallus closely appressed, not conspicuously long-ciliate; apothecial disks epruinose . *H. hypoleuca*

    2. Thallus loosely adnate to suberect, conspicuously long ciliate; apothecial disks densely pruinose . . . . . *H. echinata*

1. Thallus sorediate or isidiate.

    3. Thallus with coarse laminal isidia, the isidia granular and basally constricted . . . . . *H. granulifera*

    3. Thallus with marginal and/or terminal, farinose soredia.

        4. Lower surface ecorticate and fibrous to cottony, prevailingly yellow to orange or darkening 5

5. Medulla KOH+ yellow → red (norstictic acid); lower surface darkening to purplish black towards center, KOH- . . . . . *H. casarettiana*

5. Medulla KOH-; lower surface persistently yellow to orangish, KOH + purplish . . . . . *H. obscurata*

4. Lower surface white to tan, appearing corticate.

6. MedullaKOH+ yellow (atranorin); soralia strongly labriform and concentrated on lobe tips . . . . . *H. speciosa*

6. MedullaKOH+ yellow turning red (salazinic acid); soralia marginal and not strongly labriform . . . . . *H. albicans*

Heterodermia albicans (Pers.) Swinscow & Krog
Thallus blue-gray, adnate, typically < 5 cm broad, abundantly branched with truncate-tipped linear lobes ca. 0.3-1 mm broad, rarely with a few sparse pruina at the lobe tips. Soredia common, farinose, with a bluish cast, in linear marginal soralia extending around the lobe tips and sometimes becoming somewhat labriform in age. Lower surface corticate, pale tan, with widely scattered, pale to tan, fasciculate rhizines ca. 0.5 mm long, sometimes with irregular thickenings towards their apices. Apothecia unknown in Ozark material, although populations just south of the Ozarks are occasionally fertile. These apothecia are to 2 mm broad, laminal, with plane brown disks and well-developed thalline margins with projecting, ± incurved, lacerate-lobulate rims. [atranorin, salazinic acid, zeorin]

Occasionally the soredia become more abundant and laminal, especially towards the lobe tips on large, well-developed thalli, and can coalesce to form large continuous patches that nearly obscure the thallus surface. This trait becomes more common in material from the Gulf Coastal Plain south of the Ozarks.

Rare on bases and lower boles of a variety of hardwood trees and on *Juniperus*, usually occurring in the southeastern parts of the Ozarks. This species is more common southeast of our region in the Bootheel area of Missouri and southeastward.

Heterodermia casarettiana (A. Massal.) Trevisan
Rare in woodlands in the Boston Mountain region of the southern Ozarks in Arkansas; usually on mossy siliceous rocks, especially sandstone. All of the Ozark material contains norstictic acid, although this is absent in some populations elsewhere in the range of this species. [atranorin & norstictic acid]

Heterodermia echinata (Taylor) W.L. Culb.
Thallus pale gray, loosely adnate to erect and appearing subfruticose, with long branching lobes typically to 2 mm broad and conspicuous long pale to darkening, simple to branched and apically furcate marginal cilia to 4 mm; upper cortex pale gray, sometimes with faint whitish reticulations and slightly thickened, revolute margin. Lower surface ecorticate, with cobwebby white medullary tissue. Apothecia common, to 4 mm broad, erect and substipitate, with a thin, high-walled thalline margin corticate internally and extending to 0.5 mm above the hymenial surface and becomes erose to sublobulate in age, sometimes with scattered dark-tipped cilia. Apothecial disks dark brown, plane to slightly concave, evenly and heavily suffused with dull white pruina. Pycnidia common, subimmersed, brown, subglobose with truncate poriform apices, to ca. 0.15 mm broad. [atranorin, zeorin]

The medulla of this species is very thin, so that the color of the algal layer is visible when the thallus is viewed from below. The thalli often have small zones of minute pruina near the lobe tips and apothecial margins.

Sporadic and uncommon, although sometimes locally abundant, on exposed to lightly shaded twigs and small branches of *Juniperus virginiana* and *J. ashei* in glades and on bluffs; more rarely on hardwood branches in similar habitats.

Heterodermia granulifera (Ach.) W.L. Culb.
Thallus compact, adnate, gray to pale bluish gray, with abundant short lobes to 0.7 mm broad. Upper cortex frequently pruinose, with abundant scattered laminal and marginal, subglobose to short-cylindrical isidioid protrusions ca. 0.15 mm diameter, these occasionally proliferating from their sides and apices and becoming somewhat coralloid; when broken, the resultant circular scars sometimes appearing soralia-like. The isidia are sometimes partially ecorticate and appear coarsely sorediate. In addition to the isidia, the thallus sometimes becomes lobulate. Lower surface corticate, lustrous, initially pale but becoming tan, with the scattered slender brown rhizines becoming squarrose-branched. Apothecia unknown in Ozark material. Pycnidia occasional, on upper cortex concentrated near terminal branch points, dark, immersed, ca. 0.1 mm broad. [atranorin, salazinic acid, ± zeorin]

Infrequent on shaded bases, lower boles and larger low branches of trees in wooded uplands throughout the Ozarks, especially on *Carya*, *Quercus*, and *Juniperus*; *Quercus alba* appears to be the most frequently occupied substrate in the Ozarks.

Heterodermia hypoleuca (Muhl.) Trevisan
Thallus pale gray (sometimes with brownish overtones), adnate, with loosely adnate to imbricate or slightly ascending lobe tips, to 15 cm broad, the main lobes typically 1-2 mm broad, plane to slightly convex, the older portions commonly lobulate. Lower surface ecorticate, initially white but becoming tan with age, with frequent darkening, prevailingly marginal rhizines becoming abundantly branched. Apothecia common, laminal, sessile, basally constricted, with a tall-rimmed, internally ecorticate thalline margin extending to 1 mm above the apothecial disk and ultimately lacerate to lobulate dissected; apothecial disk plane to slightly convex, dark brown, to 6 mm broad. Pycnidia frequent, laminal, subimmersed, brown, disposed towards the lobe tips, ca. 0.12 mm broad. [atranorin, zeorin]

Well-developed margins of older apothecia sometime curl inward and nearly conceal the disk, their fimbriate margins resembling miniature insect-trapping leaves of Venus fly trap (*Dionaea muscipula*). The linear, lobulate thalli resemble those of *Anaptychia palmulata*, but the latter species is browner, lacks atranorin in the cortex and has a KOH- reaction, as opposed to the KOH+ yellow reaction of all Ozark taxa of *Heterodermia*.

Occasional, although becoming locally frequent, on lower boles of trees in intact wooded uplands throughout the Ozarks. This species typically grows higher on the bole than does *H. granulifera*.

Heterodermia obscurata (Nyl.) Trevisan
Thallus bluish gray, often with brownish tones in older portions, adnate, with the outer branches sometimes becoming somewhat imbricate, lobes notably convex, <1 mm broad, with frequent side branches and occasional fimbriate dissections at the apices. Soredia abundant, bluish, farinose, in marginal soralia associated with the lobe tips, although often extending to the lobe margins; soralia becoming thickened and somewhat upturned when well developed; lower surface ecorticate, the lower portions of the exposed medullary tissue pale to deep yellow, becoming brownish and fenestrate in age. Rhizines prevailingly marginal, widely scattered, becoming brown to dark, simple to fasciculate, sometime with squarrose branching. Apothecia unknown in Ozark material; pycnidia

on the upper cortex, infrequent, tending to occur near the terminal branch points, ca. 0.1 mm broad, slightly erumpent. [atranorin, zeorin]

The thallus of this species is a darker blue, with more strongly convex lobes, than that of *H. albicans* or *H. speciosa*.

Common, although never abundant in terms of cover, on bases and lower boles of both hardwoods and conifers, typically in lightly shaded situations in intact woodlands. This lichen also rarely occurs on shaded rocks. The thalli are typically smaller and more bluish-gray than thalli of the similar *H. speciosa*.

Heterodermia speciosa (Wulfen) Trevisan
Thallus pale gray to blue-gray, loosely to closely adnate, to 10 cm broad, with abundant linear primary branches ca. 1 mm broad, with abundant farinose soredia predominately occurring in thickened labriform soralia at the lobe tips; esorediate lobe tips in central portions of older thalli with a tendancy to become short fimbriate-dissected. Lower surface corticate, sublustrous, white, sometimes becoming pale tan in older portions of the thallus. Rhizines common, prevailingly marginal, pale, to 1 mm long, often with tiny squarrose branches. Apothecia not seen in Ozark material. [atranorin, zeorin]

Common in light to moderate shade in intact woodlands, growing on lower boles and bases of hardwoods and conifers, and on both carbonate and siliceous rocks -- often growing with mosses when on rocks. Although this species and *H. obscurata* often grow on the same tree, *H. speciosa* consistently shows a predilection for growing closer to the ground than does *H. obscurata*. The thallus of *H. speciosa* is typically larger, and paler mineral gray than that of *H. obscurata*.

Thalli of *H. speciosa* are occasionally infested with *Lichenopeltis heterodermiicola* M.S. Cole & D. Hawksw., which has 8 hyaline, 1-septate oblong-ellipsoid spores per ascus. This fungus appears as a blackish to dark gray, erumpent discoloration of the upper cortex of the *Heterodermia*, especially along the middle portions of the primary lobes. Curiously, this fungus, which was originally described from an Ozark specimen (Cole & Hawksworth 2002) does not occur on any other species of *Heterodermia* in the Ozarks.

HYPERPHYSCIA Müll. Arg. (Physciaceae)

Small foliose lichens with thin thalli and tightly appressed, narrow, nearly confluent lobes; upper cortex greenish, gray, or brown, paraplectenchymatous, lower surface prevailingly pale, lower cortex poorly developed, indistinctly prosoplectenchymatous; true rhizines lacking, rhizine-like projections rare, short, and inconspicuous ecorticate; photobiont *Trebouxia*; apothecia sessile, with a dark brown disk and thalline margin; epithecium brown, hymenium I+ blue, hypothecium hyaline; asci *Lecanora*-type, with 8 brown, thick-walled, ellipsoid, 1-septate spores; pycnidia laminal, immersed, with dark brown apices; conidia filiform, curved; 2 species in the Ozarks.

1. Thallus lacking diaspores; apothecia common . . . . . *H. syncolla*

1. Thallus sorediate; apothecia rare . . . . . *H. adglutinata*

Hyperphyscia adglutinata (Flörke) H. Mayrhofer & Poelt
Thallus inconspicuous, minutely foliose, closely adnate and often appearing confluent with the substrate, brownish to light, greenish, or blackish gray, of nearly confluent to slightly overlapping short-branched lobes typically 0.2-0.3(-0.4) mm broad, with apically expanded, erose to sublobate,

closely adnate, tips to 0.8 mm broad; upper cortex smooth, typically sublustrous; lower surface prevailingly pale to tan, sometimes darkening in central portions of older thalli; upper surface with frequent erose, rounded to elongate, prevailingly laminal soralia to 0.2 × 0.4 mm, with pale to greenish or gray, farinose soredia; apothecia infrequent, the disks typically 0.2 mm broad, with flat to slightly convex brown disks and well-defined thalline margins; paraphyses slender, ca. 1.5 µm broad, simple to sparingly branched, with expanded, brown apical cells about 3 µm broad; ascospores greenish gray, becoming brown in age, 2-celled, thick-walled, elliptical, with rounded to slightly angular lumina averaging 4 µm in diameter, 13-16 × 6.5-7µm; pycnidia uncommon, appearing as rounded, brown, 0.06-0.09 mm broad projections in the upper cortex; conidia gently curved, filiform, 19-23 X < 1 µm.

Occasional on hardwoods and conifers in relatively high light exposures, often in disturbed areas or along clearings and edges. This species is more common in the prairie biomes to the north, west, and east of the Ozarks. Thalli growing in more exposed sites tend to be darker, sometimes becoming nearly black in very exposed habitats. What appears to be this species is also rare on lightly shaded chert fragments.

In the field, *H. adglutinata* can appear nearly identical to some forms of *Phaeophyscia insignis*, which has slightly thicker lobes that do not appear as closely conformable to the substrate, elliptical conidia < 5 µm long, and a paraplectenchymatous lower cortex, with the cells ca. 4-5 µm in diameter, as opposed to the long filiform conidia and poorly defined, loosely hyphal lower surface of *Hyperphyscia*. Additionally, *P. insignis* usually has a few dark rhizines, especially near the lobe tips, and nearly circular soralia sometimes exceeding the width of the lobes.

Hyperphyscia syncolla (Tuck *ex* Nyl.) Kalb
Thallus typically to 5 cm diameter, occasionally larger, greenish to brownish gray or blackish in extremely exposed habitats; lobes thin, tightly adnate and closely conforming to the substrate, often confluent or slightly overlapping; upper surface sublustrous; lobes typically (0.2)0.3-0.4(0.5) mm broad, abundantly branched, especially towards the expanded to 2 mm broad apices; lower surface pale to sometimes darkening towards center, poorly defined and hyphal, infrequently with short rhizine-like projections <0.1 mm long; apothecia common, to 0.8 mm broad, with a ± plane dark brown disk and well-developed thalline margin projecting slightly above the disk; paraphyses simple to sparingly branched, with expanded, often furcate brown tips to 3 µm wide; ascospores thick-walled, 2-celled, greenish gray, becoming brown, 13-17 X 7-8.5 µm, with rounded to slightly angular lumina about 4 µm broad; Pycnidia laminal, often abundant, immersed in the thallus and appearing on the upper surface as brown rounded protuberances <0.1 mm broad; conidia gently curved, filiform, 15-24 X <1 µm.

Locally common throughout the Ozarks, especially on wooded floodplains, successional sites such as overgrown old fields, and along rivers; growing on a variety of hardwoods as well as on *Juniperus*, but most common on neutral barked trees such as *Acer, Ulmus, Celtis, Fraxinus,* and *Liquidambar*.

The thin, slightly shiny, closely adnate thallus appears to "flow" over the surface of the substrate. Central portions of older thalli sometimes break down into aggregations of flattened squamules and appear verruculose to almost areolate.

HYPOCENOMYCE M. Choisy (Biatoraceae)

Small green to brown squamulose lichens with discrete, basally attached squamules on conifer lignum, with a lustrous upper cortex; lower surface pale, not distinctly corticate; photobiont chlorococcoid; apothecia sessile, thalline margin lacking; ascospores simple, ellipsoid; pycnidia sessile, globose; conidia ellipsoid to filiform; 2 species in the Ozarks.

1. Thallus sorediate, P+ red (fumarprotocetraric acid); mature apothecia brown, convex . . . . *H. anthracophila*

1. Thallus not sorediate, P-; mature apothecia black, ± plane . . . . . *H. friesii*

Hypocenomyce anthracophila (Nyl.) P. James & Gotth. Schneid.
Squamules olive green to chestnut brown, to 1 mm, in ± uniformly oriented imbricate mats, slightly convex at maturity, basally attached, at maturity with whitish to locally darkening farinose soredia in labriform soralia along and under the margins of the uplifted, broadened, and short-lobate distal portions of the squamules; young squamules (to ca. 0.4 mm) adnate and esorediate; apothecia uncommon, marginal, reddish brown, ultimately convex, to 0.7 mm broad, epithecium brown, hypothecium pale, ascospores not seen in Ozark material; pycnidia occasional, marginal, sessile, black, globose, ca. 0.08 mm broad; conidia filiform, 8-11 × 0.8 µm. [fumarprotocetraric acid]

Infrequent on old, decorticate charred stumps, logs, and snags of *Pinus echinata* and, more rarely, *Juniperus virginiana* on wooded slopes and ridges in the southern half of the Ozarks.

This species often grows with *Cladonia* squamules, from which it can be difficult to distinguish. Squamules of *H. anthracophila* appear more evenly rounded and consistently sized, with a thickened, almost bullate appearance and distinctly labriform soralia, as opposed to the irregular, typically incised, flattened esorediate to irregularly sorediate squamules of *Cladonia*.

Hypocenomyce friesii (Ach.) P. James & Gotth. Schneid.
Squamules very similar to those of *H. anthracophila*, apothecia prevailingly marginal, black, about 1 mm broad, epithecium and hypothecium brown; pycnidia not seen in Ozark material.

Rare on shaded, decorticate, usually charred old stumps of *Pinus echinata* in wooded uplands, sometimes associated with *H. anthracophila*, which appears somewhat similar in gross aspect.

HYPOTRACHYNA (Vain.) Hale (Parmeliaceae)

Pale gray foliose lichens with moderate lobe widths and squarish, truncate lobe tips not much expanded; lower surface corticate, black with a narrow brown marginal zone, lustrous, with dichotomously branched rhizines becoming progressively smaller towards the margins; photobiont *Trebouxia*; apothecia laminal, sessile, basally constricted and cupuliform, with brown disks, thalline margins and crenulate to sublobulate rims; epithecium brown; hypothecium pale; asci *Lecanora*-type, with 8 simple, hyaline, ellipsoid to rotund spores ca. 10 µm long with slightly thickened walls; pycnidia laminal and immersed, appearing as 0.1-0.2 mm broad circular depressions in the upper cortex, initially brown but becoming black with age; conidia linear to narrowly bacilliform, 5-8 X <0.8 µm, sometimes slightly tapered toward the apices; local species have atranorin in the cortex and lividic acid complex in the medulla; 2 species in the Ozarks. Reference: Hale (1974).

1. Thallus lacking diaspores; apothecia common . . . . . *H. livida*

1. Thallus pustulate, these breaking and appearing sorediate; apothecia infrequent . . . . . *H. pustulifera*

Hypotrachyna livida (Taylor) Hale
Thalli adnate, to 10 cm broad, with closely spaced radiating main lobes typically to 2.5 mm broad, elongate, with frequent divisions and short side branches; lobe apices not strongly expanded, with ± truncate apices; upper cortex lustrous, sometimes with brownish tones towards the lobe tips, initially smooth but becoming regularly wrinkled in older portions, the wrinkles prevailingly transverse to the lobe length; rhizines abundant; apothecia common, to 8 mm broad; pycnidia common, especially towards the lobe tips. [atranorin, lividic & 4-O-methylphysodic acids]

A frequent and characteristic lichen of upper boles and larger branches of acidic-barked trees in intact woodlands throughout the Ozarks, occurring on a variety of hardwoods as well as on *Juniperus* and *Pinus*, and rarely on lightly shaded siliceous rocks. This species is part of a characteristic "late successional" assemblage on older canopy branches in wooded uplands, associated with *Buellia stillingiana, Myelochroa galbina, Usnea strigosa,* and *Vulpicida viridis*.

Smaller thalli of *H. livida* may be difficult to distinguish from *Myelochroa galbina*; the two species are commonly associated. *Hypotrachyna* has an entirely white medulla that reacts KOH+ dingy to purplish brown, dichotomously branched rhizines, and slightly larger and paler lobes, whereas *M. galbina* has a medulla that is locally yellowish and KOH+ yellow to reddish, at least under the apothecia, prevailing simple rhizines that may have furcate tips, and slightly smaller and subtly more bluish gray lobes.

Hypotrachyna pustulifera (Hale) Skorepa
Thalli adnate, to ca. 8 cm broad, with primary lobes to 1.5 mm broad and abundant secondary lobes and short branches; lobe tips truncate and not notably expanded; upper cortex dull to sublustrous, wrinkled and ridges except in the younger portions, with hollow, flattened or inflated, corticate pustules typically 0.5 mm tall common on thallus ridges and margins, these breaking open and appearing soredia-like. Apothecia infrequent, widely scattered, to 6 mm broad; pycnidia local and infrequent. [atranorin, lividic & 4-O-methylphysodic acids]

Local and sporadic throughout the Ozarks, usually occurring on boles and larger branches of softwoods in lightly shaded to exposed conditions in stable natural habitats. This species occurs on all four native softwoods in the Ozarks. In open woodlands with old growth *Pinus echinata*, associates on lower pine boles include *Canoparmelia caroliniana, Chaenothecopsis nana, Cladonia macilenta bacillaris, C. ravenelii, Flavoparmelia caperata,* and *Parmotrema hypotropum*. It can be the dominant lichen on boles of older *Taxodium distichum* associated with swamps and sinkhole ponds. Rarely, this species occurs on hardwoods in similar habitats, including *Vaccinium arboreum*.

This species can be mistaken for pustulose forms of *Myelochroa aurulenta* with a white medulla, which have broader, more rounded lobes, a UV- medulla, prevailingly simple rhizines, and usually a few short axillary cilia, as opposed to the narrower, squarish lobes, UV+ bluish white medulla, dichotomously branches rhizines, and complete absence of marginal cilia in *Hypotrachyna*.

IMSHAUGIA S.L.F. Meyer (Parmeliaceae)

Narrow-lobed pale gray foliose lichens, ours isidiate, with pale, rhizinate lower cortex and thamnolic acid in the medulla (KOH+ instantly deep yellow); photobiont *Trebouxia* (*Myrmecia*?); apothecia unknown in Ozark material, sessile, with thalline margin; asci *Lecanora*-type, with 8 simple, hyaline, ellipsoid spores; pycnidia dark, sessile, prevailingly marginal; 1 species on the Ozarks. Reference: Hinds (1999).

This is the only genus of foliose lichens in the Ozarks that contains thamnolic acid, although there are fruticose and crustose lichens in the region with this substance. Thamnolic acid produces a characteristic and instantaneous deep yellow reaction with KOH; with practice, it is possible to differentiate it from the slightly slower and pale yellow KOH reaction produced by atranorin.

Imshaugia aleurites (Ach.) S.L.F. Meyer
Adnate pale gray thalli to 10 cm broad, but often smaller, with narrow, radiating, typically much-branched lobes to 1 mm broad, with truncate to fimbriate tips; upper cortex smooth, sometimes brownish tinged towards the lobe tips, with abundant, finely cylindrical, simple to branched isidia

to 0.3 mm long, these usually brownish-tipped and becoming sparse towards the lobe apices; lower cortex lustrous, whitish to pale tan, with scattered pale to dark, apically thickened, occasionally branched, slender rhizines to 0.8 mm long; apothecia unknown in Ozark material; pycnidia occasional, sessile, mostly near the lobe apices, marginal or sometimes submarginal, on small marginal lobules, or even on larger marginal isidia, dark brown to black, globose to squat-cylindrical, ca. 0.9 mm broad; conidia hyaline, narrowly linear to medially narrowed and/or apically tapering, 3-4 X 0.6-0.7 µm. [atranorin, thamnolic acid]

Rare and restricted to natural habitats with relatively high light exposures and the presence of old growth conifers, where it grows on both corticate and decorticate *Pinus echinata* and, less frequently on both corticate and decorticate *Juniperus virginiana*. Typical habitats include large bluff and cliff systems, glades, and open old growth pine woodlands.

This is the one of two narrow-lobed isidiate foliose lichens in the Ozarks with a pale lower surface, readily distinguishing it from isidiate species with a black lower cortex, such as *Myelochroa obsessa, Parmelinopsis minarum,* and *P. horrescens*. The other pale isidiate taxon, *Heterodermia granulifera,* has coarse granular subsorediate isidia and a KOH+ red medullary reaction.

IONASPIS Th. Fr. (Hymeneliaceae)

Saxicolous crustose lichens with thin, continuous to areolate thalli; photobiont *Trebouxia*; apothecia immersed, plane to slightly concave, pale to brown or orange, without a thalline margin, but the thallus typically thickened around the apothecium; paraphyses somewhat moniliform; asci *Aspicilia*-type, with I- apical dome and 8 simple, ellipsoid spores; pycnidia not seen in Ozark material, pale, immersed to superficial; conidia bacilliform; at least 2 species in the Ozarks. References: Lutzoni (1990, 1994).

1. Thallus greenish gray to gray; apothecia pale tan to pinkish; epithecium pale (sometimes brownish near exciple), epihymenial crystals absent; ascospores prevailingly < 6.5 µm broad; on shaded siliceous rocks in woodlands . . . . . *I. alba*

1. Thallus yellowish brown to orange; apothecia orangish; epithecium brown, with orangish epihymenial crystals; ascospores prevailingly > 6.5 µm broad; on exposed siliceous rocks in seasonally to permanently moist sites . . . . . *I. lacustris*

Ionaspis alba Lutzoni
Thallus thin, greenish gray to gray, continuous to locally areolate, particularly in the region of the apothecia, somewhat lustrous; apothecia common, prevailingly Caucasian flesh-colored, to 0.5 mm broad, irregularly rounded and sometimes coalescing; epithecium pale or occasionaslly brown near the exciple; hypothecium pale, ascospores narrowly ellipsoid, prevailingly < 6.5 µm broad.

Occasional, but probably overlooked, on lightly shaded siliceous rocks in woodlands, including both small fragments and cobbles, larger boulders, and massive faces of both igneous and chert substrates.

Although Lutzoni (1994) characterizes this species as xerophilous, in the Ozarks it occurs in beds of intermittent streams and on seeping bluff faces as well as in more upland habitats; light to moderate shade appears to be a more consistent habitat characteristic. In addition to this habitat anomaly, Ozark material differs from the typical material described by Lutzoni in the flesh to tan tones of the apothecia which often exceed the 0.3 mm maximum diameter described by him.

Ionaspis lacustris (With.) Lutzoni
Thallus slightly thickened, areolate to rimose, not notably lustrous, yellow-brown to orange; apothecia common, essentially concolorous with the thallus, to 0.4 mm broad, surrounded by a prominently thickened zone of thallus; epithecium brown to orange-brown; hypothecium pale; ascospores ellipsoid, prevailingly > 6.5 µm broad.

Rare and scattered in the southwestern Ozarks, on exposed siliceous rocks in areas with intermittent immersion, such as small depressions in glades and on bluff summits, growing on both massive outcrops and small fragments.

Ecology of Ozark populations is anomalous for the species, which is typically associated with rocky riparian or lacustrine environments. Local material is in more xeric, although seasonally saturated, habitats, and is typically associated with upland species, such as *Porpidia tahawasiana*.

JULELLA Fabre (Arthopyreniaceae)

Crustose fungi with continuous, whitish gray thalli; photobiont absent; perithecia abundant, small, black, subimmersed; asci with apically thickened inner wall and shallow ocular chamber, with 8 hyaline, muriform spores, each with a gelatinous perispore; pycnidia black, subimmersed, with bacilliform conidia; 1 species in the Ozarks. Reference: Harris (1973).

Julella fallaciosa (Arnold) R.C. Harris
Occasional on a variety of hardwoods, usually growing on shaded lower and mid boles in wooded uplands. This species lacks any photobiont, whereas both *Anisomeridium* and *Strigula* have *Trentepohlia*.

KOZARUS R.C. Harris & Ladd *ined.* (Porpidiaceae)

Saxicolous crustose lichens with a thick, pale grayish, ± lustrous, areolate to sublobate thallus; photobiont chlorococcoid?; apothecia initially immersed, becoming sessile, black, plane, usually one per areole; asci *Porpidia* type, with 8 simple, ellipsoid, halonate spores; pycnidia immersed, with bacilliform conidia; apparently monospecific.

Kozarus thelommopsis R.C. Harris & Ladd, *sp. nov.*
Thallus to 200 µm thick, areolate, with broadly flattened marginal lobes, whitish to pale grayish, ± lustrous, KOH+ yellow; medulla P+orange, filled with crystals; apothecia with barely distinguishable margin, initially immersed, ultimately sessile, disk black, epruinose; exciple purplish black at surface, otherwise colorless; epithecium dark, partly brown or purplish and turning redder in KOH, partly dark green and KOH-, HNO_3+ reddish; hymenium colorless or purple streaked above, IKI+ dep blue; hypothecium pale to yellowish brown; ascospores halonate, 12-16 × 5.5-7.5 µm; pycnidia mostly pale, with a dark apex; conidia bacilliform, 6-7 × 0.7 µm. [pannarin?]

Rare on shaded dolomite in the western Ozarks. When first seen, this species resembles an *Aspicilia*, but differs in the non-moniliform paraphyses and smaller spores. The generic name is derived from an anagram of "Ozarks" and the specific epithet alludes to the superficial resemblance to *Thelomma*.

LECANIA A. Massal. (Lecanoraceae)

Saxicolous crustose lichens with thin greenish to olive thalli; photobiont chlorococcoid; apothecia sessile, with thalline margins; asci *Bacidia*-type, with 8 hyaline, ellipsoid, 1-septate spores; pycnidia sessile to immersed, with filiform, often curved, conidia; ? species in the Ozarks but only one mentioned here.

Lecania perproxima (Nyl.) Zahlbr.
Uncommon on mesic, shaded, carbonate substrates, such as mossy moist dolomite outcrops along small streams in ravines.

LECANORA Ach. (Lecanoraceae)

Crustose lichens with powdery, granular, continuous, areolate, or placodioid thalli; photobiont *Pseudotrebouxia*; apothecia sessile, mostly with a well-developed thalline margin; asci *Lecanora*-type, with 8 small, hyaline, ellipsoid, simple spores; pycnidia immersed, with bacilliform to filiform conidia; 23 species in the Ozarks. References: Brodo (1984), Printzen (2001).

1. Saxicolous.

    2. ThallusKOH-, atranorin absent.

        3. Thallus thin and pale to gray or lacking; apothecia to 0.5 mm broad, with elevated, persistent, whitish thalline rims . . . . . *L. dispersa*

        3. Thallus leprose to thick and lobed at the margin, yellowish green (sometimes with dense white pruina); larger apothecia >0.6 mm broad, with thin, yellowish green rims disappearing at maturity.

            4. Thallus leprose, diffuse . . . . . *L.* sp. # 1

            4. Thallus corticate above, placodioid to subfoliose, distinctly lobate.

                5. Thallus without pruina, usually on siliceous rocks; zeorin (or other triterpenoids) present . . . . . *L. muralis*

                5. Thallus mostly covered with dense white pruina, on carbonate-rich substrates; zeorin and triterpenoids absent . . . . . *L. valesiaca*

    2. ThallusKOH+ yellow, atranorin present.

        6. Apothecia uniformly black, immersed; epithecium blue-green . . . . . *L. oreinoides*

        6. Apothecia brown, sessile at maturity; epithecium brownish.

            7. Epithecium P+ orange (pannarin present); hymenium shallowly inspersed with coarse granules . . . . . *L. cinereofusca* var. *appalachensis*

            7. Epithecium P- (pannarin absent); hymenium various.

                8. Hymenium inspersed; only atranorin present . . . . . *L. cenisia*

                8. Hymenium not inspersed; atranorin and other substances present.

9. Thallus thin, continuous; narrow, white to dark prothallus usually present; frequent . . . . . *L. subimmergens*

9. Thallus thick, areolate to ± bullate or sublobate; rare.

10. Zeorin absent; 2'-O-methylperlatolic acid present; apothecial cortex distinct; spores >7 µm broad . . . . . *L. pseudistera*

10. Zeorin present; 2'-O-methylperlatolic acid absent; apothecial cortex lacking or indistinct; < 7 µm broad . . . . . *L. perplexa*

1. Corticolous or lignicolous.

11. Thallus green, leprose, with a conspicuous fibrous white prothallus . . . . . *L. thysanophora*

11. Thallus gray to yellow-green or indistinct, lacking a conspicuous white prothallus.

12. ThallusKOH- (atranorin absent); usnic or isousnic acid sometimes present.

13. Apothecial margins ecorticate and appearing sorediate; apothecia pale tan; thallus well developed, yellow-green; usnic acid present, isousnic acid absent . . . . . *L. strobilina*

13. Apothecial margins not sorediate; apothecia brown, thallus pale or brownish, without yellowish green tints, usnic acid absent, isousnic acid present or absent.

14. On bark or cones of *Pinus echinata*; isousnic acid absent . . . . . *L. minutella*

14. On lignum and weathered boards; isousnic acid present . . . . . *L. saligna*

12. ThallusKOH+ yellow or red (atranorin present, sometimes with norstictic acid); usnic and isousnic acids absent.

15. Sorediate, sterile . . . . . *L. impudens*

15. Without diaspores, fertile.

16. Apothecia often >1.2 mm broad, disks pruinose; thallus or apotheciaKOH+ and/or P+ red (norstictic or protocetraric acid).

17. Disks C+ yellow; norstictic acid present . . . . . *L. subpallens*

17. Disks C-; norstictic acid absent . . . . . *L. caesiorubella glaucomodes*

16. Apothecia to 1 mm broad, disks pruinose or not; thallus and apothecia negative or yellow inKOH and P.

18. Apothecial disk UV+ yellow (lichexanthone); apothecia densely pruinose . . . . . *L. miculata*

18. Apothecia disk UV−; apothecia usually not pruinose.

19. Upper portion of hymenium finely granular inspersed between the paraphyses.

20. Small crystals in epithecium; disks reddish brown; on hardwoods . . . . . *L. hybocarpa*

20. Coarse crystals in and on upper part of hymenium; disks dark brown to almost black; usually on *Juniperus* . . . . . *L. chlarotera*

19. Hymenium not inspersed.

21. Margins of apothecia thick, white, ecorticate, and ± byssoid; zeorin present . . . . . *L. imshaugii*

21. Margins of apothecia thin and corticate; zeorin absent (triterpenoids sometimes present).

22. Apothecia mostly <0.8 mm broad; amphithecium with clumps of large, irregular crystals . . . . . *L. argentata*

22. Apothecia mostly >1 mm broad; amphithecium with small angular crystals . . . . . *L. allophana*

Lecanora allophana Nyl.
Known only from one collection made by William Buck on *Carpinus caroliniana* in a mesic woodland in Oregon County, Missouri. [atranorin, ± triterpenoids]

Lecanora argentata (Ach.) Malme
Known from lightly shaded branches of *Quercus* and (usually decorticate) *Juniperus* at a few sites scattered across the southern Ozarks. [atranorin, ± californin]

Lecanora caesiorubella Ach. ssp. **glaucomodes** (Nyl.) Imshaug & Brodo
Apparently rare; on hardwoods in the southern Ozarks. [atranorin & protocetraric acid]

Lecanora cenisia Ach.
Rare on lightly shaded, massive siliceous rocks, usually in well-drained or protected sites. [atranorin]

Lecanora chlarotera Nyl.
Uncommon on exposed twigs of *Juniperus* in glades and along bluff systems, usually growing on exposed small twigs on apices of branches with no or few needles. [atranorin]

Lecanora cinereofusca H. Magn. var. **appalachensis** Brodo
Uncommon on shaded siliceous rocks, usually sandstone; sometimes growing on massive bluff faces. The type of this variety is from Newton County, Arkansas. [atranorin, pannarin, roccellic acid]

Lecanora dispersa (Pers.) Sommerf.
Common and weedy, often growing in disturbed areas. The characteristic habitat for this species is on calcareous substrates in exposed to lightly shaded sites. It grows on limestone, concrete, and mortar. On concrete, *Caloplaca feracissima* is a nearly constant associate, and *Endocarpon pallidulum* is a common associate.

Lecanora hybocarpa (Tuck.) Brodo
Abundant on a variety of shaded hardwoods in woodlands, usually on the lower and mid boles, but ranging into the canopy, with a predilection for growing in somewhat mesic sites. This species is extremely variable in the degree of thallus development, color, and size, and grows in wet to dry habitats. [atranorin, ± roccellic acid]

Lecanora impudens Degel.
Known from the base of a *Quercus alba* in a wooded upland in Shannon County. [atranorin]

Lecanora imshaugii Brodo
Uncommon, on shaded hardwood boles and branches in mesic habitats, especially narrow, mesic, wooded ravines; mostly in the southern Ozarks. [atranorin, zeorin, ± hypoprotocetraric acid, ± 4-O-methylnotatic acid]

Lecanora miculata Ach.
Rare; known from a few open wooded uplands in southwestern Missouri and northwestern Arkansas, where it invariably grows on *Ulmus alata*. [atranorin, zeorin; lichexanthone in apothecia]

Lecanora minutella Nyl.
Occasional on lightly shaded boles and older cones of *Pinus echinata* in wooded uplands; *Amandinea punctata* and *Lecanora strobilina* are consistent associates. A single collection from the St. Francois Mountain region of southeastern Missouri occurred on lignum of *Juniperus virginiana*.

Lecanora muralis (Schreber) Rabenh.
Common in exposed rocky sites throughout the Ozarks, usually growing on siliceous rocks, but often in areas where substrate acidity is buffered by leaching or splashing from carbonate rocks, such as on chert and sandstone fragments in dolomite glades. More rarely, it occurs on arenaceous dolomite in similar habitats, and even more rarely, it occurs on weathered decorticate wood lying on glades. This species is similar to *L. valesiaca*, but lacks the whitish pruina that nearly obscure the thallus of *L. valesiaca*. Although *L. muralis* reportedly contains psoromic and usnic acids and sometimes fumarprotocetraric acid, Ozark material falls into one of two chemotypes: 1) usnic acid and triterpenoids; and 2) usnic and gyrophoric acids and triterpenoids. There are no apparent ecological or morphological distinctions between these, although the gyrophoric acid chemotype is the more common in the western Ozarks, where it typically grows on small fragments of chert residuum in dolomite glades. [usnic acid & triterpenoids, ± gyrophoric acid]

Lecanora oreinoides (Körb.) Hertel & Rambold
Locally frequent on massive exposures of siliceous rocks, growing on both sandstone and igneous substrates, typically in glades. In the field, this species is morphologically similar to *Buellia spuria*. [atranorin, confluentic acid]

Lecanora perplexa Brodo
Known only from siliceous rocks in the Ozark National Forest of Arkansas, as reported by Brodo (1984). In the Great Lakes region, this species is also corticolous.

Lecanora pseudistera Nyl.
Rare on exposed to lightly shaded siliceous rocks in uplands, mostly in the southern Ozarks. [atranorin, 2'-O-methylperlatolic acid]

Lecanora saligna (Schrader) Zahlbr.
Occasional on decorticate wood just north of the area, and likely to be found in the region. This species grows on logs, stumps, timbers, and even old railroad ties. The inconspicuous thalli are overlooked, especially when dry. Note that this species concept as applied by Purvis *et al.* (1992) contains only atranorin. [isousnic acid]

Lecanora strobilina (Sprengel) Kieffer
Abundant throughout the Ozarks in moderate to high light intensities. This species is perhaps the most common and widely distributed crustose lichen in the region. It occurs on trees all types of trees, as well as on well-drained logs, old wood, and even lightly shaded siliceous rocks. This species is one of the first pioneer species to colonize young canopy branches and small saplings and shrubs invading old clearings. *Lecanora strobilina* also grows on lower boles of older trees if there is

sufficient light intensity. It also occurs on scales of older cones of *Pinus echinata*, invariably associated with *Amandinea punctata*. Most Ozark populations contain zeorin. [usnic acid, ± zeorin]

Lecanora subimmergens Vain.
Locally frequent on shaded sandstone and less commonly on chert boulders, often in mesic sites. This is the most common saxicolous *Lecanora* in the region. [atranorin, zeorin]

Lecanora subpallens Zahlbr. [= *Lecanora caesiorubella* Ach. ssp. *prolifera* (Fink) R. C. Harris]
Common in intact woodlands, in mesic to dry-mesic conditions - typically on lightly shaded boles and branches of hardwoods in extensive woodlands; usually growing on smooth bark in somewhat mesic habitats Most local records are from *Acer rubrum*, *Amelanchier arborea*, *Carya*, *Quercus coccinea*, and *Q. velutina*. [atranorin, norstictic & protocetraric acids, xanthone]

Lecanora thysanophora R.C. Harris *in* R.C. Harris, Brodo & Tønsberg
Locally frequent across the Ozarks, on shaded, usually circumneutral bark of tree boles in mesic woodlands, growing on a variety of hardwoods, especially *Acer* and *Fraxinus*. The thin, yellowish green, leprose thallus with a conspicuous fibrous white prothallus is distinctive. [atranorin, usnic acid, zeorin, ± porphyrilic acid]

Lecanora valesiaca (Müll. Arg.) Stizenb.
Common on exposed, massive carbonate rocks, typically in glades and on bluffs, where it occurs on both limestone and dolomite, typically associated with bright orange apothecia of *Caloplaca*. The densely white-pruinose thallus is distinctive. Ozark populations contain usnic acid only. [usnic acid, ± roccellic acid]

Lecanora sp. # 1
Infrequent on sheltered areas of massive sandstone exposures exposed to high light intensities. In the field this species looks like a species of *Lepraria*. [usnic acid, unknown substance with R_f classes of 4-5/5-6/5]

LECIDEA Ach. *s. lat.* (family?)

Crustose lichens with thin to areolate-squamulose thalli; photobiont *Trebouxia* (?); apothecia sessile, thalline margin absent, asci, with 8 hyaline, ellipsoid, simple spores; pycnidia immersed, with bacilliform conidia; species in the Ozarks. The generic delimitations of this group are taxonomically problematical, and none of the Ozark species are referable to *Lecidea sensu stricto*. All have a ± *Porpidia*-type ascus and seem to require the eventual description of several? new genera.

1. Thallus corticolous, lignicolous, or humicolous.

    2. Corticolous or lignicolous, on wood or bark.

        3. Lignicolous; apothecia strongly convex usually >0.5 mm broad; UV- or UV+ whitish.

            4. Sporodochia present, resembling whitish soralia . . . . . *Lecidea sp.*

            4. Sporodochia absent . . . . . *L. plebeja*

        3. Corticolous; apothecia flat, to 0.4 mm broad; UV+ pinkish (xanthones) . . . [*Pyrrhospora varians*]

    2. Humicolous, on humus, needle litter, or highly organic soil.

5. Thallus pale to gray; apices of paraphyses brownish and notably expanded . . . . . *L. berengeriana*

5. Thallus gray to brown or greenish brown; apices of paraphyses colorless and not notably expanded . . . . . *L. hypnorum*

1. Thallus saxicolous.

6. Thallus of thick brown areoles; apothecia brown; on carbonate rocks . . . . . *L. lurida*

6. Thallus brown or grayish brown, thin and scurfy; apothecia black; on siliceous rocks

7. Hymenium and exciple without granules; on siliceous rocks in uplands . . . . . *L. cyrtidia*

7. Hymenium and exciple with dark granules turning greenish in KOH; in beds of intermittent streams . . . . . *L. ahlesii*

Lecidea ahlesii (Körber) Nyl.
Known from sandstone in and along small shaded intermittent streams in Franklin County, Arkansas and Jackson County, Illinois. Ozark material is referable to var. *ahlesii*.

Lecidea berengeriana (A. Massal.) Nyl.
Rare on lightly shaded humus in the western Ozarks.

Lecidea cyrtidia Tuck.
Occasional on exposed to lightly shaded siliceous rocks, typically growing on small fragments and boulders. This species resembles *Micarea erratica*, which typically has a darker, greenish gray thallus and bluish green epithecium, whereas *L. cyrtidia* has a brownish to grayish thallus and pale brownish epithecium.

Lecidea hypnorum Libert
Occasional on lightly shaded humus derived from *Juniperus* needles; known from scattered localities mostly in the eastern half of the region.

Lecidea lurida (Ach.) DC.
This small, areolate-squamulose lichen grows on weathered, exposed dolomite, usually in exposed areas such as on glades and massive bluffs, at scattered locations across the northern half of the Ozarks.

Lecidea plebeja Nyl.
Uncommon on exposed to lightly shaded conifer wood in the southern Ozarks, becoming rare northward. This species grows on fallen logs and old stumps of both *Pinus* and *Juniperus*.

Lecidea sp.
Thallus olive green, continuous, with white sporodochia resembling small soralia. Apothecia dark brown, sessile, remaining ± flat; margin inconspicuous, not raised, concolorous with disk. Exciple and hymenium streaked with brown; pigment darker/grayer in KOH. Hypothecium dark brown, of intertwined hyphae, darker in KOH. Paraphyses, at least some, expanded at tips to ca. 3 µm with a dark brown cap. Asci *Micarea*-type. Ascospores ovoid, 7-7.5 × 3-4 µm, without an epispore. Sporodochia mostly immersed in thallus, white, exposed part ± hemispherical, ca. 0.1-0.15 mm diam.; conidia borne on short, irregular cells, spherical, colorless, 3-3.5 µm diam.

Occasional on decorticate logs. At first glance one would assume this was a sorediate form of *Lecidea hypnorum* Libert but the apothecia lack blue green granules, the ascospores are smaller and the "soredia" are actually sporodochia.

LECIDELLA Körb. (Lecanoraceae)

Crustose lichens with thin gray thalli; photobiont unicellular, *Chlorella*-like; apothecia sessile, black, thalline margin absent; asci *Lecanora*-type, with 8 hyaline, simple, ellipsoid spores; pycnidia immersed, with filiform conidia; 5 species in the Ozarks, but in the Midwest this genus is poorly understood.

1. Thallus with pale greenish soredia in discrete round soralia . . . . . *L. scabra*

1. Thallus esorediate (sometimes granular isidioid in *L. asema*).

2. Thallus corticolous . . . . . *L. euphorea*

2. Thallus saxicolous.

3. Apothecia remaining immersed . . . . . *L. enteroleucella*

3. Apothecia sessile.

4. Hypothecium brown to reddish brown . . . . . *L. asema*

4. Hypothecium pale to yellowish . . . . . *L. stigmatea*

Lecidella asema (Nyl.) Knoph & Hertel
Known only from sandstone in Ozark County, Missouri. [atranorin (sometimes absent?), xanthones]

Lecidella enteroleucella (Nyl.) Hertel
Occasional on exposed to lightly shaded siliceous rocks through all but the easternmost Ozarks. This species has a pale gray, continuous-areolate thallus with small (ca. 0.2 mm) black apothecia. [xanthones, ± atranorin]

Lecidella euphorea (Flörke) Hertel
Occasional on wood and bark of hardwoods, and rarely on wood of *Juniperus*; occurring through all but the extreme eastern Ozarks. [xanthones]

Lecidella scabra (Taylor) Hertel & Leuckert s. lat.
Known only from a sterile collection from the western Ozarks on sandstone in an open woodland in Sequoyah County, Oklahoma. [atranorin, xanthones, zeorin]

Lecidella stigmatea (Ach.) Hertel & Leuckert
Uncommon at scattered locations, mostly in the southeastern Ozarks. Although this species is considered to be a strong calciphile, most local populations occur on sandstone. [atranorin & zeorin]

LEMPHOLEMMA Körb. (Lichinaceae)

Small black lichens with small lobed squamules or erect, subfruticose terete lobes; photobiont *Nostoc*; apothecia terminal, minute, with an inconspicuous thalline margin; asci ± cylindrical, IKI-, with 8 hyaline, simple, broadly ellipsoid spores; pycnidia not seen in Ozark material, immersed, with bacilliform to ellipsoid conidia; 1 species in the Ozarks.

Lempholemma polyanthes (Bernh.) Malme
Thallus brown, gelatinous, with sessile, plane, chestnut brown apothecia to 0.7 mm broad, the disk with a distinct paler rim; hypothecium golden brown, prosoplectenchymatous; ascospores ca. 23-28 ×10-14 µm.

Known only from mosses over dolomite in the extensive dolomite glade region of southwestern Missouri.

LEPRARIA Ach. (Stereocaulaceae)

Sterile, powdery or granular undifferentiated crusts consisting of granules of fungal hyphae and *Trebouxia* or *Stichococcus*; conidiomata absent; a poorly understood genus with at least 6 species in the Ozarks. For convenience, some morphologically similar species are included in the key. Reference: Laundon (1992).

1. Thallus with distinct yellowish tints.

    2. Thallus bright lemon yellow . . . . . *Chrysothrix*

    2. Thallus dull grayish or brownish yellow to orangish.

        3. Thallus KOH+ deep grape purple (panaric acid derivatives); on siliceous rocks or tree bases . . . . . *L. vouauxii*

        3. Thallus KOH+ reddish to magenta (parietin); on dry sheltered faces of carbonate rocks . . . . . *Caloplaca chrysodeta*

1. Thallus greenish to bluish gray, without yellowish tints.

    4. Thallus diffuse, appearing loosely felty, dark gray-green, containing terpenes only; on shaded, sheltered carbonate rocks . . . . . *Botryolepraria lesdainii*

    4. Thallus thick and compact to diffuse, powdery, bluish, whitish, gray, or green, containing other lichen substances but not terpenes other than zeorin; substrates various.

        5. Thallus containing atranorin,KOH+ yellow.

            6. Thallus P+ red, containing fumarprotocetraric acid . . . . . *L. caesioalba*

            6. Thallus P- or P+ yellow to orangish, fumarprotocetraric acid lacking.

                7. Stictic acid present; thallus P+ orangish, thick, pale greenish gray . . . . . *L. lobificans*

                7. Stictic acid lacking; thallus P+ yellow, thin, pale gray or blue-gray.

8. Thallus KC+ red, containing alectorialic acid . . . . . *L. neglecta*

8. Thallus KC−.

9. Thallus diffuse, bluish gray; well-developed prothallus lacking; usnic acid absent . . . . . *L. caesiella*

9. Thallus compact and distinct, yellowish green; with well-developed fibrous white prothallus; usnic acid present . . . . . *Lecanora thysanophora*

5. Thallus without atranorin,KOH-; corticolous, C-, containing usnic acid and zeorin . . . . . sterile *Lecanora strobilina*?

Lepraria caesiella R.C. Harris
Very common throughout the region, occurring on shaded lower boles and bases of both hardwoods and softwoods. Most Ozark populations are corticolous, although it rarely occurs on shaded siliceous rocks. This species has a distinctive, powdery, thin, pale blue-gray thallus. [atranorin, zeorin]

Lepraria caesioalba (de Lesd.) J. R. Laundon
Occasional on massive siliceous rock exposures in full sun to very light shade, often growing on vertical faces of bluffs and rock exposures in glades. An undescribed species will key here. The thallus is dense and lobate , often with a revolute margin, creating the appearance of a gray foliose lichen or *Normandina*. [atranorin, fumarprotocetraric acid]

Lepraria lobificans Nyl.
Abundant and widely distributed in shaded, somewhat sheltered, sites; on tree bases, carbonate rocks, siliceous rocks, and even on stable, sheltered soil faces along streams. The thick, felty thallus is distinctive. This species and *Botryolepraria lesdainii* are the most shade tolerant leprose lichens in the local flora. Both species typically occur in shade levels unsuitable for most other lichens. [atranorin, stictic acid, zeorin]

Lepraria neglecta (Nyl.) Erichsen
Locally frequent on exposed siliceous rocks in glades and on bluffs. This species resembles *L. caesioalba*, but tends to occur in more exposed sites. The thallus of *L. neglecta* is KC+ red, while that of *L. caesioalba* is KC-. [alectorialic acid]

Lepraria vouauxii (Hue) R.C. Harris
Local in sheltered, high light intensity sites on massive siliceous rock exposures, especially sandstone; known from a single corticolous collection. This species usually occurs in association with glades. The thallus is unevenly suffused with grayish yellow, and consists of aggregations of leprose granules averaging 0.1-0.3 mm in diameter. This species produces a distinctiveKOH+ grape-purple reaction, although in Great Britain Purvis *et al.* (1992) consider this taxon to beKOH-. This taxon is sometimes placed in a separate genus, as *Leproloma vouauxii* (Hue) J.R. Laundon. [unknownKOH+ deep purple compound with R_f class of 1/2/1, possibly 6-methylpannaric acid or 6-methyloxypannaric acid]

LEPTOGIUM (Ach.) Gray (Collemataceae)

Gelatinous lichens with ± lustrous, lead-gray to brown thalli, upper cortex cellular; photobiont *Nostoc*; apothecia sessile, laminal, with thalline margins; asci with apical dome staining I+ pale, with an I+ dark blue axial tube, with 8 hyaline septate or submuriform to muriform spores; pycnidia rare, laminal to marginal, with bacilliform conidia; 12 species in the Ozarks. Reference: Sierk (1964).

1. Thallus densely white-tomentose beneath . . . . . *L. hirsutum*

1. Thallus not tomentose.

2. Thallus mostly crustose, granular; terricolous . . . . . *L. byssinum*

2. Thallus foliose; rarely terricolous.

3. Thallus not isidiate; lobe margins and apices not fimbriate-dissected into isidioid segments.

4. Upper surface notably wrinkled.

5. Thallus gray; lobes distinct; apothecia prevailingly laminal . . . . . *L. corticola*

5. Thallus brown; lobes anastomosing; apothecia prevailingly marginal to submarginal . . . . . *L. chloromelum*

4. Upper surface not wrinkled.

6. Lobes linear, the larger apothecia usually broader than the lobes on which they are located; on massive carbonate rock escarpments . . . . . *L. apalachense*

6. Lobes rotund, prevailingly broader than the apothecia; on mossy rocks and tree bases . . . . . *L. juniperinum*

3. Thallus isidiate and/or lobe apices and margins fimbriate-dissected into isidioid segments.

7. Upper cortex with distinct longitudinal wrinkles or ridges.

8. Thallus lead-gray, ± flattened, with fine, low wrinkles . . . . . *L. austroamericanum*

8. Thallus brown to gray-brown, often irregularly convolute or with upturned lobe tips, with coarse ridge-like wrinkles.

9. Thallus with fused overlapping lobes prevailingly more than 1 mm broad; lobe tips entire; isidia granular, mostly laminal . . . . . *L. millegranum*

9. Thallus with narrow, discrete lobes <1 mm broad; lobe tips lacerate-fringed; isidia narrowly cylindrical . . . . . *L. lichenoides*

7. Upper cortex essentially smooth.

10. Thallus minutely foliose, the central portions appearing subcrustose; lobes < 1 mm broad; rare . . . . . *L. subtile*

10. Thallus distinctly foliose throughout; lobes mostly > 1 mm broad; common.

11. Thallus lead-gray; apothecia very rare; lobes typically >1.5 mm wide . . . . . *L. cyanescens*

11. Thallus brown to dark blackish gray; apothecia frequent; lobes mostly to 1.5 mm wide . . . . . *L. dactylinum*

Leptogium apalachense (Tuck.) Nyl.
Local on very lightly shaded limestone and dolomite bluffs and outcrops. This species has narrower, darker lobes than the thalli of species of *Collema* which can appear similar, such as *C. polycarpon*.

Leptogium austroamericanum (Malme) C. W. Dodge
Occasional in woodlands in somewhat mesic microhabitats, on shaded tree bases and shaded, usually mossy, rocks.

Leptogium byssinum (Hoffm.) Nyl.
Known only from Hercules Glades Wilderness Area in Taney County, Missouri, as cited by Wetmore (1992).

Leptogium chloromelum (Ach.) Nyl.
Rare on lightly shaded to exposed hardwoods, such as along glade margins.

Leptogium corticola (Taylor) Tuck.
Occasional on shaded hardwoods in woodlands, and less commonly on *Juniperus* or even shaded rocks or humus in mesic sites.

Leptogium cyanescens (Rabenh.) Körb.
Common on lower boles of hardwoods and *Juniperus* in woodlands, and occasionally on mossy rocks. In the Ozarks, rare individuals of this species can have an olive brown thallus evocative of a *Collema*; forms with pale apothecia are also known from the region.

Leptogium dactylinum Tuck.
Occasional and widely distributed through the Ozarks, on shaded, moist, usually mossy rocks, often along streams or in ravines, as well as on the bases of hardwoods and *Juniperus* in heavily shaded sites and occasionally on soil in rocky areas with light shade. This species grows on both carbonate and siliceous rocks, as well as on mosses. This species has a smaller, darker thallus, with more abundant apothecia, than does *L. cyanescens*.

Leptogium hirsutum Sierk
Occasional in shaded mesic habitats with moderate light intensities, on mossy rocks, tree bases, and also on dolomite in woodlands and along borders of glades. This species is very similar to and often confused with *L. burnetiae* C.W. Dodge, which has cylindrical, often branched isidia, as opposed to the granular isidia of *L. hirsutum*.

Leptogium juniperinum Tuck.
Uncommon on shaded, mossy substrates, including tree bases, and both carbonate and siliceous rocks; rarely on stable, lightly shaded humus over rocks.

Leptogium lichenoides (L.) Zahlbr.
Frequent on lightly shaded, mossy outcrops of carbonate bedrock, and rarely on shaded tree bases or lightly shaded, mossy, siliceous rocks.

Leptogium millegranum Sierk
Frequent on exposed to lightly shaded boles of hardwoods and *Juniperus* in wooded uplands and along glade margins, and rarely on lightly shaded siliceous rocks in wooded uplands.

Leptogium subtile (Schrader) Torss.
Known only from a small stream ravine in dolomite bedrock in an extensive dolomite glade in Ozark County, Missouri.

LICHENOTHELIA D. Hawksw. (Lichenotheliaceae)
Lichenologist 13: 142. 1982. Type: *L. scopularia* (Nyl.) D. Hawksw. (*Rinodina aterrima* Kremp. ex Anzi).

Saxicolous fungi forming extensive black stains on moist rock, mostly sterile?; photobiont absent; ascomata perithecioid; asci fissitunicate with 8 brown 1-septate spores; ? species in the Ozarks. Reference: Henssen, 1987.

Lichenothelia is included here as all of us have probably puzzled over the numerous black patches on moist rocks. The probabilities are that many of them are this non-lichenized microfungus. Seemingly rarely fertile but under the dissecting microscope ascomata (tiny black bumps) sometimes can be found. These, upon crushing, are found to contain brown, 1-septate ascospores. Even then identification to species is virtually impossible (see Henssen, 1987). At least some species of *Lichenothelia* may prove congeneric with *Lichenostigma*.

LICHINA C. Agardh (Lichinaceae)

Small brown to black, spreading, fruticose gelatinous lichens, marine or semiaquatic (in Ozark species); photobiont *Calothrix* or *Dichothrix*; apothecia terminal with thalline margin, arising from pycnidia; asci with 8 ± globose spores; conidia bacilliform.

Lichina willeyi (Tuck.) Henssen
Known only from a single occurrence on rhyolite in the in the southeastern Missouri Ozarks.

LICHINELLA Nyl. (Lichinaceae)

Saxicolous gelatinous lichens with rounded, subimbricate to strap-like thalli, the lobes sometimes with slightly raised or thickened margins; photobiont *Xanthocapsa*; apothecia small, immersed in the thallus; asci with 8 simple, hyaline, broadly ellipsoid spores; 3 species in the Ozarks (see also discussion under *Thyrea*).

1. Thallus fruticose, with ± cylindrical lobes forming dense clumps . . . . . *L. stipatula*

1. Thallus ± foliose or umbilicate.

    2. Thallus foliose-squamulose with lobes ± erect usually in umbilicate clumps; older lobes with granular surface . . . . . *L. nigritella*

    2. Thallus umbilicate forming distinct cushions, without deeply cut lobes, smooth or essentially so . . . . . *L. minnesotensis*?

Lichinella minnesotensis (Fink) Essl.?
Known only from lightly shaded dolomite in a small ravine within a massive dolomite glade in southwestern Missouri.

Lichinella nigritella (Lettau) Moreno & Egea
Common on massive dolomite exposures on glades, bluffs, and exposed outcrops, often occurring as scattered individual thalli.

Lichinella stipatula Nyl.
Known only from low sandstone bluffs along a small stream in Cherokee County, Oklahoma.

LITHOTHELIUM Müll. Arg. (Pyrenulaceae)

Inconspicuous, corticolous crustose lichens with thin, pale grayish to greenish thalli; photobiont *Trentepohlia*; perithecia partially immersed to immersed, black, somewhat carbonaceous, the ostioles lateral or angled; asci fissitunicate, with 8 hyaline or brownish, somewhat fusiform, multi-septate spores; 5 species in the Ozarks.

1. Spores brown.

    2. Spores 3-septate . . . . . *L. phaeosporum*

    2. Spores 5+ -septate.

        3. Spores > 50 µm long . . . . . *L. macrosporum*

        3. Spores to 45 µm long . . . . . *L. septemseptatum*

1. Spores hyaline.

    4. Spores mostly > 20 µm long . . . . . *L. hyalosporum*

    4. Spores to 20 µm long . . . . . *L. illotum*

Lithothelium hyalosporum (Nyl.) Aptroot
Known only from *Carya* in a mesic woodland in Barry County, in extreme southwestern Missouri.

Lithothelium illotum (Nyl.) Aptroot
Uncommon on shaded lower boles of *Fraxinus americana*, usually in mesic sites such as along small streams and in ravines. This species also occurs rarely on other hardwoods and appears to be restricted to the eastern third of the Ozarks.

Lithothelium macrosporum (R. C. Harris) Aptroot
Known from a few collections from shaded lower boles of trees, growing on *Fraxinus americana* and *Quercus alba* in deeply shaded, mesic habitats.

Lithothelium phaeosporum (R. C. Harris) Aptroot
Infrequent on shaded bases of *Fraxinus americana*, usually in ravines with small perennial creeks; rarely on other hardwoods. This lichen may be overlooked and more common than existing records indicate; it is known from scattered localities in the eastern and southern Ozarks.

Lithothelium septemseptatum (R.C. Harris) Aptroot
Rare, known from a single collection on hardwoods.

LOXOSPORA A. Massal. (Ophioparmaceae)

Crustose lichens with continuous, pale gray,KOH+ deep yellow thalli with abundant isidioid hollow pustules and prominent pale fibrous prothallus; photobiont *Trebouxia*; 1 species in the Ozarks. Reference: Brodo and Culberson (1986).

Loxospora pustulata (Brodo & W. L. Culb.) R. C. Harris
Common and locally abundant in mature woodlands, growing on shaded tree boles, decorticate fallen logs, and lightly shaded siliceous rocks. This species resembles a *Pertusaria* at first glance, but the abundant pustules are diagnostic. Indeed, some Ozark collections have poorly developed asci that appear to be identical to those of *Pertusaria*. [thamnolic acid, ± atranorin, ± elatinic acid, ± squamatic acid]

Skyttea radiatilis R. Sant., Etayo & Diederich is an uncommon parasite that forms erumpent, pinkish brown patches on *Loxospora* thalli.

MARONEA A. Massal. (Fuscideaceae)
Flora 39: 291. 1856. Type (monotype): *M. berica* A. Massal. [= *Maronea constans* (Nyl.) Hepp]

Crustose lichens with small, scattered, superficial, olive-gray or darker thalli; photobiont chloroccoid; apothecia sessile with rather thick thalline margin, dark brown disk, branched, easily separable paraphyses; asci *Fuscidea*-type with numerous, small, colorless, nonseptate spores; alectorialic acid (or divaricatic acid in extralimital species); 1 species in the Ozarks. Reference: Magnusson (1934b).

Currently three species of *Maronea* are recognized in North America. Harris (in review) has tentatively determined that there may be only a single species, adopting the name *M. polyphaea*, for it. North American material has previously been determined as *Maronea constans* which differs from *M. polyphaea* in being generally larger in all respects, in having an inspersed hymenium and in containing divaricatic acid. Additional material will have to be investigated to confirm or deny the occurrence of *M. constans* in North America.

Maronea polyphaea H. Magn.
Thalli mostly occurring as small, separate patches, mostly less than 1 cm in longest dimension, occasionally several fusing, gray-green, matt, continuous, rugose or ± bullate, to 150 µm thick; prothallus sparse, white or not evident; cortex colorless, amorphous to weakly cellular, thin, ca. 10-15 µm thick; medulla white, KOH-, C-, KC+ red, PD- or yellowish (reactions sometimes spotty and variable in intensity, especially in specimens from shade which apparently have lower concentrations of lichen acids). Apothecia sessile, crowded to scattered, 0.5-1.0 mm across; disk dark brown, with sparse, ± coarse, white pruina; margin rather thick, raised, concolorous with thallus, with cellular cortex, ca. 25-35 µm thick, distinct white medulla, and medulla/algal layer 50-75 µm thick. Hymenium not inspersed, ca. 70-90 µm thick, colorless below, upper ca. 20 µm olive-brown (some pigment in gel matrix, thin sheath of paraphyses tips darker brown). Paraphyses irregular, branched, easily separable, with tips intricately intertwined forming ± distinct epihymenium of short, very irregular branches, with cells ± enlarged. Asci cylindrical to weakly obclavate, 60-80 x 15-20 µm. Ascospores broadly ellipsoid or ± oblong, sometimes pinched in the middle, 4-6 x 2.5-4 µm. Pycnidia colorless, immersed, ± globose, ca. 0.1 mm across. Conidia fusiform or narrowly ellipsoid, 3 x 1.5 µm. [alectorialic acid]

Common in the extensively wooded regions of the Ozarks and sporadically westward into Oklahoma; on exposed twigs and branches of canopy hardwods and younger trees along woodland edges and

glade margins, with few collections from boles. Many of the collections, both in the Ozarks and elsewhere, come from acid glades but it has also been collected in more continuous forest types. With the exception of a collection from a decorticate juniper branch and a fallen pine branch, the species occurs on hardwoods, mostly *Quercus*. The species is known to us from New Hampshire and Maine south to South Carolina and northern Alabama, Kentucky and the Ozarks. Interestingly it has not yet been seen from west of the Appalachians north of the Kentucky-Ozark axis.
Maronea polyphaea is most likely to be confused initially with species of *Rinodina*. Under the dissecting microscope a quick KC test on the stark white medulla (apothecial medulla often best reaction) will identify *Maronea polyphaea* as there is no North American *Rinodina* on bark which reacts KC+ red. A section of the apothecium will, of course, reveal colorless, nonseptate ascospores, many to the ascus in *Maronea*, brown, 1-septate, eight to the ascus in *Rinodina*.

MEGASPORA (Clauz. & Roux) Hafellner & V. Wirth

Crustose lichens with a thin, continuous, gray thallus; photobiont chlorococcoid; apothecia subimmersed, with a black disk; asci with an IKI+ pale blue apical dome, with 8 broadly ovoid spores; pycnidia unknown in Ozark material, with bacilliform conidia; 1 species in the Ozarks.

Megaspora verrucosa (Ach.) Hafellner & V. Wirth
Uncommon on the bases and lower boles of hardwoods, usually *Quercus*, in wooded uplands; scattered through the southeastern two thirds of the Ozarks.

MELASPILEA Nyl. (Patellariaceae)

Corticolous crustose lichens with thin whitish thalli; photobiont *Trentepohlia*; apothecia sessile to subimmersed, black; asci I-, with a thickened apex and ocular chamber, with 8 hyaline to slightly brownish, 1-septate, ellipsoid spores somewhat constricted at the septum; pycnidia with elongate, ± straight conidia; 1 species in the Ozarks.

Melaspilea arthonioides (Fée) Nyl.
Rare on shaded boles of trees in mesic areas, especially in sites with moderately high light intensities, such as along the margins of fens and spring branches and other areas with permanently high humidity levels and isothermal waters with a buffering effect on seasonal temperature extremes.

MICAREA Fr. (Micareaceae)

Small crustose lichens with thin, granular or inconspicuous thalli; photobiont green, reported to be of thin-walled, often paired cells 4-7 µm in diameter; apothecia small, sessile, lacking a thalline margin; asci with I+ blue apical dome and darker apical tube, with 8 hyaline, simple to 3-septate spores; pycnidia immersed to subemergent, with three conidia types: macroconidia filiform to ellipsoid, simple to septate; mesoconidia ovoid to bacilliform; microconidia short bacilliform; 6 species in the Ozarks.

1. Spores 3-septate; thallus C+, KC+ reddish (gyrophoric acid) . . . . . *M. peliocarpa*

1. Spores usually simple or 1-septate; thallus C-, KC- (no lichen substances).

2. Saxicolous.

3. Apothecia dark gray to black; hypothecium dark brown . . . . . *M. erratica*

3. Apothecia pale to orange brown; hypothecium yellow to pale brown . . . . . *M. lithinella*

2. Corticolous or lignicolous; hypothecium pale.

4. Pycnidia black, often stipitate . . . . . *M. misella*

4. Pycnidia pale to grayish, sessile or immersed . . . . . *M. prasina*

Micarea erratica (Körb.) Hertel, Rambold & Pietschm.
Occasional on exposed to lightly shaded siliceous rock fragments in wooded uplands, old fields, and along stable embankments. A typical habitat is sandstone or chert fragments on sparsely vegetated ridges in wooded uplands. The thallus is usually dark gray, with abundant, small black apothecia. *Fellhanera silicis* appears identical in the field, but has 4-celled ascospores.

Micarea globulosella (Nyl.) Coppins
Known from decorticate and dead branches and logs of hardwoods, as well as from pine bark and cones, in the southern half of the Ozarks, barely extending northward into southernmost Missouri.

Micarea lithinella (Nyl.) Hedl.
Known only from a few scattered locations across the Ozarks, growing on siliceous rocks, usually in light shade. This cryptically colored, diminutive lichen is easily overlooked and probably more common in the region than the few known records would indicate.

Micarea misella (Nyl.) Hedl.
Known only from decorticate hardwood and *Juniperus* logs at a few sites in the southeastern Missouri Ozarks.

Micarea peliocarpa (Anzi) Coppins & R. Sant.
Occasional, and easily overlooked in shaded sites, on siliceous rocks and on mosses over siliceous rocks; rarely on decorticate *Juniperus*. The apothecia range from black to nearly pure white in deeply shaded habitats. [gyrophoric acid (sometimes only in trace amounts)]

Micarea prasina Fr.
Occasional, typically growing on rotting wood and decorticate logs in exposed to lightly shaded sites; uncommonly on soil or humus. The epithecium is KOH+ violet.

MONOBLASTIA Riddle (Monoblastiaceae)
Riddle, Mycologia 15: 70. 1923. Type: *M. palmicola* Riddle

Small crustose lichens, with immersed thallus; photobiont *Trentepohlia*; ascomata perithecioid, pore eccentric or central, paraphyses branched and interconnected; asci cylindrical fissitunicate with a broad apical chamber with eight colorless, simple ascospores, with granular to spinose ornamented wall, colorless; microconidia elliptical; macroconidia lacking. 1 species in the Ozarks. Reference: Harris (1995).

Monoblastia sp. 44399
Known from a single, poor collection on sandstone. It is close to *M. buckii* R. C. Harris but has larger ascospores.

MYCOCALICIUM Vain. (Mycocaliciaceae)

Crustose non-lichenized fungi with no apparent thallus, or with an indistinct lightened zone on bark or wood; photobiont absent; apothecia dark, stipitate; asci two-walled, with an ocular chamber, I-, with 8 brownish to greenish, ellipsoid, simple ascospores, asci disintegrating after spores have matured, but not forming a mazaedium; pycnidia with short curved conidia; 4 species in the Ozarks. Reference: Tibell (1975, 1996).

1. Ascomata with notably incurved margin; outer surface of exciple with thin layer of greenish yellow pruina . . . . . *M. calicioides*

1. Ascomata margins not incurved; exciple not pruinose.

    2. Tissue at base of exciple with thin-walled, ± isodiametric cells 8-13 µm diameter . . . . . *M. albonigrum*

    2. Tissue at base of exciple with thick-walled, cylindrical to isodiametric cells 4-6 µm diameter.

        3. CapitulumKOH+ dirty reddish changing to yellowish; on *Juniperus* or rarely *Pinus* *M. ozarkanum*

        3. CapitulumKOH-; on hardwoods or *Pinus* . . . . . *M. subtile*

Mycocalicium albonigrum (Nyl.) Fink
Occasional on bark and lignum of hardwoods; particularly associated with standing decorticate *Quercus* snags in wooded uplands.

Mycocalicium calicioides (Nadv.) Tibell
Apparently rare; known from weathered, old, decorticate wood of *Juniperus virginiana* in exposed to very lightly shaded sites in several southeastern Missouri sites. A further undescribed *Mycocalicium* has been collected just outside the boundaries of the Ozarks in Osage County, Oklahoma, on oak wood. It is close to *M. calicioides* in that the upper stalk is reddish and KOH+ purple. However, the exciple is epruinose, smooth and not incurved forming a narrow mouth and the ascospores are possibly slightly smaller than in *M. calicioides*. The dryish prairie border region seems to a center of diversity for *Mycocalicium*.

Mycocalicium ozarkanum R.C. Harris & Ladd *sp. nov.*
Apothecia dark brown to brown-black, 0.5-1.1 mm tall. Capitulum narrowly to flattened obconical, 0.2-0.5 mm diam., with a new capitulum often regenerating from surface of an old, moribund capitulum forming a swollen base (looking like an apophysis), KOH+ dirty purplish red to red brown, dissolving and turning dirty orangish yellow to yellow as pigment becomes diluted, HNO_3-. Exciple dark brown, usually well developed; hyphae indistinct with ± elongate cells. Hymenium colorless to pale olive yellowish. Hypothecium conspicuous, cone shaped, pale under dissecting microscope, pale brownish or greenish in section; hyphae loosely intertwined, often containing pale yellow pigment "crystals" (presumably giving rise to the KOH reaction). Stalk ± shiny, 0.1-0.15 mm diam., brown outside, slightly paler toward the center, consisting of intertwined periclinal hyphae, sometimes containing yellowish "crystals" in the uppermost part. Asci cylindrical, with uniseriate, ± obliquely arranged spores; apex uniformly thickened, without canal. Ascospores dark brown, broadly fusiform to almost ellipsoid, with ends usually ± pointed, 7-8.5(-10) × 3.5-4(-4.5) µm; no ornamentation seen. Associated pycnidia with colorless, curved or uncinate conidia, 8-12 × ca. 1.0 µm

Occasional on weathered wood of *Juniperus virginiana* in exposed to lightly shaded sites; also known from a single occurrence on wood of *Pinus echinata*.

Mycocalicium subtile (Pers.) Szat.
Frequent on weathered, well-drained, decorticate logs and standing decorticate snags of both hardwoods and softwoods, growing on sound wood. This species typically occurs in wooded uplands.

MYCOGLAENA Höhn. (Micropeltidaceae)

Corticolous crustose non-lichenized fungi with thin, pale, silvery thalli; photobiont absent; ascomata perithecium-like, with blue-green walls; asci with truncate apex, with 8 ellipsoid to subfusiform, hyaline, 3-septate to submuriform spores; 2 species in the Ozarks. Although not lichenized, these taxa resemble lichens and have traditionally been treated in lichen floras. Reference: Harris (1973).

1. Spores submuriform, with some cells longitudinally divided; on a variety of hardwoods . . . . *M. meridionalis*

1. Spores 3-5-septate, without longitudinal septations, or rarely with a single cell longitudinally divided; on *Quercus* . . . . . *M. quercicola*

Mycoglaena meridionalis (Zahlbr.) Szatala
Occasional on small, smooth-barked twigs in high light intensities, typically on exposed branch tips of both larger trees and young trees and shrubs in old fields and along woodland edges. This species is more common in the rangelands and agricultural regions of Missouri and Arkansas. At first glance, the continuous, thin, silvery thallus of this species resembles *Arthonia quinteria*, but the ascomata of *Mycoglaena* are larger and more regular.

Mycoglaena quercicola R. C. Harris
Occasional on young, smooth, canopy twigs of *Quercus*, growing on *Q. coccinea*, *Q. marilandica*, *Q. rubra*, and *Q. velutina*.

MYCOPORUM Flot. *ex* Nyl. (Mycoporaceae)

Corticolous crustose fungi with thin, brownish gray, continuous thalli; photobiont absent; ascomata sessile to partially immersed, rounded, dark, each containing several perithecia-like locules with separate ostioles; asci subglobose, I-, with 8 brownish, ellipsoid, septate to muriform spores; conidiomata unknown; at least 3 species in the Ozarks.

1. Ascospores 2(4) celled, lacking longitudinal septa . . . . . *M. sparsellum*

1. Ascospores muriform.

    2. Ascospores > 30 µm long; on hardwoods . . . . . *M. pycnocarpoides*

    2. Ascospores < 30 µm long; on lignum or *Juniperus* . . . . . *M. acervatum*

Mycoporum acervatum R.C. Harris
Rare on wood of *Juniperus*; known from a few sites in the western and eastern Ozarks.

Mycoporum pycnocarpoides Müll. Arg.
Occasional on lightly shaded tree boles in extensive woodlands, usually on upland slopes. *Quercus coccinea* is a preferred substrate in the eastern Ozarks, but other substrates include *Carya, Cornus, Acer* and *Celtis*.

Mycoporum sparsellum Nyl.
Known only from a single collection from southwestern Missouri, growing on twigs of *Vaccinium arboreum*.

MYELOCHROA (Asahina) Elix & Hale (Parmeliaceae)

Light to bluish gray foliose lichens with small to medium sized lobes and a black lower cortex with a brown marginal zone and abundant simple to squarrosely branched rhizines; short dark cilia sometimes present near lobe axils; cortex containing atranorin; medullary tissue commonly pigmented pale yellow, at least in portions of the thallus; apothecia sessile, with plane brown disks and a thalline margin; epithecium brown; hypothecium pale; photobiont *Trebouxia*; asci *Lecanora* type, with 8 simple, hyaline ellipsoid spores; pycnidia laminal, immersed, with dark apices; conidia simple, linear; 3 species in the Ozarks.

1. Thallus without diaspores; apothecia common; typically on upper boles and twigs in exposed to lightly shaded conditions . . . . . *M. galbina*

1. Thallus isidiate or sorediate; apothecia rare; typically saxicolous or on lower, more shaded portions of trees.

    2. Thallus sorediate, lobe tips often 3 or more mm broad; corticolous or saxicolous . . . . . *M. aurulenta*

    2. Thallus isidiate; lobe tips <2 mm broad; saxicolous on siliceous rocks, rarely corticolous . . *M. obsessa*

Myelochroa aurulenta (Tuck.) Elix & Hale
Adnate foliose lichens to 15 cm broad, with the main lobes 1-2.5 mm broad, widening in the distal half, and irregularly branched into short secondary lobes; lobe tips ± rotund, occasionally with a fine white pruina, often darker gray or brown-tinged, with a distinct, lustrous, dark margin; a few short dark cilia typically present near some lobe axils; soredia laminal, abundant, irregularly rounded, arising from single to massed, friable, subpustulate cortical eruptions, with a whitish- to yellowish-gray cast; rhizines prevailingly simple to apically furcate, usually with at least a few on the older portions of the thallus with distinct squarrose branches; apothecia and pycnidia not seen in Ozark material. [atranorin, terpenes, usually with secalonic acid A]

Common in shaded habitats throughout the Ozarks, usually in more deeply shaded or somewhat mesic conditions, growing on a wide range of hardwoods, as well as on conifers and both siliceous and carbonate rocks. Corticolous specimens usually occur on the bases and lower boles.

The medulla of Ozark specimens is often white nearly throughout; usually at least a thin layer immediately under the soredia is yellowish. Depending on their degree of development, the soredia range from farinose to pustulate in appearance. Pustulate individuals may resemble *Hypotrachyna pustulifera*, but the latter species has a UV+ bluish white medulla, simple rhizines, and narrower lobed. Two sorediate species of *Canoparmelia* have narrow, eciliate lobes and uniformly simple rhizines: *C. crozalsiana* has a distinctly ridged upper cortex and contains stictic acid, whereas *C. texana* is paler, with small round soralia and contains divaricatic acid. Older herbarium specimens often become brownish.

Myelochroa galbina (Ach.) Elix & Hale
Compact, closely adnate, pale gray foliose lichens to 7 cm broad, with closely juxtaposed to slightly overlapping lobes creating the appearance of a continuous thallus; lobes 1-2 mm broad, much branched and slightly expanded distally, dividing at the apices into short, rounded to subtruncate tips, rarely with a few short dark cilia near the lobe apices, the upper cortex sometimes slightly rugose; apothecia abundant , sessile, basally constricted, initially cupuliform but ultimately ± plane, with a thin thalline margin not forming a significant rim above the 2-6 mm broad brown disks; medulla pale yellow to white, but usually yellow in the medulla of the apothecial margins and immediately beneath the apothecia; lower surface with abundant short, dark, simple to apically furcate or coalescing rhizines; ascospores broadly ellipsoid, with slightly and evenly thickened walls, 8-10 × 5.5-7 µm; pycnidia common, prevailingly near the lobe tips, the exposed dark apices 0.06-0.08 mm broad; conidia ca. 6-7 × <1 µm. [atranorin, galbinic acid, secalonic acid A, terpenes]

A common and characteristic species of canopy branches of intact woodlands throughout the Ozarks, occurring on a wide range of hardwoods, but with a predilection for the red oak group (*Quercus coccinea, Q. marilandica, Q. rubra, Q. shumardii, Q. velutina*). Very rarely, this species occurs on lightly shaded siliceous rocks in wooded uplands.

This species closely resembles and is often confused with *Hypotrachyna livida,* which is a frequent associate. *Myelochroa galbina* has a smaller, often slightly darker thallus, more irregular and sometimes wrinkled lobes, and almost always has areas of yellowish medulla with a KOH+ yellow to reddish reaction, at least in the thalline margins of the apothecia. *Hypotrachyna livida* has larger, paler, more regular and smooth lobes, and uniformly white medullary tissue that reacts KOH+ lavender purplish. Rhizines of *M. galbina* are simple to apically furcate, while *H. livida* usually has some rhizines with sparse dichotomous branches.

Myelochroa obsessa (Ach.) Elix & Hale
Narrow-lobed, closely adnate, gray to bluish gray foliose lichens to 8 cm broad, with a brownish cast near the darkened margins, lobes typically to 1 mm broad, continuous to overlapping, with frequent furcations and short branches, the rounded tips with numerous truncate lobes; marginal lobules often present; isidia common, cylindrical, ca. 0.1 mm broad, to 0.6 mm tall, with blunt, brownish apices, occasionally branched or furcate; medulla pale yellow, at least locally in areas immediately beneath the upper cortex; rhizines abundant, short, simple to furcate; apothecia rare, to 1.5 mm broad, the thalline margin typically isidiate; pycnidia usually present, but mostly solitary and widely separated, the exposed dark apices to 0.9 mm broad; conidia ca. 6-7 × <1 µm. [atranorin, galbinic acid, secalonic acid A, terpenes]

Characteristic of massive, lightly shaded, siliceous rocks in intact woodlands throughout the Ozarks, occurring on sandstone, orthoquartzite, chert, rhyolite, and granite. Common associates include *Flavoparmelia baltimorensis, Lecanora subimmergens, Loxospora pustulata,* and *Pertusaria plittiana*. This species also occurs rarely on lightly shaded lower boles of hardwoods in similar habitats. Hedrick's (1934) description of *Parmelia finkii* from a type specimen collected in Wayne County, Missouri, is referred here; the type collection is corticolous.

If the areas of yellowish medulla were overlooked, this species might be confused with *Parmelinopsis minarum,* which has slightly narrower isidia and contains gyrophoric acid in the medulla, reacting KOH-, C+ and KC+ reddish, as opposed to the KOH+ yellow to reddish, C- medullary reaction of the *Myelochroa*.

MYRIOSPORA Nägeli *ex* Hue (Acarosporaceae pro tem.)
Nouv. Arch. Mus. Hist. Nat. Paris 1: 164. 1909. Lectotype: *M. heppii* (Nägeli *ex* Körb.) Hue.

Saxicolous crustose lichens with tiny areoles surrounding individual apothecia; photobiont chlorococcoid; apothecia with greenish pruina; asci clavate, with a IKI+ blue apical structures, with >100 small, hyaline, rounded to short-bacilliform spores; pycnidia not seen in Ozark material, immersed, with globose to short-ellipsoid conidia; 1 species in the Ozarks. Sometimes included within *Acarospora*.

Myriospora immersa (Fink) R. C. Harris
Occasional at scattered sites through the Ozarks, growing on dolomite cobbles and fragments in exposed habitats, such as in glades.

NADVORNIKIA Tibell (Thelotremataceae)

Corticolous crustose lichens with thin, pale, lustrous, sorediate thalli; photobiont *Trentepohlia*; apothecia immersed; asci disintegrating into a mazaedium, with numerous small, brown, 1-septate spores; 1 species in the Ozarks. Reference: Harris (1990).

Nadvornikia sorediata R. C. Harris
Uncommon on shaded boles of hardwoods, usually in mesic woodlands in ravines and along streams. The thin, lustrous thallus with punctiform soralia is distinctive. [stictic acid]

NEPHROMA Ach. (Nephromataceae)

Loosely adnate brown foliose lichens with pale to dark, tomentose lower cortex; photobiont *Nostoc*; apothecia sessile and ± immersed, on the underside of the lobe tips, with brown disk and thin thalline margin, epithecium brown, hypothecium hyaline; asci resembling *Peltigera*-type asci, with 8 brownish, fusiform, 3-septate spores; pycnidia not seen in Ozark material, ± immersed; conidia bacilliform; 1 species in the Ozarks. Reference: Wetmore (1960).

Nephroma helveticum Ach.
Thallus mostly continuous, deep brown, with medium sized, apically rotund lobes; branches numerous, short, often lobulate-dissected along the margins and apices; upper cortex mostly smooth and lustrous, occasionally obscurely wrinkled; flattened, lobulate isidia abundant along margins and also usually on upper cortex, these occasionally branched or proliferating, typically to 0.3 mm tall; lower surface tan at the margins, becoming dark brown to black centrally, with a fine tomentum; apothecia common, to 3.5 mm broad, on the underside of often upturned lobe tips, mostly immersed and nearly level with the lower cortex; disk plane, pale brown; ascospores 18-22 × 6-7 μm. [terpenes]

Uncommon in the southern Ozarks, in lightly to moderately shaded mesic habitats, such as in canyons and in mesic woodlands in stream valleys. Most Ozark populations occur on massive, mesic, mossy shaded faces of sandstone or rhyolite, but this species also occurs less commonly on the lower boles and bases of mature hardwoods in similar habitats.

This species occasionally occurs with, and appears similar to, *Sticta*, a brown tomentose lichen with prominent round pseudocyphellae on the lower cortex.

NORMANDINA Nyl. (Verrucariaceae)

Delicate, sterile lichens with small, discrete, rounded, blue-gray squamules with upturned edges, squamules typically with concentric rings and often sorediate, lower surface white tomentose; photobiont *Trebouxia*; conidiomata unknown; 1 species in the Ozarks.

Normandina pulchella (Borrer) Nyl.
Rare on shaded, lichenose, often mossy boles of old growth *Juniperus virginiana* and hardwoods in high quality woodlands.

OCHROLECHIA A. Massal. (Pertusariaceae [pro tem])

Crustose species with well-developed, light gray, continuous thalli; photobiont chlorococcoid; apothecia sessile, with thalline margins and tan disks; asci *Lecanora*- type, with 8 large, simple, hyaline, ovoid spores; pycnidia immersed, with straight, cylindrical conidia; 5 species in the Ozarks. Reference: Brodo (1991).

1. Thallus sorediate; apothecia absent . . . . . *O. arborea*

1. Thallus esorediate, although sometimes isidiate; apothecia usually numerous.

    2. Thallus with abundant, coarse, pustular isidia; saxicolous . . . . . *O. yasudae*

    2. Thallus lacking diaspores, sometimes verrucose-warty; corticolous or rarely saxicolous.

        3. Cortex and medulla of thalline margin of apothecia C+ yellow or C-; on *Pinus* . . . . . *O. pseudopallescens*

        3. Cortex and/or medulla of thalline margin of apothecia C+ red to pink; on hardwoods or rarely siliceous rocks or conifers.

            4. Thalline margin of apothecia with C- cortex and C+ red medulla . . . . . *O. africana*

            4. Thalline margin of apothecia with C+ red cortex and C- medulla . . *O. trochophora*

Ochrolechia africana Vain.
Frequent on a wide variety of hardwoods and occasionally on *Juniperus virginiana*, growing on lightly shaded branches as well as occasionally on tree boles. This is the most common member of the genus in the Ozark region. Rarely, it occurs on shaded siliceous rocks in wooded uplands. Some Ozark material contains lichexanthone and fluoresces UV+ yellow, while other material is UV-. A population from Randolph County, Arkansas has UV+ and UV- thalli growing mixed on the same tree. [gyrophoric acid, ± lichexanthone]

Ochrolechia arborea (Kreyer) Almb.
Occasional on lightly shaded to exposed tree branches, usually in areas with remnant natural integrity. *Juniperus virginiana* branches are the preferred substrate. This species has small, round soralia averaging about 0.5 mm wide, with finely granular soredia; in some specimens the soralia coalesce into large continuous patches of soredia. The cortex fluoresces UV+ bright yellow, as contrasted with the UV- cortex and coarse corticate pustules of *Loxospora pustulata*. *Nadvornikia sorediata* has a thinner thallus that is more pale gray without bluish overtones. [gyrophoric acid, lichexanthone]

Ochrolechia pseudopallescens Brodo
Known only from the lower bole of an old-growth *Pinus echinata* in a remnant virgin pine stand in Shannon County. [gyrophoric & variolaric acids]

Ochrolechia trochophora (Vain.) Oshio
Apparently uncommon, but perhaps overlooked because of its resemblance to *O. africana*, from which it can be readily distinguished by the C reaction of the cortex and medulla of the thalline margin of the apothecia, as discussed in the key above. Although this is typically a species of lightly shaded hardwood substrates, locally it also occurs on lightly shaded siliceous rocks. Ozark material is referable to var. *trochophora*. [gyrophoric acid]

Ochrolechia yasudae Vain.
Uncommon on exposed to lightly shaded siliceous boulders and outcrops in uplands; known from both the western and eastern Ozarks. [gyrophoric acid]

OPEGRAPHA Ach. *nom. cons.* (Rocellaceae)
Kongl. Vetensk. Acad. Nya Handl. 30: 97. 1809. Type: *O. vulgata* (Ach.) Ach. (*Lichen vulgatus* Ach).

Crustose lichens with thin or obscure thalli; photobiont *Trentepohlia* or absent; apothecia sessile to immersed, elongate, lirelliform, sometimes furcate or branched, hymenium I+ orange or blue; asci said to have a small, I+ blue apical ring, with 8 fusiform to acicular, hyaline to brownish, 3-many septate spores; pycnidia sessile to immersed, with simple to septate, ellipsoid to bacilliform, straight to curved, conidia; 10 lichenized and ca. 6 lichenicolous species in the Ozarks.

1. Photobiont *Trentepohlia*; not lichenicolous 2
    2. Thallus saxicolous on carbonate rocks 3
        3. Ascospores 5- 7-septate 4
            4. Thallus endolithic, brownish, C− . . . . . *O. mougeotii*
            4. Thallus epilithic, finely rimose, C+ pink . . . . . *Opegrapha sp.* 37218
        3. Ascospores 3-septate . . . . . *O. rupestris*
    2. Thallus corticolous 5
        5. Thallus sorediate 6
            6. Soredia greenish, C− . . . . . *O. corticola*
            6. Soredia brownish, C+ pink . . . . . *Opegrapha sp.* 49437
        5. Thallus not sorediate 7
            7. Ascospores 9+ septate, many >45 µm long; epithecium pale . . . . . *O. viridis*
            7. Ascospores 3-7(-8)-septate, to 40 µm long; epithecium brown 8

8. Hymenium inspersed; ascospores (6-)7(-8)-septate, 32-36 x 5.5-6.5 µm . . . . . *Opegrapha sp.* 44363

8. Hymenium not inspersed; ascospores 3-5(-6)-septate 9

9. Ascospores (4-)5-(-6)-septate . . . . . .

3. Apothecial disk exposed, usually pruinose; spores >5 µm wide; one half of spore often notably broader than the other half . . . . . *O. varia*

3. Apothecial disk hidden, not pruinose; spores to 4.5 µm wide; spores of about the same width along their length . . . . . *O. vulgata*

9. Ascospores 3-septate; slender, pointed at both ends (*rufescens*-type) 10

10. Ascospores 21-26 x 4-5 µm; on decorticate juniper branches and boles . . . . . *O. "juniperi"*

10. Ascospores 24-28 x 5-6.5 µm; on soft bark of hardwoods . . . . . *Opegrapha sp.* 51047

1. Photobiont absent; lichenicolous 11

11. Ascospores 5-6-septate, 18-20 × 3.5-4 µm, on thallus of *Bacidina assulata* . . . . . *Opegrapha sp.*(not treated)

11. Ascospores 3-septate 12

12. Growing on thallus and apothecia of *Bacidia diffracta* (and possibly *B. polychroa* and *B. suffusa*) . . . . . *O. diffracticola*

12. Growing on other lichens 13

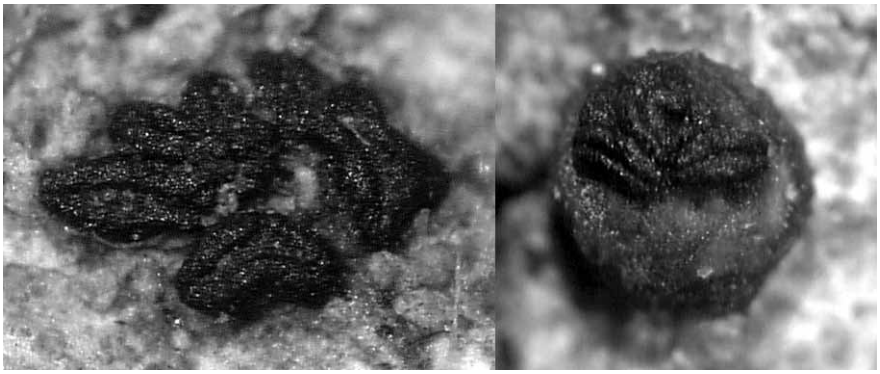
13. Growing on/with saxicolous Verrucariaceae . . . . . *O. rupestris*

13. Growing on various corticolous or terricolous lichens . . . . . *Opegrapha spp.* (not treated)
1) on squamules of *Cladonia caespiticia*
2) on thallus of *Myelochroa aurulenta*
3) on thallus of *Punctelia rudecta*

Opegrapha corticola Coppins
Thallus thin, greenish, ± continuous, sublustrous, with regular distribution of small round soralia with yellowish green soredia. Known only from hardwoods in the southern Ozarks, although also occurring on pine just south of the region.

Opegrapha diffracticola R. C. Harris & Ladd, *sp. nov.*
Ascomata lirelliform, growing on thallus and apothecia of *Bacidia diffracta*, sessile, fusiform to ± oblong, undivided to once branched, 0.3-0.5 × 0.2 mm, solitary and scattered or aggregated into irregular clusters, to 3 × 2 mm; disk concealed by appressed lips. Exciple brown-black, greenish black in KOH, entire, thickened below, to 50-60 µm. Hypothecium thin, colorless. Epihymenium yellow-brown (KOH-). Hymenium colorless, I+ patchily blue-green. Asci ovoid, with 8 ± biseriately

arranged spores. Ascospores remaining colorless, 3-septate, with thin halo, 13-15 × 4-4.5 µm. Pycnidia brown, ± globose, ca. 100 µm mm across. Conidia rod-shaped, 4.5 × 1.0 µm.



Knowledge of many groups of lichen parasites/ parasymbionts is essentially inaccessible to non-specialists. It is possible that a name for this taxon exists buried somewhere but we are unaware of anything which might apply to *O. diffracticola*. While the fact that ascomata and pycnidia are found on apothecia seems sufficient evidence for the lichenicolous nature of the *Opegrapha*, and additional confirmation was found by examining non-Ozark material of *B. diffracta* at NY, where an additional record from Vermont was found (We suggest that examination of collections of *B. diffracta* at other herbaria should reveal additional localities for the *Opegrapha*.). It has been recently collected on *B. diffracta* in Wisconsin. There seems to be no noticeable damage to the host when on the thallus but the apothecia are ± deformed and darkened. *Bacidina assulata*, although assigned to *Bacidina*, not *Bacidia*, has a very similar species of *Opegrapha* associated with it. Specimens on *B. polychroa* and *B. suffusa* seem slightly different but may ultimately prove conspecific with *O. diffracticola*.

Opegrapha "juniperi" *sp. provis*.
Uncommon on decorticate branches and boles of *Juniperus*. The ascospore type allies this taxon with *O. rufescens* Pers. but the ascomata are larger, coarser with thicker exciple and juniper lignum substrate.

Opegrapha mougeotii A. Massal.
Rare on sheltered faces of massive dolomite escarpments and bluffs, usually growing on lightly shaded faces under overhangs. The identification is tentative as the ascospores are not well developed.

Opegrapha rupestris Pers.
Scattered on saxicolous Verrucariaceae on carbonate rock, *Endocarpon sp., Staurothele diffractella*, and *Verrucaria spp.* noted for the Ozarks. Sometimes the host may not be obvious and then determination is based on the 3-septate ascospores.

Opegrapha varia Pers.
Frequent in mesic woodlands, usually occurring on boles of mature hardwoods in moderate to light shade, often in crevices or under overhanging bark. This is the most common species of *Opegrapha* in the region. It can be distinguished from *Graphis scripta* by the usually white pruinose disk and longer apothecia of the *Graphis*. The Ozark population has mostly short, simple to weakly branched ascomata with broadly expanded disk which is whitish to pale greenish pruinose. The apothecia of *O. varia* can be somewhat rounded and short, becoming almost oval. The status of some of the collections with epruinose ascomata needs to be studied in detail. A couple of these deviant collections which will key here are rather distinctive: 1) ascomata coarser, not pruinose; hymenium weakly inspersed; conidia broader, ellipsoid, 5-5.5 x 2-2.5 µm; on bole of *Populus deltoides* in Kansas; 2) ascomata coarser, not pruinose; ascospores blunter, broader in proportion to width, 20-22 x 6.5-7 µm; conidia ellipsoid, 4.5-5.5 x 2-2.5 µm; on bole of *Juniperus* in Missouri.

Opegrapha viridis (Pers. *ex* Ach.) Behlen & Desberger
Rare on hardwoods in mesic woodlands at a few sites scattered across the Ozarks. This species has small apothecia seldom attaining 1 mm long.

Opegrapha vulgata Ach.
Known from hardwoods, often species with smooth bark, such as *Acer, Carpinus, Carya, Gleditsia,* and even rarely on *Juniperus,* in moist to mesic, shaded sites. The apothecia of this species are small, narrow, and delicate, and form multi-branched, stellate patterns.

Opegrapha sp. 37218
Thallus pale gray, continuous, finely rimose, C+ pink. Ascomata lirelline, sinuous, simple, variably white pruinose. Ascospores *vulgata*-type, 5-septate, 20-23 x 3-3.5 µm. Conidia bacilliform, ca. 6 x 1.5 µm. [unknown substance]

Rare; a single collection from Arkansas on rock in hardwood-juniper woods in steep ravine.

Opegrapha sp. 44363
Thallus white, immersed. Ascomata sessile, simple or occasionally furcate. Exciple entire. Hymenium heavily inspersed. Ascospores ± *varia*-type (ends more pointed), (6-)7(-8)-septate, 32-36 x 5.5-6.5 µm. [no substances?, not tested]

Rare, a single collection on decorticate twigs of *Juniperus* on shaded dolomite bluff. Easily recognized by the large ascospores and inspersed hymenium (not a common character in *Opegrapha*)

Opegrapha sp. 49437
Thallus pale tan, thin, with discrete, mostly rounded, erose soralia with small granular soredia are C+ pink. Ascomata lirelline, simple to furcate, not pruinose. Ascospores *varia*-type, 5-septate, ca. 22-26 x 5-6.5 µm. [gyrophoric acid]

Rare; on boles of *Carya* and *Quercus* in hardwoods and floodplain woods. From description the soralia and chemistry suggest *O. fumosa* Coppins & P. James which is not known fertile and occurs in oceanic regions of Great Britain and the Pacific Northwest. More work is needed.

Opegrapha sp. 51047
Thallus whitish, immersed. Ascomata simple or furcate, not pruinose. Ascospores 3-septate, second cell from tip usually enlarged, pointed at both ends, 24-28 x 5.5-6.5 µm.

Uncommon on soft bark of *Acer negundo, Fraxinus* and *Ulmus* in floodplain woods but once in oak-hickory woods. The ascospore size and type suggest *O. herbarium* and perhaps may be a local form of that species but seems to differ in distinctive substrate preference and aspect.

PACHYPHIALE Lönnr. (Gyalectaceae)

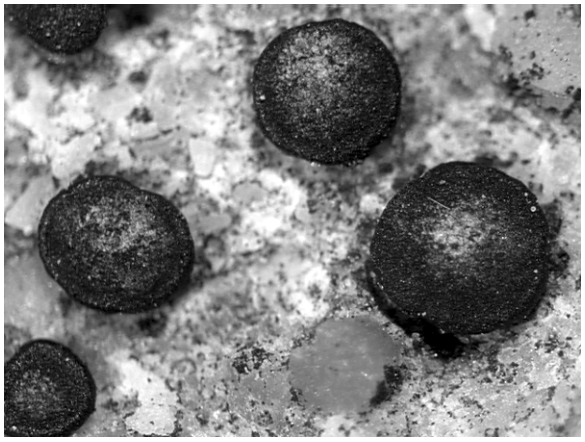
Corticolous crustose lichens with thin, grayish, continuous thalli; photobiont *Trentepohlia*; apothecia immersed to sessile, with a brownish disk; asci with IKI+ blue wall, lacking internal structures, with 16+, 4-8- celled, fusiform spores; pycnidia brownish, with filiform conidia; 1 species in the Ozarks.

Pachyphiale fagicola (Hepp) Zwackh
Thin whitish to greenish thallus with pale brownish to orangish brown, squatly subcylindrical apothecia to 0.3 mm broad, with elevated, incurving margins.

Known only from a single Ozark site; on fallen branches in a mesic ravine in southern Missouri.

PACHYPHYSIS R.C. Harris & Ladd *ined.* (Porpidiaceae)

Saxicolous crustose lichens with endolithic thalli not evident, except sometimes as an obscure grayish staining or narrow whitish prothallus; photobiont cf. *Trebouxia*; apothecia black, usually locally pruinose, eventually plane, subimmersed in pits in the substrate; asci *Porpidia*-type, with 8 simple, hyaline, subglobose to broadly ellipsoid spores; 1 species in the Ozarks.



Pachyphysis ozarkana R.C. Harris & Ladd *ined.*
Apothecia common, sessile, black, often initially pruinose and plane to slightly concave but becoming convex and irregular in circumference, ranging to ca. 1 mm broad but averaging 0.5-0.8 mm in diameter, mostly scattered to solitary but sometimes aggregated in small clusters. Young apothecia worth a well-defined proper margin, becoming obscure in age. Epithecium olive gray to blue green; hymenium ca. 60-80 µm thick (including the epithecium), wholly or partially suffused with reddish to purplish brown,KOH+ violet pigment; hypothecium deep opaque reddish brown to black, sometimes appearing slightly carbonaceous; Ascospores ovoid to broadly ellipsoid, simple, hyaline, closely packed and partially biseriate in the ascus, ca. 10.5-12 × 7.5-9 µm, with a thin perispore. This lichen has previously been reported as *Clauzadea monticola* (Ach. *ex* Schaer.) Hafellner & Bellem., a species with epruinose apothecia having an orange to reddish epithecium and narrower spores.

Occasional on exposed weathered dolomite in glades, growing on both large outcrops and small cobbles. The habitat and aspect of this lichen are evocative of *Sarcogyne regularis*.

PANNARIA Delise (Pannariaceae)

Brown foliose lichens with dense, tomentose hypothallus on lower surface; photobiont *Nostoc*; apothecia sessile, with thalline margins typically crenulate to sublobulate; asci I- internally, with 8 hyaline simple ellipsoid spores, these typically acuminate and surrounded by a thick perispore; pycnidia immersed, with bacilliform conidia; 2 taxa in the Ozarks. Reference: Jørgensen (2001).

1. Thallus lobes to 0.5 mm broad, with narrow, divided tips; apothecia to 1 mm broad; medulla P- (pannarin absent) . . . . . P. subfusca

1. Thallus lobes >0.8 mm broad, with broadly rounded tips; apothecia often >1 mm broad; medulla usually P+ red (pannarin) . . . . . *P. lurida* ssp. *quercicola*

Pannaria lurida (Mont.) Nyl. ssp. **quercicola** P.M. Jørg.
Occasional on bases and lower boles of trees in extensive mature woodlands. This species is never abundant, and usually occurs as a few scattered thalli on a single tree. [pannarin (sometimes absent?)]

Pannaria subfusca P.M. Jørg.
Uncommon on bases and lower boles of hardwoods in light shade, usually occurring in intact woodlands. One notable habitat is on boles of old growth *Nyssa aquatica* in Cupola Pond, a sinkhole pond natural area in Oregon County, Missouri. Local populations of this recently described species were formerly called *P. rubiginosa* (Ach.) Bory, under which name it was listed as Endangered in Missouri (MDC 1992).

PARMELIA Ach. (Parmeliaceae)

Blue-gray, adnate foliose lichens with truncate lobe tips; upper cortex containing atranorin, with white angular markings and reticulations near the lobe tips, these developing into elongate pseudocyphellae; lower cortex black, with squarrosely branched rhizines; photobiont *Trebouxia*; apothecia not seen in Ozark material, sessile, brown, with a well-developed thalline margin; asci *Lecanora*-type, with 8 simple, hyaline ellipsoid spores; pycnidia not seen in Ozark material, immersed; conidia bacilliform; 2 species in the Ozarks. Reference: Hinds (1998).

1. Thallus sorediate . . . . . *P. sulcata*

1. Thallus isidiate . . . . . *P. squarrosa*

Parmelia squarrosa Hale
Thallus typically to 8 cm broad, the lobes much branched, not notably expanded at the apices, the lobe tips often tinged brown and sometimes faintly pruinose; upper cortex near the lobe tips with a disconnected reticulation of angular white markings, these developing into elongate ridges, pseudocyphellae or cracks; squat, laminal isidia abundant, mostly originating from cortical cracks and reticulations, simple to branched, typically 0.2-0.3 mm tall × 0.1 mm thick. [atranorin, salazinic acid]

Rare on lightly shaded boles and large upper branches of *Quercus*, particularly *Q. velutina*, in woodlands.

The few known Ozark specimens tend to have duller and more granulose isidia than is typical from material from the main part of the range for this species in northeastern North America.

Parmelia sulcata Taylor
Thallus to about 6 cm broad, the lobes much branched, often strap-like, 2-5 mm broad, not notably expanded at the apices, the lobe tips often tinged brown and sometimes faintly pruinose; upper cortex near the lobe tips with a disconnected reticulation of angular white markings, these developing into slightly elevated pseudocyphellae or cracks; soredia common, pale to darkening, in round to elongate soralia associated with the cortical pseudocyphellae and cracks. [atranorin, salazinic acid]

Rare on lightly shaded mid and upper boles and main branches of mature trees at three sites in the northeastern edge of the Ozarks, mostly in disturbed woodlands or along woodland edges; known from *Quercus velutina* and *Gleditsia triacanthos*.

This weedy lichen is known for its disturbance tolerance and ability to rapidly colonize new sites in the northern states (Brodo 2001). Ozark populations may be recent introductions from the north — the first Ozark collection was made in 1984 (Ladd et al. 1984) and most sites have a history of anthropogenic disturbance.

PARMELINOPSIS Elix & Hale (Parmeliaceae)

Narrow-lobed, gray, isidiate foliose lichens with ciliate lobes and a dark lower cortex with simple to sparsely furcate rhizines; photobiont *Trebouxia*; apothecia sessile, brown, with a thalline margin; asci *Lecanora*-type, with 8 simple, hyaline, ellipsoid spores; pycnidia immersed, with cylindrical conidia; 2 species in the Ozarks.

1. Medulla C+ red (gyrophoric acid); isidia without apical cilia . . . . . *P. minarum*

1. Medulla C- (gyrophoric acid absent); isidia apically ciliate . . . . . *P. horrescens*

Parmelinopsis horrescens (Taylor) Elix & Hale
Rare; known only from a single collection on a small hardwood in Carter County. [atranorin, hiasic acid complex]

Parmelinopsis minarum (Vain.) Elix & Hale
Occasional on shaded tree boles and siliceous rocks in wooded uplands. In the Ozarks, this species appears to be particularly common on *Quercus velutina,* although it has also been recorded from *Amelanchier arborea, Acer rubrum, Quercus rubra,* and *Taxodium distichum*. It has not yet been documented from the extreme western Ozarks. [atranorin, gyrophoric acid]

PARMOTREMA A. Massal. (Parmeliaceae)

Broad lobed, light gray or yellow-green foliose lichens with expanded, rotund lobe apices; marginal cilia often present; upper cortex smooth and continuous, white maculate, or reticulately cracked; lobe tips rarely pruinose in all Ozark species; lower cortex brown to black, in some species with prominent white zones near the margins, rhizinate, sometimes with a broad bare marginal zone, the rhizines predominately simple, lower cortex often wrinkled or even with a fine pattern of reticulate ridges, particularly near the margins; photobiont *Trebouxia*; apothecia rare to common, large, sessile to short stipitate, cupuliform and basally constricted, with a well-developed thalline margin, the brown disk sometimes perforate, epithecium brownish, hypothecium pale; asci *Lecanora*-type, with 8 simple, hyaline, ellipsoid, ± thick-walled spores; pycnidia laminal, black, immersed near the lobe tips, the visible portion to 0.1 mm broad; conidia essentially straight, filiform to elongate bacilliform; 20 species in the Ozarks.

Species with a finely white maculate upper cortex and rhizines of two distinct lengths were previously segregated as the genus *Canomaculina* Elix & Hale. Taxa that are routinely rhizinate to the margin, with frequently branched rhizines and a reticulate upper cortex were segregated as the genus *Rimelia* Hale & A. Fletcher, but both of these segregate genera are not sufficiently distinct from *Parmotrema* to justify their segregation and are nested within the genus in gene trees.

1. Thallus without isidia or soredia.

    2. MedullaKOH- (protocetraric acid) . . . . . *P. submarginale*

    2. MedullaKOH+ red (norstictic or salazinic acids).

        3. Lower surface with a broad white to pale margin; lobes often upturned or ± erect; norstictic acid . . . . . *P. perforatum*

        3. Lower surface dark brown to black; lobes mostly adnate; salazinic acid.

4. Upper surface with a reticulate pattern of cracks or maculae; rhizines present to margins of lower cortex . . . . . *P. cetratum*

4. Upper cortex continuous and not patterned with reticulate cracks or maculae; lower cortex with a rhizine-free zone near the margins.

5. Thallus coriaceous, thick; lobe margins irregular, but lacking long laciniae *P. despectum*

5. Thallus membranaceous, thin; lobe margins rounded, typically with long laciniae . . . . . *P. eurysacum*

1. Thallus isidiate or sorediate.

6. Thallus isidiate.

7. Medulla alwaysKOH- and P-, C- or C+ pink to red.

8. Thallus yellowish green . . . . . *P. madagascariaceum*

8. Thallus mineral gray.

9. Medulla C+ red (lecanoric acid) or UV+ white (alectoronic acid); lower cortex black towards towards center; rhizines essentially uniform, absent from a broad zone along the margins of the lower cortex.

10. Medulla C+ red, UV- (lecanoric acid); marginal cilia absent; saxicolous or occasionally corticolous . . . . . *P. tinctorum*

10. Medulla C-, UV+ white (alectoronic acid); marginal cilia present; corticolous . . . . . *P. mellissii*

9. Medulla C-; rhizines of two distinct lengths, the shorter ones extending nearly to the margins of the lower cortex . . . . . *P. haitiense*

7. Medulla C-,KOH+ and P+ yellow or red to orange (salazinic or stictic acid).

11. MedullaKOH+ persistently yellow (stictic acid) . . . . . *P. crinitum*

11. MedullaKOH+ yellow turning red.

12. Medulla UV+ yellow (lichexanthone) . . . . . *P. ultralucens*

12. Medulla UV-.

13. Upper cortex smooth and continuous; lower cortex brown throughout, with rhizines of two distinct lengths . . . . . *P. subtinctorium*

13. Upper cortex with a reticulate pattern of cracks or maculae; lower cortex brown to black at center, with rhizines essentially one length . . . . . *P. subisidiosum*

6. Thallus sorediate.

14. MedullaKOH-.

15. Medulla C+ red or P+ red; rhizines essentially similar.

16. Medulla C+ red, P- (lecanoric acid) . . . . . *P. austrosinense*

16. Medulla C-, P+ red (protocetraric acid) . . . . . *P. gardneri*

15. Medulla C- and P-; rhizines of two distinct lengths . . . . . *P. conferendum*

14. MedullaKOH+ red or orange (norstictic or salazinic acid).

17. Thallus lobes ± erect, with a broad white marginal zone on the lower surface; norstictic and/or stictic acids present, salazinic acid absent

18. Norstictic acid only; common . . . . . *P. hypotropum*

18. Stictic acid present, sometimes with traces of norstictic acid; rare . . . . *P. hypoleucinum*

17. Thallus lobes adnate, lower surface black throughout; norstictic and stictic acids absent, salazinic acid present.

19. Upper cortex lacking a reticulate pattern; soralia round, delimited, prevailingly on short marginal lobes; lower cortex with a distinct marginal zone free of rhizines . . . . . *P. margaritatum*

19. Portions of the upper cortex with reticulate pattern of cracks and/or maculae; soralia linear and marginal to laminal and diffuse, not prevailingly on short marginal lobes; rhizines usually present to margin of lower cortex . . . . . *P. reticulatum*

Parmotrema austrosinense (Zahlbr.) Hale
Thallus light gray, with broad lobes often exceeding 10 mm wide, the lobe edges uplifted and convolute; older portions of the thallus sometimes wrinkled and finely subfoveolate; lobe margins thin and eciliate, with elongate, thin marginal soralia to 0.5 mm thick, the soredia pale and farinose; lower cortex black and rhizinate centrally, with a broad bare brown margin usually with large zones of white; apothecia not seen in Ozark material; pycnidia rare; conidia filiform, straight, 17-20 × 0.8-1 μm. [atranorin, lecanoric acid]

Occasional and sporadic through the Ozarks; especially on exposed to lightly shaded branches of *Juniperus virginiana* and *J. ashei*, as well as a variety of hardwoods, frequently *Ulmus alata*. This lichen usually occurs as widely scattered individual thalli on abundantly lichenose substrates, and is never abundant. It grows most frequently on old, small twigs and branches <3 cm in diameter.

Although similar to the much more common *P. hypotropum* in having ± erect, marginally sorediate lobes with a broad marginal white zone beneath, *P. austrosinense* has more delicate, crisply defined, fine, linear soralia and has no cilia along the lobe margins, whereas *P. hypotropum* has numerous black cilia along the lobe margins.

Parmotrema cetratum (Ach.) Hale [= *Rimelia cetrata* (Ach.) Hale & A. Fletcher]
Thallus typically large, to 15 cm broad, loosely adnate and often overlapping, the lobes broad, sometimes to 8 mm, and typically laciniate-dissected into elongate linear segments at the tips; lobe tips rarely with faint white pruina; upper cortex nearly throughout marked with a fine pattern of pale reticulations (best seen under 10× or greater magnification) creating a pattern of ± isodiametric polygons 0.1-0.2 mm broad, the reticulations developing into a pattern of cracks in older portions of the thallus; apothecia frequent, mostly submarginal and on elongate laciniae, often substipitate, cupuliform, to 8 mm broad; pycnidia common, immersed, black, to 0.1 mm broad, mostly near the lobe tips; conidia filiform, 7-11 μm long. [atranorin, salazinic acid]

Uncommon to occasional and scattered in intact woodlands throughout the Ozarks, on lightly shaded upper boles and larger branches of hardwoods, generally in the top half of the tree.

Young thalli of *P. reticulatum* often lack soredia or are only sparsely and locally sorediate, and may be confused with *P. cetratum*, although *P. reticulatum* lacks the elongate, linear laciniae usually characteristic of *P. cetratum*. Especially when young, *P. cetratum* can be confused with *P. despectum* and *P. eurysacum*, but these species differ in the broad marginal zones that lack rhizines, and in the lack of a well-developed pattern of maculae and/or cracks on the upper cortex.

Parmotrema conferendum Hale [= *Canomaculina conferenda* (Hale) Elix]
Thallus gray to greenish gray, broad-lobed, loosely adnate; lobe apices broadly rounded and often somewhat suberect, divided into numerous very short sublobes, margins with dark marginal cilia 0.5-1 mm long; upper cortex mostly smooth; soredia abundant, farinose, originally forming at the tips of small sublobes along the lobe apices, broadening and coalescing into elongate marginal soralia; lower cortex often finely wrinkled, the margins mottled whitish to pale tan and brown, becoming uniformly brown to blackish centrally, with a ± uniform stubble of short, dark, prevailingly simple rhizines to 0.3 mm long, these extending to the margins of the lower surface; occasional loose tufts of notably longer rhizines scattered on central portions of the lower cortex. Apotrecia and pycnidia not seen in Ozark material.[atranorin, norlobaridone]

Local and uncommon, mostly in the districts that were open grassy timbers in presettlement landscapes, occurring in the prairie and savanna country of the western Ozark region, and in the extensive glade and open timber environments of the White River and St. Francois Mountain sections; occasionally in open timbers in more anthropogenically altered habitats. This species grows on exposed to lightly shaded boles and branches of hardwoods and *Juniperus*, almost always in habitats with extensive populations of other foliose lichens.

Parmotrema crinitum (Ach.) M. Choisy
Thallus gray, loosely adnate, broad-lobed, with conspicuous black cilia to 2 mm long scattered along the margins, the cilia occasionally furcate; lobe apices sometimes dissected into small isidia; cylindrical, dark-tipped isidia to 0.1 mm broad abundant on upper cortex, to 0.5(1.0) mm tall, often branched or coralloid; some isidia usually tipped with disproportionately large erect black cilia to 2 mm long; lower cortex with a narrow brown margin, otherwise uniformly black, rhizines well separated; apothecia and pycnidia not seen in Ozark material. [atranorin, stictic acid]

Scattered through the Ozarks except for the northern and western fringes; uncommon on lightly shaded hardwood boles in intact woodland landscapes, typically growing on *Carya* and *Quercus*. This species also rarely occurs on exposed to lightly shaded siliceous boulders in woodlands.

Parmotrema despectum Kurok.
Thallus gray, loosely adnate, broad-lobed, with the lobe tips short-lobed to crenate or erose; black marginal cilia common, to 2 mm long; upper cortex not distinctly reticulate-maculate but often obscurely white-spotted; lower cortex black with a brown marginal zone; apothecia common, short-stipitate, laminal, prevailingly towards the margins and tips of the lobes, cupuliform, to 7(12) mm broad, ultimately perforate, the rim involute; pycnidia common; conidia filiform, 10-17 × 0.8-1 µm. [atranorin, salazinic acid]

Frequent in intact woodlands throughout the Ozarks, although seldom abundant at any locality; on upper boles and larger branches of canopy hardwoods, especially *Quercus* and *Carya*, and rarely on smaller trees or lower on the boles of large trees in similar habitats.

This species has been newly described as a segregate of *P. eurysacum* (Kurokawa 2001). The two species can be difficult to distinguish. The following table summarizes Kurokawa's concepts:

P. despectum	*P. eurysacum*
lobe margins crenate to erose	lobe margins subentire to broadly crenate
subpalmately divided lacinae absent	long, subpalmately divided lacinae present
upper cortex sometimes faintly maculate	upper cortex emaculate
thallus coriaceous, 260=300 µm thick	thallus membranaceous, 150-160 µm thick
marginal cilia rare to sparse, 1-3 mm long	marginal cilia frequent, often divided, 1.5-5 mm long
ascospores 10-14 × 6-10 µm	ascospores 14-16 × 7-9 µm

Ozark material of *P. despectum* agrees well with most of these characters, except that the marginal cilia are usually common, and thallus thickness is occasionally thinner than listed.

Parmotrema eurysacum (Hue) Hale
Thallus gray, loosely adnate, broad-lobed, with many of the lobe tips divided into long, linear lacinae; black marginal cilia common, to 2(3) mm long; upper cortex emaculate; lower cortex black with a brown marginal zone; apothecia common, short-stipitate, laminal, prevailingly towards the margins and tips of the lobes, cupuliform, to 8 mm broad, ultimately perforate, the rim involute; pycnidia common, immersed in the upper cortex towards the lobe tips, ca. 0.1 mm broad; conidia filiform, 10-15 × 0.8-1 µm. [atranorin, salazinic acid]

Apparently rare and restricted to a few sites in the southern Ozarks, growing on hardwood branches and upper boles in intact woodlands and more open natural habitats such as glade margins

See discussion under *P. despectum*. Both this species and *P. despectum* differ from *Parmotrema cetratum* in that the latter species has a reticulately cracked or maculate upper cortex and the lower cortex is rhizinate to the margin. [atranorin, salazinic acid]

Parmotrema gardneri (C. W. Dodge) Sérus.
Thallus gray, loosely adnate, moderately broad-lobed, eciliate; the lobes mostly less than 5 mm broad, with abundant short secondary lobes, the tips of many developing rounded capitate soralia typically to 2 mm broad, with farinose soredia; soralia sometimes becoming elongate and marginal; rounded laminal soralia sometimes on older portions of thallus; lower surface black centrally, with a brown marginal zone mottled with pale tan to white areas; apothecia not seen in Ozark material; incompletely developed pycnidia usually present near lobe tips, but conidia not seen in Ozark material. [atranorin, protocetraric acid]

Rare in the southern half of the Ozarks; on branches and boles of hardwood trees in exposed to lightly shaded conditions.

Parmotrema haitiense (Hale) Hale [= *Canomaculina haitiensis* (Hale) Elix]
Thallus gray to greenish gray, broad-lobed, loosely adnate; lobe apices broadly rounded and often somewhat suberect, divided into numerous very short sublobes, margins with ± regularly spaced, dark marginal cilia to 1 mm long; upper cortex smooth to distinctly foveolate ridged; laminal isidia abundant, cylindrical, dark-tipped, simple to branched or coralloid, usually < 0.2 mm tall, often sufficiently dense to obscure portions of the upper cortex; lower cortex mostly brown,

darkening centrally, with a uniform density of short, dark, prevailingly simple rhizines to 0.3 mm long, these extending locally to the margins of the lower surface; occasional loose tufts of notably longer rhizines scattered on central portions of the lower cortex. Apotrecia and pycnidia not examined in Ozark material. [atranorin, norlobaridone]

Occasional to locally frequent through most of the Ozarks, becoming less common near in the Illinois portions, perhaps because of extensive woodland alteration and destruction. This species occurs on mid and lower boles of hardwoods and *Juniperus* in wooded uplands.

This lichen is morphologically identical to *P. subtinctorium*, and is sometimes subsumed into it. In the Ozarks, *P. haitiense* is the less common of the two, which occur in similar habitats; *P. haitiense* perhaps has a tendency to be more intolerant of exposed conditions.

Parmotrema hypoleucinum (Steiner) Hale
Thallus identical to that of *P. hypotropum* (see description below), except for the presence of stictic acid. [atranorin, norstictic (minor amounts) & stictic acids]

Rare and sporadic in the Ozarks, with habitats similar to those of *P. hypotropum*, growing on exposed to lightly shaded hardwood substrates.

This species occurs in southwestern and southeastern North America, and Ozark populations are at the northern edge of their range. Chromatography is necessary to distinguish this species from *P. hypotropum*, since both species contain norstictic acid and can have a KOH+ yellow turning orange medullary reaction. Most of the Ozark sites where *P. hypoleucinum* is known to occur also have *P. hypotropum*, and the two species sometimes occur on the same branch.

Parmotrema hypotropum (Nyl.) Hale
Thallus gray, loosely adnate, with the margins typically wavy and upturned, often with an obscure patina of fine white maculae; lobes to 10 mm broad, the tips rounded to abundantly sublobed, usually with abundant black marginal cilia 1-2 mm long; lower cortex black centrally, the marginal zone usually completely or patchily white, otherwise brown, the white zone more common proximal to sorediate portions of the thallus; soredia abundant, marginal on upturned lobes, coarsely farinose, the soralia mostly elongate but occasionally subcapitate; laminal soredia sometime present on older portions of the thallus; apothecia rare, mostly young in Ozark material, to 1 cm broad, ultimately perforate, the rim often sorediate; pycnidia not seen in Ozark material. [atranorin, norstictic acid]

Common and often locally abundant throughout the Ozarks; on trees in woodlands, usually in relatively high light intensities. It occurs on the larger branches of canopy trees in mature woodlands, in habitats ranging from wet floodplain forests to open xeric uplands, as well as on upper boles of trees and occasionally on lightly shaded siliceous rocks. This species is particularly common on *Gleditsia triacanthos, Juniperus virginiana*, and on the lower boles and bases of *Pinus echinata* in open wooded uplands. See comments under *P. austrosinense, P. hypoleucinum* and *P. perforatum*.

Parmotrema madagascariaceum (Hue) Hale
Thallus pale yellowish green, broad-lobed, loosely adnate, the lobe tips entire to fimbriate dissected into small secondary lobes or isidia; marginal cilia abundant, typically 0.5-1.5 mm long; isidia abundant, prevailingly laminal, small, granulose to cylindrical, dark-tipped, simple to coralloid, mostly < 0.4 mm tall, usually with a scattering of the isidia tipped with erect black cilia; lower cortex black nearly throughout, with a narrow brown marginal zone; apothecia and pycnidia not seen in Ozark material. [atranorin, gyrophoric acid, usnic acid]

Rare and local; almost exclusively restricted to lightly shaded, mesic siliceous rock faces in natural areas, typically associated with *Punctelia graminicola*.

Southward in the Interior Highlands this species is sometimes corticolous, but our only corticolous record is from an old growth *Nyssa aquatica* in a forested sinkhole pond in Ripley County, Missouri. The gyrophoric acid is often present in low concentrations in Ozark populations, and not detected by a C test, but is readily revealed by thin layer chromatography.

Parmotrema margaritatum (Hue) Hale
Thallus gray, loosely adnate, with some broad lobes, and also with numerous suberect, ± linear secondary lobes; lobe margins with scattered cilia typically 1(-2) mm long; upper cortex often with obscure patina of fine whitish maculae, older portions of the cortex sometimes with a subreticulate pattern of fine ridges; lobe tips with the margins and proximal portions of the upper cortex with rounded to subcapitate soralia, these sometimes coalescing into larger areas of farinose soredia; lower surface black with a dark brown marginal zone; apothecia and pycnidia not seen in Ozark material. [atranorin, salazinic acid]

Apparently uncommon at scattered sites in the southeastern Ozarks, but possibly overlooked. This species grows on hardwood boles, particularly oaks, in mature wooded uplands.

Parmotrema margaritatum closely resembles the more common *Parmotrema reticulatum*, from which it differs in the presence of a broad rhizine free-zone near the margins of the lower cortex. While *P. reticulatum* also differs in having a distinct pattern of reticulate cracks or maculae on the upper cortex, *P. margaritatum* can have an obscurely maculate, or even cracked, upper cortex, so this character must be applied carefully. The type specimen of *P. margaritatum* at US, has a strongly reticulate-maculate upper cortex.

Parmotrema mellissii (C.W. Dodge) Hale
Thallus gray, loosely adnate, the lobe broad and rotund, with the lobe margins ciliate and sometimes dissected or subfimbriate; upper cortex sometimes obscurely white maculate and/or cracked; isidia abundant, laminal, simple to branched, <0.09 mm broad and 0.2-04 mm tall, sometimes tipped with erect black cilia; isidia frequently breaking down into granular soredia, but this feature poorly expressed in the single known Ozark specimen; lower cortex black with a pale brown marginal zone; apothecia and pycnidia unknown from the Ozark specimen. [alectoronic acid, atranorin]

Rare; known only from a single collection in the north-central Missouri Ozarks, growing on the lightly shaded bole of a small *Ulmus rubra* in an open secondary woodland. Associated lichens on this tree included *Heterodermia hypoleuca, Myelochroa aurulenta, Phaeophyscia hirtella, Physcia aipolia,* and *Physconia leucoleiptes.*

Parmotrema perforatum (Jacq.) A. Massal.
Thallus gray, broad-lobed, loosely adnate, the lobe tips rotund to narrowly laciniate, with some of the lobe margins usually suberect; marginal cilia common, 0.5-2 mm long, often creating a fringed appearance when well developed; upper cortex often obscurely and minutely white maculate, the older portions sometimes foveolate wrinkled; lower cortex black except for a broad marginal zone varying from white to white and brown mottled, to nearly or all brown; apothecia common, laminal and occasional marginal and terminal on short secondary lobes, short-stipitate, cupuliform, to 13 mm broad, ultimately perforate, the rim slightly involute; pycnidia common; conidia filiform, ± straight, 11-13 × < 1 μm. [atranorin, norstictic acid]

Common in the southern two thirds of the Ozarks except for the Illinois portion, generally growing on upper boles and larger canopy branches in mature woodlands of both wet and dry habitats, and sometimes on lightly shaded smaller trees in seral sites within woodland landscapes. Common substrates include *Acer, Quercus, Carya, Gleditsia* and *Juniperus*.

Sometimes the thalli of this species lack the characteristic marginal white zone on the underside, and the lower surface is brown nearly to the center. Younger branches of canopy oaks in mature wooded uplands often have numerous small (< 1 cm) thalli of a *Parmotrema* that contains norstictic acid; it is impossible to determine if these are *P. hypotropum* or *P. perforatum*.

Parmotrema reticulatum (Taylor) M. Choisy [= *Rimelia reticulata* (Taylor) Hale & A. Fletcher]
Thallus loosely adnate, to 12 cm broad, with the main lobes long, often exceeding 4 cm, much branched, and 3-6 mm broad; upper cortex mostly marked with a fine pattern of pale reticulations (best seen under 10× or greater magnification) creating a pattern of ± isodiametric polygons to 0.4 mm broad, these reticulations developing into cracks on the older portions of the thallus; soredia common at maturity, farinose, marginal, originating on rounded subcapitate soralia on the upturned lobe tips and on short side branches along the margins of the main lobes; these often coalescing into elongate upturned marginal soralia; apothecia rare, the thalline margin sometimes sorediate; pycnidia not seen on Ozark material. [atranorin, salazinic acid]

Very common throughout the Ozarks; this species, *Flavoparmelia caperata, F. baltimorensis* and *Punctelia rudecta* are the most common large foliose species in the Ozarks. Typical habitats for *P. reticulatum* include the boles and bases of both hardwoods and conifers in mature woodlands, well-drained decorticate logs in open woodlands, lightly shaded siliceous rocks, and even mossy dolomite outcrops and stable *Juniperus* needle humus over rocks. This is one of few species of broad-lobed foliose lichens to occur in degraded urban parks and suburbs of major cities such as St. Louis, where it occurs as diminutive thalli on lower tree boles. See comments under *P. cetratum* above.

Parmotrema subisidiosum (Müll. Arg.) Hale [= *Rimelia subisidiosa* (Müll. Arg.) Hale & A. Fletcher]
Thallus adnate, to 15 cm broad, the lobes generally somewhat rounded and expanded at their apices, and typically with short lacerate divisions along the margins, 3-6 mm broad; lobe tips rarely with a zone of faint white pruina; upper cortex marked with a fine pattern of pale reticulations (best seen under 10× or greater magnification) creating a pattern of ± isodiametric polygons to 0.4 mm broad, these reticulations developing into cracks on the older portions of the thallus; isidia common, small, laminal and also sometimes originating from marginal dissections, usually somewhat localized on portions of the thallus, dark-tipped, cylindrical, to 0.03 mm broad and typically to 0.3 mm tall, occasionally branched, friable; clusters of isidia sometimes braking into granulose sorediate masses, and occasional subsorediate isidioid granules about 0.3 mm broad also sometimes present on the upper cortex. Apothecia and pycnidia not seen on Ozark material. [atranorin, salazinic acid]

Uncommon, and mostly in the southern half of the Ozarks in extensive intact woodlands, where it grows on lightly shaded bases and lower boles of hardwoods, as well as on shaded siliceous rocks.

This species is at the northern edge of its interior range in the Ozarks. In very rare instances, a few isidia can be tipped with black cilia; this feature is better developed in populations south of the Ozarks.

Parmotrema submarginale (Michx.) DePriest & B. Hale
Thallus gray, loosely adnate, broad-lobed, with rotund lobe apices, the margins sometimes dissected into small short lobes; margins short ciliate, the cilia often sparse and prevailingly < 0.5 mm long; upper cortex sometime finely and obscurely white maculate and/or wrinkled; lower cortex black with a brown to pale tan marginal zone; apothecia common, short stipitate, marginal, submarginal, and laminal, cupuliform, never perforate, to 14 mm broad, the rim involute and often crenulate; pycnidia common; conidia elongate bacilliform, 6-7 × 0.8-1 µm. [atranorin, protocetraric acid]

Occasional and seldom abundant at any locality, in woodlands through the southeastern half of the Ozarks, uncommon or absent elsewhere in the region; usually on upper boles and larger canopy branches of hardwood trees in extensive, mature woodlands.

Although this species is difficult to distinguish in the field from *P. eurysacum* and *P. cetratum*, it displays a preference for higher light intensities and typically grows at higher levels above the ground. Additionally, the lobes of *P. submarginale* have a tendency to be more dissected into small marginal segments. Prior to the work by DePriest & Hale (1998), this lichen was known as *P. michauxianum* (Zahlbr.) Hale.

Parmotrema subtinctorium (Zahlbr.) Hale [= *Canomaculina subtinctoria* (Zahlbr.) Elix
Thallus gray to greenish gray, broad-lobed, loosely adnate; lobe apices broadly rounded and often somewhat suberect, divided into numerous very short sublobes, margins with ± regularly spaced, dark marginal cilia to 1 mm long; upper cortex smooth to distinctly foveolate ridged; laminal isidia abundant, cylindrical, dark-tipped, simple to branched or coralloid, usually < 0.2 mm tall, often sufficiently dense to obscure portions of the upper cortex; lower cortex mostly brown, darkening centrally, with a uniform density of short, dark, prevailingly simple rhizines to 0.3 mm long, these extending locally to the margins of the lower surface; occasional loose tufts of notably longer rhizines scattered on central portions of the lower cortex. Apothecia and pycnidia not seen in Ozark material. [atranorin, norlobaridone, salazinic acid]

Locally frequent in intact woodlands through most of the Ozarks, becoming uncommon to absent in regions with extensive fragmentation and woodland conversion. As with the previous species, this species occurs on mid and lower boles and branches of hardwoods and *Juniperus*, and also occurs lightly shaded upper boles and larger branches of mature hardwoods, apparently with a slight tendency to be more tolerant of more exposed microhabitats.

Parmotrema tinctorum (Delise *ex* Nyl.) Hale
Thallus pale gray, adnate to loosely adnate, with broad, typically overlapping, lobes; lobe apices rotund or with short rotund sublobes; margins eciliate, thin and ± uplifted, sometimes dissected into isidia; small laminal isidia abundant, often imparting a matte or soft appearance to the thallus, the isidia dark-tipped or concolorous, typically 0.05 mm broad and 0.1-0.2 mm tall, somewhat granular, simple to obscurely divided; lower cortex black, with a distinct, broad, pale brown marginal zone; apothecia and pycnidia unknown in Ozark material. [atranorin, lecanoric acid]

Rare in widely scattered sites in the southern and eastern Ozarks, mostly on massive siliceous rock formations. This species occurs on both sandstone and igneous rocks, typically on lightly shaded, mesic bluff faces. *Usnea amblyoclada* is a consistent associate in this habitat. Less commonly, and mostly in the southern Ozarks, this species occurs on corticolous substrates, including *Juniperus virginiana* and *Vaccinium arboreum*.

Interestingly, this species is an abundant corticolous lichen in woodlands on the Gulf coastal plain south of the Ozark region; Ozark populations constitute the northernmost range for this species.

Parmotrema ultralucens Krog) Hale
Rare and confined to the Boston mountain region of Arkansas, in the extreme southern Ozarks, where it usually occurs on massive, mesic, lightly shaded sandstone faces on lower bluffs and canyon walls.

PAULIA Fée (Lichinaceae)

Small subsquamulose lichens with erect, fruticose lobes and a black, gelatinous thallus; photobiont a chroococcoid cyanobacterium; apothecia minute, ± immersed; asci IKI-, with 8 simple, broadly ellipsoid spores; pycnidia unknown in Ozark material, laminal, immersed, with ellipsoid to bacilliform conidia; 1 species in the Ozarks.

Paulia pyrenoides (Nyl.) Henssen
Known only from the extensive dolomite glade country in the White River region of southern Missouri, growing on dolomite bedrock in a small creek bordering Caney Mountain.

PELTIGERA Willd. *nom. cons.* (Peltigeraceae)_
Fl. Berol. Prodr. 347. 1787. Type. *Lichen caninus* L. = *P. canina* (L.) Willd.

Brown or grayish, mostly terricolous, foliose lichens with smooth, scabrid, or tomentose upper cortex, rhizinate, ecorticate lower surface with distinct veins in most species, and apothecia on ± erect thallus lobes, photobiont (in local taxa) *Nostoc*, asci *Peltigera*-type, with 8 narrow, elongate, colorless to light brown, 3-7-septate spores, tenuiorin/gyrophoric agg and terpenoids or no substances; 6 species in the region. References: Brodo et al. (2001 photos!), Goffinet & Hastings (1994), Goffinet & Miadlikowska (1999), Miadlikowska & Lutzoni (2000), Vitikainen (1994).

1. Lobe tips tomentose or tomentose-scabrid; veins raised; rhizines pale and simple at margin, darker and ± squarrose or fasciculate inward 2

2. Isidia present; isidia laminal, granular, ± cylindrical to flattened; rare . . . . . *P. evansiana*

2. Isidia absent but often with ± lobulate phyllidia on margins, especially where damaged, and/or along cracks in upper cortex but not truly laminal 3

3. Lobes broad, 10-15 mm across, not caniculate but often markedly crisped; marginal tomentum ± loosely arachnoid . . . . . *P. praetextata*

3. Lobes narrow, to 5 mm across, caniculate and ± crisped; marginal tomentum becoming dense and clumped (scabrose appearing) . . . . . *P. praetextata s. lat.*

1. Lobe tips shiny or weakly pruinose, not tomentose; veins not raised, weakly raised or absent; rhizines various 4

4. Veins lacking; lower side becoming black, soft and ± spongy, often with pale patches especially at margins . . . . . *P. elisabethae*

4. Veins distinct 5

5. Lobe tips not pruinose; veins pale brown to dark brown; apothecia, when present, brown . . . . . *P. polydactylon s. lat.*

5. Lobe tips weakly pruinose; veins blackening; apothecia, when present, short stalked, black 6

6. Phyllidia absent; apothecia sometimes present, short and tooth-like, often blackish . . . . . *P. neckeri*

6. Phyllidia present; apothecia usually absent . . . . . *P. phyllidiosa*

Peltigera elisabethae Gyelnik
Rare, mostly on shaded sandstone in mesic woods, once in an overgrown dolomite glade. [tenuiorin, zeorin]

Peltigera evansiana Gyelnik
Rare, only a single collection from a shaded limestone ledge, a typical habitat. The species is a North American endemic, distributed widely in the Northeast but rarely abundant. Care must be taken to distinguish between isidia and phyllidia. [no lichen substances]

Peltigera neckeri Hepp ex Müll. Arg.
Uncommon over mosses on shaded carbonate rock, more rarely sandstone or tree bases. [tenuiorin, zeorin].

Peltigera phyllidiosa Goffinet & Miadlikowska
Uncommon over mosses on shaded carbonate rock in mesic woods, once on an oak root and once on sandstone. Differs from *P. elisabethae* in more distinct veins. Specimens with sparse phyllidia will end up as *P. neckeri*. [tenuiorin, zeorin]

Peltigera polydactylon (Necker) Hoffm. *s. lat.*
Rare on shaded sandstone in Illinois and Missouri and on chert outcrop in Oklahoma. We do not pretend to understand the *P. polydactylon* complex in eastern North America. In our region this is the only taxon with terpenoids other than zeorin. [tenuiorin agg., peltidactylin. dolichorrhizin, zeorin]

Peltigera praetextata (Flörke ex Sommerf.) Zopf
Widely distributed in a variety of habitats, mostly on soil and over mossy rock, the most common species in the region. It is an almost cosmopolitan species. Generally *P. praetextata* has been understood as defined by the production of phyllidia. However, a substantial percentage of eastern North American collections, including most Ozark material, lack phyllidia and have previously been determined as *P. canina* (L.) Willd. or *P. rufescens* (Weiss) Humb. The non-phyllidiate and phyllidiate material is held together by simple marginal rhizines, tomentum, in having older parts of thallus brown and without tomentum, margins upturned and often ruffled, and, when present, broad apothecia. *Peltigera canina* and *P. rufescens* have confluent fasciculate rhizines. [no lichen substances]

Peltigera praetextata s. lat.
Not uncommon, apparently not distinct from *P. praetextata* in ecology and Ozark distribution. At this time it is not known to occur outside our region. This eventually may be worthy of taxonomic recognition. *Peltigera praetextata* is generally understood to have broad, ± ruffled lobes, 10-15 mm across which become brown in older parts. A small but significant proportion of material from the Ozarks has narrow lobes, to 5 mm across, which are often at least somewhat caniculate, less ruffled and are a brighter bluish without much tendency to become brown. Also the marginal tomentum seems denser, tending to be clumped and scabrose looking. Specimens with sparse tomentum and/or sparse phyllidia can be confused with *P. neckeri* or *P. phyllidiosa* if the raised veins are not noticed. [no lichen substances]

PELTULA Nyl. (Peltulaceae)

Marginally sorediate, saxicolous lichens with discrete, thick, round squamules; photobiont *Anacystis* (?) or *Chroococcidiopsis* or *Myxosarcina*; apothecia immersed, thalline margin lacking; asci thin-walled, I-, with 100 or more hyaline, narrowly ellipsoid, simple spores; pycnidia immersed, with ovoid to fusiform conidia; 6 taxa in the Ozarks. Reference: Wetmore (1970).

1. Thallus marginally sorediate.

    2. Squamules thin, to 2 mm broad; rare . . . . . *P. bolanderi*

    2. Squamules thick, > 4 mm broad; occasional . . . . . *P. euploca*

1. Thallus without diaspores.

    3. Squamules usually > 3 mm; minutely fruticose . . . . . *P. tortuosa*

    3. Squamules tiny, to 2.5 mm broad; thallus squamulose to peltate.

        4. Squamules strongly convex and about as tall as wide, peltate . . . . . *P. omphaliza*

        4. Squamules flat to slightly convex, ± adnate.

            5. On base-rich carbonate rock rocks . . . . . *P. obscurans deserticola*

            5. On acidic siliceous rocks . . . . . *P. obscurans hassei*

Peltula bolanderi (Tuck.) Wetmore
Known only from the extensive dolomite glades in the White River region of southwestern Missouri, as cited by Wetmore (1992).

Peltula euploca (Ach.) Poelt
Uncommon and local, on massive exposures of dolomite, sandstone, and chert, often in areas receiving intermittent seepage or runoff. *Peltula euploca* has immersed apothecia lacking a thalline margin, while *P. bolanderi* has sessile apothecia with a thalline margin; unfortunately, all local material seen to date is sterile.

Peltula obscurans (Nyl.) Gyelnik var. **deserticola** (Zahlbr.) Wetmore
Uncommon in the carbonate bedrock region of the Ozarks, growing on both limestone and dolomite in glades and on bluff systems.

Peltula obscurans (Nyl.) Gyelnik var. **hassei** (Zahlbr.) Wetmore
Known from a single site in the St. Francois Mountains region of southeastern Missouri, growing on exposed granite along a small river.

Peltula omphaliza (Nyl.) Wetmore
Known only from a single site each in the western and eastern Ozarks. The eastern population is on exposed weathered granites along a small river, and the western population is on low sandstone outcrops along a stream.

Peltula tortuosa (Nees) Wetmore
Rare on exposed igneous rocks in the St. Francois Mountains region of southeastern Missouri; typically occurring in uplands.

PERTUSARIA DC. (Pertusariaceae)

Crustose lichens with well-developed, corticate, continuous thalli, the thallus continuous to cracked and becoming areolate in older portions, commonly with a pale marginal zone; photobiont *Trebouxia*; apothecia common, immersed, single or aggregated, in poriform to lecanorate warts, the lecanorate forms commonly sorediate or coarsely pruinose; in poriform-fruited species, each apothecium usually with an apical ostiole; asci *Pertusaria*-type, with 1-8 large (usually > 50 µm long), single- or double-walled spores, smooth or conspicuously grooved on their inner walls; pycnidia rare, not seen in Ozark material, immersed; conidia bacilliform to elongate; 19 species in the Ozarks. References: Dibben (1980), Ladd & Wilhelm (1998).

The following key, largely adapted from Ladd and Wilhelm (1998), relies on thallus morphology, chemical spot tests, fluorescence under long-wave ultraviolet light (360 nm), and spore number and ornamentation. Note that the color reactions from chemical tests are often localized, such as the C+ yellow-orange reaction of *P. texana*, which often is visible only around the ostioles of the warts and can take up to two minutes to develop. Several KOH- taxa can react weakly dingy yellow; this should not be confused with the clearly KOH+ yellow reaction produced by stictic and thamnolic acids. Fluorescence under UV light is characterized as UV+ yellow (lichexanthone), UV+ pinkish to orange (various other cortical xanthones) or UV- (no xanthones present). Spores are either single-walled and 1-2 per ascus in the disciform fruited subgenus *Pionospora* or double-walled and prevailingly 2, 4, or 8 per ascus in the poriform-fruited subgenus *Pertusaria*. Some species in subgenus *Pionospora* commonly have aborted or undeveloped asci and rarely produce spores. In subgenus *Pertusaria*, the warts range from steep-sided, or pertusariate, to broadly rounded and subconical, or ampliariate.

1. Thallus isidiate, muscicolous . . . . . *P. globularis*

1. Thallus not isidiate, rarely muscicolous

2. Fruiting bodies disciform, the warts lecanoroid (and often pruinose) or sorediate; spores 0, 1, or 2, the walls single (subg. *Pionospora*).

3. Cortex UV+ yellow (lichexanthone).

4. Wart C+ red (lecanoric acid), with low, often eroded rims commonly covered by coarse white pruina . . . . . *P. velata* (lichexanthone strain)

4. Wart C−; with thick, prominent rims not much covered by pruina, but often becoming sorediate . . . . . *P. hypothamnolica*

3. Cortex UV− or UV+ pinkish.

5. Wart K+ yellow or C+ red.

6. Wart C+ red, KOH− (lecanoric acid); spores 1 per ascus, mostly more than 175 um long . . . . . *P. velata*

6. Wart C−, KOH+ yellow (thamnolic acid); spores 0(1) or 2 per ascus, less than 175 um long . . . . . *P. trachythallina*

5. Wart both KOH− and C−.

7. Wart KC+ violet (picrolichenic acid) . . . . . *P. amara*

7. Wart KC− . . . . . *P. multipunctoides*

2. Fruiting bodies poriform, the warts mostly corticate; spores 2-8, the walls double (subg. *Pertusaria*).

8. Spores prevailingly 5-8, the inner wall smooth.

9. Cortex UV+ yellow (lichexanthone) . . . . . *P. paratuberculifera*

9. Cortex UV− or UV+ pinkish to orange.

10. Cortex, especially near the ostioles, C+ yellow (thiophaninic acid); thallus characteristically with tints of yellow, UV+ brilliant orange.

11. Medulla P+ orange (often weak or poorly developing); containing stictic acid . . . . . *P. texana*

11. Medulla P-; containing variolaric acid . . . . . *P. epixantha*

10. Cortex C− throughout; thallus without yellowish tints, UV− or UV+ weakly pink.

12. Medulla KOH+ yellow turning red (norstictic acid); cortex UV−; warts open and appearing lecanorine, often pale or white in the center . . . . . *P. propinqua*

12. Medulla KOH−; cortex UV+ pinkish (unknown xanthone), though often weakly so;
warts small, apically corticate . . . . . *P. ostiolata*

8. Spores 2-4, the inner wall smooth or ornamented.

13. Cortex UV+ yellow (lichexanthone) . . . . . *P. valliculata*

13. Cortex UV− or UV+ pinkish to orange.

14. Spores prevailingly 3 or 4.

15. Medulla KOH− (stictic acid absent); spores smooth; rare . . . . . *P. globularis*

15. Medulla KOH+ yellow (stictic acid); spores ornamented; occasional *P. tetrathalamia*

14. Spores 2.

16. Medulla KOH+ yellow turning red (norstictic acid); cortex UV−.

17. Thallus saxicolous; many warts more than 1 mm in diameter . . . *P. plittiana*

17. Thallus corticolous or lignicolous; warts commonly fused, but individual ones notably less than 1 mm in diameter . . . . . *P. neoscotica*

16. Medulla KOH− or KOH+ yellow; cortex UV+ orange to pink (rarely UV−).

18. Cortex, especially around the ostioles, C+ yellow, KC+ yellow orange; ostioles black or thallus with distinct yellow tint.

19. Ostioles black, usually > 0.2 mm broad; thallus gray to bluish gray; spore walls smooth . . . . . *P. pustulata*

19. Ostioles pale to brownish, usually < 0.15 mm broad; thallus distinctly yellowish; spore walls grooved . . . . . *P. xanthodes*

18. Cortex C-, KC-; ostioles pale to brownish; thallus without any yellowish tints.

20. Spores smooth to slightly ornamented; medulla P+ orange-red (fumarprotocetraric acid) . . . . . *P. subpertusa*

20. Spores with conspicuous ornamentation; medulla P+ yellow to orange (stictic acid).

21. Inner side of inner spore wall sculpted with ± broadly rounded ridges; lumen and spore walls usually KOH+ pale violet; warts often with broad, flat to slightly concave apices; . . . . . *P. macounii*

21. Outer (and sometimes also inner) side of inner spore wall finely and densely sculpted with reticulate ridges; lumen and spore walls KOH−;
warts usually with rounded apices . . . . . *P. tetrathalamia*

Pertusaria amara (Ach.) Nyl.
Thallus bluish or greenish gray, lustrous, becoming thin and indistinct at the margins, with abundant and ± evenly distributed circular lecanorine warts typically 0.3-0.8 mm broad, with vertical corticate margins becomimg ragged with age; the warts densely covered with snow-white soredia; spores 1/ascus, smooth-walled, present in about half of the specimens examined. [picrolichenic acid, ± protocetraric acid]

Occasional in wooded uplands, although never abundant on any single tree, scattered through most of the Ozarks, but especially in the eastern half of the region. This species occurs on shaded lower and mid boles of deciduous trees, typically hickories and oaks, as well as other hardwoods and junipers. Rarely it occurs on siliceous rock fragments in wooded uplands. Ozark populations have abundant small sorediate warts; in the northern United States this lichen typically has the warts fused into irregular rounded masses of soredia.

Most Ozark populations lack protocetraric acid, although specimens with protocetraric acid are known from a few sites scattered across the region. Dibben (1980) mentions that the protocetraric acid strain has a predominately western distribution in North America, while the strain without protocetraric acid is restricted to the eastern portion of the continent. This lichen is extremely bitter to the taste.

Pertusaria epixantha R.C. Harris
Thallus small, gray-green to green, sometime with yellowish tints, pale marginal zone absent or narrow and indistinct, thallus typically cracking into small areoles; warts common, mostly discrete, ± steep sided, often with a flattened apex, 0.3-0.7 mm broad, with 1 (rarely 2-3) small pale brown ostioles surrounded by a distinct pale zone. In the field, this species resembles closely *P. texana*, which also has 8 smooth spores per ascus. [variolaric acid, thiophaninic acid, xanthone]

Apparently uncommon and scattered in the southern Ozarks, although similar in appearance to *P. texana* and perhaps mistaken for it. On boles and branches of hardwoods in light shade to full exposure.

Pertusaria globularis (Ach.) Tuck.
Thallus gray to pale bluish gray, thin, closely conforming to and appearing to flow over the bryophytes on which it grows; most Ozark specimens sterile — these with abundant short, simple to branched or short-coralloid, blunt isidia, the isidia typically 0.15 mm broad and 0.2-0.3 mm tall, with dull irregular cortex; fertile material rare in the Ozarks, these with few or no isidia, the warts widely scattered and about 1 mm broad, with dark ostioles; spores 4/ascus, but not seen in Ozark material. [xanthone, 2'-O-methylperlatolic acid]

Uncommon, widely scattered, and when present usually occurring in low numbers, growing over bryophytes on siliceous boulders and less frequent over bryophytes on hardwood logs, in mesic to dry-mesic, extensive woodlands.

Loxospora pustulata has pustular isidia and sometimes grows on mossy rocks and logs; it contains thamnolic acid and reacts KOH+ instantly deep yellow, as contrasted with the KOH- reaction of *P. globularis*. *Ochrolechia yasudae* has a paler gray thallus, coarser isidia, and contains lecanoric acid, reacting C+ red in the medulla.

Pertusaria hypothamnolica Dibben
Thallus pale gray to occasionally greenish gray, often with a pale creamy marginal zone; warts abundant, lecanorine, typically 0.7-1.3 mm broad, with a well-developed cortical margin, densely white sorediate or sometimes with the black epithecium exposed, the dark contrasting strikingly with the encircling white soredia, bordered by the cortical margin of the wart, this margin typically well developed, slightly constricted at the base, and often extending as a broad rounded rim above the sorediate interior. Spores smooth, 1/ascus. [hypothamnolic acid, lichexanthone]

Common on lower and mid boles of trees in wooded uplands, typically on *Quercus, Carya* and *Juniperus*, but occurring on a variety of other deciduous trees. It is especially common on boles and branches of older *Juniperus virginiana* in overgrown glades. Rarely in wooded uplands, *P. hypothamnolica* occurs on shaded siliceous rocks.

This species has a distinctive pale and discontinuous fluorescence under UV light, distinguishing it from the typical UV+ bright yellow fluorescence of species such as *P. paratuberculifera* and *P. valliculata*. Although all Ozark material examined to data is UV+ yellow, Dibben (1980) mentions that some populations lack lichexanthone and are UV-. Any such specimens locally would key to *P. amara* because of the KC+ wine reddish purple color reaction of hypothamnolic acid, but could be easily distinguished by the larger, better developed lecanorine warts not completely obscured by soredia. The thallus of *P. amara* is typically darker than the usually pale gray thallus of *P. hypothamnolica*.

Diagnostic Characters for Ozark *Pertusaria*[1] [largely modified from Dibben (1980)]						
Species	UV	K	C	KC	P	Spores
amara		± yellow →red[m]		+ violet[m]	± yellow →orange[m]	1
epixantha	+ orange		+ yellow	+ yellow-orange		(6)8
globularis	± weak yellow-pink					2 or 4
hypothamnolica	+ yellow	± yellow →violet[m]		+ rose/violet[m]		1
macounii	± pink/orange	+ yellow[m]		± weak yellow	+ yellow →orange[m]	1-2 (3-4)[o]
multipunctoides		± yellow →brown[m]			+ yellow →red[m]	1
neoscotica		+ yellow →red[m]			+ yellow →orange[m]	(1) 2
ostiolata	± weak orange-pink					8
paratuberculifera	+ yellow	± weak yellow		± weak yellow		8
plittiana		+ yellow →red[m]			± yellow →orange[m]	0-2
propinqua		+ yellow →red[m]			+ yellow →orange[m]	(4 or 6) 8
pustulata	+ pinkish orange	+ yellow[m]	+ yellow	+ yellow-orange	+ yellow →orange[m]	(1) 2 (3)
subpertusa	± weakish pink	± yellow →red[m]			+ yellow →red[m]	(1) 2
tetrathalamia	± weak orange-pink	+ weak yellow[m]		± weak yellow	+ yellow →orange[m]	2-5°
texana	+ orange-red	± yellow	+ yellow	+ yellow-orange	± yellow →orange[m]	(6) 8
trachythallina		+ deep yellow[m]			+ yellow →orange[m]	0-2
valliculata	+ yellow	± weak yellow		± weak yellow		2-5[o]
velata	± yellow		+ red[m]	+ red[m]		1 (2)
xanthopes	+ orange	+ yellow[m]	+ yellow	+ yellow-orange	± yellow →orange[m]	(1) 2 (3)

[1]description applies to cortex unless superscripted by an "m", for medulla
[o]denotes notable ornamentation on the inner spore wall

Pertusaria macounii (I. M. Lamb) Dibben
Thallus pale gray to bluish or greenish gray, sometimes with a paler margin; wart prominent, usually closely crowded, to 2 mm broad, often slightly concave at summit, with nearly vertical sides, sometimes with > 10 ostioles/wart; spores usually 2/ascus, but occasionally 1 or 3, the inner side of the inner wall sculpted with broadly rounded ridges. [stictic acid, xanthones]

Uncommon on hardwoods, usually red oak group (*Quercus* subgenus *Erythrobalanus*) in mature woodlands in the northeastern Ozarks. *Pertusaria tetrathalamia* sometimes has two prominently ornamented spores per ascus, but the spores have a fine reticulate sculpting on the outside (and sometimes also the inside) of the inner wall, while the spores of *P. macounii* have sculpting of rounded grooves on the inside of the inner wall. Additionally, *P. tetrathalamia* often grows on *Juniperus* and has more rounded and diffuse warts. Spores of *P. macounii*, especially when young, are often KOH+ pale violet, while spores of *P. tetrathalamia* are KOH-. Older specimens of *P. macounii* are said to have tinted or darkening spores, but this character seems subtle and inconsistent.

Pertusaria multipunctoides Dibben
Thallus gray to dark bluish gray, with a narrow pale marginal zone; warts abundant, lecanorine, sorediate, irregularly rounded, typically 0.2-0.5 mm broad, initially corticate, then erupting, with the cortical border bumpy and irregular; spores smooth, 1/ascus. [fumarprotocetraric acid]

Apparently rare and occurring at a few sites scattered through the eastern half of the Ozarks, but possibly under-collected, It occurs on lightly shaded boles and branches of trees in extensive, mature woodlands; local substrates include *Amelanchier arborea, Celtis occidentalis, Juniperus virginiana*, and *Quercus* spp.

Pertusaria neoscotica I. M. Lamb
Thallus light gray, sometimes with locally pale brownish tints, uniformly colored to the thin and often indistinct margin, without a notable pale marginal zone; warts abundant and often nearly continuous, creating a tuberculate to rugose appearance, convex and irregularly rounded, to 1 mm broad but sometimes coalescing into convolute masses or short bumpy ridges; ostioles not prominent, usually 4 or less per wart; spores smooth, 2/ascus. [norstictic acid]

Uncommon or possibly overlooked; known from a few scattered sites in intact wooded uplands in the interior of the Ozarks, where it occurs on lightly shaded boles of *Quercus* and *Carya*. One collection is from a mossy decorticate log.

Pertusaria ostiolata Dibben
Thallus bluish gray to dark bluish gray, lustrous, with a narrow pale tan marginal zone; warts abundant, uniform, pertusariate, typically 0.4-0.7 mm broad, occasionally aggregating, smoothly and bluntly rounded, with 1 to less commonly a few small dark ostioles, creating a ± papillate appearance on the thallus; spores smooth, 8/ascus. [xanthone]

Locally frequent in the southern two thirds of the Ozarks, in woodlands on the shaded boles of a variety of hardwood trees as well as on *Juniperus virginiana*. This species has a predilection for more mesic microhabitats than *P. hypothamnolica* and *P. paratuberculifera*, and often occurs on mossy tree bases and lower boles. Less frequently, it occurs on mid boles and branches of trees in woodlands.

The somewhat papuliform, elongate warts are distinctive, as is the muted pinkish UV reaction.

Pertusaria paratuberculifera Dibben
Thallus pale gray to greenish gray, usually roughened to subpustulate or even appearing convoluted, sometimes with a narrow pale tan marginal zone; warts large, commonly exceeding 1 mm broad, broadly rounded to pertusariate, frequently coalescing into flat-topped to centrally depressed mounds, with few to several small brownish to darkening ostioles; spores 8/ascus, smooth. [lichexanthone, 2-O-methylperlatolic acid]

A common, characteristic, and locally abundant lichen on lightly shaded lower and mid boles of trees in extensive wooded uplands throughout the Ozarks, often representing one of the top five corticolous lichens in terms of importance value (Ladd 1996b). This is the most common *Pertusaria* in the Ozarks and occurs on a wide variety of deciduous trees, although most commonly on *Quercus stellata, Q. coccinea* and *Q. velutina*. This species also occurs occasionally on *Juniperus* and rarely on shaded siliceous boulders in uplands.

Pertusaria paratuberculifera is superficially identical to the rarer *P. valliculata*, which has four spores per ascus compared to the 8 spores per ascus of *P. paratuberculifera*.

Pertusaria plittiana Erichsen
Thallus pale gray, somewhat dull, with a pale tan marginal zone; warts prominent, somewhat steep-sided (pertusariate), distinct to coalescing, typically 0.8-1.2 mm broad; ostioles several per wart, appearing as slight depressions with pale borders and dark centers; spores usually 2/ascus, rarely 4, usually with somewhat roughened inner walls. [norstictic, perlatolic & stenosporic acids]

Locally frequent in wooded uplands throughout the Ozarks, on massive, shaded igneous rocks and especially sandstone, typically forming large colonies. This is the only regularly saxicolous *Pertusaria* in the Ozarks, although other species in the genus rarely grow on rocks.

Small dark green thalli of *Buellia vernicoma* frequently grow on or adjacent to *P. plittiana*. Another saxicolous species containing norstictic acid, *Phlyctis "petraea"*, differs in its smoother, thick, paler gray thallus, frequent sorediate patches, and lack of well-defined warts; it is usually sterile whereas *P. plittiana* is usually fertile.

Pertusaria propinqua Müll. Arg.
Thallus light gray, occasionally with slightly greenish hues, thallus often appearing finely rugulose, the margins usually thin and concolorous with the main thallus; warts common, flat-topped, usually remaining ± distinct even when juxtaposed, 0.7-1.5 mm broad, pertusariate and often slightly constricted at the base, with a well-developed cortical margin and dark to more commonly white pruinose central disk, creating an almost lecanorate appearance; spores 8/ascus, smooth. [norstictic acid]

Occasional through the Ozarks, but more common in the western portions, where the landscape is more open and fragmented, occurring on both boles and branches of open grown trees in moderate to high light intensities in habitats such as woodland edges, fencerows, pastured woodlands, prairies, savannas, and glades. *Carya* is a preferred substrate; this species also occurs on a variety of other hardwoods and *Juniperus virginiana*. This lichen often grows in the canopy, and seems to be less shade tolerant than many other species of *Pertusaria*.

While most species of *Pertusaria* occurring in the Ozarks have populations in eastern North America, particularly the Appalachian region, *P. propinqua* has a biogeographic pattern associated with the prairie regions of southern midcontinental North America. The thick-rimmed expanded warts can appear distinctly lecanorine.

Pertusaria pustulata (Ach.) Duby
Thallus pale gray to somewhat bluish gray, ± sublustrous, sometimes finely rugulose, occasionally with a narrow pale marginal zone; warts ampliariate, with poorly defined bases, typically 0.4-0.7 mm broad, distinct to occasionally coalescing and fusing into small aggregations; ostioles mostly 1-3/wart, but usually appearing as one irregular dark ostiole > 0.2 mm broad; spores 2/ascus, smooth. [stictic acid, xanthone]

Frequent throughout the Ozarks, although slightly less common southeastward, on exposed small twigs and upper branches of canopy hardwood trees in woodlands and more open habitats. It also occurs on lightly shaded tree boles, particularly on *Carya ovata* — lightly shaded stands of this tree is grazed woodlands are often characterized by extensive, nearly continuous colonies of *P. pustulata* on the lower and mid boles.

Pertusaria pustulata seems to require higher light intensities than typical woodland members of the genus such as *P. amara, P. hypothamnolica, P. paratuberculifera*, and *P. velata* This species is among the smallest of our local *Pertusaria*, although in favorable sites thalli often fuse to form large continuous patches. *Pertusaria xanthodes* is similar to this species, but has more distinctly yellowish tints in the thallus and ornamented spores.

Pertusaria subpertusa Brodo
Thallus appearing dull, pale gray to gray, usually with a narrow plane marginal zone; warts mostly distinct and well separated, appearing slightly paler than the thallus, broadly rounded to occasionally flat-topped and slightly constricted at the base, about 1 mm broad, the several tiny ostioles in each wart pale and inconspicuous; spores 2/ascus, smooth to slightly ridged on the inner wall. [fumarprotocetraric acid, xanthone]

Occasional in the southern Ozarks and particularly in the Current and Eleven Point river drainages in Missouri, growing on smooth-barked hardwoods, generally in mesic sites on slopes and in valleys. *Amelanchier arborea*, when it occurs near the hydric end of its niche, is a preferred substrate, along with *Acer rubrum, Carpinus caroliniana, Carya tomentosa*, and *Fagus grandifolia*.

Ozark populations are the northwestern most known for this woodland endemic of eastern North America. Although Dibben (1980) described the spores of this species as radially grooved, Ozark populations have spores that frequently appear nearly smooth, with no conspicuous ornamentation. *Pertusaria pustulata* also has two spores per ascus, but is a smaller lichen with smaller warts each having fewer and larger, dark ostioles that react C+ yellow. *Pertusaria macounii* and *P. tetrathalamia* have similar morphologies and can have two spores per ascus, but both of these taxa have strongly ornamented spores and contain stictic acid.

Pertusaria tetrathalamia (Fée) Nyl.
Thallus gray to dark gray or slightly bluish, usually with a pale marginal zone; warts about 1 mm broad, separate and distinct to coalescing into flat-topped mounds with several darkish ostioles each about 0.1 mm broad; spores 2-5/ascus, with conspicuous, fine reticulate sculpting on the outside, and sometime also on the inside, of the inner wall. [stictic acid, xanthones]

Occasional on tree boles and larger branches in landscapes with remnant natural integrity. The vast majority of Ozark records are from *Juniperus virginiana* and *J. ashei*; other substrates include *Carpinus* and *Quercus*.

Ozark populations of this taxon require critical study. Dibben (1980) listed the substrate as prevailingly hardwoods. Most Ozark populations have 2 spores per ascus, although asci with 3,4

or 5 spores occur, sometimes in the same ascoma. Populations from *Juniperus* are more likely to have 2 spores per ascus, while thalli from hardwoods are more likely to have more spores. See comments under *P. macounii*.

Pertusaria texana Müll. Arg.
Thallus small and variable in color, ranging from gray with slight greenish tints to green or strongly yellow green, but always with notable green hues, pale marginal zone absent or narrow and indistinct, thallus typically cracking into small areoles; warts common, mostly discrete, ampliariate, 0.4-0.7 mm broad, with 1(-3) small pale brown ostioles surrounded by a distinct pale zone which is usually yellowish tinted; spores 8/ascus, smooth. [stictic acid, thiophaninic acid, xanthone]

Frequent on boles and upper branches of trees in wooded uplands throughout the Ozarks, typically in very light shade, occurring on a wide diversity a hardwoods, as well as on *Juniperus*. Some of the more unusual substrates include *Bumelia lanuginosa, Hamamelis vernalis* and *Rhododendron roseum*.

On exposed upper branches of hardwoods, *P. texana* sometimes occurs with *P. pustulata*, from which it can be distinguished by the pale ostioles and usually strong tincture of greenish yellow in the thallus of *P. texana*, as opposed to the dark or black ostioles and gray thallus of *P. pustulata*. *Pertusaria texana* is frequently parasitized by *Minutoexcipula tuckerae* V. Atienza & D. Hawksw., a small, black, lichenicolous deuteromycete with two-celled, brown conidiospores. This species is nearly identical in appearance to *P. epixantha*, which has slightly steeper, more flat-topped warts, lack of yellowish tints around the ostiole, absence of stictic acid, and presence of variolaric acid.

Pertusaria trachythallina Erichsen
Thallus pale to medium gray, typically somewhat rugulose and roughened, creating a dull appearance except near the margins, where a narrow pale zone is often present; warts common to sparse, usually well separated, irregularly rounded, 0.4-1 mm broad, usually covered with coarse white pruina and appearing sorediate, the sides low, with the cortex often breaking down and becoming indistinct; spores absent or 2/ascus, smooth. [thamnolic acid]

Occasional, but not commonly collected, on large upper branches of canopy trees in somewhat mesic sites; occasionally on shaded hardwood boles in similar habitats. This species seems to prefer stable, smooth-barked hardwood substrates, including smooth bark of large branches of *Quercus and Carya*, and boles and branches of *Amelanchier arborea, Acer rubrum* and *Carpinus caroliniana*.

This species superficially resembles a small *P. hypothamnolica*, and may be overlooked. The UV- cortex and KOH+ instantly deep yellow reaction readily distinguish this species.

Pertusaria valliculata Dibben
Thallus pale gray to greenish gray, smooth to roughened or subpustulate, sometimes with a narrow pale tan marginal zone or a broader, indistinct whitish margin; warts large, commonly exceeding 1 mm broad, broadly rounded to pertusariate, frequently coalescing into flat-topped to centrally depressed mounds, with few to several small brownish ostioles; spores 4/ascus, conspicuously roughened and grooved on the inner wall. [lichexanthone]

Occasional through the Ozarks, and apparently common in the north-central portion of the Ozarks. This species occurs on a variety of deciduous trees and also on wood and decorticate limbs of *Juniperus virginiana*, but is most common on *Carya* and a variety of species of *Quercus*

in both subgenera (*Erythrobalanus* and *Lepidobalanus*). It typically grows on shaded lower and mid boles, and more rarely on shaded lower branches.

In the field this species is usually indistinguishable from the more common *P. paratuberculifera*, and must be examined microscopically to confirm the fewer, ornamented ascospores. One less common phase of *P. valliculata*, with fewer, more widely separated and seldom coalescing, largely ampliariate warts, is distinctive. A specimen from Oregon County, Missouri (*Harris 21689*, NY) may represent a new species; it has the lichexanthone restricted to the warts and contains stictic acid, but otherwise resembles *P. valliculata*.

Pertusaria velata (Turner) Nyl.
Thallus uniformly pale gray, often rugose and convoluted, with a narrow pale tan marginal zone; warts abundant, lecanorine, discrete and ± even spaces except near the margins of the thallus, typically 0.5-0.7 mm broad, with low eroding cortical margins or with the cortical margin persisting as a rounded pseudolecanorine rim, the surface of the warts mostly flattish, densely covered with compacts white pruina; spores usually 1/ascus, smooth. [lecanoric acid, ± lichexanthone]

Common in the eastern half of the Ozarks, occasional in the western Ozarks; on lightly shaded lower and mid boles of trees in wooded uplands. This species occurs on a wide variety of hardwoods as well as on *Juniperus virginiana* and occasionally on decorticate mossy logs and siliceous boulders in wooded uplands; it is especially common on *Carya texana*, *Quercus stellata*, and *Q. velutina*.

Most material from the area is UV-, but UV+ yellow populations containing lichexanthone occur sporadically through the southern Ozarks, with the same habitats and substrates as the typical chemotype. The population with lichexanthone was formerly called *P. pulchella* Malme.

Pertusaria xanthodes Müll. Arg.
Thallus suffused with yellowish tints, pale gray to greenish, sometimes finely rugulose, occasionally with a narrow pale marginal zone; warts ampliariate, with poorly defined bases, typically 0.4-0.7 mm broad, distinct to occasionally coalescing and fusing into small aggregations; ostioles mostly 1-3/wart, pale to light brown, 0.1 - 0.15 mm broad; spores 2/ascus, roughened to grooved on the outside of the inner wall. [stictic and thiophaninic acids]

Rare on exposed small branches of hardwoods in the southern Ozarks.

This species is similar to *P. pustulata*, but differs in the pronounced yellowish tints of the thallus, smaller, paler ostioles, and ornamented ascospores.

PHAEOCALICIUM A. F. W. Schmidt (Mycocaliciaceae)

Crustose fungi with no apparent thallus; photobiont absent; apothecia minute, black, stipitate, narrowly subcylindrical; asci single-walled, with uniformly thickened apex and 8 ellipsoid, pale brownish, 1-septate spores with rounded apices — the asci tardily disintegrating after spore maturity, but not forming a mazaedium; conidiomata unknown; 1 species in the Ozarks.

Phaeocalicium polyporaeum (Nyl.) Tibell
Frequent in woodlands, growing on thalli of the polyporous fungus *Trichaptum biforme*, which inhabits rotting logs and standing dead snags of hardwood. The *Trichaptum* appears to be especially common on *Quercus*.

PHAEOPHYSCIA Moberg (Physciaceae)

Small, narrow lobed dark gray to brownish foliose lichens, upper cortex KOH-, lower cortex usually dark, occasionally pale, usually with abundant simple rhizines; photobiont *Trebouxia*; apothecia sessile, with a well-developed thalline margin; asci *Lecanora*-type, with 8 ellipsoid, brown, 1-septate, thick-walled spores; pycnidia dark, ± immersed, with ellipsoid conidia; 8 species in the Ozarks. References: Esslinger (1978).

1. Thallus sorediate.

    2. Medulla prevailingly red . . . . . *P. rubropulchra*

    2. Medulla white throughout.

        3. Upper cortex with fine white hairs, particularly near lobe tips . . . . . *P. hirsuta*

        3. Upper cortex glabrous.

            4. Lower cortex dark throughout, or with a narrow pale marginal zone.

                5. Soredia coarsely granular and sometimes appearing almost isidioid, in poorly defined marginal and laminal soralia; thallus lobes 0.5-2 mm wide . . . . . *P. adiastola*

                5. Soredia farinose, in well-defined, rounded soralia; thallus lobes mostly to 0.5 mm wide.

                    6. Soralia strongly capitate and elevated, usually terminal or on small secondary lobes; thallus loosely adnate; larger lobes to 0.5 mm broad . . . . . *P. pusilloides*

                    6. Soralia orbicular, sessile, usually laminal; thallus closely adnate; larger lobes to 0.3 mm broad . . . . . *P. insignis*

            4. Lower cortex pale.

                7. Larger thallus lobes to 0.3 mm broad; soralia laminal and often broader than the lobes; lower cortex paraplectenchymatous . . . . . *P. insignis*

                7. Larger thallus lobes 0.5 or more mm broad; soralia marginal or laminal and narrower than their lobes; lower cortex prosoplectenchymatous . . . . . *Physciella*

1. Thallus not sorediate, although sometimes with abundant fine marginal lobules.

    8. Thallus with abundant dissected marginal lobules; apothecia rare . . . . . *P. squarrosa*

    8. Thallus lacking lobules; apothecia common.

        9. Upper cortex glabrous . . . . . *P. ciliata*

        9. Upper cortex with fine white hairs, particularly near lobe tips and on thalline margins of apothecia . . . . . *P. hirtella*

Phaeophyscia adiastola (Essl.) Essl.
Common in shaded woodlands, often in mesic ravines. The typical habitat for this species is shaded, mossy ledges and boulders of both siliceous and carbonate rocks, although it infrequently occurs on mossy tree bases as well. The granular, almost isidiate-appearing soredia, and abundant projecting black rhizines are characteristic.

Phaeophyscia ciliata (Hoffm.) Moberg
Frequent on exposed to lightly shaded branches and boles of trees, particularly trees with less acidic bark, such as *Juglans nigra* and *Fraxinus americana*. This species requires higher light intensities than many of our woodland lichens, and typically occurs in more open habitats. It occurs very rarely on lightly shaded rocks. This species sometimes grows in mixtures with *P. hirtella.*

Phaeophyscia hirsuta (Mereschk.) Essl.
Locally abundant in exposed disturbed habitats, as well as on trees in wooded uplands and along woodland edges. Typical habitats include exposed old wood, lightly shaded rocks in disturbed areas, and even old concrete. In woodlands, the thalli are typically small and fragmentary. *Juniperus virginiana* is a preferred substrate. The only other pubescent *Phaeophyscia* in our area is *P. hirtella*, with a more regular, better-developed thallus, no soredia, and numerous apothecia. Local material of *Phaeophyscia hirtella* was formerly called *Phaeophyscia cernohorskyi* (Nádv.) Essl.

Phaeophyscia hirtella Essl.
Occasional, with habitats and substrates similar to those of *P. ciliata*; the two elements often occur together, although *P. ciliata* appears to be the more common element in the Ozarks. See comments under *P. hirsuta*.

Phaeophyscia insignis (Mereschk.) Moberg
This diminutive lichen is uncommon in the Ozarks, occurring on hardwoods and rocks in light to moderate shade. The lower surface is usually pale over much of the thallus. Species of *Physciella* might be keyed here, but can be distinguished by their usually paler gray upper cortex, larger thallus lobes, and prosoplectenchymatous lower cortex. *Phaeophyscia insignis* is about the same size as *Hyperphyscia adglutinata*, but *Hyperphyscia* is more appressed, without evident well-developed rhizines, and has linear or oblong soralia, as opposed to the round soralia of *P. insignis*. Occasional appressed forms of *P. insignis* can be distinguished by their ellipsoid conidia, as opposed to the filiform conidia of *Hyperphyscia*.

Phaeophyscia pusilloides (Zahlbr.) Essl.
Common on tree boles in woodlands, particularly on *Quercus* and *Carya* in wooded uplands. This species has a distinctive, greenish cast to the round, capitate soralia, which appear slightly elevated on the lobe tips.

Phaeophyscia rubropulchra (Degel.) Essl.
Common in shaded woodlands, growing on rocks, decorticate logs, and lower portions of tree boles. This species has a browner thallus than other local taxa of *Phaeophyscia*, with characteristic, dark soralia. In some specimens, portions of the medulla are white. [skyrin]

Phaeophyscia squarrosa Kashiw.
Common on shaded rocks and tree bases in a variety of woodland habitats, but often in more mesic sites. This species, formerly called *Phaeophyscia imbricata* (Vain.) Essl., is easily recognized by the abundant, fine, isidia-like marginal lobules on the thallus. *Anaptychia palmulata* can be lobulate, but is bright green when wet, uniformly pale beneath with pale

rhizines, and usually has apothecia. *Phaeophyscia squarrosa* is pale greenish gray when wet, dark beneath towards the center of the thallus, with black rhizines, and usually sterile.

PHLYCTIS (Wallr.) Flotow *nom. cons.* (Phlyctidaceae)
Bot. Zeitung (Berlin) 8: 571. 1850. *Peltigera* sect. *Phlyctis* Wallr., Fl. Crypt. Germ. 3: 553. 1831. Type: *Peltigera agelaea* (Ach.) Wallr. (*Lichen agelaeus* Ach.) = *P. agelaea* (Ach.) Flotow.

Crustose lichens with pale gray, well-developed, rimose thalli; photobiont chlorococcoid; apothecia small, immersed and usually obscured by coarse pruina, thalline margin present but often poorly developed and irregular; asci thin-walled, not thickened at apex, with 1 hyaline, septate to muriform spore; pycnidia with bacilliform conidia; 3 species in the Ozarks.

1. Growing on rock; thallus white, rimose areolate, KOH+ red (norstictic acid); sorediate with relatively few coarse soredia in small, discrete erose to slightly raised soralia; almost never fertile (ascospores possibly 1/ascus muriform as in *P. argena*) . . . . . *P. "petraea"*

1. Growing on bark; thallus green gray, KOH−; soredia likewise in small, discrete groups but almost always covering fertile ascomata 2

2. Ascospores transversely multiseptate; thallus, etc., PD+ yellow (psoromic acid); on boles of hardwoods in mesic woodlands; not common . . . . . *P. ludoviciensis*

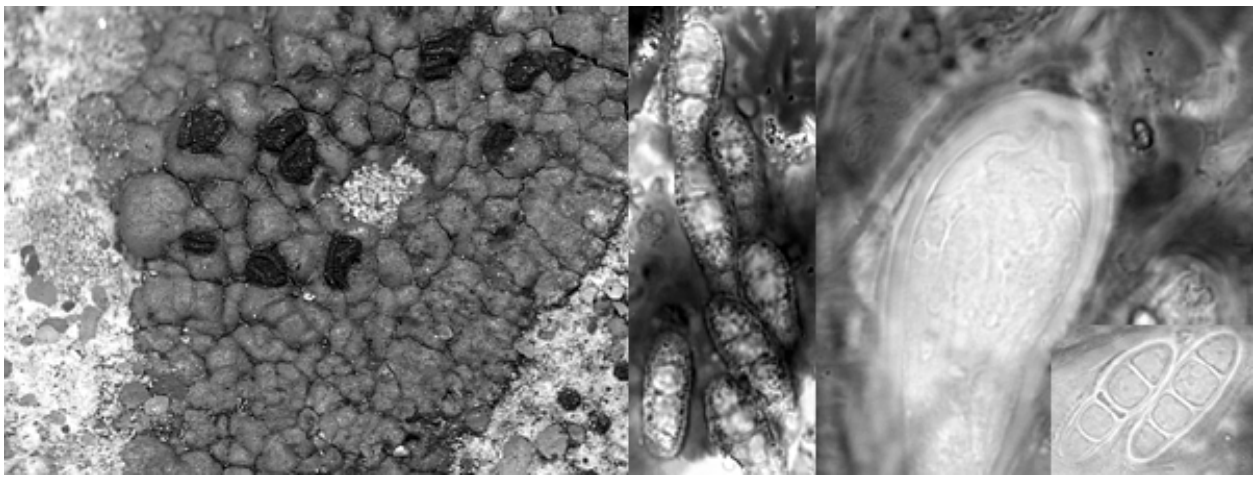
2. Ascospores muriform; thallus PD− (no substances) . . . . . *Phlyctis sp.* 51152

Phlyctis ludoviciensis (Müll. Arg.) Lendemer
Rare on lightly to moderately shaded boles of hardwoods, particularly *Carpinus caroliniana*, in mesic woodlands, particularly along small wooded streams, fens, and other sources of permanent humidity. This species was formerly called *Phlyctidia ludoviciensis* Müll. Arg. [psoromic acid]

Phlyctis "petraea" *sp. provis.*
Uncommon on shaded sandstone or rhyolite boulders and outcrops, typically in more humid sites such as along lightly shaded streams in natural areas; rarely on chert lenses of massive dolomite exposures. Frequent associates include *Buellia vernicoma, Flavoparmelia baltimorensis*, and *Pertusaria plittiana*. This taxon is common on shaded, moist rock faces throughout eastern North America. Pesumably related to *P. argena* (Sprengel) Flotow which is corticolous and consistently fertile while *P. petraea* is saxicolous and consistently sterile. [norstictic acid]

Phlyctis sp. 51152
Rare, known from a single collection on *Cornus* from Searcy County, Arkansas. Superficially indistinguishable from *P. ludoviciensis* but very distinct in having muriform ascospores and in lacking lichen substances. [no lichen substances detected]

PHOEBUS R.C. Harris & Ladd *gen. provis.* (Rocellaceae)



Phoebus hydrophobius R.C. Harris & Ladd *gen. et sp. provis.*
Thallus placodioid, orange, KOH+ violet black (violet in section). Cortex thick, of mostly anticlinal hyphae obscured by small crystals. Photobiont *Trentepohlia*. Medulla thick, white, filled with oxalate? crystals, I-, KOH-, C-, KC-. Apothecia sessile, ± round, with raised margin, black, epruinose. Epihymenium with dark pigment forming dark brown granules in KOH. Hypothecium not extending into thallus. Ascus *grumulosa*- type? Ascospores 8/ascus, 4-celled, colorless, becoming brown and coarsely ornamented. [unknown pigment]

Rare and local in the southwestern Ozarks, with an old collection from the Kansas Ozarks. Restricted to extensive dolomite and limestone bluff systems in intact woodland landscapes, where it occurs in shaded, sheltered microhabitats with relatively high light intensities that are protected from extensive rain or direct runoff.

Further study may show that this taxon can be accommodated in *Roccellina* Darbish. It would be anomalous in ascomatal type and thallus pigmentation. From *Dirina* Fr. it differs in placodioid thallus and thallus pigmentation. Originally thought to be an Ozark endemic, *Phoebus* was found in the Edwards Plateau, Texas by the 2005 ABLS Foray. The generic name was suggested by the orange "sun bursts" in otherwise dark places (Phoebus = Greek sun god), the epithet by its ecological preference (hydrophobius = water fearing).

PHYLLOPSORA Müll. Arg. (Biatoraceae)

Greenish corticolous lichens with a pale, obscure to obvious prothallus and isidioid-dissected, aggregated subsquamulose thallus; photobiont *Trebouxia*; apothecia sessile, brown, convex, lacking a thalline margin; asci *Bacidia*-type, with 8 hyaline, short-fusiform, simple spores; 1 species in the Ozarks. Reference: Brako (1991).

1. Thallus lobes ≥0.5 mm broad . . . . . *P. corallina*

1. Thallus lobes ≤0.4 mm broad . . . . . *P. kalbii*

Phyllopsora corallina (Eschw.) Müll. Arg.
Uncommon on shaded, often mossy, boulder and shaded bases of mature trees, particularly *Quercus velutina*, in extensive woodlands. Local material does not contain lichen substances and is referable to var. *corallina*.

Phyllopsora kalbii Brako
Known only from the extreme western Ozarks of Oklahoma, as cited by Brako (1991).

PHYSCIA (Schreber) Michx. (Physciaceae)

Small, narrow lobed pale gray foliose lichens with a KOH+ yellow upper cortex, pale lower cortex with pale rhizines; photobiont *Trebouxia* (?); apothecia sessile, with thalline margins; asci *Lecanora*-type, with 8 ellipsoid, brown, 1-septate, thick-walled spores; pycnidia hyaline with a dark ostiole, immersed, with bacilliform conidia; 14 species in the Ozarks. Reference: Thomson (1963).

1. Thallus sorediate, the soredia sometimes appearing finely lobulate.

    2. Lobes >0.7 mm broad, usually with the main lobes > 1 mm broad; soredia laminal, or terminal and labriform, prevailingly in well-defined soralia.

        3. Soralia labriform, suberect; medulla KOH-; long white marginal cilia present . . . . . *P. adscendens*

        3. Soralia laminal, sessile; medulla KOH+ yellow; eciliate, although sometimes with a few projecting pale rhizines of normal length.

            4. Thallus dark gray, at least on soralia and lobe tips; zeorin present; saxicolous; rare [*P. caesia*]

            4. Thallus pale gray throughout; zeorin absent; usually corticolous; common to rare.

                5. Soredia farinose, in well-defined orbicular soralia . . . . . *P. americana*

                5. Soredia coarse and mixed with isidiate pustules, diffuse . . . . . *P. clementei*

    2. Lobes to 0.5 mm broad; soredia prevailingly marginal or terminal, without well-defined soralia.

        6. Thallus saxicolous on siliceous rocks; lobes typically ca. 0.15 mm, long and narrow, or to 0.3 mm broad and slightly fan-shaped, and closely appressed, but lobes more than twice as long as wide; soredia granular.

            7. Lobes confluent, > 0.15 mm broad; lower cortex rudimentary or lacking; soredia mostly near lobe tips; usually in exposed sites . . . . . *P. dakotensis*

            7. Lobes separated, to 0.15 mm broad; lower cortex well developed; soredia marginal and terminal; usually in light shade . . . . . *P. subtilis*

        6. Thallus usually corticolous, very rarely on rocks and concrete in disturbed areas; main lobes typically >3 mm, short and less than twice as long as wide, with abundant side branches loosely adnate; soredia flattened and lobulate . . . . . *P. millegrana*

1. Thallus esorediate.

8. Thallus lobes <0.3 mm broad; saxicolous on siliceous rocks . . . . . *P. halei*

8. Thallus lobes mostly >0.4 mm broad; substrates various, but uncommon on siliceous rocks.

9. Medulla KOH-; zeorin and other triterpenoids absent.

10. Upper cortex not pruinose (but typically with prominent white spots); common . *P. stellaris*

10. Upper cortex conspicuously white pruinose; rare . . . . . *P. biziana*

9. Medulla KOH+ yellow; zeorin and/or other triterpenoids present.

11. Saxicolous.

12. Apothecia not notably pruinose; lobes mostly <1 mm broad . . . . . *P. phaea*

12. Apothecia usually with abundant pruina; lobes >1 mm broad . . . . . *P. aipolia*

11. Corticolous.

13. Zeorin absent; lobe tips not white spotted; apothecia rhizinate . . . . . *P. neogaea*

13. Zeorin present; lobe tips usually white spotted; apothecia lacking rhizines.

14. Lobes >1 mm broad, ±confluent, flat; spores ≥19 µm long . . . . . *P. aipolia*

14. Lobes <1 mm broad, separated, usually slightly convex; spores ≤18 µm long . . . . . *P. pumilior*

Physcia adscendens (Fr.) H. Olivier
Known only from a small cemetery in the eastern Missouri Ozarks, growing on old marble tombstones. This species is typically corticolous in regions north of Missouri, and local populations almost certainly represent recent introductions. This lichen is documented from tombstones at a few other locations well south of its main range and just north of the Ozarks in Illinois and Missouri. [atranorin]

Physcia aipolia (Humb.) Fürnr.
Occasional south and eastward, becoming common north and westward in the Ozarks, on exposed to lightly shaded hardwood boles and branches; rarely on exposed boles of *Juniperus* and even more rarely on shaded siliceous rocks in uplands. This species is characteristic of pastured regions, where it is common on boles of trees along roadsides and fencerows. [atranorin, zeorin, ± other triterpenoids]

Physcia americana G. Merr.
Common throughout the Ozarks on lightly shaded boles of a variety of hardwoods and *Juniperus*, with a predilection for *Quercus alba*, *Q. muehlenbergii*, and *Q. stellata*. This species also occurs on shaded dolomite. [atranorin, triterpenoid]

Physcia biziana (A. Massal.) Zahlbr.
Extremely rare in the Ozarks, occurring on exposed hardwood branches at a few scattered locations, particularly westward. [atranorin]

[**Physcia caesia** (Hoffm.) Fürnr.]
Previous reports from the Ozarks represent misidentifications. This species occurs north and west of the Ozarks in the Great Plains and Great Lakes regions. [atranorin, zeorin, ± other triterpenoids]

Physcia clementei (Sm.) Lynge
Known only from a single woodland in Arkansas, growing on branches of *Juniperus* and dolomite. [atranorin, triterpenoids (often in trace amounts)]

Physcia dakotensis Essl..
Sporadic, but locally common, on exposed siliceous rocks in glades, open rocky prairies and pastures, and on bluff summits. This lichen occurs on small cobbles and large boulder and bedrock expanses. It is more common in the western half of the Ozarks. [atranorin]

Physcia halei J. W. Thomson
Occasional in very lightly shaded, massive siliceous rock exposures, growing on chert, sandstone and igneous rocks. [atranorin]

Physcia millegrana Degel.
Common and widely distributed, although seldom abundant in natural habitats. This species grows on boles and especially exposed branches of most types of trees, frequently associating with *Candelaria concolor* and *Physcia stellaris*. It can become abundant on trees in disturbed areas, such as in towns and cities and around residences and farmsteads. *Physcia millegrana* also grows on old boards, weathered wooden fence posts, old rusted iron, and rarely, on rocks and concrete. [atranorin]

Physcia neogaea R.C. Harris
Apparently uncommon; on hardwoods in wooded uplands, particularly in the western Ozarks. [atranorin, triterpenoids]

Physcia phaea (Tuck.) J.W. Thomson
Rare in the extreme western Ozarks, with a single record from southwestern Illinois; on lightly shaded siliceous boulders in wooded uplands, often in small ravines. [atranorin, zeorin, ± other triterpenoids]

Physcia pumilior R. C. Harris
Occasional on trees, usually in extensive woodland. Although this species occurs on both canopy branches and tree boles, in the Ozark region it appears to be more characteristically associated with shaded tree boles and larger branches, as opposed to the morphologically similar *P. stellaris*, which is typically a species of canopy branches and young trees in high light intensities. A KOH test is necessary to reliably determine these two taxa. *Physcia aipolia* has lobes more than 1 mm broad, as opposed to the lobes of *P. pumilior*, which are prevailingly less than 1 mm wide. [atranorin, zeorin, other triterpenoids]

Physcia stellaris (L.) Ach.
Abundant on exposed to slightly shaded branches, especially young branches of canopy trees, where associates include *Amandinea polyspora, Arthonia caesia, Lecanora strobilina*, and *Pyrrhospora varians*. This species also occurs on lightly shaded rocks, and even old asphalt shingles and rusty ironwork. [atranorin]

Physcia subtilis Degel.
Locally frequent on lightly shaded siliceous rocks, including both massive outcrops and smaller boulders and fragments. Substrates include sandstone, chert, granite, and rhyolite. *Physcia subtilis* is described as having a KOH+ yellow medullary reaction, but all Ozark material examined reacts KOH-. Esslinger and Egan (1996) pointed out that the medulla of *P. subtilis* is actually KOH- but the lower cortex may be KOH+ yellow. The taxonomy of this complex in the region is problematical: Thomson (1963) indicated that *P. subtilis* has spores 8-13 × 6.5 µm, while related narrow-lobed species, such as *P. intermedia* Vain. and *P. teretiuscula* (Ach.) Lynge (both now considered synonymous with *P. dubia* (Hoffm.) Lettau, a usually broader-lobed species), have spores 16-25 × 7-11 µm. The single fertile collection examined from the lower Midwest, from northeastern Oklahoma (*Ladd 18459*), has spores ranging from 11 to 18 µm long! There are probably two distinct woodland taxa in the Ozarks that have been included under this name. [atranorin]

PHYSCIELLA Essl. (Physciaceae)

Narrow lobed, pale gray foliose lichens with a KOH- upper cortex and a pale, prosoplectenchymatous lower cortex; photobiont *Trebouxia* (?); apothecia sessile, with thalline margin; asci *Lecanora*-type, with 8 ellipsoid, brown, 1-septate, thick-walled spores; pycnidia dark, immersed, with ellipsoid conidia; 2 species in the Ozarks. References: Esslinger (1986).

1. Soralia marginal and terminal, mostly hooded and labriform or crescent shaped . . . . . *P. chloantha*

1. Soralia prevailingly round and laminal, occasionally some marginal soralia present but these not hooded or labriform . . . . . *P. melanchra*

Physciella chloantha (Ach.) Essl.
Occasional on shaded boles of hardwoods and especially shaded, mossy boles of *Juniperus virginiana*; also on shaded dolomite, limestone, and old shaded concrete. At first glance this species looks like a *Physcia*, but lacks atranorin in the cortex and reacts KOH-.

Physciella melanchra (Hue) Essl.
Infrequent; usually growing on shaded dolomite; also on tree bases and shaded lower boles of trees, sometimes found in anthropogenically disturbed areas. Local populations are less robust than typical populations of *P. melanchra* from the Great Plains, and, except for the predominately laminal soralia, display a disturbing resemblance to *P. chloantha*.

PHYSCONIA Poelt (Physciaceae)

Narrow-lobed, brown or grayish, typically pruinose, foliose lichens with a rhizinate lower cortex; photobiont *Trebouxia* (?); apothecia sessile and laminal, with a thalline margin; asci *Lecanora*-type, with 8 brown, ellipsoid, thick-walled, 1-septate spores; pycnidia dark, immersed, with bacilliform conidia; 2 species in the Ozarks. Reference: Esslinger (1994).

1. Soredia absent; apothecia common; extremely rare . . . . . *P. subpallida*

1. Sorediate; apothecia extremely rare; common species throughout the Ozarks . . . . . *P. leucoleiptes*

Physconia leucoleiptes (Tuck.) Essl.
Frequent on shaded lower boles of hardwoods and *Juniperus*, as well as on shaded rocks, both carbonate and siliceous. Previous reports of *P. detersa* (Nyl.) Poelt from the region are referable here. Some local populations contain gyrophoric acid and react KC+ reddish in the medulla; these were formerly called *P. kurokawae* Kashiw. Both chemical strains sometimes occur admixed on the same tree or rock. [secalonic acid A in soralia, ± gyrophoric acid]

Physconia subpallida Essl.
Known only from a single site in the western Ozarks region of Oklahoma, where it occurs on hardwoods bordering an open glade.

PLACIDIOPSIS Beltr. (Verrucariaceae)

Saxicolous lichens with tiny gray squamulose thalli; photobiont *Trebouxia*-like; perithecia immersed; asci resembling those of *Verrucaria*, with 8 small, hyaline, ellipsoid, 1-septate spores; conidiomata unknown; 1 species in the Ozarks. Reference: Harris (1979b).

Placidiopsis minor R. C. Harris
Known only from rhyolite fragments in a seasonally moist bedrock depression in an extensive rhyolite glade near the summit of Stegall Mountain in Carter County. As noted by Harris (1979b) points out, at first glance this species resembles an *Acarospora*.

PLACIDIUM (Flot.) Breuß (Verrucariaceae)

Brown squamulose lichens with well-developed thalli; photobiont *Myrmecia*; perithecia immersed; asci thin-walled, with 8 simple, hyaline, ellipsoid spores; pycnidia ± immersed, with ellipsoid to bacilliform conidia; 4 species in the Ozarks. References: Breuß (1996), McCune (1987), Thomson (1987).

1. Thallus corticolous or occasionally saxicolous on mossy dolomite, thallus of fused and overlapping squamules; rhizines abundant . . . . . *P. arboreum*

1. Thallus terricolous, of ± discrete squamules; rhizines present or absent.

    2. Squamules with free, slightly raised margins, bright green when wet . . . . . *P. chilense*

    2. Squamules closely appressed, dark when wet.

        3. Attached by rhizohyphae only . . . . . *P. squamulosum*

        3. Attached by both rhizohyphae and coarse rhizines . . . . . *P. lacinulatum*

Placidium arboreum (Michener) Lendemer
Occasional on lower boles of trees in lightly shaded uplands, and uncommonly on shaded, mossy dolomite. This species exhibits a preference for *Fraxinus* and white oaks (*Quercus alba*, *Q. muehlenbergii* and *Q. stellata*). A typical habitat is on trees bordering dolomite glades. This species was previously called *Placidium tuckermanii* (Ravenel *ex* Mont.) Breuß.

Placidium chilense (Räsänen) Breuß
Uncommon in the Ozarks, known only from Cherokee County, Oklahoma and Madison and Newton counties, Missouri. In the Ozarks, *Placidium chilense* grows on soil or on soil over rock

in rhyolite, chert or acidic sandstone glades. *Dermatocarpon arenosaxi* is invariably present in these same habitats in the Ozarks and thus is always a close associate of *Placidium chilense*. *Placidium chilense* is distinguished from *Dermatocarpon* by a squamulose thallus attached by rhizohyphae, not holdfasts or an umbilicus, a lower cortex that is composed of thin (mostly ≤1 µm) walled cells which are ± spherical, and not of the *Dermatocarpon*-type (see Harada, 1993) composed of thick (mostly 2-4 µm) walled, cells which are rectangular, sub-cuboidal to sub-spherical. *Dermatocarpon* and *Placidium chilense* both have sharply delimited medullae. This delimitation is less sharp in *P. chilense* than in *Dermatocarpon* partly because of a few anticlinal medullary hyphae that morph into lower cortex cells. This does not occur in *Dermatocarpon* in which the medullary hyphae remain periclinal to the lower cortex. *Placidium chilense* is characterized by squamules to 5 mm broad with margins that are free from the substrate, a medulla which is sharply delimited from the lower cortex, laminal pycnidia with short cylindrical conidia (3-4 × 1-1.3 µm), and small spores [10-14 (-16) × 5-6 µm] (Breuß, 1993). The squamules with free margins make this species of *Placidium* easily mistaken for small lobed *Dermatocarpon arenosaxi* in the Ozarks where these two species are found growing intermixed. The anatomy and thin walled cells of *Placidium chilense* impart a fragility and friable nature to the thallus. *Dermatocarpon* can be brittle but since it is composed of thicker-walled cells and a well-developed lower cortex it is ± leathery and not friable. *Placidium chilense* is tightly adhered to the soil. *Dermatocarpon arenosaxi* is easily removed from the soil because it is not centrally attached by rhizohyphae. *Placidium chilense* is bright green when wet with little or no brown pigment. *Dermatocarpon arenosaxi* which is usually dark brown is only ever partly green when wet. Sometimes the margin of lower surface of *Placidium chilense* is white. The lower surface of *Dermatocarpon arenosaxi* is never white.

Placidium lacinulatum (Ach.) Breuß
Occasional in thin xeric soil over bedrock at scattered sites across the Ozarks, occurring in both carbonate and siliceous habitats.

Placidium squamulosum (Ach.) Breuß
Common and widespread in its limited habitat: exposed thin soils over carbonate bedrock, in areas with minimal competition from vascular vegetation, such as on glades and bluff summits. In higher quality glades, *Heppia adglutinata, Psora decipiens* and *P. russellii* are characteristic associates.

PLACYNTHIELLA Elenkin (Agyriaceae)

Lignicolous or saxicolous crustose lichens with dark brown thalli composed of tiny coralloid-isidiate granules or areoles dissolving into isidioid masses; photobiont chlorococcoid; apothecia sessile, brown, lacking a thalline margin; asci resembling those of *Trapelia,* with I+ bluish apical dome, lacking an ocular chamber, with 8 hyaline, ellipsoid, simple spores; conidiomata unknown; 2 species in the Ozarks.

1. On decorticate wood; “isidiate” . . . . . *P. icmalea*

1. On rock; areoles forming granular isidioid masses . . . . . *P. knudsenii*

Placynthiella icmalea (Ach.) Coppins & P. James
Common but often overlooked, on lightly to moderately shaded decorticate logs and stumps of hardwoods in woodlands throughout the Ozarks. From a distance, the minute brown thalli resemble rotting wood. [gyrophoric acid]

Placynthiella knudsenii Lendemer
Rare, known from a single collection from a Missouri rhyolite glade. Distribution is unclear as the species was only recently described from southern California (Lendemer, 2004b).

PLACYNTHIUM (Ach.) Gray (Placynthiaceae)

Saxicolous gelatinous lichens with crustose to placodioid or subfoliose thalli; photobiont *Dichothrix* and *Scytonema*; apothecia sessile, thalline margin absent; asci *Peltigera*-type, with 8 hyaline, ellipsoid, 1-3 septate spores; pycnidia dark, immersed, with ellipsoid to fusiform or bifusiform conidia; 3 species in the Ozarks. Reference: Henssen (1963).

1. Thallus crustose to placodioid, isidiate; conspicuous blue-black prothallus present (sometimes obscure) . . . . . *P. nigrum*

1. Thallus subfoliose, with well-developed narrow lobes, usually not isidiate; prothallus lacking

    2. Thallus bluish to darkening beneath . . . . . *P. petersii*

    2. Thallus pale beneath . . . . . *P. stenophyllum*

Placynthium nigrum (Huds.) Gray
Occasional on exposed to lightly shaded carbonate substrates, particularly in areas with somewhat moist microclimate. In the Ozarks, this species grows on dolomite, limestone, and sometimes even on old, shaded concrete.

Placynthium petersii (Nyl.) Burnham
Uncommon on exposed to lightly shaded, massive dolomite ledges, boulders, and escarpments in upland sites, typically associated with glades and bluffs.

Placynthium stenophyllum (Tuck.) Fink
Thallus poorly developed, often almost squamulose; lobes obscure, < 0.1 mm broad, subterete, ± lustrous, elongate, sparsely branched, sometimes with cylindrical isidia; thallus yellowish under microscopic examination, lacking bluish tints.

Known only from dolomite at a few sites through the central Ozarks.

POLYBLASTIA A. Massal. (Verrucariacene)

Saxicolous crust with thin, continuous, smooth, black thalli; photobiont chlorococcoid; perithecia immersed in tiny thallus warts, with minute apical ostioles; asci thin-walled, *Verrucaria* type, with 8 pale, muriform spores; 1 species in the Ozarks.

Polyblastia sp.
Known only from shaded chert fragments in a xeric wooded upland in MOFEP site 6, in Reynolds County.

POLYSPORINA Vězda (Acarosporaceae)

Saxicolous crustose lichens with thin to obscure or partly endolithic, gray thalli; photobiont *Myrmecia* or *Trebouxia*; apothecia sessile, without a thalline margin, the disks irregularly ridged and lumpy, paraphyses abundantly branched and anastomosed; asci strongly thickened apically, with an I- apical dome, with numerous, minute, bacilliform spores; 1 species in the Ozarks.

Polysporina simplex (Davies) Vězda
Occasional on siliceous rocks in exposed to lightly shaded habitats, growing on sandstone and rhyolite. See comments under *Sarcogyne privigna*.

PORINA Müll. Arg. (Porinaceae)

Corticolous crustose lichens with a thin, ± continuous thallus containing oxylate crystals; photobiont *Trentepohlia*; perithecia brownish, embedded in thalline warts, the ascomatal wall yellow to reddish; asci narrowly cylindrical, uniformly thin-walled, with 8 hyaline, 8+ septate ascospores, usually with an evident attenuate "tail" at one end; pycnidia not seen in Ozark material, immersed, with bacilliform conidia; 1 species in the Ozarks.

Porina heterospora (Hedrick) R.C. Harris
Known only from *Carpinus caroliniana* in a mesic streamside woodland in Franklin County, Arkansas. This species becomes more common in the Ouachita region south of the Ozarks.

PORPIDIA Körb. (Porpidiaceae)

Saxicolous crustose lichens with white to grayish thalli; photobiont *Asterochloris*; apothecia immersed or sessile, lacking a thalline margin; asci *Porpidia*-type, with 8 hyaline, ellipsoid, simple spores; pycnidia rare, immersed, with bacilliform conidia; 3 species in the Ozarks. Reference: Gowan (1989).

1. Thallus thick, gray; apothecia mostly immersed, blue-gray, densely gray pruinose . . . . . *P. albocaerulescens*

1. Thallus thin, whitish; apothecia sessile, jet black, epruinose.

    2. Margin radially cracked; exciple carbonaceous throughout; hyphae not discernable in exciple; occasional . . . . . *P. tahawasiana*

    2. Margin not radially cracked; outer exciple greenish; hyphae discernable in exciple; rare . . . *P. crustulata*

Porpidia albocaerulescens (Wulfen) Hertel & Knoph
Locally frequent in shaded mesic sites on siliceous rocks, typically on boulders at the base of moist talus slopes, on moist lower faces of massive bluffs, and on large boulders of rhyolite, chert, or sandstone in the bottom of narrow ravines. [stictic acid]

Porpidia crustulata (Ach.) Hertel & Knoph
Known from a single collection from sandstone pebbles in the southern Ozarks.

Porpidia tahawasiana Gowan
Occasional on lightly shaded siliceous rocks, especially sandstone, in wooded uplands.

PROTOBLASTENIA (Zahlbr.) J. Steiner (Psoraceae)
Verh. Zool.-Bot. Ges. Wien 61: 47. 1911. *Blastenia* sect. *Protoblastenia* Zahlbr. In Engler & Prantl, Natürl. Pflanzenfam. 1(1*): 226. 1907.

Crustose lichens on carbonate rocks, with thin, superficial or immersed, grayish to pale brownish thalli and sessile, convex, orange to orangish brown apothecia (KOH+ purple, parietin), thalline margin absent; photobiont chloroccoid; asci *Porpidia*-type, with 8 colorless, ellipsoid, simple spores; 2 species in the region.

It is possible to confuse *Protoblastenia* with *Caloplaca* which also occurs on carbonate substrates and has KOH+ purple apothecia. In the field the broadly attached swollen dull rusty orange apothecia are ± diagnostic. Confirmation may be obtained by examination of the spores, undivided with uniform walls in *Protoblastenia*, divided and with thickened walls in *Caloplaca*. The two species can be separated on the thallus characteristics and *P. rupestris* usually has a paler apothecial margin, while doubtful cases may have to be examined for the differences in hypothecium and spore width.

1. Thallus sordid gray, superficial, usually cracked or areolate, or reduced to sparse areoles near the apothecia; hypothecium without granules; ascospores 6-8 µm broad . . . . . *P. rupestris*

1. Thallus pale greenish gray, immersed in rock; hypothecium obscured by colorless granules; ascospores 4-5.5 µm broad . . . . . *P. ozarkana*

Protoblastenia ozarkana *sp. provis.*
Thallus immersed in rock, visible as pale green gray stain. Apothecia rusty orange, matt, often orange pruinose, weakly to strongly convex (margin not visible at any stage), broadly attached, constricted at base, 0.3-0.5 mm in diameter. Exciple poorly developed, colorless. Hypothecium colorless, obscured by dense colorless granules (not dissolving in KOH). Ascospores narrowly ellipsoidal to ellipsoidal, 9(-11-)13 × 4(-4.9-)5.5 µm. Pycnidia sparse or numerous, blackish, immersed in rock, 1-1.5 mm in diameter, with microconidia or macroconidia and in one case with both in single pycnidium. Microconidia broadly rod-shaped, ca. 7 × 1.5-2 µm. Macroconidia broadly ellipsoid or with one end ± swollen, 11-14 × 4-5 µm. [parietin? in apothecia]

This species is apparently endemic to the Ozarks, and is known from both dolomite and limestone at four sites near the Arkansas/Missouri border in both eastern and western parts of the states. This species may have a predilection for more exposed, xeric sites than does *P. rupestris*.

Protoblastenia rupestris (Scop.) J. Steiner
Thallus superficial, grayish (sometimes darkened by algae, etc. on surface), pale gray-brown or tan, matt to slightly shiny, divided into areoles by narrow to broad cracks, rarely smooth, occasionally only patchily developed. Apothecia with orange disk darkening to orange-brown (occasionally discolored blackish), with yellowish margin darkening to orange and eventually disappearing, epruinose, weakly to strongly convex, broadly attached, weakly to strongly constricted at base, reaching 0.8 mm in diameter. Exciple colorless, with ± radiating hyphae. Hypothecium colorless to pale buff or orangish, without granules, sometimes extending stipe-like into the thallus. Ascospores ellipsoid to broadly ellipsoid, 11(-12.2-)13 × 6(-7.1-)8 µm. Pycnidia rare, inconspicuous, immersed, very pale orangish (KOH+ weakly red), ca. 50-100 µm in diameter. Microconidia rod-shaped, 6-7.5 × 1.5 µm. Macroconidia not seen. [parietin in apothecia]

Locally frequent on lightly shaded dolomite, particularly on horizontal surfaces of both larger rocks and ledges and small fragments. Typical habitats include the lower edges of glades and along small runoff streams in upland waterways. *Endococcus protoblasteniae Diederich*, a small

peritheciate lichenicolous fungus with eight 2-celled brown spores per ascus, occasionally parasitizes this species, as does *Muellerella lichenicola* (Sommerf. *ex* Fr) D. Hawksw., which has dark perithecia with polysporous asci and septate brown ascospores.

PSEUDOCYPHELLARIA Vain. (Lobariaceae)

Large corticolous lichens with brown upper cortex, pale brown, pseudocyphellate, tomentose lower surface, and bright yellow marginal soralia and medulla; photobiont (in our taxon) *Chlorella*-like or *Dictyochloropsis*; apothecia usually lacking, sessile, with thalline margin; asci *Peltigera*-type, with 8 brown, fusiform-ellipsoid, 1-3- septate spores; pycnidia immersed, with bacilliform conidia; 1 species in the Ozarks.

Pseudocyphellaria aurata (Ach.) Vain.
In the Ozarks, known only from Missouri, the bole of an old growth *Platanus occidentalis* along the outflow from Greer Spring, where it was discovered in 1986. This species is designated as Endangered in Missouri. [calycin, pulvinic acid, pulvinic dilactone]

PSEUDOSAGEDIA (Müll. Arg.) M. Choisy (Tichotheliaceae)

Small crustose lichens with dull, dark gray, continuous to rimose thalli lacking crystals; photobiont *Trentepohlia*; perithecia small, sessile, black with pale apical ostiole; asci thin-walled, with slight apical thickening, with 8 hyaline, elongate, multi-septate spores that are often attenuate-acuminate at one end; 3 species in the Ozarks. These species were formerly included in the genera *Porina* and *Trichothelium*. Reference: Harris (1995).

1. Thallus isidiate; rare . . . . . *P. isidiata*

1. Thallus without diaspores; occasional.

    2. Corticolous; ascospores 8-13- celled, 38-50 × 5.5-7.5 µm . . . . . *P. cestrensis*

    2. Saxicolous; ascospores 8(9)- celled, 32-45 × 5-6 µm . . . . . *P. guentheri*

Pseudosagedia cestrensis (Tuck. *ex* E. Michener) R.C. Harris
Occasional on shaded boles of hardwoods in mesic sites along streams and on wooded floodplain terraces and in ravines. In our region, the two most common substrates are *Carpinus caroliniana* and *Celtis occidentalis*.

Pseudosagedia guentheri (Flotow) R.C. Harris
Apparently occasional, but more likely overlooked; on lightly shaded siliceous rocks.

Pseudosagedia isidiata (R.C. Harris) R.C. Harris
This green, finely isidiate crust is known from tree bases at a single site in Missouri and several in Illinois.

PSORA Hoffm. (Psoraceae)

Saxicolous or terricolous squamulose lichens with thick thalli; lower surface pale, with a minute hairy tomentum; photobiont chlorococcoid (*Myrmecia* ?); apothecia sessile, plane to convex, ultimately emarginate; epithecium yellowish to reddish brown, with small yellowish to brownish orange parietin crystals, KOH+ magenta in section; asci *Porpidia*-type, with 8 simple, hyaline, ellipsoid spores typically to 16 × 7 µm; pycnidia absent in Ozark material; 4 species in the Ozarks. References: Timdal (1986, 2002).

1. Thallus green to greenish yellow; medulla UV+ orange (rhizocarpic acid); rare and restricted to exposed soil pockets in channel sandstone glades . . . . . *P. icterica*

1. Thallus various shades of gray or brown; medulla UV-; on soil and rocks associated with carbonate substrates.

    2. Thallus saxicolous . . . . . *P. pseudorussellii*

    2. Thallus terricolous.

        3. Squamules brown; medulla KOH+ yellow to orange-red (norstictic acid); apothecia prevailingly laminal, reddish brown . . . . . *P. russellii*

        3. Squamules reddish brown; medulla KOH-; apothecia prevailingly marginal or submarginal, black . . . . . *P. decipiens*

Psora decipiens (Hedw.) Hoffm.
Squamules dark pinkish tan to brick red, to 6 mm broad, with a prominent white erose margin, irregularly rounded to somewhat elongate or sublobed; upper surface often pruinose, especially near the margins, the upper cortex sometimes fissured; apothecia common, typically 1-2/squamule when present, prevailingly marginal to submarginal, convex, black, to 1.3 mm broad; epithecium deep reddish brown, the pigmentation suffusing into the hymenium.

Occasional on exposed high-base soils over both limestone and dolomite, usually in glades. This species is almost always associated with *Placidium squamulosum*, which has a brown peritheciate thallus with concolorous margins, as contrasted with the reddish-tinged, apotheciate thallus with prominent white margins of *Psora decipiens*.

Psora icterica (Mont.) Müll. Arg.
Squamules green to yellowish green, to 8 mm broad, with narrow, well-defined, involute white margins, usually sublobate and sometimes appearing almost foliose; upper surface occasionally with cracks and marginal zones of faint pruina; medulla pale yellow, particularly in the upper portions; apothecia occasional, prevailingly laminal, brown to darkening, plane to convex, to 1.4 mm broad; epithecium yellowish brown. [rhizocarpic acid]

Rare and restricted to thin soil pockets over Pennsylvanian channel sandstones in glades in the Springfield Plains subsection of the western Missouri Ozarks, associated with characteristic vascular species such as *Geocarpon minimum* and *Selenia aurea*. These sandstones were formed in braided freshwater streams, and have an unusual composition including several heavy metals.

Psora pseudorussellii Timdal
Squamules tan to brown, or grayish brown in more shaded sites, to 7 mm broad, rounded to sublobate, loosely adnate, with free or upturned, thick white margins; upper cortex lustrous,

usually not pruinose, sometimes with frequent fissures; apothecia common, prevailingly laminal, reddish brown, to 1.5 mm broad, convex, usually 3 or less per squamule.

Frequent and characteristic on exposed dolomite in glades and on bluff summits, occurring on both bedrock and boulders. This species also occurs, but less frequently, on limestone glades. A single collection from St. Louis County is from old weathered concrete. Because extensive exposures of carbonate bedrock are limited in the southern Ozarks, this species is most common in the northern two thirds of the region.

This species sometimes survives in shaded habitats in overgrown glades, and the scars left by the thalli can be seen long afterwards in overgrown shaded glades, testifying to their formerly more open character. *Lecidea lurida*, a species of similar habitats, might key here; it has concolorous thallus margins and smaller, dark apothecia.

Psora russellii (Tuck.) A. Schneid.
Squamules chocolate brown to occasionally more grayish tinged, round to convolute, to 6 mm broad, loosely adnate, with the prominent thick white margins frequently ± upturned; individual squamules often massing into continuous mats; upper surface sometimes locally or completely pruinose; apothecia common, to 8/squamule, prevailingly laminal, to 1.5 mm broad. [norstictic acid]

Uncommon and sporadic, but often locally abundant, on exposed thin soils over extensive dolomite bedrock in glades, often associated with *Psora decipiens, Placidium squamulosum* and, less commonly, *Heppia adglutinata*.

PSOROGLAENA Müll. Arg. (Verrucariaceae)

Minute filamentous or crustose lichens with papillate cortical cells; photobiont chlorococcoid; perithecia semi-immersed, pale to dark, with apical ostiole; paraphyses absent; hymenial gel I+ bluish to orangish; asci fissitunicate with 1-8 transversely septate to muriform spores; pycnidia unknown; 1 species in the Ozarks.

Psoroglaena dictyospora (A. Orange) Harada
Rare; known only from old hardwood logs in two woodlands in the northern Ozarks. This species was formerly known as *Macentina dictyosprra* A. Orange.

PSOROTICHIA A. Massal (Lichinaceae)

Saxicolous crustose lichens with low granular isidia, the thallus black, gelatinous, areolate to squamulose; photobiont *Chroococcidiopsis*; apothecia subimmersed, with a granular thalline margin, the disk brown; asci cylindrical, IKI-, without apical thickenings or structures, with 8 simple, ellipsoid spores; pycnidia immersed, with bacilliform conidia; 1 species in the Ozarks.

Psorotichia schaereri (A. Massal.) Arnold
This diminutive black crust is frequent, but often overlooked, on exposed hard carbonate rocks, occurring on both dolomite and limestone. It typically occurs on low horizontal surfaces, growing on small fragments, boulders, and bedrock flats.

PSORULA Gotth. Schneid. (Psoraceae)

Small brown to grayish squamulose lichenicolous lichens; photobiont chlorococcoid; apothecia black, marginal, sessile, lacking a thalline margin; asci *Porpidia*-type, with 8 hyaline, ellipsoid, simple spores; pycnidia unknown in Ozark material, sessile, marginal, typically greenish, with ellipsoid conidia; 1 species in the Ozarks. This monospecific genus differs from *Psora* in the KOH- reaction of all parts of the apothecia, the presence of green pigments in the apothecia and pycnidia, and the lack of calcium oxalate crystals in the thallus.

Psorula rufonigra (Tuck.) Gotth. Schneid.
Small, thick, crenate to rounded squamules to 2.5 mm broad, brown to grayish or olive brown, occurring singly or more commonly imbricate, partly adnate, with thickened, distinctly dark gray margins; upper cortex smooth, somewhat lustrous; lower surface dark, frequently with a pale marginal zone on the unattached portions of the squamule, the dark attached portions with dark tomentum-like filaments to 0.08 mm long; apothecia common, marginal to submarginal or sometimes even appearing extramarginal, black, to 1.3 mm broad, initially hemispherical but ultimately plane, with slightly thickened margins; epithecium bluish to greenish gray, lacking crystals; hypothecium pale to purplish gray; ascospores simple, hyaline, irregularly ellipsoid, ca. 11-14 × 5-6 μm; pycnidia not seen in Ozark material.

Occasional through the Ozarks, on exposed to very lightly shaded siliceous rocks, growing on *Spilonema revertens*, usually on flat surfaces, small depressions, or in crevices, and often on a thin layer of fine silty soil. This species occurs in areas with large siliceous bedrock exposures, such as sandstone, igneous and chert glades and bluffs, and on solitary sandstone and chert boulders in dolomite glades. Global distribution: scattered throughout the temperate Northern Hemisphere, mostly in semi-arid sites.

Psorula rufonigra is apparently an obligate parasite on *Spilonema revertens*, a minute, subfruticose cyanobacterial lichen, and all the Ozark collections have varying amounts of the characteristic cushions of branched brown filaments characteristic of the *Spilonema*.

PUNCTELIA Krog (Parmeliaceae)

Medium-broad lobed, light gray, adnate foliose lichens with a pseudocyphellate upper cortex containing atranorin and white to pale brown lower cortex with numerous, simple to coalescing rhizines averaging ca. 0.5 mm long; photobiont *Trebouxia*; apothecia sessile, with a thalline margin; epithecium brown, hypothecium pale, asci *Lecanora*-type, with 8 simple, hyaline, ellipsoid spores typically 12-16 × 7-8.5 μm; pycnidia pale to dark, laminal, immersed; conidia unciform to elongate bacilliform; 6 species in the Ozarks. References: Adler (1997), Aptroot (2003), Krog (1982), Wilhelm & Ladd (1992).

1. Thallus without diaspores.

    2. Medulla C-, containing only fatty acids; almost invariably corticolous . . . . . *P. bolliana*

    2. Medulla C+ red, containing lecanoric acid; corticolous or saxicolous . . . . . *P. graminicola*

1. Thallus isidiate or sorediate.

    3. Thallus with fine cylindrical isidia, these usually darkened at the apices . . . . . *P. rudecta*

    3. Thallus sorediate, and sometimes also bearing small ± flattened lobules.

4. Soredia coarse and granulose, frequently associated with partially corticate granules; thallus after copiously lobulate . . . . . *P. missouriensis*

4. Soredia farinose; thallus not markedly lobulate.

5. Thallus smooth; soredia often in round laminal soralia . . . . . *P. subrudecta*

5. Thallus foveolate-ridged to scrobiculate; soredia prevailingly marginal and/or associated with the thallus ridges . . . . . *P. perreticulata*

Punctelia bolliana (Müll. Arg.) Krog
Thallus large, to 15 cm broad, pale gray to bluish gray, occasionally with lobules associated with the lobe margins, pseudocyphellae, and cracks in the upper cortex; lobes apically expanded and ± rotund, to 6 mm broad; upper cortex often ± regularly wrinkled and ridged; pseudocyphellae common, well separated, round to slightly elongate, 0.1-0.2 mm broad, tending to be more disposed towards the thallus ridges; apothecia common, laminal, with strongly constricted bases, initially cupuliform but becoming less so with age, with conspicuously pseudocyphellate thalline margins, the ± plane brown disks to 12 mm broad; pycnidia common, laminal, immersed, tending to be grouped towards the lobe tips, the pale to ultimately dark exposed apices 0.04-0.08 mm broad; conidia bacilliform, 4-7 × 1-1.4 µm. [atranorin, fatty acids]

Locally frequent on hardwoods and *Juniperus* in exposed habitats, such as in glades and along borders of old fields. This species is more common in the grassland biome of the Great Plains to the west of the Ozarks, and tends to be more common in the northern and western Ozarks, where open habitats, including anthropogenic openings, are more common. *Physcia aipolia* has similar habitat affinities and distributional patterns in the Ozarks, and the two species are sometimes associated. There is a single collection from a lightly shaded sandstone boulder in the western Missouri Ozarks.

A C test is necessary to distinguish this species from the morphologically identical *P. graminicola*, which occurs in similar habitats; the two are sometimes associated. The medulla of both species is often very faintly yellowish-dingy.

Punctelia graminicola (de Lesd.) Egan
Thallus large, to 15 cm broad, pale gray to bluish gray, lobes apically expanded and ± rotund, to 5(-6) mm broad; upper cortex sometimes somewhat wrinkled, occasionally lobulate; pseudocyphellae common, well separated, round to slightly elongate, 0.1-0.2 mm broad, tending to be more disposed towards the thallus ridges; apothecia common on corticolous specimens, rare on saxicolous thalli, laminal, with strongly constricted bases, initially cupuliform but becoming less so with age, with conspicuously pseudocyphellate thalline margins, the ± plane brown disks to 12 mm broad; pycnidia common, laminal, immersed, tending to be grouped towards the lobe tips, the pale to ultimately dark exposed apices 0.04-0.08 mm broad; conidia bacilliform, 4-7 × 1-1.3 µm. [atranorin, lecanoric acid]

Infrequent on exposed to lightly shaded trees in habitats similar to those of *P. bolliana*. *Punctelia graminicola* also occurs regularly on lightly shaded, usually somewhat mesic, faces of massive siliceous bluffs and outcrops in intact woodland and glade systems. Rhyolite and sandstone appear to be preferred substrates, and lichen associates in these habitats include *Coccocarpia, Palmicola, Parmotrema madagascariaceum, Pertusaria plittiana* and *Usnea amblyoclada*.

This lichen is similar to and has often been mistaken for *P. hypoleucites* (Nyl.) Krog, a species of the desert Southwest with straight filiform conidia usually > 10 µm long. Adding to the confusion, *P. graminicola* was long known as *P. semansiana* (W.L. Culb & C.F. Culb.) Krog,

until the recent nomenclatural correction by Egan (2003). Although it is probably not significant on a statistical basis, among local populations the conidia of this species appear to be slightly narrower than those of *P. bolliana*. One puzzling corticolous collection from Pettis County, Missouri, *Ladd 14264*, is a mixture of typical *P. graminicola* and a morphologically identical thallus with distinctly curved, filiform conidia 7-11 µm long.

Punctelia missouriensis G. Wilh. & Ladd
Thallus to 20 cm broad, with broadened lobes typically to 5 mm broad, the margins often tinged brownish; upper cortex ± lustrous, commonly lobulate, often with weak white reticulations near the lobe tips; pseudocyphellae abundant, minutely punctate near the lobe margins to 0.3 mm broad on older portions of the thallus, often with one or two elongate cracks in the cortex radiating from the pseudocyphella; pseudocyphellae and cortical cracks commonly erupting into coarse, granular or lobuliform, often partially corticate, sorediose granules, these soraliate eruptions with <10 granules each, but sometimes coalescing into larger areas. Apothecia very rare, to 6 mm broad, with frequent pseudocyphellae and sorediose granules on the thalline margin; pycnidia rare; conidia narrowly bacilliform, typically 5-5.5 × 0.8 µm. [atranorin, lecanoric acid]

Common throughout the Ozarks on a variety of lightly shaded substrates in wooded uplands, including hardwoods, conifers, and siliceous rocks; often associated with *P. rudecta*. The type collection of this species is from the Ozarks, in Crawford County, Missouri (Wilhelm & Ladd 1992). Global range: North and South America for *P. missouriensis*; *P. punctilla* (see below) also occurs in Africa.

This species has been confused with *P. rudecta* and *P. subrudecta* because of misinterpretation of the nature of the diaspores. When wet, the thallus of *P. missouriensis* is paler than that of *P. rudecta*. Even when the lobules of *P. missouriensis* appear isidioid, they are not dark tipped like the finely cylindrical isidia of *P. rudecta*. *Punctelia subrudecta* has farinose soredia in well-delimited soralia, whereas *P. missouriensis* has soredia in patches associated with the pseudocyphellae on the upper cortex. Adler (1997) described the morphology of the diaspores in detail, and included *P. missouriensis* within *P. punctilla* (Hale) Krog, but Van Herk and Aptroot (2000) considered the species to be distinct; Wilhelm and Ladd (1992) provided a key separating the two. The distinctions appear sufficient to justify maintaining local material as a separate entity for now. *Punctelia missouriensis* is occasionally parasitized by *Nectriopsis parmeliae*; see discussion under *P. rudecta*.

Punctelia perreticulata (Räsänen) G. Wilh. & Ladd
Thallus pale blue gray, the lobes typically 4 mm or less broad, with crenate to sub-lobed tips, the margins concolorous with the upper cortex or brownish only in a very narrow band; upper cortex often dull, with conspicuous reticulate pattern of ridges and wrinkles creating a scrobiculate appearance; pseudocyphellae sparse, to 0.2 mm broad, mostly transformed into round soralia with farinose soredia; soralia prevailingly marginal and associated with thallus ridges, often coalescing and becoming elongate linear masses of farinose soredia; apothecia unknown in Ozark material; pycnidia very rare; conidia narrowly bacilliform, 6-8 × ≤ 1 µm. [atranorin, lecanoric acid]

Local on corticolous substrates in exposed to lightly shaded sites scattered through most of the Ozarks, often associated with glade and bluff systems in intact habitats. Exposed branches and boles of old growth *Juniperus virginiana* and *J. ashei* appear to be favored substrates, although this species also occurs on *Pinus echinata*, *Ulmus alata* and rarely on other hardwoods.

See discussion under *P. subrudecta* regarding taxonomic issues between these two entities.

Punctelia rudecta (Ach.) Krog
Thallus blue gray, the lobes to 5 mm, with distinctly brownish margins; upper cortex lustrous, often with indistinct whitish reticulations near the lobe tips; pseudocyphellae common, minute near the lobe tips but to 0.2 mm broad on older portions of the thallus; cylindrical isidia abundant, typically to 0.2 × 0.1 mm, with dark brown tips, sometimes branched or coralloid, arising from the upper cortex, pseudocyphellae, and lobe margins; small marginal lobules sometimes present; apothecia uncommon, to 5 mm broad, with abundant pseudocyphellae on the thalline margin; pycnidia unknown in Ozark material. [atranorin, lecanoric acid]

In terms of both number of individuals, ubiquity, and total biomass, this is the most common and pervasively distributed lichen in the Ozarks, occurring throughout the region on virtually all corticolous and saxicolous substrates, as well as decorticate logs, in dry to mesic conditions and exposed to deeply shaded sites. It is nearly ubiquitous on a wide variety of trees, occurring on all portions but the youngest canopy branches.

Young thalli in shaded habitats are often sparsely or only incipiently isidiate, but can be distinguished from *P. graminicola* by the habitat and the less wrinkled lobes with angular pale markings near the tips. Corticolous specimens of *P. rudecta* in woodlands are frequently parasitized by *Nectriopsis parmeliae* (Berk. & M.A. Curtis) D. Hawksw. (Hypocreaceae), a lichenicolous fungus with fuzzy, orange-pink, globose perithecia to 0.2 mm broad sessile on the upper surface of the host thallus. The ascospores of the *Nectriopsis* are unusual in that each ascus produces one or two large macroascospores and 4-5 markedly smaller microascospores; both spore types are hyaline, ellipsoid, and 1-septate. Other lichens that are parasitized by *N. parmeliae* in the Ozarks include *Flavoparmelia caperata, Myelochroa aurulenta, Physcia americana, Punctelia missouriensis Pyxine sorediata* and rarely, *Heterodermia obscurata* and *Lecanora hybocarpa*. The host thallus becomes necrotic in the region of the *Nectriopsis* infestation.

Punctelia subrudecta (Nyl.) Krog
Thallus pale blue gray, the lobes typically 4 mm or less broad, with crenate to sub-lobed tips, the margins often brownish tinged; upper cortex not or only slightly and inconspicuously wrinkled; pseudocyphellae common, particularly towards the lobe tips, to 0.2 mm broad, in older portions of the thallus these typically transformed into circular soralia ca. 1 mm broad, with abundant farinose soredia; small areas of marginal soralia sometimes also present; apothecia unknown in Ozark material; pycnidia unknown in Ozark material. [atranorin, lecanoric acid]

Occasional in lightly to moderately shaded habitats, usually on conifers in sites with remnant natural integrity, but also known from several species of hardwoods. A favored substrate is the lower boles and bases of *Pinus echinata* in open wooded uplands. *Ulmus alata* is another common substrate, and a single collection is known from a shaded sandstone boulder.

Ozark material of this taxon is questionably distinct from *P. perreticulata*. Although the two entities are clearly distinguishable at their extremes, there are some intergrading specimens. Adler and Ahti (1996) determined that the only reliable character was the conidia: narrow and elongate in *P. perreticulata* and unciform in *P. subrudecta*. They regarded the presence or absence of ridges in the upper cortex as an environmentally induced variant. Van Herk and Aptroot (2002) regard the ridged upper cortex and soralia type and distribution as valid, and found them to be correlated with conidial types. Unfortunately, none of the Ozark material has pycnidia. A specimen of *P. subrudecta* from north-central Kentucky (*Ladd 23321*) that appears identical to Ozark concepts of *P. subrudecta* has narrow, elongate conidia. While the two entities in the Ozarks may be conspecific, it is interesting to note that they have different niches, and, in the rare situations where they occur together, appear to be readily distinguishable. To complicate matters further, it seems likely that the European concept of *P. subrudecta*, upon which the type is based, differs from the material to which the name has been applied in North America.

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PYCNOTHELIA Dufour (Cladoniaceae)

Small gray fruticose lichens arising from a persistent granular primary thallus, the pseudopodetia hollow, corticate, simple to branched, narrowing to dark tips; photobiont chlorococcoid; apothecia unknown in Ozark material, rare, terminal on the pseudopodetia; asci *Cladonia*-type, with 8 simple to 1-septate spores; pycnidia apical, brownish, with curved, filiform conidia; 1 species in the Ozarks.

Pycnothelia papillaria Dufour
The pseudopodetia are usually constricted at the base.

Rare on thin soil and sparse humus over extensive sandstone exposures in glades. This species is known from only a few sites scattered in the southern half of the region, and seems to have a predilection for freshwater sandstones, which have a high content of heavy metals. [atranorin & protolichesterinic acid]

PYRENOCOLLEMA Reinke (Xanthopyreniaceae)

Saxicolous crustose lichens with a thin or obscure thallus; photobiont cyanobacterial; perithecia dark, superficial to immersed in the substrate; asci apiculate, IKI-, with 8 1-septate, typically asymmetrical, spores; pycnidia with bacilliform to ellipsoid conidia; 2 species in the Ozarks.

1. Ascomata collapsing and becoming cupuliform; ascospores 30-35 x 13-15 µm . . . . . *P. cupulare*

1. Ascomata not collapsing, convex; ascospores 17-23 x 8-11 µm . . . . . *P. prospersellum*

Pyrenocollema cupulare *sp. provis.*
Thallus immersed, seen only as brownish flecks of the photobiont between rock crystals. Photobiont/host cyanobacterial with bright yellow brown sheaths. Ascomata mostly immersed, to 0.5 mm in diameter, with the upper part around ostiole broadly collapsing with the dry ascoma resembling an apothecium with raised margin. Ascospores large, 30-35 × 13-15 µm. Microconidia narrowly ellipsoid to ± fusiform, 4-5 × 2 µm.

Known from a single collection from dolomite in the bed of a seasonal stream ravine in Ozark County, Missouri.

Pyrenocollema cupulare is unique in the genus in the ascomata which collapse in a very regular fashion fooling the casual observer into thinking it is a discomycetous lichen. Other species of *Pyrenocollema* may show a small indentation around the ostiole or be ± flattened when dry but none form such a broad depressed area. Additionally the ascospores are the largest yet encountered in the genus. *Pyrenocollema cupulare* seems to be semiaquatic as is common in the genus. It is known only from the type locality.

Pyrenocollema prospersellum (Nyl.) R.C. Harris
Rare, known only from dolomite above Table Rock Lake.

PYRENULA Ach. *nom. cons.* (Pyrenvlaceae)

Syn. meth. lich. 117. 1814. Type (conserved): *P. nitida* (Weigel) Ach.

Corticolous crustose lichens with thin or obscure, continuous thalli and immersed perithecia; photobiont Trentepohlia; asci fissitunicate, with eight brown, ellipsoid, 3-septate to muriform distoseptate spores; 9 species in the region. References: Harris (1989. 1995).

1. Ascospores 3-septate (rarely submuriform in *P. subelliptica*).

2. Ascospores with a layer of endospore separating lumen of terminal locules from the outer spore wall.

3. Ascospores small, 21-26 x 8.5-10 µm; hymenial gel I− . . . . . *P. micheneri*

3. Ascospores larger, 24-45 x 10-17 µm; hymenial gel I+ or I−.

4. Hymenial gel I−; ascospores with a dark cap at ends, 36-45 x 12-17 µm; thallus usually UV+ yellow; on *Carya*.

4. Hymenial gel I+ orangish; ascospores without a dark cap at ends; thallus UV−; on hardwoods but rarely *Carya* 5

5. Ascospores with median lumina longitudinally elongate, occasionally submuriform, 24-35 x 10-15 µm; hymenium inspersed . . . . . *P. subelliptica*

5. Ascospores with median lumina not elongate, 32-42 x 13-17 µm, never submuriform; hymenium not inspersed . . . . . *P. punctella*

2. Ascospores with lumen of terminal locules directly against the outer spore wall . . . . . .

6. Ostiole ± lateral; ascospores with terminal locules elongate . . . . . *P. cuyabensis*

6. Ostiole apical; ascospores with terminal locules not elongate.

7. Thallus olivaceous, shiny, UV+ yellow; hymenium inspersed; common . . . . . *P. pseudobufonia*

7. Thallus whitish, matt, UV−; hymenium not inspersed . . . . . *P. plittii*

1. Ascospores muriform, 40-60 x 16-27 µm.

8. Ostioles eccentric, at the end of a short neck, usually several closely approximated or even fused into a common plate; ascomata in groups clustered around central point . . . . . *P. ravenelii*

8. Ostioles apical, not fused, flush or slightly sunken; ascomata not in groups, clustered around a central point but may be crowded and irregularly appressed but ostioles remain separate . . . . . *P. leucostoma*

Pyrenula caryae R. C. Harris
Occasional on smooth bark of boles or branches of young hickories mostly in oak-hickory or oak woods but once on *Cladastris lutea*. *Pyrenula caryae*, first discovered in the Ozarks and typified by a Missouri specimen, is known from scattered collections in the southeastern United States from North Carolina to northern Florida. If the thallus is UV+ there is no problem identifying this species since the only other UV+ species, *P. pseudobufonia*, has very different ascospores. If the thallus is UV−, the definitive character of the odd dark caps at the ends of the ascospores is hard to see without a good microscope and one may have to depend on the I− hymenium and the substrate to separate it from *P. punctella* which has similar ascospores. [± lichexanthone]

Pyrenula cuyabensis (Malme) R. C. Harris
Rare on boles of hardwoods. The orientation of the ostiole is not always clear but the elongate terminal lumina are diagnostic.

Pyrenula leucostoma Ach.
Rare on *Acer* and *Carpinus* in floodplain forest from a single site at the southernmost edge of the region. This is a subtropical/tropical species common in the southern part of the Coastal Plain but

one record as far north as New Jersey. In external aspect it is distressingly variable apparently in relation to the host tree. The ascospores with rather few and comparatively large locelli are distinctive although often collected with all or most ascomata moribund lacking ascospores.

Pyrenula micheneri R. C. Harris
Known from a single collection on *Carpinus caroliniana* in mesic hardwoods from Oregon County, Missouri. When *P. micheneri* was described in 1989, it was thought to be probably extinct as all three known collections were previous to 1900. It occurs in North Carolina, Pennsylvania and Ontario, and was recently discovered in north central Kentucky. It is a rather undistinguished species defined by the combination of ascospore size and type, I− hymenium, small crystals around the ostiole and UV− thallus.

Pyrenula plittii R. C. Harris
Known from a single Arkansas collection on bole of *Fagus* in mesic woods. *Pyrenula plittii* has the same spore type as *P. pseudobufonia* but differs in whitish, UV− thallus and uninspersed hymenium. It was described only in 1989 and like *P. micheneri* thought to be possibly extinct as it had not been collected since 1910. It is known from scattered localities in the Northeast.

Pyrenula pseudobufonia (Rehm) R. C. Harris
Frequent on shaded boles of hardwoods, mostly *Quercus*, in woodlands. This is the most common species in eastern North America and the Ozark region. It is one of two species with UV+ yellow thallus and differs from *P. caryae* in spore type and inspersed, I+ blue green hymenium. [lichexanthone]

Pyrenula punctella (Nyl.) Trevisan
Uncommon in mesic floodplain woodlands; known from *Carpinus caroliniana*, *Carya cordiformis* and *Fagus*. It is recognized by ascospore size and type, uninspersed, UV+ orangish hymenium and UV− thallus.

Pyrenula ravenelii (Tuck.) R. C. Harris
Occasional on hardwoods in mesic areas. Local substrates are *Acer rubrum* and *Carpinus caroliniana*. It differs from the only other species in our region with large muriform ascospores *P. leucostoma* in having aggregated ascomata joined by the ostiolar necks and in slightly broader ascospores with smaller, more numerous locelli.

Pyrenula subelliptica (Tuck.) R. C. Harris
Occasional on hardwoods in woodlands, usually in mesic sites. Widely distributed in eastern North America from Canada to South Carolina. It differs from species with similar ascospores in the elongated median spore lumina and inspersed, I+ orangish hymenium. The inspersed hymenium is unusual associated with this ascospore type.

PYRRHOSPORA Körb. (Lecanoraceae)

Corticolous crustose lichens with pale gray, continuous, granular thalli; photobiont *Trebouxia* (?); apothecia sessile, brown to bright orange-red, lacking a thalline margin; asci *Lecanora*-type, with 8 small, hyaline, ellipsoid, simple spores; pycnidia immersed, with filiform, typically curved, conidia >10 µm long; 2 species in the Ozarks.

1. Apothecia bright red, >0.5 mm broad at maturity, with irregular to crenate margins . . . . . *P. russula*

1. Apothecia pale to dark brown, without reddish tints, ≤0.4 mm broad . . . . . *P. varians*

Pyrrhospora russula (Ach.) Hafellner
Rare and scattered, on exposed small branches of hardwoods near permanent humidity sources, such as perennial streams and rivers. *Ulmus alata* is a common substrate. This is a common species of the Gulf coastal plain in the southeastern states, but becomes rare in the Ozarks. [fumarprotocetraric acid, lichexanthone]

Pyrrhospora varians Ach.
Very common on exposed twigs and branches in exposed to lightly shaded sites, including the canopy level of trees in mature woodlands, as well as on smaller trees and lower branches in clearings and along woodland edges. This species is one of the first pioneer lichens to inhabit exposed young branches in woodlands, growing with *Amandinea polyspora, Arthonia caesia*, and *Lecanora strobilina*. Hafellner (1993) noted that this taxon does not have the generic characters of *Pyrrhospora*, but did not suggest where it should be assigned; Harris (1995) suggested interim replacement in *Lecidea*, although a new segregate genus may be a more appropriate final disposition. [xanthone]

PYXINE Fr. (Physciaceae)

Narrow-lobed, bluish gray, sorediate foliose lichens with marginal pseudocyphellae and pigmented medullary tissue; upper cortex with pruina towards the lobe tips; lower cortex black, rhizinate; photobiont *Trebouxia*; apothecia rare, sessile, with black disks and a thalline margin, epithecium blue-black, KOH+ purple; asci *Lecanora*-type, with 8 brown, ellipsoid, 1-septate, thick-walled spores; pycnidia not seen in Ozark material, laminal, immersed; conidia bacilliform, to 4 μm long; 2 species in the Ozarks. Reference: Amtoft (2002).

1. Upper cortex UV+ yellow, KOH- (lichexanthone present, atranorin absent); discrete patches of fine white pruina near the lobe tips but not extending to the edge of the lobes, the pruina appearing continuous within the patch even at 15× magnification . . . . . *P. subcinerea*

1. Upper cortex UV-, KOH+ yellow (often difficult to detect because of the yellow medulla — lichexanthone absent, atranorin present); diffuse patches of coarse granular pruina near the lobe tips and extending to the edges, the pruina readily distinguishable at 15× magnification . . . . . *P. sorediata*

Pyxine sorediata (Ach.) Mont.
Thallus adnate, bluish gray to dark gray, sometimes with locally brown tinted zones, often paler gray towards the lobe tips; medulla dull mustard yellow to dingy orangish yellow; lobes typically 1-1.5(-2) mm broad, not notably expanded at the tips, moderately sublobed, with elongate white pseudocyphellae along the margins; upper cortex mostly smooth, with patches of diffuse, coarse white pruina towards the lobe tips, the patches extending to the edges of the lobes, with the pruina to 0.05 mm broad; soredia common, pale lead gray, finely granular, in rounded to sublabriform marginal soralia — and sometimes also in laminal soralia near the lobe margins; lower cortex black, densely rhizinate, with abundant short, often branched, rhizines; apothecia very rare, to 2 mm broad, laminal, with well-developed thalline margins. [atranorin, terpenes, unknown pigment]

Very common in wooded uplands throughout the Ozarks; on shaded lower boles and bases of hardwoods and *Juniperus*, as well as on shaded, often mossy boulders of chert, dolomite, sandstone, and igneous rocks. This species is more regularly saxicolous than is *P. subcinerea*, and also occurs in more disturbed habitats, such as along older trees in fencerows.

Pyxine subcinerea Stirton
Thallus closely adnate, bluish gray to dark gray; medulla pale lemon yellow; lobes much branched, not notably expanded at the tips, to 1 mm broad; marginal pseudocyphellae usually present but obscure and inconspicuous; upper cortex smooth; lobe tips with discrete patches of

continuous fine white pruina, but separated from the edges of the thallus by a distinct zone of bare cortex; soredia abundant, pale, farinose, in orbicular to sublabriform, marginal or sometimes laminal soralia near the lobe edges, the individual soralia typically to 0.5 mm broad; lower cortex black, with scattered simple to furcate rhizines usually < 0.4 mm long. [lichexanthone, terpenes, unknown pigment]

Abundant in woodlands throughout the Ozarks, occurring on all levels on trees in wooded uplands, but seldom detected in the canopy unless the branches are assayed with UV light, since the thallus is typically minute and fragmentary. This species has been documented from most hardwood trees in the Ozarks, as well as commonly occurring on *Juniperus*. It rarely occurs on shaded rocks in wooded uplands, where it has been recorded from sandstone and dolomite.

A related species, *Pyxine caesiopruinosa* (Tuck.) Imshaug, occurs just south of the Ozarks in the Ouachita region of Arkansas and should be looked for in the extreme southern Ozarks; it has coarser soredia and pruina, angular white maculae on the upper cortex, and a KOH+ purple medullary reaction.

RAMALINA Ach. (Ramalinaceae)

Yellowish green fruticose lichens with basally attached, flattened, shrubby thalli; photobiont *Trebouxia*; apothecia sessile to substipitate, with thalline margin and pale tan disks; asci *Bacidia*-type, with 8 hyaline, narrowly ellipsoid, 1-septate, sometimes curved spores; pycnidia laminal, subimmersed, with bacilliform conidia; 4 species in the Ozarks. Reference: LaGreca (1999).

1. Thallus esorediate; almost always corticolous.

    2. Containing usnic acid only; uncommon . . . . . *R. americana*

    2. Containing some combination of divaricatic, evernic, or lecanoric acids . . . . . *R. culbersoniorum*

1. Thallus sorediate; saxicolous.

    3. Medulla P+ orange red (protocetraric acid) . . . . . *R. petrina*

    3. Medulla P- . . . . . *R. pollinaria*

Ramalina americana Hale
Uncommon on exposed branches and boles of hardwoods, often occurring on *Fraxinus americana* along margins of glades. [usnic acid (often in low concentrations)]

Ramalina culbersoniorum LaGreca
Occasional on the upper portions of canopy trees in woodlands, as well as sometimes on lightly shaded lower boles. This species can become locally abundant in limited areas along glade margins or in clearings reverting to young woodland, but this only occurs in rare instances, and many seemingly similar sites are devoid of *Ramalina*. Some populations in the region contain lecanoric acid in the medulla and react C+ red — this is chemical strain 5 of Culberson *et al.* (1990). These populations are morphologically analogous to the C- populations, but the lecanoric acid containing strain is more likely to occur in extensive mature woodlands, in moderately heavy shade. Taxonomy of corticolous *Ramalina* populations is problematical; there is almost certainly more than one species represented in the confusing complex of morphologies in the Ozark region. Our material ranges from small, almost linear thalli with essentially smooth upper cortex, to broadly expanded, coarsely rugose thalli exceeding 2 cm broad. [usnic acid, plus divaricatic or evernic & lecanoric acids]

Ramalina petrina Bowler & Rundel
Rare on lightly shaded massive sandstone exposures at a few sites in the Arkansas portion of the southern Ozarks, often in sheltered microhabitats. [atranorin & protocetraric acid]

Ramalina pollinaria (Westr.) Ach.
Rare; in habitats similar to those for *R. petrina*; known from a few Arkansas and Missouri localities scattered through the southern half of the Ozark region. Previous reports of *R. intermedia* (Delise *ex* Nyl.) Nyl. from the Ozarks should be referred here. [evernic & usnic acids]

RAMONIA Stitzenb.(Gyalectaceae)
Ber. Thatiigk. St. Gallischen Naturwiss. Ges. 1861: 168. 1862. Type (monotype): *R. valenzueliana* (Mont.) Stitzenb.

Minute crustose lichens with immersed thallus; photobiont *Trentepohlia*; apothecia immersed, deeply cup-shaped, opening by a broad pore, with a cracked-lobed apothecial margin, well-developed periphysoids, I+ dirty blue-green hymenial gel, unbranched paraphyses, mostly with I- asci with 8 or numerous nonseptate, transversely septate or muriform spores; 2 species in the Ozarks.
References: Vězda, 1966, Folia Geobot. Phytotax. Bohemoslov. 1: 154-175; Vězda,1967, Folia Geobot. Phytotax. 2: 311-317. Coppins, 1987, Lichenologist 19: 409-417.

1. Ascospores nonseptate, 6-8 x 3-3.5 µm, halonate . . . . . *R. microspora*

1. Ascospores 7-septate, acicular, 25-30 x 4-4.5 µm, not halonate . . . . . *Ramonia sp.*

Ramonia microspora Vězda
Thallus immersed, light green-gray. Apothecia initially immersed and closed, breaking open and form deep cups opening by a broad pore with margin radially cracked into small lobules, more emergent with age, pinkish white, 0.3-0.7 mm across, with pore 0.1-0.2 mm across. Exciple pallid with a well developed layer of periphysoids on inner surface. Paraphyses slender, unbranched. Hymenial gel I+ dirty blue-green. Asci ± cylindrical with tapered tip, I-, with numerous nonseptate spores. Ascospores 6-8 x 3-3.5 µm, halonate.

Known from the Ozark region by a single collection from Butler County, Missouri. There is also one collection from Jefferson County, Arkansas south of the Ozarks. The type is from Argentina with the first report for North America from Louisiana. There are additional unpublished records from Florida, Georgia and South Carolina. All the North American collections are from boles of oaks in mesic hardwoods.

Ramonia sp.
Thallus immersed, light green-gray. Apothecia immersed, deep cup-shaped, opening by a large pore; disk visible through pore, yellow; margin radially cracked, whitish, ca. 0.3 mm across; pore ca. 0.15 mm across. Exciple pallid with a layer of periphysoids on the inner surface. Paraphyses slender, unbranched, with weakly clavate tips. Asci ± cylindrical, with 8 spores. Ascospores acicular, 7-septate, not halonate, 25-30 x 4-4.5 µm.

MISSOURI: Barry County: Roaring River State Park, ravine N of cabins, NW of Nature Center along CR F, 3634'50"N, 9350'00"W, E-facing slope with dolomite outcrops in *Quercus*-dominated forest, on bole of *Carya*, 3 Nov 2000, *Harris 44770-A* (NY).

This specimen seems to be a member of the *R. luteola* Vězda group differing in narrower ascospores. Coppins (1987) found the British record also somewhat at variance with the eastern European type collection of *R. luteola*. Only additional material can resolve whether only one or

several taxa should be recognized. Even less conspicuous that the previous species, the single Ozark collection is very scanty. We can only hope to stumble on better material.

RHIZOCARPON Ramond *ex* DC. (Rhizocarpaceae)

Saxicolous crustose lichens with rimose to areolate thalli; photobiont chlorococcoid; apothecia marginal or attached to hypothallus; asci *Rhizocarpon*-type, with 8 hyaline to green or brown, 1-septate to more commonly muriform spores; pycnidia rare and reported from only a few members of the genus, unknown in Ozark material, immersed in the areoles or sessile on the hypothallus, with bacilliform to acicular conidia; 5 species in the Ozarks. References: Fryday (2000, 2002).

1. Cortex and medulla C+ pink (gyrophoric acid); spores greenish to brown . . . . . *R. grande*

1. Cortex and medulla C- (gyrophoric acid absent); spores hyaline (sometimes becoming pale brownish in age).

    2. Spores 2-celled.

        3. Exciple dark internally, without crystals; medulla KOH− . . . . . *R. hochstetteri*

        3. Exciple pale internally obscured by small crystals; KOH+ yellow or red . . *R. cinereovirens*

    2. Spores muriform.

        4. Medulla I+ violet . . . . . *R. distinctum*

        4. Medulla I− . . . . . *R. reductum*

Rhizocarpon cinereovirens (Müll. Arg.) Vain.
Rare locally, on lightly shaded sandstone in woodlands; mostly in the central and eastern Ozarks. [1) norstictic acid 2) stictic ± norstictic acids]

Rhizocarpon distinctum Th. Fr.
Known only from an unconfirmed literature report from chert in the north-central Ozarks.

Rhizocarpon grande (Flörke *ex* Flot.) Arnold
Occasional on exposed, massive siliceous escarpments, usually associated with glades and bluffs. This species occurs on igneous substrates in the region, but is also known from massive chert exposures in the western Ozarks. [gyrophoric & stictic acids]

Rhizocarpon hochstetteri (Körber) Vain.
Rare, on siliceous rock in open woods.

Rhizocarpon reductum Th. Fr.
Uncommon on siliceous rock, including chert fragments in carbonate areas, as well as on sandstone and igneous rocks. [stictic acid]

RHIZOPLACA Zopf (Lecanoraceae)

Centrally attached, thickly areolate to umbilicate lichens with yellow-green upper cortex, lacking rhizines; photobiont *Trebouxia*; apothecia sessile, tan, crenulate to incised, with a somewhat irregular thalline margin; asci *Lecanora*-type, with 8 simple, hyaline, ellipsoid spores; pycnidia immersed, with curved, filiform conidia; 1 species in the Ozarks. Reference: McCune (1987).

Rhizoplaca chrysoleuca (Sm.) Zopf
Uncommon on massive exposures of siliceous rocks on glades, bluffs, and ledges. Common associates include *Acarospora fuscata, Candelariella vitellina, Dimelaena oreina,* and various *Xanthoparmelia* species. Ozark material consists of confluent masses of stalked, bullate areoles; this morphology is sometimes segregated as *R. subdiscrepans* (Nyl.) R. Sant. [pseudoplacodiolic & usnic acids]

RINODINA (Ach.) Gray (Physciaceae)
Nat. Arrang. Brit. Plants 1: 448. 1821.

Small crustose lichens with continuous to areolate to obscure thalli; photobiont *Trebouxia;* apothecia sessile to subimmersed, with thalline margin well developed or absent, asci *Bacidia*- or *Lecanora*-type, with 8 brown or greenish, ellipsoid, 1-septate spores with thick walls and often angular or prismatic lumina; 17 species in the region. References: H. Mayrhofer (1979); Giralt (2001).

Through the very great kindness of John Sheard we have had access to the latest version of his key but in our bumbling we have not been able to place a number of taxa. This treatment was cobbled together at the last minute and as a result is at best very tentative. There are still a few collections left in limbo. *Rinodina* seems to be more diverse in the Ozark region than we would have imagined previously.

1. Thallus on bark or on bryophytes over bark 2

2. On bryophytes; apothecia biatorine; ascospores ± *Physcia*-type, 17.5-19.5 x 9.5-11 µm . . . . . *Rinodina sp.* 42859

2. On bark 3

3. Thallus blastidiate 4

4. Blastidia marginal, ciliate (fuzzy looking); thallus areolate, ± shiny; ascospores *Pachysporaria*-type, 16-19 x 9-10 µm . . . . . *R. papillata*

4. Blastidia/small warts laminal, not "fuzzy"; thallus rimose, matt; ascospores *Pachysporaria*-type, ca. 14-17 x 7.5-9 µm . . . . . *Rinodina sp.* 40178

3. Thallus without blastidia 5

5. Apothecia soon swollen and thalline margin lost; ascospores *Pachysporaria*-type, ca. 14-17 x 7-8 µm . . . . . *Rinodina sp.* 24165

5. Apothecia with persistent thalline margin or ± immersed 6

6. Thallus subsquamulose-areolate; ascospores *Pachysporaria*-type, 22-24(-30) x 10-14 µm; zeorin present . . . . . *R. dolichospora*?

6. Thallus not subsquamulose; ascospores smaller, <20 µm long 4

7. Thallus whitish, not areolate; ascospores *Physcia*-type, 15-20 x 9-11 µm; zeorin present . . . . . *R. subminuta*

7. Thallus olive or gray; zeorin absent 8

8. Thallus olive, with flattened ± shiny areoles; ascospores *Pachysporaria*-type, 16-19 x 8-9.5 µm very common . . . . . *R. maculans*

8. Thallus gray, rough, matt; ascospores *Pachysporaria*-type, 16-19.5 x 9-11 µm; rare . . . . . *R. pachysperma*

1. Thallus saxicolous 9

9. Apothecia without evident thalline margin; margin ± concolorous with disk; thallus not evident . 10

10. Ascospores with pigmented band around septum (*bischoffii*-type), 15-21 x 9-12 µm; hymenium inspersed; on carbonate rock . . . . . *R. bischoffii*

10. Ascospores *Physcia*-type, 19-22 × 11-12 µm; hymenium not inspersed; on HCl− sandstone . . . . . *Rinodina sp.* 31947

9. Apothecia with persistent thalline margin or immersed in thallus 11

11. Thallus or thalline margin whitish, KOH+ yellow, C− or KOH+ yellow, C+ pink or KOH−, C+ pink 12

12. Thallus KOH-, C+ pink; ascospores *Physcia*-type, 22-24(-27) x 11-13 µm . . . . . *Rinodina sp*. 35992

12. Thallus KOH+ yellow, C± pink; ascospores *Physcia*- or *Mischoblastia*-type . 13

13. Thallus C−; epihymenium brown but exciple may be green; ascospores Mischoblastia-type 14

14. Thallus ± continuous, rimose-areolate; ascospores <20 x 12 µm; very common . . . . . *R. oxydata*

14. Thallus of scattered subsquamulose areoles; ascospores >20 x 12 µm; very rare . . . . . *R. vezdae*

13. Thallus C+ pink; epihymenium dark green; apothecia immersed to emergent; ascospores *Physcia*-type, 18-21 x 9.5-12 µm . *Rinodina sp*. 47558

11. Thallus dark, KOH−, C± or not evident 15

15. Ascospores with pigmented band around septum (*Bischoffii*-type), 15-21 x 9-12 µm; hymenium inspersed; on carbonate rock . . . . . *R. bischoffii*

15. Ascospores *Mischoblastia*-, *Pachysporaria*- or *Physcia*-type; hymenium not inspersed; on HCl− rock 16

16. Ascospores *Pachysporaria*-type, 13-16 x 7-8.5 µm; thallus C− . . . . . *Rinodina sp*. 44440

16. Ascospores *Mischoblastia*- or *Physcia*-type; thallus C± pink 17

17. Ascospores *Physcia*-type, 17-24 x 8-14 µm; thallus C± pink . . . . . *R. tephraspis*

17. Ascospores *Mischoblastia*-type, 18-22 x 9-12 µm; thallus C− . . . . . *R. cana s. lat.*

Rinodina bischoffii (Hepp) A. Massal.
Thallus often endolithic but occasionally well developed, pale. Apothecia often biatorine but occasionally with a well-developed thalline margin. Hymenium inspersed. Ascospores *Bischoffii*-type, 15-21 x 9-12 µm. [no lichen substances]

Occasional on carbonate rock. The ascospore type and inspersed hymenium are unique in the Ozarks. One collection from Montgomery County, Missouri has an uninspersed hymenium. *Muellerella lichenicola* (Fr.) D. Hawksw. occurs on one collection.

Rinodina cana (Arnold) Arnold *s. lat.*
Thallus dark gray or gray-brown, areolate. Apothecia mostly immersed. Generally has the aspect of a small, dark *Aspicilia*. Ascospores *Physcia*-type?, 18-22 x 9-12 µm. [no lichen substances]

Frequent on moist, HCl- rock. Giralt (2001) indicated that *R. cana* has small crystals in the epipsamma. Ozark material lacks these. The lichenicole *Endococcus propinquus* (Körber) D. Hawksw. has been found on one specimen.

Rinodina dolichospora Malme ?
Thallus subsquamulose-areolate, gray, ± shiny. Apothecia sessile with ± persistent thalline margin. Ascospores *Pachysporaria*-type, large, 22-24(-30) × 10-14 µm. [zeorin]

Rare, known from five collections on *Quercus* in oak or oak-hickory woods. These specimens are assigned to *R. dolichospora* on the basis of well-developed areolate to subsquamulose thallus and large ascospores. As far as we can tell, zeorin is not reported from this species, hence "?".

Rinodina maculans Müll. Arg.
Thallus conspicuous, pale olive-green to olive, continuous and ± shiny or ± continuous at margin but soon areolate; areoles flattened with rough surface (almost isidiate?) and in section algal layer divided by thin columns of sterile tissue. Apothecia sessile with lecanorine margin. Ascospores *Pachysporaria*-type, 16-19 × 8-9.5 µm. [no lichen substances]

Common, on branches but also boles of hardwoods. The small thalli with flat, ± shiny areoles and the small *Pachysporaria*-type ascospores are diagnostic. An Oklahoma collection is otherwise similar to *R. maculans* but is aberrant in having 3-septate ascospores.

Rinodina oxydata (Massal.) Massal. s. lat.
Thallus whitish to pale tan, rimose areolate, with smooth, flat areoles, occasionally with areoles dispersed on rough substrates, KOH+ yellow. Apothecia mostly immersed but occasionally becoming ± sessile. Ascospores *Mischoblastia*-type, 19-23 x 9-12 µm [atranorin].

Occasional on shaded HCl– rock. The thin whitish, KOH+ yellow thallus and ascospore type are characteristic for this species. The lichenicolous fungi *Endococcus propinquus* (Körber) D. Hawksw. and *Polycoccum microstictum* (Leighton) Arnold have been encountered once each on *R. oxydata*.

Rinodina pachysperma H. Magn.
Thallus rimose, green gray, with rough surface. Apothecia semi-immersed with a thin thalline margin ± concolorous with thallus. Ascospores *Pachysporaria*-type, 16-19.5 x 9-11 µm. [no substances?, not tested]

Known from a single collection on the bole of *Acer saccharinum* in a disturbed floodplain woods along the Lamine River.

Rinodina papillata H. Magn.
Thallus of scattered to rarely aggregated, flat, gray, ± shiny areoles with marginal blastidia. Blastidia usually shortly ciliate, appearing slightly fuzzy. Apothecia rare, with or without distinct thalline margin. Ascospores *Pachysporaria*-type, 16-19 x 9-10 µm. [no lichen substances]

Probably the most common *Rinodina* in the region, on hardwoods, especially *Quercus.*

Inconspicuous and often found only as an admixture. It is almost always without apothecia but easily recognizable by the "fuzzy" blastidia.

Rinodina subminuta H. Magn.
Thallus whitish, continuous, smooth. Apothecia erumpent, initially immersed in thallus. Ascospores *Physcia*-type, 15-20 x 9-11 µm. [zeorin]

Occasional on boles of hardwoods in mesic woods. The pale thallus, erumpent apothecia and *Physcia*-type ascospores are diagnostic.

Rinodina tephraspis Tuck.
Thallus variable, gray to brownish, well developed and ± continuous with weakly lobed margins, of crowded, flattened to weakly rounded areoles to inconspicuous small areoles among rock crystals, C+, KC+ pink or C–, KC–. Apothecia conspicuous, sessile with well-developed lecanorine margin. Ascospores *Physcia*-type, 17-24 x 8-14 µm. [zeorin, 5-O-methylhiascic acid or zeorin alone]

Occasional on shaded HCl- rock. Confusion with the *Mischoblastia*-type make verification of the presence of zeorin sometimes necessary to confirm identification. The other saxicolous taxa with *Physcia*-type ascospores differ in thallus color and type or in having biatorine apothecia.

Rinodina vezdae H. Mayrh.
Thallus of scattered, whitish, subsquamulose areoles, KOH+ yellow. Apothecia initially ± immersed, becoming nearly sessile and losing the thalline margin, with exposed margin black. Exciple bright blue green in apothecia without thalline margin. Ascospores *Mischoblastia*-type (check immature spores), 21.5-23.5 x 11-13.5 µm (Ozark collection). [atranorin].

Known from a single site on top of sandstone bluff. *Rinodina vezdae* is a member of the *R. oxydata* complex and some authors suggest it should be reduced to synonymy with *R. oxydata*. Our material is very distinct from Ozarkian material assigned to *R. oxydata* in thallus type and ascospore size.

Rinodina sp. 24165
Thallus areolate, gray brown, ± shiny. Apothecia initially with thalline margin but soon lost, becoming swollen. Ascospores *Pachysporaria*-type, small, 14-17 × 7-8 µm. [no lichen substances detected]

Rare; known from a single collection on a branch of *Ulmus alata* in hardwood-*Juniper* woods over rhyolite. The specimen seems distinctive in apothecia soon without thalline margin and smallish ascospores.

Rinodina sp. 31947
Thallus not evident, on HCl- sandstone. Apothecia black, without thalline margin; proper margin ± thick, raised. Outer exciple blackish green, with inner part colorless. Hymenium not inspersed. Ascospores *Pachysporaria*-type?, 19-22 × 11-12 µm. [no substances?, not tested]

Rare; known from 3 specimens on sandstone in oak woodland in Missouri and possibly a moribund specimen on sandstone from Oklahoma may belong here. Superficially this species is very similar to saxicolous specimens of *Amandinea punctata* which has *Buellia*-type ascospores. *Rinodina bischoffii* may also lack obvious thallus and thalline margin but its hymenium is inspersed and the ascospore type different.

Rinodina sp. 35992
Thallus whitish to gray, areolate to subsquamulose, C+, KC+ pink. Apothecia large, to 1.0 mm,

with whitish, persistent, thalline margin and black disk. Ascospores *Pachysporaria*-type?, 18-20 × 10-12 µm. [gyrophoric acid?]

Known from a single Missouri collection on HCl– sandstone in a glade. *Rinodina tephraspis* can also be C+ but has darker thallus, *Physcia*-type ascospores and contains zeorin in addition to 5-O-methylhiascic acid or zeorin alone.

Rinodina *sp.* 40178
Thallus light green gray, thick, rimose, with upper surface becoming covered with blastidia or small warts?. Apothecia semi-immersed with thalline margin concolorous with thallus and light brown disk. Ascospores *Pachysporaria*-type, ca. 14-71 x 7.5-9 µm. [no lichen substances detected]

Known from a single collection on decorticate *Taxodium*? in a *Taxodium-Nyssa* swamp.

Rinodina sp. 42859
Thallus gray, ± continuous, minutely and weakly areolate. Apothecia sessile, black, biatorine. Ascospores *Physcia*-type, 17.5-19.5 x 9.5-11 µm. [no substances?, not tested].

Known from a single specimen on decorticate *Juniperus ashei*? in Ashe Juniper woodland. The substrate and the biatorine apothecia are distinctive.

Rinodina sp. 44440
Thallus brownish, areolate. Apothecia with persistent thalline margin, semi-immersed to emergent with margin ± concolorous with disk. Ascospores *Pachysporaria*-type, 13-16 x 7-8.5 µm. [no substances?, not tested]

Not common; on siliceous rock in dry woodlands and once on a rusted tin can on the ground. Externally similar to *R. cana* which differs in having *Physcia*-type ascospores.

Rinodina sp. 47558
Thallus whitish, rimose, KOH+ yellow, C+ pink. Apothecia initially immersed, becoming weakly emergent with a thin thalline margin. Epihymenium dark green. Ascospores *Physcia*-type, ca. 18-19(-21) x 9.5-10.5(-12) µm. [atranorin, gyrophoric acid?]

Known only from Gist Ranch Conservation Area in Texas County, Missouri, growing on chert in dolomite glade.

SANTESSONIELLA Henssen (Pannariaceae)

Small dark brown, foliose to subsquamulose, somewhat gelatinous lichens; photobiont *Nostoc*; apothecia sessile, brown, lacking a thalline margin at maturity; asci with indistinct IKI+ blue apical layer and ring-like plug with an internal canal, with 8 simple, hyaline, ellipsoid spores; pycnidia? 1 species in the Ozarks. Reference: Jørgensen (2001).

Santessoniella crossophylla (Nyl.) P.M. Jørg.
Thallus initially pale gray, with slender lobes slightly expanded apically; older thalli dark gray, becoming black when wet, imbricate, forming small, warty, obscurely lobed cushions; cortex of a single layer of cells, medulla not evident; apothecia convex, with a poorly developed thalline margin ultimately disappearing; disk pinkish tan; proper margin poorly developed, of ± oblong radiating cells becoming more isodiametric centrally; hymenium IKI+ bluish becoming sordid olivaceous; ascospores broadly fusiform, with a thin, weakly warty epispore, 18-21 × 8.5-11 µm.

Known only from moist shaded sandstone outcrops in an extensive wooded canyon system at Sparkling Hollow in Howell County. This species looks like a small *Pannaria*.

SARCOGYNE Flotow (Acarosporaceae)
Bot. Zeitung (Berlin) 9: 753, 759. 1851.Type: *S. corrugata* Flotow

Saxicolous crustose lichens with thin to obscure or partly endolithic, gray thalli; photobiont *Myrmecia* and *Trebouxia*; apothecia sessile, plane, without a thalline margin, paraphyses unbranched; asci strongly thickened apically, with an I- apical dome, with numerous, minute, bacilliform spores; pycnidia immersed, with broadly ellipsoid conidia; 7 species in the Ozarks, 4 of which are treated here. Reference: Magnusson (1934a). Based on sequence data the *S. regularis* group, not unexpectedly, will probably eventually be united with the *Acarospora glaucocarpa* complex.

1. On carbonate rock 2

2. Disk with thick, stark white pruina; margin black, ± epruinose, strongly raised; apothecia large, ca. 1 mm across; paraphyses thick, ca. 6 µm across at tips with broad locule, ca. 5 µm across, appearing moniliform; ascospores ca. 4-5 × 2.5 µm; pycnidia not found; rare . . . . . *Sarcogyne sp.* 423

2. Disk black or slightly reddish, usually pruinose, occasionally epruinose; pruina thin, whitish; margin usually raised, occasionally disappearing, black, usually epruinose, occasionally thinly pruinose; rarely whole apothecium moderately pruinose; apothecia variable in size, ca. 0.5-1 mm across; exciple mostly pale within, dark brown outside, often only above adjacent to hymenium, composed of rather large radiately arranged cells; ascospores ca. 4-6 × 2-3 µm; pycnidia inconspicuous, ± globose; conidiospores elliptical to elliptic-oblong, 2.5-3.5 × 1-1.5 µm; common . . . . . 3 *(Sarcogyne regularis s. lat.)*

3. Apothecia sessile . . . . . *Sarcogyne regularis*

3. Apothecia sunken in limestone, ± flush with surface, with external aspect of a *Verrucaria*, 0.3-0.7 mm diam, thin, ca. 0.1 mm in center; margin black, slightly raised above disk; disk blackish, weakly to moderately whitish pruinose; epithecium yellow-brown; exciple dark brown outside, paler brown inside; pigment mainly between hyphae; ascospores 5-7 × 2-2.5 µm; thallus white; Taney County, MO, *Wetmore 68706* (MIN) . . . . . *Sarcogyne sp*. 68706 (*S. regularis s. lat.*)

1. On rock HCl− 4

4. Disk broken up by intercalated carbonaceous material; paraphyses branched and interconnected . . . . . *Polysporina*

4. Disk not broken up by intercalated carbonaceous material; paraphyses not branched and interconnected 5

5. Disk and margin black to slightly reddish, epruinose, usually smooth and shiny; margin weakly raised; disk occasionally minutely fissured and roughened in old age; exciple dark brown outside, pale brown inside, with large celled radiating hyphae visible; ascospores rod-like, ca. 4.5-5.5 × 1.5-2.2 µm; pycnidia common, rather large and conspicuous, occasionally in clusters; conidiospores tiny, ca. 2-4 × 0.5 µm; common, favoring sandstone? . . . . . *S. similis*

5. Disk reddish, smooth, epruinose; margin black, raised; rare, on granite and rhyolite 6

6. Apothecia large to 3 mm across; hypothecium brown . . . . . *S. clavus*

6. Apothecia to 2 mm across; hypothecium pale.

7. Apothecia to 2 mm across; margin radiately cracked and weakly crenate; exciple black and hyphae not visible; ascospores similar to *S. similis*; pycnidia not seen . . . . . *S. privigna*.

7. Apothecia to 0.8 mm across, thin; margin smooth; exciple brown outside, paler inside, with irregular bodies of darker pigment between? hyphae; pycnidia not seen; ascospores ca. 5.5 × 2.3 µm . . . . . *Sarcogyne sp.* 21572

Sarcogyne clavus (DC.) Kremp.
Known from a single Arkansas record on a sandstone bluff.

Sarcogyne privigna (Ach.) A. Massal.
Known only from an old granite quarry along the Current River south of Van Buren, growing on exposed granite. If mistaken for a *Sarcogyne*, *Polysporina simplex* would key here — it has branched and anastomosing paraphyses and the disk is irregularly ridged and lumpy, as contrasted with the unbranched paraphyses and smooth disks of *Sarcogyne*.

Sarcogyne regularis Körb.
Locally frequent on exposed, often weathered, carbonate substrates, ranging from massive bedrock to small pebbles and fragments. This species is occasional in glades and on massive escarpments. It is sometimes frequent on limestone and dolomite blocks in walls, old concrete, and limestone paving stones. The apothecia are usually densely pruinose.

Sarcogyne similis H. Magn.
Frequent on siliceous rocks in a variety of habitats, typically in uplands, on igneous and especially sandstone substrates. This species grows on small fragments and massive boulders and ledges, and occurs in both exposed sites and in light shade. The thallus is often obscure, with only the apothecia apparent.

SCHISMATOMMA Flot. & Körb. *ex* A. Massal. (Roccellaceae)

Corticolous crustose lichens with thin, ± continuous thalli, or thalli not evident; photobiont *Trentepohlia*; apothecia somewhat elongate and partially immersed in the substrate, usually with white pruina; asci apically thickened, with I+ blue apical ring and 8 hyaline, 4± celled, bacilliform spores; pycnidia dark, ± immersed, with bacilliform to filiform, straight to curved, hyaline to brownish conidia; 2 species in the Ozarks.

1. Apothecia pruinose with coarse white pruina, the margins not distinguishable; ascospores 4-celled . . . . . *S. glaucescens*

1. Apothecia with brown disks and a prominent white margin; ascospores typically 6-celled . . . . . *S. rappii*

Schismatomma glaucescens (Nyl. *ex* Willey) R.C. Harris
Occasional in wooded uplands, but often overlooked, on lightly shaded boles of the red oak group, particularly *Quercus coccinea*. This species usually occurs along the rough angled bark on the sides of broad bark fissures, and appears as a pale brownish zone with small, rounded to elliptical, whitish pruinose apothecia.

Schismatomma rappii (Zahlbr.) R.C. Harris
Known only from the bole of an *Acer negundo* on a wooded floodplain in the eastern Ozarks of southern Missouri.

SCOLICIOSPORUM A. Massal. (Lecanoraceae)

Small crustose lichens with thin, scurfy, often obscure thalli; photobiont chlorococcoid and reported as often forming goniocysts; apothecia tiny, sessile, ultimately convex, black or brown; asci *Lecanora*-type, with 8 hyaline, fusiform to acicular, multi-septate spores often notably twisted or curved, especially in the ascus; pycnidia immersed to subimmersed, the upper walls pigmented as in the apothecia, with bacilliform to filiform-curved conidia; 2 species in the Ozarks.

1. Corticolous; ascospores straight, 4-5 µm broad . . . . . *S. chlorococcum*

1. Saxicolous; ascospores ± twisted, 2-3 µm broad . . . . . *S. umbrinum*

Scoliciosporum chlorococcum (Stenh.) Vězda
Occasional on shaded boles and branches of *Juniperus*, *Pinus*, *echinata*, and hardwoods with circumneutral or basic bark pH; shaded decorticate twigs of *Juniperus virginiana* are a preferred substrate.

Scoliciosporum umbrinum (Ach.) Arnold
Infrequent on siliceous rocks in exposed to shaded, mesic to dry sites; known from sandstone and rhyolite in a variety of habitats.

SEGESTRIA Fr. (Porinaceae)

Crustose lichens with continuous, thin brown to brownish green thalli; photobiont *Trentepohlia*; perithecia sessile, reddish brown to darkening; asci similar to those of *Porina*, with 8 hyaline, 4-celled, fusiform spores; pycnidia unknown in Ozark material, with bacilliform conidia; 1 species in the Ozarks. Reference: Harris (1995)

Segestria lectissima Fr.
Known from sandstone at a single site in the western Ozarks.

SPEERSCHNEIDERA Trevisan (Lecanoraceae)

Saxicolous foliose lichens with narrow, imbricate lobes; upper cortex thick, tough; lower surface pale, without rhizines; photobiont *Trebouxia*; apothecia sessile, with brown disk and thalline margin, epithecium brown, hypothecium hyaline; asci *Lecanora*-type, with 8 hyaline 1-3-septate spores; pycnidia laminal, sessile with bacilliform conidia; a monospecific genus that occurs in the Ozarks. Reference: Hafellner and Egan (1981).

Speerschneidera euploca (Tuck.) Trevisan
Thallus gray to brownish gray, turning bright green when wet, with tough, rigid, somewhat inflated linear lobes to 0.3 mm wide, the lobes dichotomously branched and typically growing loosely over each other, creating a net-like appearance when viewed from above; lobe tips truncate to tapering; upper cortex smooth; lower cortex poorly developed, pale and dull; apothecia frequent, laminal near the axils of lobe branches, to 2 mm broad, with a pale brown, plane disk, the thalline margin often becoming thin at maturity; spores 2-3(-4)- celled, with tapering, blunt apices, 12-14 × 3-4.5 µm; pycnidia occasional, brownish, globose to subconical, about 0.2 mm broad; conidia bacilliform, 2.5-4 × 0.8-1 µm.

Local and sporadic through all but the northern Ozarks; growing on massive, lightly shaded, high base rocks, usually in sites with limited direct water exposure. Typical habitats include sheltered mid and lower faces of massive bluffs, in areas with moderately high light intensity, large outcrops along streams and creeks, and shaded ledges at the edges of glades. This species grows on limestone, dolomite, and sandstone with percolation from overlying carbonate rocks.

The color of the dry thallus often blends perfectly with the color of the substrate, making the narrow lobes extremely inconspicuous. *Speerschneidera* can grow in large thalli that radiate outward and die centrally, forming hollow rings up to 30 cm broad. These rings eventually lose continuity and develop into numerous smaller individual thalli.

SPHINCTRINA Fr. (Sphinctrinaceae)

Lichenicolous fungi lacking an evident thallus and photobiont; apothecia subglobose, lustrous black, on stout black stipes; asci single-walled, I-, eventually disintegrating, with 8 simple, brown, ellipsoid, ± ornamented spores; 3 species in the Ozarks. In addition to the species enumerated below, an unknown *Sphinctrina* has been collected from *Ramalina petrina* in the southern Ozarks of Arkansas.

1. Ascospores 1-septate; on *Pertusaria velata* . . . . . *S. benmargana*

1. Ascospores simple; on other species of *Pertusaria*.

    2. Ascospores lemon-shaped . . . . . *S. tubiformis*

    2. Ascospores broadly ellipsoid to subspherical . . . . . *S. turbinata*

Sphinctrina benmargana Selva
Rare; the type collection is from Newton County, Arkansas. Otherwise known from only one other collection from New York.

Sphinctrina tubiformis A. Massal.
Uncommon on thalli of *Pertusaria* in wooded uplands; *P. paratuberculifera* is the most common host. This species occurs as scattered stipitate black apothecia on the host thallus.

Sphinctrina turbinata (Pers.) De Not.
Rare, once each on *Pertusaria neoscotica*, *P. plittiana*, and *P. propinqua*.

SPILONEMA Bornet (Coccocarpiaceae)

Minutely subfruticose black to dark brown lichens consisting of cyanobacterial filaments irregularly surrounded by fungal tissue, often with a bluish to black hyphal hypothallus; photobiont *Stigonema*; apothecia not seen on Ozark material, black, sessile, lateral and convex; asci similar to *Lecanora*-type asci, with a cylindrical I+ blue apical dome, with 8 hyaline, simple, narrowly ellipsoid spores; pycnidia not seen in Ozark material, sessile, with ellipsoid conidia to 2.5 µm long; 1 species in the Ozarks.

Spilonema revertens Nyl.
Thallus consisting on minute cushion-like mounds of ± terete, lustrous, black to dark brown filaments to 0.3 mm long, with frequent short branches; filaments 26-34 µm broad; brownish to bluish black hypothallus sometimes visible; apothecia and pycnidia not seen in Ozark material.

Occasional throughout the Ozarks, on exposed to very lightly shaded siliceous rocks, usually on ± horizontal surfaces, often growing in small crevices or depressions where moisture and a thin layer of windblown silt accumulates. All Ozark records are associated with *Psorula rufonigra*, which is considered to be an obligate parasite of the *Spilonema*. Whether this is a reflection of the diminutive and cryptic nature of unparasitized occurrences of *Spilonema*, or whether all local populations are parasitized by *Psorula* is unknown.

Another black filamentous lichen of siliceous rocks, *Cystocoleus ebeneus*, grows in microhabitats protected from direct rainfall or runoff, usually on sheltered vertical surfaces, contains *Trentepohlia* as the photobiont, and consists of thinner, longer, much more sparsely branched filaments to 1 mm long.

STAUROTHELE Norman (Verucariaceae)

Saxicolous crustose lichens with brown, rimose-areolate thalli; photobiont *Stichococcus*; perithecia dark, immersed; asci lacking an ocular chamber, with 8 hyaline to brownish, muriform spores; pycnidia laminal, conidia bacilliform; 3 species in the Ozarks. Reference: Thomson (1991).

1. Thallus scant or lacking except for subspherical perithecial warts; spores 2/ascus . . . . . *S. elenkinii*

1. Thallus well developed, rimose to rimose-areolate; spores 2 or 8/ascus.

    2. Thallus gray, gray brown or medium brown; perithecia not noticeably protruding; asci with 8 colorless spores . . . . . *S. diffractella*

    2. Thallus dark brown; perithecia protruding; asci with 2 brown spores . . . . . *S. fissa*

Staurothele diffractella (Nyl.) Tuck.
Occasional on shaded, massive dolomite boulders, ledges, and outcrops, often growing with mosses. This species also rarely occurs on shaded siliceous rocks in lightly shaded, mesic sites. The thallus consists of contiguous areoles, as compared with the discrete, non-confluent areoles of *Endocarpon pallidulum*, which has two spores per ascus, as contrasted with the 8 spores per ascus in *Staurothele diffractella*.

Staurothele elenkinii Oksner
Rare, reported by Thomson (1991) from Pine Hills, Union County, Illinois.

Staurothele fissa (Taylor) Zwackh
Rare, known from a single collection on granite along the St. Francis River at Tiemann Shut-Ins.

STENOCYBE (Nyl.) Körber (Mycocaliciaceae)

Crustose fungi with no thallus; photobiont absent; apothecia minute, black, stipitate (stipes frequently forking, with each branch terminating in an apothecium); asci single-walled, with thickened apex, tardily disintegrating after spore maturity but not forming a mazaedium, with 8 ellipsoid, 1-3-septate, light brown spores; conidiomata unknown; 1 species in the Ozarks.

Stenocybe pullatula (Ach.) Stein
Rare and local in the eastern Missouri Ozarks; restricted to bark of *Alnus serrulata*, usually growing on middle and lower portion of stems in lightly shaded, stable *Alnus* stands associated with high quality streams and fens, and restricted to areas without significant flood scouring.

STICTA (Schreber) Ach. (Lobariaceae)

Large, broad-lobed, brown, loosely adnate to suberect, foliose lichens with conspicuous cyphellae common on the tan tomentose lower surface; photobiont *Nostoc*; apothecia unknown in Ozark material, uncommon, laminal; asci *Peltigera*-type, with 8 pale to brown, ultimately 1+ septate, ellipsoid to attenuate spores; pycnidia unknown in Ozark material, immersed, with bacilliform conidia; 1 species in the Ozarks.

Sticta carolinensis McDonald
Uncommon, known from a handful of collections from the Boston Mountains region of the southern Ozarks in Arkansas. Restricted to lightly shaded, intact mesic woodland with perennial humidity, where it occurs on bases and lower boles of hardwoods and occasionally on mossy sandstone. Otherwise the species is known from the Appalachians. Separated from the more common northeastern *S. beauvoisii* Delise by having phyllida (not isidia) and smaller size, and from recently described *S. fragilinata* McDonald in the KOH– medulla (not KOH+ purplish).

STRANGOSPORA Körb. (Lecanoraceae)

Small crustose lichens, the thallus thin or obscure, continuous, with poorly delimited margins; photobiont chlorococcoid; apothecia laminal, rounded, without a thalline margin; asci with an apically thickened IKI+ blue wall and an IKI+ blue apical dome, with 100+ minute, simple globose spores; pycnidia unknown in Ozark material, with ellipsoid conidia; 2 species in the Ozarks.

1. Apothecia dark brown, KOH-; spores to 2.5 µm broad . . . . . *S. moriformis*

1. Apothecia orange tinted, KOH+ reddish purple; spores > 3.5 µm broad . . . . . *S. ochrophora*

Strangospora moriformis (Ach.) Stein.
Known from braches of hardwoods at a single site in a wooded upland in the central Ozarks.

Strangospora ochrophora (Nyl.) R. Anderson
Rare and inconspicuous; on hardwoods and *Juniperus* in wooded uplands at a few scattered sites through the Ozarks.

STRIGULA Fr. (Strigulaceae)

Syst. Myc. 2: 535. 1823. Lectotype (Santesson, 1952): *S. smaragdula* Fr.

Minute crustose lichens with immersed thallus; photobiont *Trentepohlia*; perithecia black, unbranched paraphyses, I- hymenial gel; asci thin-walled, ± thin-tipped, cylindrical with 8 colorless, 1-septate to muriform spores; pycnidia black containing colorless, bacilliform or fusiform microconidia or colorless, cylindrical, 1-septate to submuriform macroconidia; 7 species in the region.

Strigula is most likely to be confused with *Anisomeridium*, or if on rock, *Thelidium*. *Anisomeridium* differs in having branched paraphyses, ascospores with more rounded ends and nonseptate macroconidia, *Thelidium* in lacking paraphyses and having I+ hymenial gel. *Strigula* is most diverse in the tropics, originally described for species inhabiting leaves but species on bark and rock are no way be distinguishable except in substrate. Although it is a nuisance to hunt them down, often the best character is the size of the macroconidia for separating similar species or determining specimens with poor ascospores. None of the species occurring in the Ozarks seems common but this may merely reflect their inconspicuous nature.

1. Growing on carbonate rock; ascospores 1-septate, 12-15 x 4-5 µm; macroconidia 11-15 x 3-4 µm . *S. buckii*

1. Growing on bark 2

2. Ascospores 1-septate 3

3. Ascospores 17-25 x 4-5.5 µm, one or both ends gradually tapered, subbiseriate in the ascus; macroconidia (12-)15-17 x 3-3.5 µm . . . . . *S. americana*

3. Ascospores 14-18 x 4-5 µm, ends abruptly pointed or ± rounded, uniseriate in the ascus; macroconidia (8-)10-12 x 2.5-3.5 µm . . . . . *S. viridiseda*

2. Ascospores 3-septate or 5-7 transversely septate, often submuriform 4

4. Ascospores 5-7 transversely septate or submuriform 5

5. Ascospores 20-27 x 6-7.5 µm, often with 1-several longitudinal septa (submuriform) . . . . . *S. submuriformis*

5. Ascospores 24-42 x 5-7.5 µm, without longitudinal septa . . . . . *S. stigmatella*

4. Ascospores 3-septate 5

6. Ascospores 15-20 x 4-6 µm; macroconidia 3-septate, 14-17 x 3 µm (from Scottish material, not yet found in any American collections) . . . . . *S. jamesii*

6. Ascospores 19.5-22(-26) x (4-)5-6.5 µm; macroconidia 5-septate, 25-27 x 3-4 µm . . . . . *Strigula sp.* 41471

Strigula americana R. C. Harris
Thallus immersed, pale gray-green to whitish. Ascomata black, initially immersed becoming emergent, sometimes ± sessile, conical to hemispherical, 0.3-0.5 mm across; ascomatal wall brown-black, lacking or very thin below. Asci cylindrical, 70-85 x 7-9 µm, with 8 (often fewer by abortion) subbiseriate spores. Ascospores 1-septate, narrowly fusiform, with cells often quite unequal, one or both cells with ends acute, gradually tapered, 17-25 x 4-5.5 µm. Pycnidia black, conical to hemispherical, 0.1-0.2 mm across. Microconidia fusiform, 3-5 x 1.5 µm. Macroconidia cylindrical, (12-)15-17 x 3-3.5 µm.

Strigula americana is occasional in the Ozarks, occurring on boles of hardwoods in mesic woodlands and floodplain forest. It has been collected on *Carya*, *Fagus*, *Fraxinus*, *Nyssa* and *Ulmus*. This species is endemic to eastern North America, originally described from Iowa, and occurs in scattered localities from Minnesota and Massachusetts to Florida and Louisiana. *Strigula americana* can be difficult to separate from *S. viridiseda* and, to complicate determination, a few specimens produce almost no ascospores. Macroconidial size is the most useful character for resolving these problems although in sufficiently fertile specimens ascus size and ascospore arrangement can be used.

Strigula buckii R. C. Harris & Ladd, *sp. nov.*
Thallus immersed, pale brownish or not evident. Ascomata black, conical to hemispherical, ¼–½-immersed, 0.3-0.35 mm across; ascomatal wall brown-black above, absent or very thin below. Ascospores fusiform or tapered at one end, 1-septate, 11-15 × 3-4 µm. Pycnidia black, conical to hemispherical, 0.1-0.2 mm across. Microconidia not found. Macroconidia cylindrical, 1-septate, 11-15 × 3.5-4 µm.

Rare (undetected?) on shaded dolomite and calcareous sandstone. The species is named for W. R. Buck, the only person to collect this species (and many others like it that are invisible to normal

mortals). It is close to the saxicolous *S. bermudana* (Tuck. *ex* Nyl.) R.C. Harris and corticolous *S. viridiseda*. It differs from both in having the ascospores in two rows in the ascus and larger macroconidia. Further *S. bermudana* has larger ascomata, 0.5-1.0 mm across, a white, ± superficial thallus over oolitic limestones in Bermuda and southernmost Florida while *S. buckii* has a darker, immersed thallus on shaded dolomites or calcareous sandstone.

Strigula jamesii (Swinscow) R. C. Harris
Thallus immersed, pale green-gray. Ascomata black, immersed to sessile, hemispherical to ± spherical or pyriform, with an adherent or ± spreading, dark brown clypeus, pale below, 0.2-0.35 mm across (incl. clypeus). Asci cylindrical or slightly clavate, ca. 70-80 x 10 µm, with 8 (fewer by abortion) biseriate spores. Ascospores fusiform, often tapered at one end, 4-celled, 15-20 x 4-6 µm. Pycnidia 0.1-0.15 mm across. Microconidia oblong, 4-5 x 1.5 µm. Macroconidia not found in American material, 14-17 x 3 µm from Scotland.

Occasional on soft bark (*Fraxinus*, *Juniperus*, *Quercus alba*) in moist microhabitats in acid and dolomitic glades through the Missouri portion of the Ozarks. Elsewhere it is known from the British Isles and a handful of scattered localities in eastern North America from southern Ontario to Louisiana. Ozark material has slightly larger ascomata than in the British Isles but the ascospore size matches. Macroconidia are often useful for species discrimination in *Strigula* but have not been found in American specimens. Pending additional information we retain our material in *S. jamesii*.

Strigula stigmatella (Ach.) R. C. Harris
Thallus well developed, continuous, smooth, greenish gray, with abundant *Trentepohlia*. Ascomata scattered to crowded, immersed or slightly emergent with thin thalline covering, dark brown to blackish, globose or subglobose, 0.2-0.4 mm across; ascomatal wall pale below. Asci cylindrical, 80-110 x 13-15 µm, with eight biseriate or subbiseriate spores. Ascospores fusiform, 7-septate, 24-42 x 5-7.5 µm. Macroconidia 7-septate, 23-30 x 3.5-5 µm.

Known from a single collection on base of *Quercus rubra* in a mesic canyon in the southeastern Missouri Ozarks. See *S. submuriformis* below for separation from that species

Strigula submuriformis (R. C. Harris) R. C. Harris
Thallus immersed, light gray to white, with abundant *Trentepohlia*. Ascomata scattered to clustered and even partially fused (separating walls sometimes colorless), black, hemispherical, mostly ca. 1/3- immersed but varying from nearly superficial to almost entirely immersed, 0.3-0.5 mm across; ascomatal wall pale/lacking below. Asci cylindrical to clavate-cylindrical, 75-95 x 13-16 µm, with eight biseriately or subbiseriately arranged spores. Ascospores fusiform, 5-7 transversely septate, often with 1-2 cells longitudinally septate, 20-27 x 6-7.5 µm. Pycnidia black, ± globose, 0.1-0.2 mm across. Microconidia oblong, 3-4 x 1.5 µm. Macroconidia cylindrical, 5-7-septate, 18-23 x 4-4.5 µm.

Rarely collected in the Ozark region on boles of hardwoods in mesic or floodplain forests. The species is endemic to eastern North America, most common in the Midwest from Minnesota to Missouri and Oklahoma with somewhat disjunct occurrences in Pennsylvania and New Hampshire. The combination of perithecioid ascomata, unbranched paraphyses and submuriform ascospores distinguish *S. submuriformis*. *Strigula stigmatella* has ascospores also 5-7-septate but they are larger, lacking longitudinal septation. It also differs in darker thallus, longer macroconidia and more mesic habitat preference(?).

Strigula viridiseda (Nyl.) R. C. Harris
Thallus immersed, pale gray-green to whitish. Ascomata initially immersed, emergent and occasionally ± superficial, conical or hemispherical to subglobose, 0.25-0.5 mm across; ascomatal wall brown-black, thinner or lacking below. Asci cylindrical, 90-105 x 7-8 µm, with 8 (often fewer by abortion) uniseriate spores. Ascospores 2-celled, ± fusiform with cells equal or slightly

unequal, with rounded or abruptly pointed ends, 14-18 x 4-5 µm. Pycnidia black, conical or hemispherical, 0.1-0.2 mm across. Microconidia oblong, 3-5 x 1.5 µm. Macroconidia short cylindrical, (8-)10-12 x 3-3.5 µm.

Rare in mesic sites on boles of *Quercus* and *Tilia*. It is a subtropical-tropical species, described from French Guiana and known from Brazil, Trinidad and the Greater Antilles. In North America it occurs mainly in Florida with isolated records from Alabama, Louisiana, South Carolina and Texas. See *S. americana* above for separation from that species.

Strigula sp. 41471
Thallus immersed. Perithecia mostly immersed, ca. 0.3-4 mm diam. Perithecial wall brown above, colorless below. Asci cylindrical or ± obclavate, 80 x 12-15 µm, with eight ± uniseriate spores. Ascospores fusiform or short clavate, 4-celled, 19-22 × 5-6.5 µm. Microconidia not found. Macroconidia cylindrical, 5-septate, 25-27 x 3-4 µm in globose, pycnidia, immersed, ca. 0.2 mm across.

MISSOURI. Carter County: Mark Twain National Forest, along S side of Skyline Drive (FS 3280), ca. 2.8 mi SW of MO 103, 36°57'N, 91°02'W, 220-265 m, oak-pine-*Nyssa* woodland, on *Nyssa*, 13 Oct 1997, *Harris 41471* (NY).

This taxon might be confused with *S. jamesii* or *S. affinis* (A. Massal.) R. C. Harris (not known from North America) which have smaller ascospores and 3-septate, smaller macroconidia. The 5-septate macroconidia might lead one to *S. submuriformis* with 5-7-septate but they are shorter, 18-23 µm. The North American population of *S. jamesii* seemingly lacks macroconidia. This taxon is known from a single rather poor specimen.

STROMATELLA Henssen (Lichinaceae)

Small areolate-squamulose gelatinous lichens; photobiont a chroococcoid cyanobacterium; apothecia laminal, ± immersed, with a bumpy thalline margin; asci IKI-, with 8 simple, ellipsoid spores; pycnidia not seen in Ozark material, laminal, immersed, with bacilliform conidia;1 species in the Ozarks. In addition to regular apothecia, these lichens can produce pycnoascomata, which develop beneath a pycnidium.

Stromatella bermudana Henssen
Known from dolomite in a small glade along Rocky Creek, in the igneous region of southeastern Missouri.

SYNALISSA Fr. (Lichinaceae)

Minutely shrubby, fruticose, gelatinous lichens with closely clustered compact branches of terete lobes; photobiont *Gleocapsa* (with a reddish, KOH+ purplish sheath); apothecia terminal and initially poriform, later expanding, with a well developed thalline margin; asci thin-walled, I-, with 8 or more simple, hyaline, broadly ellipsoid spores; pycnidia immersed, with ellipsoid conidia; 1 species in the Ozarks.

Synalissa symphorea (Ach.) Nyl.
Uncommon, but possibly overlooked, on massive exposures of carbonate rock, typically on glades or large bluffs.

TELOSCHISTES Norman (Teloschistaceae)

Shrubby fruticose lichens with a central holdfast and flattened, dorsiventrally differentiated thalli, and orange or yellowish tints; photobiont *Trebouxia*; apothecia marginal and terminal, with thalline margin, epithecium granular, yellowish, hypothecium pale; asci *Teloschistes*-type, with 8 hyaline, ellipsoid, polarilocular spores; pycnidia yellow to orange, immersed to emergent; conidia bacilliform; 1 species in the Ozarks.

Teloschistes chrysophthalmus (L.) Th. Fr.
Thallus erect, forming a compact mound of orange to grayish orange, abundantly and irregularly branched, flattened lobes to 2 cm tall, sometimes with a few perforations; lobes linear and truncate, to 2 mm broad, with irregular to erose margins; many lobe tips, and sometimes lobe margins, with long cilia to 1 mm long, concolorous with the thallus; lower cortex paler, tinged grayish to whitish; both sides of the thallus typically with a pattern of obscurely reticulate raised veins; upper cortex bumpy and irregular; apothecia common, to 3(-4) mm broad, marginal and terminal on short lobes, shallowly concave, the thalline margin terminating as a slightly raised, irregularly ciliate rim; the disk bright orange, matte; spores 14 × 7 µm, isthmus 7-8 µm. [parietin]

Locally frequent in the western Ozarks, on exposed hardwood branches in open areas such as glades and woodland edges; growing on both trees and shrubs such as *Rhus* and *Crataegus*. It is locally abundant on the extensive dolomite glades in the White River section of the western Missouri Ozarks; *Punctelia graminicola* and *Ramalina culbersoniorum* are characteristic associates in this habitat. *Teloschistes chrysophthalmus* is also frequent on trees in native grass pastures in the extreme western Ozarks, and becomes even more abundant in the prairie country of the Osage Plains west of the southwestern Ozarks This species also occurs more rarely elsewhere in the central and southern Ozarks, usually in high light intensities on canopy branches on hardwoods in mature woodlands. It occurs very rarely on lightly shaded siliceous boulders in open wooded uplands.

A related species in the western Ouachita region south of the Ozarks, *T. exilis* (Michx.) Vain., is similar, but has elongate, subterete branches < 0.5 mm broad.

TEPHROMELA M. Choisy (Tephromelataceae)

Gray crustose lichens with verrucose, continuous to rimose thalli; photobiont chlorococcoid; apothecia sessile, with black disk and well-developed, low, thalline margin; asci *Bacidia*-type, with 8 hyaline, ellipsoid, simple spores; pycnidia immersed, with ± straight, filiform conidia; 1 species in the Ozarks.

Tephromela atra (Huds.) Hafellner
Thallus crustose, gray, adnate, ± thick, of continuous subbullate verrucae ca. 0.2-0.7 mm broad (most pronounced in saxicolous specimens); older portions of thalli becoming somewhat rimose; upper cortex matte, epruinose; lower surface white, hyphal, ecorticate, closely adherent to the substrate; rhizines lacking; apothecia common, sessile, laminal, to 1.4 mm broad, somewhat constricted basally, the well-developed thalline margin shallowly crenulate and slightly elevated above the plane black to dark brownish disk; epithecium deep reddish to deep reddish purple or purplish brown, suffusing throughout hymenium; hypothecium reddish to purplish brown, concolorous with hymenium; exciple concolorous with epithecium; ascospores 8, hyaline, simple, broadly ellipsoid, sometimes sparse in Ozark material; pycnidia not seen in Ozark material.

Rare and scattered through the Ozarks, usually growing on exposed to lightly shaded siliceous rocks; collected twice on hardwoods. [atranorin]

THELENELLA Nyl. (Thelenellaceae)

Mém. Soc. Sci. Nat. Cherbourg 3: 193. 1855. Type: *T. modesta* Nyl.

Saxicolous, muscicolous or corticolous crustose lichens with thin continuous thallus; photobiont chlorococcoid; perithecia with wall mostly pale, greenish at apex, paraphyses branched and anastomosed, especially above asci; asci fissitunicate?, I−, with distinct ocular chamber and an apical plug staining with phloxine, with 2-8 submuriform to muriform, colorless spores; conidia filiform; 4 species in the region. [no lichen substances] References: Harris (1995), H. Mayrhofer (1987).

1. Growing over bryophytes **or** on bark 2

    2. Growing on bryophytes; 2-4 spores in the ascus . . . . . *T. muscorum*

    2. Growing on bark; 8 spores in the ascus . . . . . *T. pertusariella*

1. Growing on rock 3

    3. Ascospores 20-32 x 9-13 . . . . . *T. brasiliensis*

    3. Ascospores 30-45 x 12-19 . . . . . *T. luridella*

Thelenella brasiliensis (Müll. Arg.) Vainio
Uncommon on shaded sandstone, chert or rhyolite in a variety of mostly open, woodland types. As far as we can tell separated from the other saxicolous species only by ascospore size. The only other eastern United States specimen is from New Jersey. Reported by Mayrhofer (1987) from South America, West Indies and China.

Thelenella luridella (Nyl.) H. Mayrh.
Rare, known from one collection from Kansas and one from Missouri, both on sandstone in disturbed areas. Reported by Mayrhofer (1987) from the Southern Hemisphere and West Indies.

Thelenella muscorum (Fr.) Vainio
Occasional on bryophytes over rock, soil and occasionally tree bases, mostly in carbonate glades but also in dry woods. It has been found in scattered North American localities and is widely distributed in Europe and known from northern Africa (Mayrhofer 1987). This is the most commonly collected species of *Thelenella* in the Ozarks as a result of the bryological eye of Bill Buck. The substrate and reduced number of ascospores are diagnostic. An 8-spores variety is known but has not been found in our region. Formerly known as *Chromatuchlaymus muscorum* (Fr.) H. Mayrh & Poelt.

Thelenella pertusariella (Nyl.) Vainio
Known in the Ozarks from a single site on the Spring River in Oklahoma on *Carya* and *Quercus* in open woodland. It is known also from the Great Lakes region (NY) and from Northern Europe and the Alps (Mayrhofer 1987). This species might be confused with *Topelia aperiens* which has yellow brown to blackish ascomata (not ± colorless).

THELIDIUM A. Massal. (Verrucariaceae)

Saxicolous crustose lichens on carbonate substrates, thalli thin, sordid whitish to pale gray, sometimes suffused with pink; photobiont *Protococcus* or *Trebouxia*; perithecia small, mostly immersed in pits in the substrate; asci ± thick-walled, I-, with a small ocular chamber but no

apical structures, with 8 hyaline, ellipsoid, 1-3-septate spores; conidiomata unknown; 4 species in the Ozarks.

1. Perithecia immersed in carbonate rock.

    2. Ascospores 1-septate . . . . . *T. decipiens*

    2. Ascospores 3-septate . . . . . *T. incavatum*

1. Perithecia superficial on sandstone or dolomite.

    3. Ascospores 1-septate . . . . . *T. minutulum*

    3. Ascospores 3-septate . . . . . *T. zwackhii*

Thelidium decipiens (Nyl.) Kremp.
Uncommon on dolomite and limestone usually near water, especially small streams.

Thelidium incavatum Mudd
Uncommon on limestone and dolomite in lightly shaded to exposed beds of temporary runoff streams, and along the margins of larger streams, often growing on small loose rock pieces. The perithecia are often pinkish-purple, and resemble the perithecia of *Verrucaria marmorea*, a species of dry exposed limestone and dolomite.

Thelidium minutulum Körber
Rare, a few collections on sandstone along streams.

Thelidium zwackhii (Hepp) A. Massal.
Rare, on sandstone and dolomite, usually along or in streams.

THELOCARPON Nyl. *ex* Hue (Acarosporaceae)

Inconspicuous minute crustose lichens with the thallus consisting of pale to yellowish, globule-like warts; photobiont chlorococcoid; apothecia apical, tiny and appearing almost perithecioid, typically pruinose; asci broadly pyriform, with > 50 tiny simple spores; pycnidia not seen in Ozark material, pale, immersed, with ellipsoid conidia; 3 species in the Ozarks.

1. Terricolous; ascospores 8-12 × 3-5 µm . . . . . *T. superellum*

1. Lignicolous, corticolous or saxicolous; ascospores 1.5-5 × 1-2 µm.

    2. Paraphyses absent; ascospores bacilliform, 3-4 × 1-1.5 µm; thallus pale yellowish *T. intermediellum*

    2. Paraphyses present; ascospores globose, 1.5-5 × 1.5-2 µm; thallus lemon yellow . . . . . *T. laureri*

Thelocarpon intermediellum Nyl.
Rare, but possibly overlooked, on old wood and hardwood lignum, usually in sheltered microhabitats.

Thelocarpon laureri (Flotow) Nyl.
Uncommon and scattered, typically in anthropogenically disturbed sites, where it occurs most commonly on weathered conifer lignum, such as western red cedar fence rails and posts, or old cedar shingles. It also occurs on rocks. At a distance, the minute globose thallus granules resemble a diminutive *Candelariella xanthostigma*.

Thelocarpon superellum Nyl.
Uncommon on stable consolidated loamy soils in areas where competition from vascular vegetation is minimal, typically in mesic or dry-mesic habitats with light shade but relatively high light intensities.

THELOPSIS Nyl. nom. cons. (Gyalectaceae?)
Mém. Soc. Sci. Nat. Cherbourg 3: 194. 1855. Type (monotype): *T. rubella* Nyl.

Minute crustose lichens with immersed thallus; photobiont *Trentepohlia*; ascomata perithecioid, periphysoids, unbranched paraphyses, hymenial gel I+ greenish blue becoming dirty orangish; asci thin-walled without apical structures, with numerous, colorless, nonseptate, transversely septate or submuriform ascospores, halonate or not; 2 species in the Ozarks. References: Vězda, Folia Geobot. Phytotax. 3: 363-406. 1968; Harris, Bryologist 82: 77,78. 1979.

1. Ascomata pallid to brownish; pore region whitish; ascospores simple, globose or slightly elongate, halonate, 6-7 µm across or 5-6 x 7-7.5 µm; on bark . . . . . *T. flaveola*

1. Ascomata reddish; ascospores 3(-5)-septate, 12-18(-21) x 5-6 µm; on bark or sandstone . . . . . *T. rubella*

Thelopsis flaveola Arnold
Thallus immersed or ± superficial, pale gray. Ascomata pale to medium brown where exposed, immersed to ca. half exposed with age, pyriform or more globose with a short stout papilla, 0.3-0.4 mm across; pore usually surrounded by a whitish ring; ascomatal wall ± colorless, two-layered, outer amorphous, sometimes containing a few algal cells, inner of thick-walled, parallel, elongate cells. Periphyses embedded in colorless gel. Asci cylindrical with pointed tip, 140-170 x 10-12 µm (Vězda, 1968). Ascospores globose or slightly elongate, halonate, 6-7 µm across or 5-6 x 7-7.5 µm, not including 1-1.5 µm thick halo.

Occasional (but if one could see *T. flaveola* in the field, it might be common in the Ozarks since it has been picked up mostly accidentally as an admixture) mostly on *Quercus* (once on *Carya*) in intact, dryish oak or oak-hickory woodlands. The only previous record from North America of this otherwise European species from is from Virginia. *Topelia aperiens* is similar externally but lacks the whitish ring around the pore and is internally distinct in having eight muriform spores per ascus. The ascospores of American collections are larger than those reported by Vězda, 4-6 x 3-4 µm.

Thelopsis rubella Nyl.
Thallus immersed, not evident. Ascomata dark red to red-brown above, paler toward base, sessile, ovoid, 0.2-0.3 mm across, with small, pale pore; ascomatal wall reddish outside where exposed, otherwise ± colorless. Asci cylindrical, 150-200 x 18-25 µm (Vězda, 1968). Ascospores ± cylindrical to narrowly ellipsoid, mostly 3-septate but a few 4-septate or with one cell divided lengthwise, 12-15 x 4-5 µm, not halonate.

Rare in the western Ozarks; known only from a moist, vertical sandstone face along a stream in Cherokee County, Oklahoma and from *Juniperus ashei* in Stone County, Missouri. *Thelopsis rubella* is otherwise known in eastern North America from six collections on bark from Georgia, Kentucky, Louisiana and Texas. *Thelopsis rubella* is apparently a mainly corticolous species, found rarely on rock, in moist habitats in Europe. In England this species is considered an indicator of old growth forests (Purvis et al., 1992). Specimens from rock could be distinguished as var. *saxicola* Hulting if one is impressed by substrate differences. Some of the other American collections have an even greater percentage of 4-5-septate ascospores than observed in the Ozark collection. Thus the American population apparently consistently deviates from the European population which has (1-)3-septate ascospores.

THELOTREMA Ach. (Thelotremataceae)

Crustose lichens with a pale, gray or brown, continuous thallus; photobiont *Trentepohlia*; apothecia appearing poriform or perithecioid; asci IKI-, with the wall notably thickened at the apex, with 6-8 hyaline, I+ violet, 7+ septate spores; pycnidia unknown in Ozark material, with bacilliform conidia; 1 species in the Ozarks.

Thelotrema subtile Tuck.
Known only from a shaded hardwoods in a moist woodland terrace along a small stream in the southern Ozarks; growing on *Carpinus caroliniana* and *Ulmus alata*.

THROMBIUM Wallr. (Thrombiaceae)

Terricolous crustose lichens with scant to obsolete thalli; photobiont *Leptosira*; perithecia immersed, with dark ostioles and persistent paraphyses; asci thin-walled, with I+ blue apical cap and dome with narrow, cylindrical axial mass, with 8 simple, hyaline, ellipsoid spores; conidiomata unknown; 1 species in the Ozarks. Reference: Bird & Beil (1972).

Thrombium epigaeum (Pers.) Wallr.
Inconspicuous and apparently rare, on exposed, well-drained, stabilized sandy soils at a few scattered sites throughout the Ozarks, growing in areas where competition from vascular vegetation is minimal.

THYREA A. Massal. (Lichinaceae)

Saxicolous gelatinous lichens with black or gray, foliose thalli typically with elongate strap-like lobes; photobiont a chroococcoid cyanobacterium; apothecia small, immersed, mostly marginal; asci thin-walled, with 8 hyaline, simple, broadly ellipsoid spores; pycnidia immersed, with ellipsoid to bacilliform conidia; at least 1 species in the Ozarks, but part of a poorly understood polygeneric complex of taxa with seemingly abstruse generic delimitations.

Thyrea confusa Henssen
Widely distributed in suitable habitats but never abundant, occurring on exposed to lightly shaded, massive dolomite on glades and upper portions of bluffs, often growing in channels receiving intermittent runoff or seasonal seepage. The thallus is usually sterile, consisting of narrow or somewhat expanded, basally attached lobes often clustered around a central attachment point. The thallus is typically densely pruinose and grayish.

Our material may include or consist of other members of the Lichinaceae. Several smaller black crustose taxa also occur on exposed carbonate substrates in the Ozarks, but their taxonomy and ecology remain unknown. Generic delimitations as currently applied in the Lichinaceae are morphologically abstruse and seem all but useless from a field perspective, especially since much of the material in the Interior Highlands is consistently sterile.

TONINIA A. Massal. *nom. cons.* (Bacidiaceae)
Ric. auton. lich. crost. 107. 1852. Lectotype: *T. cinereovirens* (Schaerer) A. Massal.

Small squamulose or crustose saxicolous or terricolous lichens; photobiont chlorococcoid; apothecia sessile and laminal to marginal; thalline margin absent, black, pruinose or not, flat and marginate becoming swollen with hidden margin; asci *Bacidia*-type, with eight, bacilliform, 0-7-septate spores; pycnidia unknown in Ozark material, laminal, immersed, with filiform conidia; 1

species in the Ozarks. Reference: Timdal (1991).

Toninia submexicana de Lesd. *s. lat.*
Thallus of small brown lobules with marginal black to dark brown apothecia that can appear centrally punctate; epithecium purplish, KOH+ purple; spores 4-celled, 20-21× 4.7 µm.

Apparently rare, but possibly overlooked, on exposed to shaded carbonate rocks, usually associated with glade and bluff systems. This species can appear similar to squamules of *Lecidea lurida* or *Placidium*. Our specimen agrees with the description and with material from Mexico annotated by Timdal (ASU) in the squamulose thallus, epithecium and exciple KOH+ purple, colorless hypothecium and 3-septate ascospores (ca. 17-20 x 4.5 µm in Ozark collection). It differs from the Mexican specimens in having a paraplectenchymatous hypothecium with thick-walled cells. Timdal (1991) indicated the name *T. submexicana* may apply to a complex of species so it does not seem inappropriate to add our lone specimen to the *Toninia submexicana* puzzle.

TOPELIA P. M. Jørg. & Vězda (Gyalectaceae?)
Nova Hedwigia Beih. 79: 502. 1984. Type: T. rosea (Servít) P. M. Jørg. & Vezda

Tiny crustose lichens with thin, inconspicuous, grayish thallus; photobiont *Trentepohlia*; ascomata, immersed, perithecioid, periphysoids, slender unbranched paraphyses, hymenial gel I+ greenish blue becoming dirty orangish; thin-walled without apical structures, with 8 colorless, submuriform to muriform spores; pycnidia unknown on Ozark material, with bacilliform conidia; 1 species in our region. Reference: Jørgensen & Vězda, Beih. Nova Hedwigia 79: 501-511. 1984.

Topelia aperiens P. M. Jørg. & Vězda
Thallus ± superficial, green-gray, in one collection almost subiculum-like, of loose, reticulate, rather broad hyphae, more compact in the other. Ascomata immersed, ± emergent with age with conical tip exposed, flask-shaped, pale tan, becoming yellow-brown to brown (or even black?) with age/exposure, ± translucent, 0.2-0.4 mm across; pore punctiform, open or closed, more open and broadening in a few older ascomata; ascomatal wall pale, with an amorphous outer layer and a inner layer of ± thick-walled, elongate cells, lined with periphysoids extending into the cavity in the upper part. Asci cylindrical with acute tip, thin-walled, with 8 ascospores in a single row. Ascospores ellipsoid to broadly ellipsoid, muriform with 6-8 rows of cells, 16-22 x 9-12 µm. Pycnidia not found.

Occasional on boles of hardwoods in oak-hickory or oak woods. The type and only previously known collection is on *Taxodium* from Louisiana. We have not examined it but our material matches the original description. Superficially *T. aperiens* is similar to *Thelopsis flaveola* in its brownish, mostly immersed, perithecioid ascomata but is easily separated by the ascospores, 8/ascus and muriform in the former, while many/ascus and non-septate in the latter. The exposed part of the ascoma in a few collections is black and on further study may prove to be sufficiently distinct to merit taxonomic recognition.

TRAPELIA M. Choisy (Agyriaceae)

Saxicolous crustose lichens with pale gray, areolate thalli; photobiont *Chlorella*; apothecia small, sessile, brown to blackish, with obscure thalline margins sometimes disappearing in age; asci with I+ bluish apical dome, lacking an ocular chamber, with 8 hyaline, ellipsoid, simple spores; pycnidia immersed, with cylindrical to filiform conidia; 2 species in the Ozarks.

1. Thallus sorediate; apothecia lacking in Ozark material . . . . . *T. placodioides*

1. Thallus esorediate; apothecia common . . . . . *T. glebulosa*

Trapelia glebulosa (Sm.) J.R. Laundon
Formerly known as *T. involuta* (Taylor) Hertel, this species is occasional on small siliceous pebbles, rock fragments, and small cobbles in well-drained, exposed to lightly shaded sites, such as along the edges of wooded uplands, on stable roadside embankments, and in upland old fields. In harsh sites, this species may be restricted to the sides or lower edges of rocks. [gyrophoric acid]

Trapelia placodioides Coppins & P. James
Rare on siliceous rocks in wooded uplands, often growing on cobbles and small boulders. [gyrophoric acid]

TRAPELIOPSIS Hertel & Gotth. Schneid. (Agyriaceae)

Mostly lignicolous, occasionally corticolous crustose lichens with granular areolate, C+ pinkish thalli; photobiont *Chlorella* or *Pseudochlorella*; apothecia sessile, black, thalline margin absent; asci thin-walled, with I- or I+ weakly blue apical dome, with 8 hyaline, ellipsoid, simple spores; pycnidia ± immersed, with bacilliform conidia; 1 species in the Ozarks.

Trapeliopsis flexuosa (Fr.) Coppins & P. James
Frequent on sound, well-drained lignum in exposed to lightly shaded sites, growing on decorticate logs, stumps, charred wood, and standing decorticate snags in wooded uplands, as well as on weathered exposed boards, particularly of *Thuja* or *Juniperus*, and on bark of *Pinus echinata* in lightly shaded wooded uplands. The thallus is composed of dark grayish green, thin, sorediate areoles, and the apothecia, when present, have plane disks. A species with thicker, gray areoles and convex apothecia, *T. granulosa* (Hoffm.) Lumbsch, occurs in similatr habitats north and east of the region, but has not been documented in the Ozarks. [gyrophoric acid]

TRYPETHELIUM Sprengel (Trypetheliaceae)

Corticolous crustose lichens with thin, continuous, sublustrous greenish to yellowish thalli; photobiont *Trentepohlia*; perithecia dark, clustered in carbuncular pseudostromata; asci bitunicate, with a broad, shallow ocular chamber, with 8 hyaline, fusiform, (3-)7-9 septate spores, the cells rhomboid to elliptical; 1 species in the Ozarks.

Trypethelium virens Tuck. *ex* E. Michener
Uncommon and local in mesic habitats, growing on shaded boles of hardwoods, usually on species with smooth, hard bark. Although *Fagus grandifolia* is a favored substrate throughout much of the range of this species, *Fagus* is confined to the extreme southern and eastern portions of the Ozarks, and local populations of *Trypethelium* are often on *Carpinus caroliniana* or even *Amelanchier arborea* and *Carya*.

TUCKERMANELLA Essl. (Parmeliaceae)

Small brown foliose lichens with short, branched lobes, upper cortex with elongate marginal pseudocyphellae and a pale brown lower surface with occasional rhizines; photobiont *Trebouxia*; apothecia laminal, with a well-developed thalline margin and brown disk; asci Lecanora- type, with 8 simple, ellipsoid spores; pycnidia common, black, laminal to submarginal, sessile, with bifusiform conidia; 1 species in the Ozarks. Reference: Esslinger (2003).

Tuckermanella fendleri (Nyl.) Essl.
Occasional throughout all but the northern Ozarks, on lightly shaded to exposed boles and branches of *Pinus echinata*, including young trees along roadsides and woodland edges in areas of extensive oak-pine woodlands. More rarely it grows on old, undetached pine cones. This species sometimes grows on *Pinus echinata* boles in older plantations that were planted by the Civilian Conservation Corps during the 1930's. The thallus is typically chestnut brown, and turns deep yellowish green when wet. [fatty acids]

TUCKERMANOPSIS Gyelnik (Parmeliaceae)

Loosely adnate, corticolous foliose lichens with greenish brown to olive or brown upper cortex, usually with abundant marginal black pycnidia, pseudocyphellae occasional, not prevailingly marginal; lower cortex pale to tan, rhizinate; photobiont *Trebouxia*; apothecia sessile and usually marginal, with well-developed thalline margin; asci *Lecanora*-type, with 8 hyaline, ellipsoid, simple spores; pycnidia usually abundant, prevailingly marginal, sessile, with bifusiform conidia; 2 species in the Ozarks.

1. Lobes larger and broader, many >1 mm broad; apothecia uncommon; medulla C+ red or UV+ white (alectoronic or olivetoric acids).

    2. Medulla C+ red, UV- (olivetoric acid); uncommon . . . . . *T. ciliaris*

    2. Medulla C-, UV+ white (alectoronic acid); rare . . . . . *T. americana*

1. Lobes small and narrow, to 0.4 mm broad; apothecia abundant; medulla C- and UV- (fatty acids only) . . . . . *Tuckermanella fendleri*

Tuckermanopsis americana (Sprengel) Hale
Rare; known only from lower boles of *Pinus echinata* in a small region of Shannon County, where it is significantly disjunct from its main range in the mixed and coniferous woodlands of the Great Lakes region. All our populations are associated with remnant old growth *Pinus echinata* woodlands, although it has been collected on *P. echinata* in an older planting next to an old growth stand. [alectoronic acid]

Tuckermanopsis ciliaris (Ach.) Gyelnik
Uncommon on *Pinus echinata* in areas of extensive mature woodland, growing on boles, branches, and even old stumps. [olivetoric acid]

UMBILICARIA Hoffm. (Umbilicariaceae)

Large saxicolous foliose lichens with umbilicate growth form and centrally attached to the substrate, thallus rather thick, brown to grayish brown; photobiont *Trebouxia* (?); apothecia not seen in Ozark material, laminal, sessile, black, typically gyrose; asci thick-walled, with an I+ blue apical dome, in our taxon with 8 ellipsoid spores; pycnidia mostly immersed to erumpent, with balilliform conidia; historic record of 1 species in the Ozarks.

Umbilicaria mammulata (Ach.) Tuck.
Known only from a 1926 collection by R.P. White labelled “Ozark Region, Mo.” (FH; duplicate at MIN). This is a considerable southern disjunction from the main range of the species. The nearest known localities to the Ozarks are the Great Lakes and Appalachian regions. Intensive searches for this lichen in areas of suitable substrate have been unsuccessful.

USNEA Dillenius ex Adanson (Parmeliaceae)

Adanson, Fam. 2: 7. 1763. Lectotype: *Usnea plicata* (Linnaeus) A. L. Smith (*Lichen plicatus* Linnaeus) = *U. ceratina* Ach.

Slender, terete, abundantly branched, yellowish green fruticose lichens, with cortex and medulla surrounding a central cord, apothecia pale tan, terminal; thalline margin present, often with corticate fibrillose cilia; photobiont *Trebouxia*; asci *Lecanora*-type, with 8 small, simple, colorless ascospores; 10 species in the region.

The input of James Lendemer (PH) is gratefully acknowledged in the untangling of *Usnea*.

1. Thallus shrubby, with terminal apothecia, usually abundant 2

    2. Ascospores 7-9 x 5-6 µm; medulla sometimes red pigmented but more often white or pale pink; chemistry various (see discussion); norstictic acid not yet known in Ozark material . . . . . *U. rubiginea*

    2. Ascospores 9-11 x 6-7 µm; medulla usually red pigmented, occasionally white, containing norstictic acid or rarely usnic acid alone . . . . . *U. strigosa*

1. Thallus various, without terminal apothecia 3

    3. Soredia and isidia absent; central cord dark, reddish or brownish . . . . . *U. trichodea* Ach.

    3. Soredia and/or isidia present; central cord pale, opaque 4

        4. Thallus pendent; main branches markedly ridged . . . . . *U. angulata*

        4. Thallus shorter, shrubby or subpendent; main branches terete 5

            5. Medulla red pigmented (pigment sometimes patchy) 6

                6. Thallus with abundant soralia and isidiomorphs . . . . . *U. mutabilis*

                6. Thallus without soralia . . . . . *U. strigosa*-group

            5. Medulla without red pigment 7

                7. Cortex orange-red mottled; medulla white . . . . . *U. pensylvanica*

                7. Cortex not orange-red; medulla white or faintly pink 8

                    8. Medulla rapidly KOH+ red (norstictic, salazinic, ± galbinic acid) 9

                        9. Isidiomorphs on soralia, not clustered, or singly on cortex, often black tipped; soralia punctiform, very numerous; on rock . . . . . *U. amblyoclada*

                        9. Isidiomorphs mostly on soralia, clustered, not black tipped; soralia larger and less numerous; on trees,rarely rock . . . . . *U. dasaea*

                    8. Medulla KOH- (chemistry not as above) 10

                        10. Medulla CK-; (protocetraric acid); cortex thick, glassy; soralia small, not excavate . . . . . *U. subscabrosa*

10. Medulla CK+ orange (diffractaic acid), pinkish; cortex thinner, not glassy; soralia larger, excavate, often reaching half or more the branch diameter . . . . . *U. entoviolata*

Usnea amblyoclada (Müll. Arg.) Zahlbr.
Sporadically distributed on exposed to massive, lightly shaded, well-drained rock, mostly granite, rhyolite or sandstone but occasionally also dolomite. Some specimens have isidiomorphs without black tips and are placed here as they possess numerous isidiomorphs directly on the cortex. *Usnea dasaea*, otherwise similar, is said to differ in having isidiomorphs only on the soralia but the single Ozark collection seems to have a few on the cortex also. It has, however, better developed soralia. Previously *Usnea amblyoclada* along with *U. halei* P. Clerc has been treated as *U. herrei* ined. [usnic acid, galbinic acid agg.]

Usnea angulata Ach.
Known from a single Ozark site, on old growth *Juniperus* on a massive dolomite bluff in southern Missouri. *Usnea angulata* was once apparently widely distributed in eastern North America. The long, pendent thallus presumably makes it highly sensitive to pollution and lowered humidity. In addition to this site, only a few presumably extant populations in North Carolina are now known to us. [usnic acid, norstictic acid, caperatic acid]

Usnea dasaea Stirton
Rare, known from only a single Arkansas collection on bole of *Prunus* in an oak woods. The species is often distinctive in having numerous spinulose fibrils. The Arkansas collection is moderately fibrillose. See also comments on *U. amblyoclada*. [usnic acid, galbinic acid agg.]

Usnea entoviolata Motyka
We have not seen Ozark material of this species but it is reported by Clerc (2004) from Madison County, Arkansas on sandstone collected by Mason Hale. This species has excavate soralia which may become as wide as the branches. It has previously been confused with *U. ceratina* Ach. (Clerc 2004) which also has a pink medulla and contains diffractaic acid but differs in having numerous white tipped tubercles, decorticate apically, developing into slightly raised soralia. [usnic acid, diffractaic acid]

Usnea mutabilis Stirton
Frequent but scattered in the region, occurring in mature woodlands on hardwoods, *Juniperus*, *Pinus echinata*, and less commonly on decorticate logs and rock. This is by far the most common sorediate species of *Usnea* in the region. [usnic acid, pigment]

Usnea pensylvanica Motyka
Uncommon on hardwoods and occasionally rock in mature woodlands. This has only recently been separated out of the *U. rubicunda* complex (Lendemer 2004a). A single thallus from Johnson County, Arkansas morphologically resembles *U. pensylvanica* but lacks the stictic acid complex and instead contains fatty acids; it is retained here *faut de mieux.* [usnic acid, stictic acid agg.]

Usnea rubiginea (Michaux) A. Massal.
Locally abundant in extensive woodlands; probably the most common *Usnea* in the Interior Highlands as preliminarily it seems more common than *U. strigosa*. It and *U. strigosa* are a major component of the canopy lichen vegetation and frequently may be picked up on fallen branches. *Usnea rubiginea* is only now being separated from *U. strigosa*. Material lacking apothecia can be confused with *U. mutabilis* if abundant fibrils are mistaken for isidia. Such thalli cannot be assigned to species with certainty and should be discarded, or identified as "*Usnea strigosa* – group". The adoption of the name *U. rubiginea* and its circumscription will be dealt with by Lendemer & Ohmura (in prep.) to whom we are indebted for permission for its use here. In the

Ozarks *U. rubiginea* may be chemically distinct in not having norstictic acid which it possesses in other parts of its range but the ascospore size in fertile specimens with norstictic acid or usnic acid alone should be checked as this is the most reliable distinction between *U. rubiginea* and *U. strigosa*. The most common chemotype in our region is usnic acid, ± bourgeanic acid, psoromic acid. A few thalli have been found of the usnic acid, ± bourgeanic acid, fumarprotocetraric acid and usnic acid. ± bourgeanic acid, thamnolic acid chemotypes. All of these chemotypes may be found in a single collection together with *U. strigosa.*

Usnea strigosa (Ach.) Eaton
Locally abundant? often co-occurring with *U. rubiginea* and probably has similar habitat requirements and distribution in the Ozark ecoregion. The identity of *U. strigosa s. str.* in our region has been confirmed with sequence data (Lendemer & Ohmura, in prep.). See *U. rubiginea.* [1) usnic acid, ± bourgeanic acid, norstictic acid, pigment; 2) usnic acid, pigment]

Usnea subscabrosa Motyka
Uncommon, scattered through the region; about half the collections are on rock, half on trees. A single thallus from Johnson County, Arkansas, which morphologically resembles *U. subscabrosa* but contains norstictic acid and an unknown often found in *U. subscabrosa* (Lendemer pers. comm.) instead of protocetraric acid, is placed here provisionally. [usnic acid, protocetraric acid]

Usnea trichodea Ach.
Rare, restricted to lightly shaded old growth populations of *Juniperus*, usually on bluffs above permanent water sources. Although not reported in the literature, *U. trichodea s. lat.* has a number of chemotypes. The most common chemotype is diffractaic acid + constictic acid. Both diffractaic acid and constictic acid occur by themselves in some eastern specimens. There are two additional less common, more geographically restricted, chemotypes: diffractaic acid + psoromic acid in the Ozark region and diffractaic acid + salazinic acid agg. so far known only from the Coastal Plain. [1) usnic acid, diffractaic acid, constictic acid; 2) usnic acid, diffractaic acid; 3) usnic acid, diffractaic acid, psoromic acid]

VERRUCARIA Schrader *nom. cons.* (Verrucariaceae)
Spic. Fl. Germ. 1: 108. 1794.Type: *V. rupestris* Schrader

Crustose, mostly saxicolous lichens with endolithic, continuous, or areolate thalli; photobiont various unicellular algae, including *Myrmecia*, *Trebouxia*, and chlorococcoid taxa; perithecia immersed to subsessile, in some species inhabiting carbonate rock imbedded in pits in the rock; paraphyses absent; hymenial gel I+ bluish becoming orangish; asci fissitunicate, with 8 hyaline, ellipsoid, simple spores; ? species in the Ozarks, 12 treated here. The following treatment is tentative and flawed; species concepts for local taxa are still fluid, so habitat, distribution, and abundance information is sketchy.

1. Growing on carbonate rock 2

    2. Thallus reddish or purplish; ascomata etching pits in rock; wall dark only at apex; ascospores 20-30 x 13-17 µm . . . . . *V. marmorea*

    2. Thallus white, gray or brown 3

        3. Thallus pale (shades of white, pale gray or pale tan), endolithic to epilithic, continuous to rimose or weakly rimose-areolate 4

            4. Exciple colorless; clypeus black, dome-shaped; “perithecial wall” lacking at base; ascospores large, 27-32 x 14-16 µm . . . . . *V. muralis*

4. Exciple and/or clypeus black, forming an entire “perithecial wall” 5

5. Ascomata mostly ca. half immersed with dome-like clypeus in addition to thin, entire, black exciple; ascospores 19-23(-27) x 11-13(-15) µm . . . . . *V. calkinsiana*

5. Ascomata immersed, etching pits in the rock 6

6. Clypeus forming a small apical disk, smaller in diameter than the deeply immersed hymenium; thallus thin, whitish or endolithic; ascospores mostly not developed, 18-22 x 9-12 µm [*Bagliettoa*] . . . . . *V. baldensis*.

6. Clypeus absent/fused with exciple?; ascoma subspherical; wall thin, ± uniform; thallus not evident; ascospores 20-22 x 8-11 µm . . . . . *V. calciseda*

3. Thallus dark (gray, brown or greenish), epilithic, continuous, rimose orrimose-areolate, or with dispersed areoles 7

7. Black prothallus at margin or areoles with well-developed black “medulla” or basal layer; ascomatal wall entire, usually fusing with black basal layer 8

8. Thallus shades of brown or dark brown, often irregularly mottled with black; ascospores 19-28 x 8-16 µm; areoles not black-edged; lower half of areole section black . . . . . *V. nigrescens*.

8. Thallus gray to brownish gray; ascospores under 20 µm long 9

9. Ascospores small, 11-14 x 6-7 µm; ascomata, pycnidia or sterile columns of black “medulla” visible as many small black dots on areole surface; thallus thick, rimose-areolate, pale to medium brownish gray; areoles, flat, often black-edged . . . . . *V. fayettensis*

9. Ascospores variable, 10-19 x 6-8 µm; areoles with 1-few larger black ascomata (not with small black dots); thallus brown with black “medulla”, i.e., a thin black line at base of areole or pale . *V. fuscella*

7. Black prothallus/basal layer, absent or poorly developed or prothallus pale 10

10. Ascospores large, 21-24 x 13-16 µm; ascomata ± large and readily visible; thallus dark brown . . . . . *V. nigrescens s. lat*

10. Ascospores small, 15 x 7 µm or less; ascomata small, ca. 0.1-2 mm across, immersed, difficult to see or visible as small black dots on areole surface 11

11. Thallus dark brown, strongly areolate . . . . . *V. compacta*

11. Thallus thin, olive to brown-gray, granulose to minutely areolate; ascospores 12-15 x 6-7 µm (14-25 x 4-6 µm fide Brodo, 1988) . . . . . *V. nigrescentoidea*

1. On siliceous rocks, substrate HCl- or on bark 12

12. Saxicolous . . . . . *V.* sp. # 1

12. Corticolous . . . . . *V. phloeophila*

Verrucaria baldensis A. Massal.
Common on lightly to moderately shaded massive dolomite exposures. It has previously been confused with *V. calciseda*, so local abundance and distribution are uncertain.

Verrucaria calciseda DC.
Occasional on well-drained or sheltered, exposed to lightly shaded, massive dolomite. See comment under *V. baldensis*.

Verrucaria calkinsiana Servít
Frequent on exposed dolomite in glades, typically occurring on smaller fragments and cobbles, although sometimes growing on more massive boulders and ledges.

Verrucaria compacta (A. Massal.) Jatta
Areoles contiguous or occasionally solitary, irregular, thick, widening from a narrower base (subumbilicate?), and therefore ± easily broken off the rock; mostly ending abruptly but occasionally with a few smaller, flatter marginal areoles, in section appearing compound above but thick, white medulla ± continuous; hypothallus not evident; ascomata completely immersed (small black ostioles nearly invisible); ascomatal wall colorless except at mouth; ascospores ca. 13-15 x (5-)7-8 µm. Pycnidia not found.

Known from three sites in the Missouri Ozarks: two in carbonate glades and one from a rhyolite glade.

Superficially *Verrucaria compacta* could be confused with *Staurothele drummondii* but easily separated when fertile. Because of the very thick thallus this species was once included in *Dermatocarpon*. It is synonymized by Santesson et al. (2004) with *V. fuscula* Nyl., Breuss (Östrerr. Zeitschr. Pilzkunde 3: 15-20. 1994) recognized both species. However, conidia have not been located and we cannot say to which species Ozark material belongs (or neither?).

Verrucaria fayettensis Servít
Uncommon on lightly shaded, massive dolomite outcrops and ledges; often in somewhat mesic habitats, such as ledges along streams in ravines. Local populations have been previously called *V. ionensis* Fink.

Verrucaria fuscella (Turner) Winch
Infrequent in parts of the Ozarks, especially in the northern half of the region, growing on shaded dolomite on wooded upland slopes and in overgrown glades.

Verrucaria marmorea (Scop.) Arnold
Uncommon on massive dolomite and limestone exposures in glades and on bluffs, typically growing on small loose rocks lying on massive bedrock exposures. This species is most frequent, although still relatively uncommon, on the huge dolomite glades of the White River region of the western Missouri Ozarks. It also occurs infrequently in the eastern Ozarks. The pink to purplish thallus and perithecia are distinctive, but see comments under *Thelidium incavatum*.

Verrucaria muralis Ach.
Frequent throughout the Ozarks; on exposed dolomite in glades and on very lightly shaded ledges and outcrops.

Verrucaria nigrescens Pers.
Occasional on lightly to moderately shaded dolomite in carbonate bedrock districts of the Ozarks.

Verrucaria nigrescentoidea Fink
? Rare on mesic, typically mossy, dolomite escarpments.

Verrucaria phloeophila Breuß
Uncommon or overlooked; on shaded bases and lower boles of hardwoods and *Juniperus*, sometimes growing over bryophytes. This species is known from the eastern half of the Ozarks, but also occurs just west of the Ozark region in central Oklahoma.

Verrucaria sp. # 1
Frequent on exposed to lightly shaded, small siliceous pebbles and cobbles of chert and, less commonly, sandstone. This species has a thin, dull, grayish olive, continuous to rimose-areolate thallus, without any visible prothallus, with abundant, evenly distributed, sessile black perithecia with tiny pale apical ostioles. The perithecia are about 0.15 mm broad, with a fairly wide, flat marginal zone that somewhat abruptly rises to a subconical center. The spores are narrowly ellipsoid and fairly thick-walled, with slightly irregular outlines, and average 18-20 × 6.4-7.5 µm; they are contained in broadly rounded asci that are typically 60 × 35 µm.

VEZDAEA Tscherm.-Woess & Poelt (Vezdaceae)

Inconspicuous, greenish, minutely granular crusts; photobiont *Leptosira*; apothecia tiny, usually substipitate, irregularly rounded, emarginate; asci IKI+ blue, with an IKI- apical pore, with 8 simple to ultimately 2-celled spores; conidiomata unknown; 1 species in the Ozarks.

Vezdaea leprosa (P. James) Vězda
Common throughout the Ozarks, but inconspicuous and often overlooked. This species occurs in both intact woodlands, where mossy soil and tree bases in wooded uplands are a typical habitat, and in more disturbed sites, such as degraded thickets and along shaded mossy roadbanks. Buck et al. (1999) have discussed the tolerance of this species for substrates with elevated concentrations of metallic contaminants.

VULPICIDA Mattsson & M. J. Lai (Parmeliaceae)

Compact, small, loosely adnate, yellowish green foliose lichens with a bright yellow medulla; upper cortex often wrinkled or folded; lower cortex pale, sparsely rhizinate; photobiont *Trebouxia* (?); apothecia sessile, with well-developed thalline margin, epithecium brown, hypothecium pale; asci *Lecanora*-type, with 8 hyaline, simple ellipsoid spores; pycnidia usually abundant, black, marginal, sessile; conidia citriform; 1 species in the Ozarks.

Vulpicida viridis (Schwein.) Mattsson & M.J. Lai
Thallus rounded, compact, to 4 cm broad, loosely adnate to suberect; medulla bright yellow; lobes short, rounded, abundantly divided into short sublobes and fimbriations, the margins convolute, slightly thickened, and usually uplifted; upper cortex uniformly deep yellowish green, smooth to irregularly wrinkled; lower cortex pale ivory to yellowish, usually with raised reticulate ridges, with an occasional pale simple rhizine to 1 mm long; apothecia common, laminal near the margins, sessile, basally constricted and often appearing short-stipitate, typically to 4 mm broad, with a lustrous plane brown disk; thalline margin often terminating as a narrow rim of small crenulations; spores broadly ellipsoid to subrotund, ± thick-walled, to 8 × 6 µm; pycnidia abundant, black, laminal and marginal, rounded, to 0.12 mm broad; conidia citriform, 2.5-3.5 × 1.5 µm. [pinastric, usnic & vulpinic acids]

Common in intact woodlands through most of the Ozarks, except in the northern portions or in regions with extensive woodland fragmentation and agricultural development. This species typically occurs on canopy branches of mature hardwoods in extensive wooded uplands, usually on the red oak group: *Quercus coccinea, Q. marilandica, Q. rubra* and *Q. velutina*. It also occurs on *Carya, Fraxinus, Prunus, Ulmus* and a few other species.

XANTHOMENDOZA L. Lindblom (Teloschistaceae)

Small orange to bright deep yellow sorediate foliose lichens with abundantly branched lobes and pale, rhizinate lower cortex; photobiont *Trebouxia*; apothecia sessile, with well-developed thalline margin; asci *Teloschistes*-type, with 8 hyaline polarilocular spores; pycnidia yellow to orange, immersed, with bacilliform conidia; 3 species in the Ozarks. Reference: Lindblom (1997). This genus was formerly included within *Xanthoria*, but differs in having bacilliform conidia and well-developed rhizines, as opposed to the ellipsoid conidia and lack of rhizines, with hapters sometimes present, in *Xanthoria*. Kondratyuk & Kärnefelt (2003) have further divided *Xanthomendoza*, placing the Ozark species into *Oxneria* Kondratyuk & Kärnefelt. This disposition is sufficiently untested that we are willing to go only as far as recognizing *Xanthomendoza*.

1. Thallus lobes <0.5 mm broad, prevailingly ca. 0.2 mm broad; soralia marginal and terminal, <0.4 mm long . . . . . *X. fulva*

1. Thallus lobes prevailingly >0.6 mm broad; soralia primarily labriform and marginal, >0.5 mm long.

    2. Thallus closely adnate; with appressed lobe tips; soredia farinose, in labriform soralia produced in marginal slits between the upper and lower cortex . . . . . *X. fallax*

    2. Thallus ± loosely adnate, with the lobes loose to locally ascending; soredia granular, arising marginally and laminally from the upper cortex . . . . . *X. ulophyllodes*

Xanthmendoza fallax (Hepp) Søchting et al.
Uncommon on trees and sometimes rocks, in exposed, often disturbed, sites. This species is more common in the prairie areas north and west of the Ozarks, but appears to be an uncommon (and perhaps recent) component of the contiguous woodland area of the Ozarks. [parietin]

Xanthomendoza fulva auct.
Occasional in sites with high light intensities, such as rocks along the margins of glades and boles of solitary trees in glades, pastures, and along roadsides. This species is distinctive because of its golden orange color and minute, abundantly branched lobes. Specimens in heavily shaded sites are more greenish yellow in color, and may superficially resemble *Candelaria concolor*, from which they may be distinguished by the KOH+ deep magenta cortex of *Xanthoria*, versus the KOH- (or weakly orange-reddish) cortex of *Candelaria*. [parietin]

Xanthomendoza ulophyllodes (Räsänen) Søchting et al.
Apparently rare in the Ozarks; known only from the reports by Lindblom (1997). [parietin]

XANTHOPARMELIA (Vain.) Hale (Parmeliaceae)

Large yellowish green foliose lichens with a lustrous upper cortex containing usnic acid; photobiont *Trebouxia*; apothecia sessile, brown, with a thalline margin; asci *Lecanora*-type, with 8 simple, hyaline, ellipsoid spores; pycnidia laminal, immersed, with bacilliform to fusiform or bifusiform conidia; 13 species in the Ozarks. Reference: Hale (1990).

Thalli of *Xanthoparmelia* are occasionally parasitized by *Stigmidium xanthoparmeliarum* Hafellner, which forms necrotic black, gray-margined spots on the lobes of the host, with perithecioid ascomata producing colorless 2-celled spores.

1. Thallus isidiate, the isidia laminal, fine and cylindrical [note: if the isidia are pustular and friable, see *Flavoparmelia baltimorensis*, which has more broadly rounded lobe tips and a less lustrous upper cortex].

2. Lower surface white to tan or becoming pale brown centrally.

3. Medulla KOH- to sordid brownish, P+ red (fumarprotocetraric acid); common *X. subramigera*

3. Medulla KOH+ yellow to orange or reddish, P+ orange (salazinic or stictic acid); rare.

4.Medulla KOH+ dark red (salazinic acid) . . . . . *X. mexicana*

4. Medulla KOH+ yellow or eventually orangish (stictic acid) . . . . . *X. plittii*

2. Lower surface dark brown to black, occasionally with a paler marginal zone.

5. Medulla KOH+ dark red (salazinic acid) . . . . . *X. australasica*

5. Medulla KOH+ yellow or eventually orangish (stictic acid).

6. Lobes linear and elongate; thallus loosely adnate . . . . . *X. isidiascens*

6. Lobes ± short, apically broadened; thallus tightly adnate . . . . . *X. conspersa*

1. Thallus lacking diaspores.

7. Lower surface dark brown to black, occasionally with a paler marginal zone.

8. Medulla KOH- to sordid brownish, P+ red (fumarprotocetraric acid) . . . . . *X. hypomelaena*

8. Medulla KOH+ yellow to orange or reddish, P+ orange (salazinic or stictic acid); rare.

9.Medulla KOH+ dark red (salazinic acid) . . . . . *X. tasmanica*

9. Medulla KOH+ yellow or eventually orangish (stictic acid) . . . . . *X. angustiphylla*

7. Lower surface white to tan or becoming pale brown centrally.

10. Medulla KOH+ dark red, P+ orange (salazinic acid) . . . . . *X. viriduloumbrina*

10. Medulla either KOH+ yellow or P+ yellow.

11. Medulla KOH+ deep red, P+ yellow (norstictic acid as major component, stictic acid absent) . . . . . *X. californica*

11. Medulla KOH+ yellow, P+ orange (stictic acid with minor norstictic acid).

12. Lobes apically broadened, often imbricate and laciniately divided . . . . . *X. cumberlandia*

12. Lobes linear throughout, not imbricate or laciniately divided . . . . . *X. neotaractica*

Xanthoparmelia angustiphylla (Gyeln.) Hale
Frequent throughout the Ozarks. This species typically occurs on exposed sandstone. [constictic, norstictic, stictic, & usnic acids]

Xanthoparmelia australasica D.J. Galloway
Rare; known only from exposed sandstone in an extensive sandstone glade complex in Dade County, Missouri. [salazinic & usnic acids; ± traces of norstictic & protocetraric acids]

Xanthoparmelia californica Hale
Known from exposed siliceous rocks in domomite and limestone glades in the White River Hills of the southwestern Ozark region, as well as from exposed chert in a limestone glade in the northeastern Ozarks. The underside in Ozark collections is dark brown. Whether this difference is one of population or species remains to be determined. [connorstictic, norstictic & usnic acids]

Xanthoparmelia conspersa (Ach.) Hale
Although common east of the Ozark region, this species is infrequent and scattered through the eastern and southern Ozarks, becoming common only in the extreme eastern Ozarks of southwestern Illinois. It occurs on exposed to lightly shaded, usually massive, siliceous rocks, particularly sandstone, and igneous substrates. [norstictic, stictic & usnic acids]

Xanthoparmelia cumberlandia (Gyeln.) Hale
Locally frequent on exposed siliceous rocks, and also growing in lightly shaded xeric areas, such as on sandstone or chert boulders on sparsely wooded ridges. This species also grows on lightly shaded, weathered asphalt shingles. [constictic, norstictic, stictic, & usnic acids]

Xanthoparmelia hypomelaena (Hale) Hale
Occasional throughout the Ozarks, on exposed to lightly shaded, siliceous substrates in well-drained to xeric sites. South and west of the region, some populations otherwise referable to this species appear to contain protocetraric acid instead of fumarprotocetraric acid. [fumarprotocetraric, succinprotocetraric, & usnic acids, ± traces of physodalic acid]

Xanthoparmelia isidiascens Hale
Known from literature reports from the northeastern Ozarks of Missouri (Hale 1984), and from a recent collection on exposed sandstone in northwestern Arkansas. [constictic, norstictic, stictic & usnic acids]

Xanthoparmelia mexicana (Gyeln.) Hale
Rare on exposed siliceous rocks, mostly in the western Ozarks. [norstictic, salazinic & usnic acids]

Xanthoparmelia neotaractica Hale
Rare on igneous and chert substrates in the eastern and central Ozarks. This species is said to be less tightly adnate than *X. cumberlandia*. In our experience, even within *X. cumberlandia* there is a spectrum of degree of adnation that appears to be somewhat controlled by substrate characteristics. [constictic, norstictic, stictic & usnic acids]

Xanthoparmelia plittii (Gyeln.) Hale
Apparently rare, except for the extreme eastern Ozarks of southwestern Illinois. This species occurs on exposed to lightly shaded asandstone. [constictic, norstictic, stictic & usnic acids]

Xanthoparmelia subramigera (Gyeln.) Hale
Frequent throughout the Ozarks on exposed to lightly shaded siliceous substrates, occurring on both massive exposures and smaller boulders of chert, sandstone, and igneous rocks. This is the

most common isidiate *Xanthoparmelia* in the region. [fumarprotocetraric & usnic acids; ± physodalic & succinprotocetraric acids]

Xanthoparmelia tasmanica (Hook. f. & Taylor) Hale
Occasional on exposed to lightly shaded siliceous boulders. [salazinic & usnic acids, ± consalazinic acid, ± norstictic acid, ± traces of protocetraric acid]

Xanthoparmelia viriduloumbrina (Gyeln.) Lendemer
Common throughout the Ozarks, on well-drained siliceous substrates, apparently with a predilection for lightly shaded boulders in uplands and along naturally occurring edges of woodlands. Until recently, local populations were called *X. somloensis* (Gyeln.) Hale (Lendemer 2005). [consalazinic, norstictic, salazinic & usnic acids, ± lobaric acid]

XANTHORIA (Fr.) Th. Fr. (Teloschistaceae)

Small, adnate, orange foliose lichens with narrow, branched lobes and pale lower cortex lacking well-developed rhizines but sometimes with some short hapters; photobiont *Trebouxia*; apothecia sessile, with well-developed thalline margin; asci *Teloschistes*-type, with 8 hyaline polarilocular spores; pycnidia yellow to orange, immersed, with ellipsoid conidia; 1 species in the Ozarks. Reference: Lindblom (1997).

Xanthoria elegans (Link) Th. Fr.
Known only from massive xeric limestone exposures in the extreme eastern Ozarks of southwestern Illinois. [parietin]

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