

OZARK LICHENS

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

April 2018 Draft
[revised and expanded from October 2005 draft]

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

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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 \pm adnate to the substrate 2
 2. Thallus foliose to squamulose, of \pm 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, \pm 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 \pm circular, sometimes slightly irregular or substellate in outline, but prevailing 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 > 0.3 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 terete5
 5. Thallus branches solid, not hollow6
 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 hollow7
 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 straplike9

9. Thallus black, not pruinose, typically subumbilicate; wet thallus <250 µm thick *Lichinella*
9. Thallus grayish, usually pruinose, typically of suberect straplike lobes; wet thallus >250 µm thick.....*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**Dendroscopaulon intricatum*

1. Thallus filamentous, the main branches < 0.2 mm broad11
 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 substrates12
 12. Thallus a felty mat of elongate, remotely branched, terete filaments < 0.02 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 < 0.3 mm long; photobiont a cyanobacterium; 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 cyanobacterial2
2. Thallus distinctly foliose, attached to the substrate at multiple locations, ± horizontally spreading and appressed to substrate3
 3. Lobes extremely narrow, < 0.2 mm broad *Placynthium*
 3. Lobes > 0.2 mm broad4
 4. Thallus dull above, black to brownish or olive; upper surface composed of loosely aggregated hyphae5
 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 umbilicate6

- 6. Thallus of small subterete branches < 0.6 mm wide.....*Synalissa symphorea*
- 6. Thallus of flattened straplike to umbilicate lobes mostly > 1 mm wide7
 - 7. Thallus of grayish pruinose ± straplike lobes*Thyrea confusa*
 - 7. Thallus epruinose, umbilicate to broadly squamulose *Lichinella nigrifella*

1. Thallus not gelatinous, variously colored, with a distinct algal layer, upper and lower surfaces usually different colors; photobiont various8
 8. Upper cortex tinted with orange or yellow, ranging from yellow green or sea green to lemon yellow or orange9
 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 rhizines13
 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 lacking14
 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 areolate16

16. Thallus loosely adnate and convoluted; medulla bright yellow; lower cortex yellowish	<i>Vulpicida viridis</i>
16. Thallus closely adnate, \pm 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 baltimorensis*
- 19. Sorediate, the soredia sometime originating from pustules, but
coalescing to form laminal soredia.....*Flacoparmelia caperata*
- 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 or regularly maculate with
large white rounded patches*Peltigera*
- 23. Lower surface lacking raised or darkened veins or maculations24
- 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 caroliniensis*
- 24. Lower surface lacking pores; soredia, if present, not yellow26
- 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 surface27
- 27. Apothecia without a thalline margin.....*Santessoniella crossophylla*
- 27. Apothecia with a distinct thalline margin28

28. Thallus squamulose to subfoliose, grayish, with abundant whitish marginal zones; hymenium ultimately IKI+ reddish brown (sometime initially blue green); ascospore 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 \pm 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; apotheciate or sterile31
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32. Upper cortex not pruinose33
33. Lower cortex black *Phaeophyscia*
33. Lower cortex pale34
34. Thallus lobes minute, < 0.5 mm wide and tightly appressed; well-developed rhizines lacking..... *Hyperphyscia*
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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 simple36
36. Upper cortex lustrous, not lobulate; marginal dark pycnidia usually common; apothecia marginal to submarginal; ascospores simple, hyaline37
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, brown38
38. Apothecia common; lower surface pale throughout; thallus lobes elongate and uniformly narrow, the margins dissected into linear, \pm 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, prevailing <5 mm wide; thallus typically closely appressed.....41
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 - 45. Upper cortex abundantly pruinose*Physconia*
 - 45. Upper cortex essentially epruinose.....46
 - 46. Lower cortex black, at least centrally *Phaeophyscia*
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 - 47. Thallus uniformly appressed and tightly adnate to substrate; rhizines not evident..... *Hyperphyscia*
 - 47. Thallus appressed, but not inseparably adnate to substrate; rhizines evident48
 - 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 | <i>Physciella</i> |
| 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..... | 51 |
| 51. Isidia dark grey, thin, cylindrical; upper cortex K+ instantly deep yellow (thamnolic acid)..... | <i>Imshaugia aleurites</i> |
| 51. Isidia pale grey, granular and subsorediate; upper cortex K+ pale yellow (atranorin)..... | <i>Heterodermia</i> |
| 50. Thallus not isidiate..... | 52 |

52. Lobes ca. 1 mm broad; upper cortex of parallel, elongate hyphae..
.....*Heterodermia*
52. Lobes < 1 mm broad; upper cortex of \pm isodiametric cells.....
.....*Phycia*
49. Lower surface black or purplish, sometimes with a pale marginal zone53
53. Lower surface tomentose; lobes appearing thickened and inflated
.....*Anzia colpodes*
53. Lower surface rhizinate; lobes flattened54
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 \pm isodiametric cells.....56
56. Medulla white throughout, K-; at least some rhizines with
dichotomous branches; upper cortex \pm 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 sorediate57
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)..... | <i>Myelochroa obsessa</i> |
| 60. Medulla white throughout, KC+ reddish (gyrophoric
acid or hiasic acid agg.)..... | <i>Parmelinopsis</i> |
| 57. Thallus sorediate, the soredia sometimes arising from coarse,
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- 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 \pm 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 tan, \pm 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.....65
 - 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 marginal7
 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, ascending10
 - 9A. Squamules adnate, rounded, entire, yellow-green, with prominent pale, ± thickened margins, UV+ orange (rhizocarpic acid).....*Psora icterica*
 - 9A. Squamules loose to ascending, strap-shaped to incised, lacking yellowish tints, the margins not pale or thickened, UV- or UV+ white (rhizocarpic acid lacking)..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 substrate12

Key C: Squamulose Lichens (continued)

- 12. Photobiont a cyanobacterium.....13
 - 13. On calciferous soils; apothecia immersed; photobiont *cf. Scytonema*
.....*Heppia*
 - 13. Saxicolous; apothecia sessile; photobiont *Nostoc**Fuscopannaria*
- 12. Photobiont chlorophycean14
 - 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 soil15
 - 15. Terricolous.....*Psora*
 - 15. Saxicolous16
 - 16. Squamules with \pm 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+ blue17
 - 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; substrates various2
 - 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 grayish or brownish yellow5

- 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 gray6
 - 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 tints11
 11. Medulla C+ reddish and/or KC+ reddish (gyrophoric acid or erythrin).....12
 12. Saxicolous.....13
 - 12A. Thallus isidiate *Placynthiella*
 - 12A. Thallus not isidiate13
 13. Erythrin present, gyrophoric acid absent; on sandstone; photobiont *Trentepohlia* *Dirina massiliensis* var. *sorediate*
 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
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19. Thallus K+ yellow turning red (norstictic acid); saxicolous
.....*Phlyctis "petraea"*
19. Thallus K+ yellow (atranorin, stictic or thamnolic acids); corticolous or
saxicolous20
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 (xanthonenes); muscicolous or rarely
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23. Thallus UV-, KC-; substrate various24
24. Thallus isidiate25
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 present27
27. Thallus thin, orbicular soralia with small soredia
.....*Opegrapha corticola*
27. Thallus distinctly areolate to subsquamulose28

28. Thallus of minute, rounded, strongly convex squamules.....
 *Agonimia* sp. #1
28. Thallus \pm 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 prevailing 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 prevailing 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 7
 7. On twigs of *Juglans*; young asci with a short blunt canal or canal lacking *Phaeocalicium*
 7. On lignum; young asci penetrated by a long narrow canal *Chaenothecopsis*
 3. Ascospores simple 7
 8. Asci disintegrating early and forming a mazaedium; spores maturing outside the asci 8
 9. On thalli of *Pertusaria*; stipes $< 2 \times$ longer than apothecia; mazaedium blackish *Sphinctrina*
 9. Corticolous or lignicolous; stipes usually $> 2 \times$ longer than apothecia; mazaedium pale brownish *Chaenotheca*
8. Asci persistent; spores maturing within asci 9
 10. Lichenicolous; ascospores $\geq 4.5 \mu\text{m}$ broad *Sphinctrina*
 10. Substrate various, rarely lichenicolous; ascospores $< 4 \mu\text{m}$ broad 10
 11. Apex of ascus uniformly thickened *Mycocalicium*

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

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

If you have problems reaching a determination, recheck spore color. In *Pyrenula*, pale brown spores may seem 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 sometimes 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 (but not to boiling point).

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, rock or soil; ascomata various, often with >32 spores per 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*

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. Paraphysoids present; hymenial gel I-; ascospores strongly ornamented 11A
 - 11A. Photobiont Trentepohlia; asci narrowly cylindrical, uniseriate; conidiospores elliptical *Monoblastia*
 - 11B. Photobiont chlorococcoid; asci broadly cylindrical, ±biseriate; conidiospores globose *Monoblastiopsis*
 11. Paraphyses absent; hymenial gel I+ bluish or orangish ascospores not ornamented 11B
 - 11B. Perithecia sessile; thallus and perithecia lacking purplish tints *Verrucaria*
 - 11B. Perithecia immersed in pits in rock and/or thallus & perithecia with purplish tints *Bagliettoa*
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*
 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- 17A

17A. Thallus KOH+ yellow (stictic acid); apothecia immersed and sunken into thallus Myriotrema

17A. Thallus KOH- (stictic acid absent); ascomata supercificial 18

18. Photobiont absent; 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. Photobiont *Trentepohlia*; 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 to septate
- 31A. Outer perithecial wall ± cellular; perithecial wall without bark
cells; pseudoparaphyses long-celled, with straight-margins;
common
Anisomeridium
- 31A. Outer perithecial wall hyphal; involucrellum and perithecial wall
with bark cells; pseudoparaphyses ± moniliform; rare
Arthopyrenia
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 \pm cylindrical;
paraphyses slender [*Arthopyrenia minor*]

34. Ascospores >25 μm ; asci pear-shaped; paraphyses thicker,
 \pm 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 \pm 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 μ m long.

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

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

37. Ascospores 13-19 x 5-7 μ m, weakly striate at high magnification;
common on plates of *Carya* spp. [*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 *Segestria*

40. Ascoma blackish; wall blackish in section 41

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

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

38. Corticolous 42

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

43. Ascospores hyaline 44

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

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

43. Ascospores brown 44A
 45. Lichenized; photobiont present 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*
 45. Not lichenized; photobiont lacking *Requienella*
42. 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. Ascospores narrow, worm-like, 20+ septate, > 80 μm long ; photobiont *Trebouxia* or absent 50
 50. Photobiont *Trebouxia*; ascomata urceolate with very broad apical pore *Stictis urceolatum*
 50. Photobiont absent; ascomata recumbent with ostiole lateral, slit-like in a round plate (resembling 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

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

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

54. 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 orangish6

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 and K+ 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, K- or K+ reddish 4
 4. Saxicolous; of flattened, isodiametric, \pm contiguous areoles with immersed apothecia; ascospores $> 100/\text{ascus}$ *Acarospora*
 4. On various substrates; thallus crustose or of small granules or tiny \pm elongate squamules; apothecia superficial; ascospores 32 or less per ascus *Candelariella*
 3. Thallus color various, if yellow, then thallus and/or apothecia K+ magenta (anthraquinones) 5
 5. Spores simple 5A
 - 5A. On carbonate rocks; thallus thin, grayish; spores 8/ascus *Protoblastenia rupestris*
 - 5A. Corticolous; Thallus granular, lemon yellow; ascospores numerous per ascus *Piccolia nannaria*
 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; apothecia K- 7
 7. Photobiont absent 8
 8. Spores simple; apothecia sessile, reddish to darkening *Agyrium rufum*
 8. Spores septate to muriform; apothecia \pm 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. Corticolous; spores notably quadrangular, with broad square apices
Collema occultatum
14. Saxicolous, on carbonate rock; spores ellipsoid *Collema pustulatum*
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. Thallus K+ yellow or red (stictic or norstictic acid) or C+ orange (xanthonenes), or else thallus a well-developed, ± thick, areolate saxicolous crust; conidia elliptical to bacilliform
Buellia
28. Thallus K-, 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
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 $\leq 5 \mu\text{m}$ 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 $> 9 \mu\text{m}$ 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, $> 5 \times$ longer than wide 43
 - 43. Conspicuous thalline margin present; apothecia reddish; epithecium KOH+ bright magenta-red *Haematomma fenizianum*
 - 43. Thalline margin absent; apothecia not red; epithecium KOH- or KOH+ yellowish to darkening 44
 - 44. Ascospores $> 100 \mu\text{m}$ long 45
 - 45. Muscicolous; apothecia substipitate; pale, stipitate hyphophores present *Gomphillum americanus*
 - 45. Corticolous; apothecia \pm immersed, perithecioid; hyphophores absent *Conotrema urceolatum*
 - 44. Ascospores $< 70 \mu\text{m}$ long 46
 - 46. Photobiont *Trentepohlia* *Schismatomma*
 - 46. Photobiont *Trebouxia* or chlorococcoid 47
 - 47. Muscicolous *Bilimbia sabuletorum*
 - 47. Saxicolous, corticolous, or lignicolous 48

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

49

49. Spores delicate, thin walled, often $\leq 2\mu\text{m}$ broad and $<40\ \mu\text{m}$ long; exciple with thin-walled, rounded cells; in humid, shaded sites

Bacidina

Key H: Crustose lichens with round apothecia (continued)

49. Spores slightly stouter, often $> 40 \times 2\ \mu\text{m}$; exciple with \pm thick-walled, elongate cells; habitat various *Bacidia*

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

Scoliciosporum

42. Spores ellipsoid or fusiform to elongate bacilliform, prevailing $< 5\times$ longer than wide 50

50. Saxicolous 51

51. Photobiont *Trentepohlia* 52

52. Sorediate; spores curved *Dirina*

52. Esorediate; spores \pm straight; apothecia dark, surficial; exciple carbonaceous

Cresponea premnea saxicola

51. Photobiont chlorococcoid 53

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

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

54. Paraphyses mostly unbranched; thallus dark greenish grey; hypothecium usually pale
Fellhanera

54. Paraphyses much branched; thallus pale to dark greyish or greenish; hypothecium usually pigmented
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 $> 28 \times 5$ 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 $< 22 \times 5$ 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 \pm immersed 60
60. Ascomata mostly dark, \pm 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
41. 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, \pm 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 elongated, clavate to cylindrical; spores usually \pm symmetrical 66.
- 66. Apothecia pallid, yellowish to golden or orange 67
- 67. Photobiont *Trentepohlia*; apothecia >0.2 mm broad *Dimerella*
- 67. Photobiont chlorococcoid; apothecia ≤ 0.2 mm broad 67A
- 67A. Thallus granular; apothecia short stipitate, mostly taller than broad
Vezdaea leprosa
- 67A. Thallus thin, \pm effuse; apothecia sessile, broader than tall
Absconditella delutula
- 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
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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
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71. Apothecia immersed, or superficial and lacking a thalline margin

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 soresdiate or pruinose verrucae *Pertusaria*
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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*
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79. On carbonate rocks, usually in exposed sites 80
80. Epithecium green to olive grey 81
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80. Epithecium orange to reddish, purplish or brown; sometimes with green zones 82
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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 bluish gray, areolate to continuous, KC+ orange to red; 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 (if pale grey then with brownish overtones); KC-; apothecia usually gray to black 93

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

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 prevalingly < 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 is a difficult and poorly understood family including 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, prevailing marginal, granular isidia 101

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

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

ABSCONDITELLA V_zda (1894) Stictidaceae

Inconspicuous crustose lichens with indistinct, shiny, filmy greenish thalli becoming slightly gelatinous when wet; photobiont chlorococcoid; apothecia minute, tan to pale, concave, to 0.15 (0.2) mm broad, margins paler, initially raised above the disks; apothecial tissues pale in section; paraphyses simple to sparingly branched distally, the apices \pm swollen; asci evocative of *Bacidia*-type asci, but IKI-, with 8 spores; ascospores 1-3 septate, ellipsoid to fusiform; pycnidia unknown; 2 species in the Ozarks; the taxa appear identical in the field and examination of the ascospores is necessary for identification. Reference: Bielczyk & Kiszka (2001).

1. Terricolous or lignicolous; ascospores 1-septate *A. delutula*

1. Lignicolous; ascospores 3-septate *A. lignicola*

Similar taxa:

-*Coenogonium pineti* has similar habitats, substrates, and ascospores, but it has a duller thallus with usually more prominently pinkish tan and larger apothecia (to 0.4 mm broad), and the photobiont is *Trentepohlia*.

-*Pachyphiale fagicola* occurs on hardwood branches; it has darker, pinkish to reddish brown apothecia with incurved margins and subacicular 16+ multi-septate spores per ascus, and the photobiont is *Trentepohlia*

-*Micarea* species in similar microhabitats usually have darker apothecia without evident margins; if the apothecia are pale, they are greyish white rather than pale tan as in *Absconditella*.

Absconditella delutula (Nyl.) Coppins & H. Kilius

Thallus and apothecia as described for the genus; ascospores oblong-ellipsoid, 1-septate, 10-14 \times 3-6 μ m. Coppins (2009) indicates that British material of this species has a lower hymenium (60-65 μ m tall) versus that of *A. delutula* (75-90 μ m tall), but there seems to be some overlap in local material.

Chemistry: no lichen substances

Rare, but likely overlooked, known from a few sites in the western Ozarks, where it occurs on rotting decorticate logs and mossy soil/humus (??).

Absconditella lignicola V_zda & Pišút

Thallus and apothecia as described for the genus; ascospores fusiform, 3-septate, 10-15 \times 4.5-6.5 μ m.

Chemistry: no lichen substances

Apparently rare, but minute, cryptic, and likely overlooked given that most local records result from admixtures found on other collections. Usually occurring on moist, well-rotted logs, often in wet, shaded habitats. The minute, drably pale apothecia and inconspicuous thalli are difficult to detect on moist wood and virtually impossible to see when dry.

ACAROSPORA A. Massal. (1852) Acarosporaceae
(including *Trimmatothelopsis*)

Saxicolous crustose lichens with well developed, often subsquamulose, areolate thalli and usually immersed, rarely sessile apothecia; photobiont ?*Trebouxia*; 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; 16 species in the Ozarks. References: Clauzade et al. (1981), Harris & Knudsen (2005).

This treatment is very tentative with several taxa which cannot be comfortably accommodated in any known species, many of which are 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 \pm elliptical and small, ca. 3-4 μ m 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 in section (norstictic acid); areoles contiguous, citrine greenish yellow and entirely white pruinose or pruinose only around brown apothecial disk; on dolomite or non-calcareous rock in calcareous habitats *Acarospora heufleriana*
 2. Cortex KOH-, KC- or KC+ red (gyrophoric acid?); medulla KOH-, KC-; thallus \pm bright yellow (except in deeply shaded sites), pruinose or not; on non-calcareous rock.
 3. Medulla KC+ red; thallus pruinose or not..... *Acarospora tuckerae*
 3. Medulla KC-; thallus usually not pruinose.
 4. Areoles contiguous separated by deep fissures forming a substantial patch with effigurate margins *Acarospora novomexicana*
 4. Areoles scattered *Acarospora chrysops*

1. Thallus some shade of brown or gray
 5. Apothecia \pm 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 (*Trimmatothelopsis?*) 6
 6. Ascospores broadly ellipsoid to spherical, 7-9 x 5-7 μm or 7-10(-11.5) μm diam. *Acarospora* "*sphaerosperma*"
 6. Ascospores ellipsoid, 4.5-5.5 x 2-2.5 μm
 7. Apothecia initially immersed in dolomite and remaining basally immersed *Acarospora* "*sepulta*"
 7. Apothecia not immersed; on non-calcareous rock; common *Acarospora 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 weakly convex, with 1(-few) apothecia; disk dark brown, slightly sunken; common *Acarospora janae*
 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, \pm easily visible; apothecia flush or sunken, without raised rim; common *Acarospora fuscata*
 10. Thallus white pruinose, tan; areoles thin, flat, aggregated, broadly attached; mature apothecia with raised rim; rare *Acarospora nicolai*.
 8. Cortex KC-.
 11. On calcareous rocks; apothecial disks pruinose or not.
 - 11A. Areoles < 0.5 mm wide; apothecial disks greenish pruinose; ascospores 1.7-2 μm wide *Caeruleum immersum*
 - 11A. Areoles often >0.5 mm wide; apothecial disks epruinose or rarely slightly grey pruinose; ascospores XXX *Acarospora canadensis*
 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; apothecial(-few)/areole, Lecanora-like; disk red brown, epruinose *Acarospora* "*decorticata*"

13. Thallus never pruinose, brown, shiny, thin, tightly adnate; cellular cortex present; apothecia 1-several/areole, slightly sunken, never *Lecanora*-like.
- 13A. Cortical cells 2-3 μm diameter; cortex 15-20 (25) μm thick; lower edge of areoles pale..... *Acarospora veronensis*
- 13A. Cortical cells ≥ 3 μm diameter; cortex 20-35 μm thick; lower edge of areoles usually brown..... *Acarospora americana*
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.....
..... *Acarospora "atromarginata"*
14. Areoles aggregated into extensive sheet, orange brown, without black margin; apothecia becoming sessile, with distinct, shiny, black margin; disk red brown
..... *Acarospora "spadicea"*

***Acarospora americana* H. Magn.**

Known in the Ozarks from two sites - on siltstone at the extreme western edges of the Ozarks in Oklahoma, and the other from exposed rhyolite in the St. Francois Mountain region of southeastern Missouri.

***Acarospora "atromarginata"* sp. provis.**

Thallus of scattered areoles; areoles tan with a slightly raised shiny, black margin, epruinose, rounded or irregular, broadly attached; cortex K-, KC-; medulla K-, 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 canadensis* H. Magn.**

Known only from a single collection from old concrete at Sam A. Baker State Park in Wayne County.

***Acarospora chrysops* (Tuck.) H. Magn.**

Thallus forming small patches of \pm contiguous areoles, initially scattered; areoles bright greenish yellow, epruinose or sometimes with patches of white pruina, irregularly rounded or angular where crowded, attached by narrowed base, becoming subsquamulose in age; cortex K-, KC-; medulla K-, KC-; underside pale. Apothecia 1-several/areole, rounded or \pm irregular, slightly sunken; disk brown, epruinose. Paraphyses expanded at tips, sometimes 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 \pm 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; upperside K-, KC-; medulla K-, 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 μ m. [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. [= *Trimmatothelopsis dispersa* (H. Magn.) K. Knudsen & Lendemer]**

Thallus often of scattered areoles, or loose groups of \pm 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 (\pm 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; cortex K-, KC-; medulla K-, 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) μ m. 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 μ m. [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. janae*. *Acarospora dispersa* belongs to a small subgroup of *Acarospora* distinguished by \pm perithecioid apothecia (*Trimmatothelopsis*). The other two species grow on dolomite or chert in calcareous habitats: *A. "sphaerosperma"* with larger, \pm 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) Arnold**

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 \pm vertical sides, broadly attached; cortex K-, KC+ red; medulla K-, 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 μ m (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; cortex K+ red; medulla K+ red; underside pale or darkening. Apothecia immersed, irregular or \pm 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 μ m. [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 janae* K. Knudsen**

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, \pm rounded or less commonly irregular, often weakly lobed, rather broadly adnate, to 1 mm across; cortex K-, KC+ red; medulla K-, 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 \pm cylindrical, 4-5.5 x 2-2.5 μ m. [gyrophoric acid].

Acarospora janae is apparently common in our region in exposed situations, on rhyolite, hard sandstones and rarely chert, often on pebbles and small rocks in temporary pools associated with *Polysporina simplex* and *A. dispersa*. As far as we can tell from the literature, *A. janae* 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 nicolai* B. de Lesd..**

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, \pm entirely adnate; cortex K-, KC+ red; medulla K-, 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]

Rare in the Ozark region; known from only two sites, on mine spoil and on chert in a seepy dolomite glade. *Acarospora nicolai* is distinctive in its stark white pruina and KC+ cortex.

***Acarospora novomexicana* H. Magn.**

Thallus forming extensive patches of contiguous areoles weakly lobed at margin; areoles bright greenish yellow, epruinose, subsquamulose marginally, angular inward, \pm elevated but rather broadly attached; cortex K-, KC-; medulla K-, 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* “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 \pm raised; cortex K-, KC-; medulla K-, 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; cortex K-, KC-; medulla K-, 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 (lecidine in aspect), large, to 1.0 mm across; margin with a sharply demarcated black outer layer and a colorless inner layer of \pm radiating hyphae above and a medullary layer below which contains a few clumps of algae; disk red brown, epruinose. Paraphyses broad, 3-4 μ m below, with tips swollen to ca. 5-6 μ m. Ascospores 4-5.5 x 2.3-2.5 μ m. [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 lecidine 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 \pm irregular, especially when young, flattened to \pm hemispherical, broadly attached; cortex K-, KC-; medulla K-, 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 μ m or 7-10(-11.5) μ m across. Conidia bacilliform, 5-6 x 1-1.2 μ m. [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) μ m. 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 tuckerae* K. Knudsen**

Thallus of scattered areoles or forming small patches of \pm contiguous areoles, sometimes weakly lobed; areoles bright greenish yellow, patchily white pruinose or epruinose, subsquamulose marginally, angular inward, broadly attached to \pm narrowed at base; cortex K-, KC-; medulla K-, KC+ red; 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 μ m. [rhizocarpic acid, gyrophoric acid].

The most common yellow *Acarospora* in the Ozarks, known from Missouri and Oklahoma on exposed acid rock, often rhyolite but also chert in calcareous sites and once on granite. *Acarospora tuckerae* is separated from the other yellow Ozark species in containing gyrophoric acid (KC+ red).

***Acarospora veronensis* A. Massal.**

Thallus forming loose aggregations of areoles separated by \pm broad “cracks” or of scattered areoles; areoles brown, shiny, thin (\pm 100 μ m), angular, tightly adnate; cortex K-, KC- red, not distinct but with outer layer of swollen, brown cells and sometimes with colorless epinecral layer; medulla K-, 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) μ m. [no lichen substances?, not tested].

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. (1854) Monoblastiaceae

Small crustose lichens with endophloideal thalli; photobiont *Trentepohlia*; ascomata perithecioid, pseudoparaphyses slender, branched and anastomosed; asci narrowly cylindrical, fissitunicate, with a broad apical chamber, IKI-; ascospores 8, uniseriate, 1-septate, with ornamented walls; pycnidia XXX; conidiospores elliptical; 1 species in the Ozarks. Reference: Harris (1995).

Similar taxa:

Anisomeridium - smaller perithecia and smaller, unornamented ascospores
Lithothelium -

***Acrocordia megalospora* (Fink) R.C. Harris**

Thallus mostly immersed, creating a dull whitish to pale grey discoloration of the substrate; ascomata initially immersed, ultimately subimmersed, to 0.5 (1) mm broad, the exposed portions dark, immersed portions pale; ostiole ca. 0.1 mm, usually off-center and sometimes terminating a globose or narrow projection; asci 150-250 x 15-25 μ m; ascospores broadly fusiform, typically to 50 x 22 μ m, halonate, usually constricted medially, with well-developed fine granular ornamentation, apices subacute; pycnidia rare, XXX; conidiospores 4-5 x 2 μ m.

Chemistry: no lichen substances

Occasional on shaded boles of hardwoods throughout the Ozarks, in sites ranging from wooded floodplains and riparian corridors to dry-mesic uplands and glade margins. *Fraxinus* appears to be a favored substrate; other hosts include *Nyssa*, *Platanus*, *Quercus*, and *Ulmus*.

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*.

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

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

Agonimia opuntiella (Buschardt & Poelt) V_za

Common, but often overlooked, usually growing on or among shaded pleurocarpous bryophytes on rocks and shaded tree bases. The squamules often appear incipiently soresiate. 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.

Occasional and scattered through the Ozarks, mostly on smooth, decorticate, rotten wood of standing *Juniperus* in woodlands, often in somewhat mesic sites. This species also occurs on decorticate hardwood logs. The continuous, whitish thallus with scattered, round, 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.

Similar taxa: *Cryptodiscus permiscens* XXX

AMANDINEA Choisy ex Scheid. & H. Mayrh. (1993) Caliciaceae

Small crustose lichens with dark to not apparent thalli, photobiont *Trebouxia*, asci \pm 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
2. Ascospores 15.5-18 x 7-9.5 μm ; thallus evident, pale, areolate, \pm glossy *A. submontana*
2. Ascospores smaller, 9-16 x 4-8 μm 3
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
4. Apothecia without thalline margin; thallus pale or not evident 5

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
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
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* *Amandinea* sp. 48743
1. Asci with more than eight spores 8
8. Ascospores $\pm 32/\text{ascus}$, 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 $\pm 16/\text{ascus}$, 9-11.5 x 5-6 μm ; apothecia ca. 0.15 mm. diam.; thallus pale; on dead stems of *Selaginella* *Amandinea "selaginellae"*

***Amandinea dakotensis* (H. Magn.) P. May & Sheard**

Uncommon on small, exposed, smooth-barked hardwood twigs in canopy branches, and occasionally on young branches of smaller trees in fields and along woodland edges. 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 collection from wood of *Juniperus* on bluff along 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*, 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 (Michaux) Vainio

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 X 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 X 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.) M. Choisy (1928) Monoblastiaceae

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 ; photobiont not evident *Anisomeridium sp.* 45111
2. Ascomata at most initially immersed becoming clearly emergent with clypeus appressed to the conical to hemispherical ascoma; ascospores 11-20 x 3-7 μm ; photobiont present3
3. Ascospores mostly slipper-shaped (\pm 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 \pm unequal or equal4
4. Ascospores 11-15 x 5.5-7 μm ; straight *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, \pm globose, 0.3-0.6 mm across; ascomatal wall entire or lacking below. Asci cylindrical or \pm clavate, 55-70 x 13-15 μm , with 8 (commonly fewer by abortion) biserially 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 \pm 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 \pm biserially arranged spores. Ascospores short clavate to fusiform, 1(-2-3)-septate, with cells mostly markedly unequal, 18-23 x 6-8 μm . Pycnidia pyriform with a short beak to \pm 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 \pm 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 biserially 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. bifforme*, differing in smaller asci, narrower ascospores which are biserial 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 & Ever.) 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 biserially 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 cylindrical, ca. 120 x 12 µm, with eight uniserially 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.

MISSOURI: Madison County: St. Francis River Natural Area, Mill Stream Gardens Conservation Area, Tiemann Shut-Ins along St. Francis River, 3735'10"N, 9028'50"W, mesic hardwoods along river, on trunk 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. 1.5mm broad; upper cortex rugose and white maculate, the tips dissected into short blunt fimbriations; lower cortex dark brown to black, of a thick reticulated network of tomentum, with sparse, dark, simple, bulbous-clavate 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, $6-7.5 \times 1 \mu\text{m}$, 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)

Small crustose lichens, thallus thin or indicated only by discoloration of bark or not apparent, with small immersed to sessile, often irregular or branched ascomata, photobiont *Trentepohlia*, 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 34
 - 2.(1) Ascomata pale, whitish, pinkish or yellowish, rounded to lobate; epihymenium
with crystals; ascospores 4-celled, with median cells \pm larger, 12.5-15.5 x 4.5-5 μ m
..... *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 6
5. Ascospores 1-septate or submuriform 12
 - 6.(5) Ascospores 2(-3)-septate, 9.5-10 x 3.5-4 μ m *Arthonia* sp. 50416
 6. Ascospores 3-6-septate, larger, over 15 μ m long 7
- 7.(6) Ascospores, when present, 3-6-septate with enlarged end cell 8
7. Ascospores with cell \pm equal, 3-5-septate 11
 - 8.(7) Ascospores 25-30 x 9.5-11 μ m, 5-6-septate *Arthonia* sp. 45333
 8. Ascospores to 25 x 9 μ m 9
9. Ascospores 21-25 x 6.5-9 μ m, 5-6-septate; ascomata not "pruinose" due to residual bark;
on twigs of *Quercus* *Arthonia* sp. 50883
9. Ascospores less than 20 x 8 μ m (often lacking in *A. quintaria*); ascomata "pruinose" or not 10
 - 10.(9) Ascomata on mostly twigs, elongated, irregular, effuse, often "pruinose"
due to residual bark, mostly immature; ascospores rare, 5-septate,
17.5-18.5 x 6.5-7.5 μ m (*A. punctiformis* auct. Ozark) *Arthonia quintaria*
 10. Ascomata on bole of *Prunus*, raised with \pm vertical sides,
not "pruinose"; ascospores 5-septate, ca. 18.5 x 6-6.5 μ m [*Arthonia* sp. 47847]
- 11.(7) Ascospores 3-5-septate, (rarely with 1-2 cells subdivided), 19-22 x 6.5-8 μ m;
on *Rhamnus* *Arthonia* sp. 44474
11. Ascospores 3-septate, 16-17.5 x 5.5-6.5 μ m; 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, elongated, irregular, occasionally branched;
ascospores 18-19 x 7-8.5 μ m, occasionally bent *Arthothelium* sp. 50153
13. Ascomata emergent, \pm rounded to elongated, irregular to sinuose, with whitish "pruina"
of bark cells; ascospores 22-27 x 8.5-11 μ m
..... [*Arthothelium lirellans*]
- 14.(12) Ascomata brown, elongated, becoming weakly branched or lobate;
ascospores 13-16.5 x 4.5-6 μ m *Arthonia* sp. 32832
14. Ascomata black, narrow, ca. 0.1 mm, lirelline, \pm thread-like, weakly branched;

| | | |
|----------|---|---|
| | ascospores 11-12.5 x 4.5-5.5 μm | <i>Arthonia</i> 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 <i>Trentepohlia</i> present) | <i>Arthonia</i> 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 | <i>Arthonia</i> sp. 50266 |
| 17. | Ascospores broader, 13-14 x 6-7 μm , with rounded ends and constricted at septum,
thin walled; thallus greenish brown | <i>Arthonia apatetica</i> ? |
| | 18.(15) Ascospores muriform | <i>Arthonia susa</i> |
| | 18. Ascospores 3-septate | 19 |
| 19.(18) | Thallus superficial, greenish, \pm leprose; ascomata rounded, bluish pruinose;
ascospores with \pm equal cells | <i>Chrysothrix caesia</i> |
| 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 | <i>Arthonia</i> sp. 48400 |
| | 20. Ascomata not pruinose, lecideoid, tiny; hymenium red pigmented, KOH + violet;
ascospores 12-15 x 4-5 μm with cells \pm equal | <i>Arthonia</i> 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 \pm equal, 12-15 x 5-6 μm ;
ascomata _cracked_ into polygonal units, brown, whitish pruinose
..... | <i>Arthonia pyrrhuliza</i> |
| | 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 \pm equal or with middle cells \pm larger (1-septate spores key here) | 29 |
| | 24.(23) Ascospores (4-)5-septate, large, 32-37 x 12-16 μm | <i>Arthonia rubella</i> |
| | 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 elongated,
becoming branched and dendritic; ascospores 3?-septate, ca. 15-16 x 5.5-6 μm
(material poor and immature) | <i>Arthonia</i> 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 | <i>Arthonia diffusa</i> |
| | 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 elongated, becoming dendritic
or stellate, brown, not pruinose; KC+ pink at edge of ascomata (gyrophoric acid)
or KC- (no substances) (<i>A. radiata</i> auct. Ozark pr. p.)
..... | <i>Arthonia "dryadum"</i> (<i>A. anglica</i> 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
..... | <i>Arthonia</i> sp. 84959 |
| | 28. Thallus whitish; ascomata thick, ascomata _cracked_ into polygonal units,
light brown, pruinose | <i>Arthonia</i> 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 | <i>Arthonia</i> sp. 31940 |
| | 30. Ascomata \pm immersed, rounded to \pm elongate and/ or \pm 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
..... | <i>Arthonia "infrafusca"</i> |
| 31. | Ascospores 11-13(-14) x 4.5-5.5 µm | <i>Arthonia sp.</i> 49390 |
| 32 (29). | Hypothecium distinct, dark brown | 33 |
| 32. | Hypothecium indistinct, pale; ascospores 3-5-septate; ascomata irregularly shaped | |
| 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 | <i>Arthonia sp.</i> 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 | <i>Arthonia sp.</i> 51102 |
| 34.(32) | Ascomata light brown, pruinose; ascospores 3-septate, 15-18 x 6-7 µm
..... | <i>Arthonia sp.</i> 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 | <i>Arthonia "fontana"</i> |
| 35. | Ascospores (4-)5-septate, upper end rounded 16-18 x 5-6.5 µm; ascomata
elongated, weakly lobed, black | <i>Arthonia sp.</i> 32081 |
| 36.(21) | Ascospores muriform, 26-36 x 12-15 µm (Brodo) | <i>Arthothelium spectabile</i> |
| 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-
..... | <i>Arthothelium ruanum</i> |
| 37. | Ascomata ± raised, small, not dying in center; thallus pale; ascospores
23-24 x 9.5-10.5 µm with sheath I+ orangish | <i>Arthothelium sp.</i> 46579 |
| 38.(1) | On rock | 39 |
| 38. | On lichens | 41 |
| 39.(38) | Photobiont chlorococcoid; ascospores 1-septate, 11-19 x 5-6.5 µm
..... | <i>Arthonia lapidicola</i> |
| 39. | Photobiont <i>Trentepohlia</i> ; ascospores 3-5-septate | 40 |
| 40.(39) | Thallus superficial, thick, ± soft, KOH+ red (norstictic acid), with abundant
large celled <i>Trentepohlia</i> ; 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 | <i>Arthonia "norstictica"</i> |
| 40. | Thallus immersed, KOH+ weakly yellowish, TLC-; ascomata blackish, pruinose,
rounded to irregular and occasionally ± elongated, not branched; ascospores
3-(4)-septate, with ± equal cells, 15-16 x 4.5-5 µm; on HCl- sandstone
..... | <i>Arthonia "buckii"</i> |
| 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 <i>Pertusaria propinqua</i> Müll. Arg. | <i>Arthonia sp.</i> 46606-A |
| 41. | Ascospores 1-septate; on <i>Aspicilia</i> or <i>Rinodina</i> | 42 |
| 42.(41) | On <i>Aspicilia contorta</i> (Hoffm.) Kremp.; ascomata immersed in thallus;
hypothecium colorless; ascospores 12-15 x 6.5-7.5 µm, with unequal cells
..... | <i>Arthonia sp.</i> 45394 |
| 42. | On <i>Rinodina</i> ; ascomata sessile, brown-black; hypothecium colorless or brown | 43 |
| 43.(42) | Hypothecium brown; ascospores 11-12 x 5.5-6 µm; on <i>Rinodina papillata</i> H. Magn.
..... | <i>Arthonia sp.</i> 50183 |
| 43. | Hypothecium colorless | 39 |
| 44.(43) | Ascospores ca. 11 x 5.5 µm; on <i>Rinodina maculans</i> Müll. Arg.
..... | <i>Arthonia sp.</i> 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 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, \pm 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 anglica* Coppins**

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 \pm 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 \pm equal. The occurrence of gyrophoric acid in the ascomata of some specimens is unique among Ozark species. [gyrophoric acid]

Arthonia "fontana" sp. provis.

A half dozen collections widely scattered from Kansas, Missouri and Oklahoma on branches and trunks 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 woods near springs. The photobiont is *Trentepohlia*.

Arthonia "infracusca" sp. provis.

Uncommon on trunks 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. "*infracusca*" "dark below" for the brown hypothecium.

Arthonia lapidicola (Taylor) Branth & Rostrup

Rare, known from one Missouri and one Illinois collection 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 (\pm “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.

Arthonia rubella (Fée) Nyl.

Uncommon, mainly southern; on lightly shaded tree trunks 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 susa R.C. Harris & Lendemer

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 species 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. In North America, this taxon was long referred to as *Arthothelium taediosum* auct. Amer.

***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 trunks of *Carya* from a Missouri single site in mesic woods. Identified by ascospore mostly 5-septate with \pm equal cells, pale hypothecium and *Trentepohlia* photobiont

***Arthonia* sp. 32832**

Two Missouri collections, one on a twig in mesic woods, the other on trunk 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, and a single Missouri collection on *Rhus glabra*. 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 \pm 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 trunk 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**

Known from two Missouri collections - one from twigs of *Quercus* in a channel sandstone glade and one from twigs of *Acer rubrum drummondii* in a swampy woodland. Conidiospores are narrowly bacilliform, to 6.5×1.2 μm . 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, \pm equal celled ascospores, brown hypothecium and *Trentepohlia* photobiont. It differs from sp. 47563 in its dark thallus and larger ascospores.

***Arthonia* sp. 84959**

A single Arkansas collection on trunk 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, \pm 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 $< 20 \mu\text{m}$ long *A. sp.* 50153
 2. Apothecia broader, rounded to elongated; ascospores $> 21 \mu\text{m}$ long [*A. lirellans*]
1. Photobiont present; spores muriform to submuriform.
 3. Apothecia branched and elongate, typically $< 0.3 \text{ mm}$ wide on their narrow axis; photobiont chlorococcoid *Arthonia susa*
 3. Apothecia larger and irregularly rounded, many typically $> 1 \text{ mm}$ diameter; photobiont *Trentepohlia*.
 4. Spores muriform, $26\text{--}36 \times 12\text{--}15 \mu\text{m}$ *A. spectabile*
 4. Spores muriform to submuriform, $< 24 \times 11 \mu\text{m}$.
 5. Thallus dark; apothecia flat; spores with IKI- sheath *A. ruanum*
 5. Thallus pale; apothecia \pm raised; spores with IKI+ orangish sheath *A. 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 $> 20 \mu\text{m}$ 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* (Flotow) 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 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.

ARTHOPYRENIA A. Massal. (1852)

Arthopyrenia degelii R.C. Harris

Arthopyrenia minor R.C. Harris

ASPICILIA A. Massal. (Megasporaceae)

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. Thallus K+ red (norstictic acid) *A. cinerea*

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

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

3. Thallus pale to dark greenish gray, K+ 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 [= *Circinaria caesiocinerea* (Nyl. ex Malbr.) A nordin, Savi_ & Tibell]

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) suggest inclusion of morphologically similar specimens containing stictic acid under this name.

Aspicilia contorta (Hoffm.) Kremp. [= *Circinaria contorta* (Hoffm.) A. Nordin]

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, \pm 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, \pm 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. (Ramalinaceae)

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

Crustose lichens with sessile apothecia lacking a thalline margin, photobiont chlorococcoid, 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 $32-88 \times 2-4.3 \mu\text{m}$; very common *Bacidia schweinitzii* complex
 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 purpurans*
 6. Pigmented parts distinctly KOH+ rose 7
 7. Thallus granular; spores $32-69 \times 2-4 \mu\text{m}$; common *Bacidia diffracta*
 7. Thallus smooth; spores $31-74 \times 2-5 \mu\text{m}$; 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 $38-91 \times 2.5-4.3 \mu\text{m}$, not spirally twisted; common *Bacidia suffusa*
 9. Apothecia never pruinose; spores $33-81 \times 2-3.7 \mu\text{m}$ 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* S. Ekman (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 \pm 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, $(13)-18-27 \times 2-3 \mu\text{m}$; rare *Bacidia crenulata*
 13. Apothecial margin smooth 14
 14. Exciple of hyphae with narrow lumina, enlarged only in outermost cells; ascospores $> 16 \mu\text{m}$ long..... 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 × 2.5-3.5 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; ascospores < 16 µm long 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 19A
- 19A. Thallus thin to scurfy, without granules; conidiospores straight ...
..... *Bacidina phacodes*
- 19A. Thallus granular soresiose; conidiospores curved
..... *Bacidina 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

| | | |
|---|---|------|
| | <i>Bacidina</i> 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 <i>Bilimbia sabuletorum</i> | |
| 24. Spores needle-like, multiseptate, without punctate outer layer; apothecia with persistent margin, pruinose | <i>Bacidia suffusa</i> | |
| 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 <i>Fellhanera "granulosa"</i> | |
| 26. Thallus ± thin, not composed 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 <i>Scoliciosporum umbrinum</i> | |
| 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 <i>Micarea peliocarpa</i> | |
| 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 (?XXX) | <i>Bacidia granulosa</i> /B. <i>coprodes</i> | |
| 31. Always on siliceous rocks, especially chert; exciple dark at margin, remaining distinct from brown hypothecium; 12-14 × 4-5 µm (?XXX) | see <i>Fellhanera silicis</i> | |
| 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 <i>Cresponea premnea</i> var. <i>saxicola</i> | |
| 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 <i>Lecania cuprea</i> | |
| 33. Apothecia reddish, perithecium-like; spores 3(-5)-septate, 12-18(-21) × 5-6 µm; on sandstone; very rare | see <i>Thelopsis rubella</i> | |
| 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 silicate 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, $38-91 \times 2.5-4.3 \mu\text{m}$,
with many cross walls; mostly on bark, very rarely
on calcium rich rock *Bacidia suffusa*
25. Growing on bryophytes on rock or soil37
37. Apothecia usually swollen, with margin mostly hidden, brown-black to whitish;
spores broad, $5-8 \mu\text{m}$ wide, fusiform, 3-5(-7)-septate, with a punctate sheath;
common, over lime rocks and occasionally soil see *Bilimbia sabuletorum*
37. Apothecia usually remaining \pm flat; spores needle-like, $4 \mu\text{m}$ or less wide38
38. Rarely growing from calcium rich rock onto bryophytes;
spores $38-91 \times 2.5-4.3 \mu\text{m}$, with many cross walls; apothecia pruinose;
epithecium and hypothecium pale *Bacidia suffusa*
38. On calcium rich soil; spores needle-like, tapered, 3-7-septate,
 $25-45 \times 2-3 \mu\text{m}$; apothecia not pruinose; epihymenium green;
hypothecium brown; not known from Ozark region but might be
expected as occurs in central Kansas [*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 \pm continuous thallus, occasionally \pm rugose; areoles initially \pm 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 \pm 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 $5 \mu\text{m}$ across, central part (under hypothecium) of intertwined hyphae. Hypothecium colorless, loosely prosoplectenchymatous with some enlarged cells, ca. $30-40 \mu\text{m}$ thick. Epihymenium with clumped dark green pigment or in paler forms \pm colorless (KOH-). Hymenium streaked with dark green (KOH-), or \pm colorless, ca. $50-60 \mu\text{m}$ thick. Paraphyses \pm unbranched, some with end cells enlarged, pyriform, with a green sheath (sheath extending downward a cell or two), ca. $4-5 \mu\text{m}$ across, others little or not enlarged, without colored sheath, ca. $2 \mu\text{m}$ across. Ascospores narrowly clavate or narrowly cylindrical, with weakly acute ends, 3-septate, $19-28 \times 2.5-3 \mu\text{m}$. Pycnidia

pyriform, green above, with or without brownish layer below green, colorless below, 20-30 μm across. Conidia filiform, curved, 20-25 \times 0.8 μm . [no lichen substances detected]

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, \pm tomentose; hairs short, colorless, very irregular, contorted and multilobed; ascospores broadly ellipsoidal, smooth, 9-10 \times 6-7.5 μm - Missouri. Greene County, *Buck* 38314, 38328, also on a sterile crust from Kentucky, *Buck* 39904 (all NY)].

***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 \pm 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 \pm 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 \pm 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 \pm fusiform, often narrower at one end, 3-septate, $13-18 \times 2.5-3.5 \mu\text{m}$, not halonate. Pycnidia usually present, globose; wall often greenish above, brownish below. Conidia filiform, mostly semicircular curved, not septate, $13-18 \times 1.0 \mu\text{m}$. [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. One specimen from Kansas has apothecia parasitized by *Lichenocodium* sp.

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 \pm 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 granosa* 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. granosa* of radiating hyphae with only the end cell \pm enlarged and the interior of the *Fellhanera* exciple is paler greenish, clearly distinct from the brown hypothecium, not dark brownish and \pm continuous with the hypothecium as in *B. granosa*. 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. granosa*, with a dark apical tube in *F. silicis*) and conidial type (filiform, curved in *B. granosa*, short, bacilliform to bowling pin shaped in *F. silicis*, pycnidia usually present in both). A very similar rare species, *Bacidia coprodes* (Körber) Lettau, has been reported from dolomite in Taney county (Llop & Ekman 2007); it differs in XXXX.

Bacidia crenulata R. C. Harris & Ladd, *sp. nov.*

Thallus on bark, whitish, \pm 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 \pm clustered, sessile, persistently flat, strongly constricted at base, 0.3-0.6 mm across; margin black, concolorous with disk, not pruinose, usually raised, occasionally \pm level with disk, persistent, variously crenulate, denticulate or weakly radiately grooved, occasionally smooth; disk black, not pruinose. Exciple brown, paling to \pm 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, \pm 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-), \pm uneven as some paraphysis tips not pigmented. Hymenium colorless, ca. 50 μm thick.

Paraphyses mostly unbranched, many with end cells enlarged, \pm 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 \times 2-3 μm ($_ = 20.5 \mu\text{m}$). Pycnidia semi-immersed, \pm globose, with brown wall above, colorless below, ca. 1.0 mm across. Conidia filiform, strongly curved, not obviously septate, ca. 15-20 \times 0.8 μm , or mixed with rod-shaped conidia, ca. 7-9 \times 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, \pm 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, \pm 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 \times 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 \times 2-4 μm (Ekman, 1996), not spirally arranged in ascus. Pycnidia pale brown (KOH-), \pm globose, ca. 150 μm across. Conidia filiform, curved, ca. 20 \times 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 trunks 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 hand lens. 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 \pm 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. diffracticola*.

***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, \pm shiny, not pruinose at any stage, scattered, flat, rarely weakly convex, round or \pm 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 \pm enlarged; central part denser, with hyphae more irregularly arranged. Hypothecium colorless, 40-60 μm thick. Epithymenium 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 \pm immature), broader toward one end, gradually tapering in a long tail, 11-15-septate, $47-64 \times 3.5-4.5 \mu\text{m}$. Pycnidia globose, brownish, ca. 100 μm across. Conidia filiform, curved, $20-27 \times 0.8 \mu\text{m}$. [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, \pm 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) emphasizes 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 μ m 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 \pm 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 μ m thick; excipular hyphae radiating, with end cells \pm enlarged, ca. 4 μ m across, with brown pigment located between the hyphae. Hypothecium with thin brownish layer above, otherwise colorless, ca. 30-40 μ m thick, extending downward stipe-like. Epihymenium colorless, with few to many, irregular, brown-black granules, to 5 μ m across, KOH-, not dissolving, N-, dissolving. Hymenium partially or entirely diffusely brown tinged, ca. 50 μ m thick (KOH slightly purplish brown). Paraphyses unbranched, not pigmented, with end cells not enlarged (ca. 2 μ m across) or enlarged, \pm pyriform (ca. 4 μ m across). Asci short clavate. Ascospores narrowly clavate to narrowly cylindrical, with weakly acute ends, 3-septate, 18-22 \times 2.5-3 μ m. Pycnidia with upper part green, lower part brown. Conidia filiform, curved, ca. 20 \times 0.8 μ m. [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 be 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, \pm dispersed areoles barely raised above bark to raised, crowded and \pm 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 μ m thick; outer cup-like, of radiating hyphae with broader lumina, to 70-120 μ m thick, with terminal cells \pm expanded, clavate, sometimes containing large, colorless crystals, \pm colorless outside, yellowish to yellowish brown inward; pigmented areas KOH+ rose. Hypothecium yellow-brown, 40-60 μ m thick (KOH+ rose); hyphae irregularly arranged, not gelatinized, with some cells inflated (ca. 6 μ m across or oval, 12-6-7 μ m). Epihymenium colorless to pale yellow-brown (KOH+ rose). Hymenium sometimes streaked with yellow-brown in upper part, KOH+ rose, 80-120 μ m thick. Paraphyses unbranched, not or slightly expanded at tips. Ascospores needle-like, 2-15-septate, 31-74 \times 2-5 μ m (Ekman, 1996), not spirally arranged in ascus. Pycnidia almost colorless to pale orange-brown, \pm globose, KOH-, ca. 100 μ m across. Conidia filiform, curved, ca. 20-25 \times 0.8 μ m. [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 \pm 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 purpurans* R.C. Harris, Lendemer & Ladd**

Rare on boles of hardwoods in mature woodlands, usually in humid or mesic situations; known from a few widely scattered sites across the Ozarks. See discussion under *Bacidia schweinitzii*.

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 \pm 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 μ m 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 \pm 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 \pm obscured by density of pigmentation, inner lens-shaped, deep red-brown (KOH+ deep purple-brown), ca. 100-150 μ m 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 μ m thick; rim often green adjacent to epihymenium. Hypothecium brown(KOH-), or concolorous and indistinguishable from the inner part of the exciple, ca. 60 μ m thick. Epihymenium with dense to sparse clumps of green pigment (KOH-), often extending downward into upper hymenium. Hymenium ca. 100 μ m thick. Ascospores needle-like, 3-15-septate, $32-88 \times 2-4 \mu$ m. Pycnidia blackish, globose, 0.15-0.2 mm across, with upper wall dark brown. Conidia filiform, curved, $20-25 \times 0.8 \mu$ m. [\pm atranorin] Illustrations: Brodo et al. (2001), fig. 126; Ekman (1996), figs. 8A, 42D,E.

The variation in apothecial pigmentation falls 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 variant in our region and occurs occasionally throughout the range of *B. schweinitzii*. This element has recently been described as *Bacidia eckmaniana* R.C. Harris, Lendemer & Ladd (Lendemer et al. 2016).

2) *Bacidia purpurans* R.C. Harris, Lendemer & Ladd: apothecia dull brown; exciple inner part yellowish to light orangish brown, outer light orangish brown inside (KOH-), pale grayish or \pm colorless outside (KOH+ faint purplish, C+ faint purplish); hypothecium concolorous with inner exciple; epihymenium spottily faint grayish pigmented or \pm colorless (KOH+ faint purplish, C?). Otherwise as in *B. schweinitzii*. The apothecia of this form seem to lack the same two pigments as the first variant but contain low amounts of *Sedifolia*-grey [*Thalloidima* Green sensu Ekman] in the upper edge of the exciple and in the epihymenium.

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 trunks 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. Schneider**

Thallus on bark or rarely rock or bryophytes, whitish or rarely gray, superficial, areolate; areoles \pm dispersed to crowded and becoming \pm continuous, mostly nearly flat but sometimes raised and weakly constricted at base, rarely almost bullate, 0.2-0.3 mm across, with interspaces \pm 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 \pm 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) μ m thick; outer cup-shaped, with outer part chestnut brown, especially rim (KOH-), paling to colorless inward, 90-120 μ m thick, of radiating hyphae with narrow lumina inward and several rows of enlarged cells outside. Hypothecium mostly yellowish (KOH-), sometimes colorless, 50-70 μ m 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 μ m thick. Ascospores needle-like, 3-17-septate, $38-91 \times 2.5-4$ μ m. Pycnidia blackish brown, globose, ca. 100 μ m across, with upper wall chestnut brown. Conidia filiform, curved, ca. $20-30 \times 0.8$ μ m. [atranorin] Illustrations: Ekman (1996), figs. 3C, 42G.

Common, mainly on the trunks 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 \pm spherical to irregular, isidioid granules, ca. 50 μ m across to ca. 100 \times 50 μ m, loosely attached, weakly dispersed to crowded, without evident hypothallus; granules with coarse, bluntly conical papillae, 10-15 μ m 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 \pm thick in young apothecia, remaining \pm raised or even with the disk in older apothecia. Exciple colorless, outer part cup-shaped, colorless, ca. 100 μ m thick, of indistinct, radiating hyphae with thick walls and narrow lumina, with end cells slightly enlarged, inner part, colorless, ca. 40 μ m thick, of interwoven hyphae, with thick wall and narrow lumina. Hypothecium pale yellowish (KOH-), ca. 30 μ m thick, of \pm loose hyphae, with some cells enlarged. Hymenium colorless, ca. 100 μ m thick. Asci *Bacidia*-type. Ascospores needle-like, multiseptate, 46-74 \times 2.5-3 μ m. 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 \pm irregular, 0.05-0.15 mm across, to 100 μ m 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 μ m across; central part denser, colorless, of thick-walled, intertwined hyphae. Hypothecium colorless, of \pm loose hyphae with \pm large lumina. Epihymenium colorless. Hymenium colorless or faintly green streaked (KOH-). Asci *Bacidia*-type.

Ascospores rod-shaped, 3-septate, $13-15 \times 2.5-3.5 \mu\text{m}$. 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 *V_zda*, *nom. cons.* Ramalinaceae

(Folia Geobot. Phytotax. Praha 25: 431. 1991. Holotype: *Bacidina phacodes* (Körber) *V_zda*.

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 $2.5 \mu\text{m}$), thin-walled, 3-7-septate spores, conidia filiform, mostly curved, rarely needle-like; ca. 6 species in the Ozarks. 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 not 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 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?), \pm 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, \pm 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, $36-43 \times 2-2.5 \mu\text{m}$ (Ekman, 1996). Pycnidia immersed, colorless (Ekman, 1996). Conidia filiform, curved, non-septate, ca. $10 \times 0.5 \mu\text{m}$ (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 delicata (Leighton) V. Wirth & V_zda
XXX

Bacidina egenula (Nyl.) V_zda

Thallus on calcium rich substrates, rarely silicate rock, pale tan or pale gray, superficial, usually of small, confluent or \pm 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 goniospores 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. Epithymenium and with clumps 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 \times 1.5-2 μm . Pycnidia blackish, immersed, globose, ca. 100 μm across. Conidia filiform, curved or spiral, 20-27 \times 1.0 μm . [no lichen substances, not tested]

Bacidina egenula is easily recognized by the narrow spores and dark green epithymenium. 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 epithymenium, 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) cites 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) V_zda

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, \pm 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 μ m thick, of radiating hyphae with narrow lumina and end cell(s) enlarged and thick-walled. Hypothecium colorless, ca. 30 μ m thick, of intertwined hyphae with some cells enlarged. Epihymenium colorless. Hymenium colorless, ca. 65-70 μ m thick. Paraphyses unbranched, with tips not enlarged or capitate, to 5 μ m across. Ascospores needle-like, 5-7-septate, $31-43 \times 2 \mu$ m [3-7-septate, $29-45 \times 1.5-2 \mu$ m (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, 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 & V_nda. 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** [possibly ***Bacidina arnoldiana (Körber) V. Wirth & V_nda?]

Known only from old, weathered, partially shaded, treated landscape timbers in suburban St. Louis County.

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 \pm 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 μ m across. Ascospores needle-like, 0-3-septate, $24-32 \times 1.5-2 \mu$ m. Pycnidia pale to dark brown, semi-immersed, globose, ca. 100 μ m across. Conidia needle-like, often broader toward one end, almost straight or slightly curved, $20-30 \times 1-1.5 \mu$ m. [no lichen substances?, not tested]

ILLINOIS. UNION COUNTY: Pine Hills, edge of Otter Road, on old sycamore log, 14 Aug 1966, *Skorepa* 2432 (NY). Also from weathered, old, treated, lightly shaded landscape timbers in suburban St. Louis County.

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, \pm 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 μ m across. Ascospores needle-like, 0-3-septate, 21-26 \times 1.5 μ m. 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.

BAGLIETTOA A. Massal. Verrucariaceae

see *Verrucaria* [*V. baldensis*, *V. calciseda*, *V. marmorea*]

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 (1997)
Verrucariales insertae sedis

Sterile crustose lichens that appear leprose in the field, but are actually byssoid, leprose thallus lacking cortical development in all stages; photobiont chlorococcoid; a monotypic genus that occurs in the Ozarks. References: Canals et al. (1997).

This species was formerly included within *Lepraria*, from which it differs by the branching clusters of hyphae partially enveloping photobiont cells near their apices and said to resemble bunches of grapes.

Botryolepraria lesdainii (Hue) Hernández-M., Gómez-B. & Llimona

Thallus dull greyish green to slightly bluish green, dull, appearing leprose, felty, lacking well-defined margins, of abundant anastomosed, septate hyphae with slightly undulating walls; photobiont cells in clusters at the ends of hyphal branches.

Chemistry: lesdainin (6 α -acetoxypentan-22-ol, a triterpenoid with an R_f value just above zeorin in solvents A, B, and C); all spot tests negative

Common throughout the Ozarks, where it is restricted to shaded, sheltered rocks, occurring in crevices and on sheltered faces and under overhangs in areas protected from runoff or direct wetting. Typical habitats included shaded underhangs below large bluffs and outcrops, deep crevices in dolomite and limestone exposures, and on cave walls near the light extinction zone. This species is most commonly found on carbonate rocks (dolomite and limestone), but also on sandstone. It occasionally grows on thin soil over bedrock, or bryophytes over bedrock, as well as on old shaded, sheltered foundation blocks and walls of stone culverts.

This species and *Lepraria finkii* are the most shade tolerant leprose lichens in the Ozarks.

Similar taxa:

-Many species of *Lepraria* have similar appearance, but the thalli are less drab and typically more bluish or greyish; they generally do not grow on carbonate rocks except for *L. disjuncta*, which is distinctly pale or yellowish green (usnic acid) and UV+ orange (xanthone)

BUELLIA De Not. (Caliciaceae)

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 disk2
2. Thallus light gray to white, K+ yellow or red (stictic or norstictic acids)3
3. Thallus corticolous4
4. Spores <15 μ m long, to 6 μ m wide, with bluntly rounded apices *B. stillingiana*
4. Spores >15 μ m long, >6 μ m wide, typically with +/- acute apices *B. curtisii*
3. Thallus saxicolous5
5. Ascospores 3-septate *Diplotomma venustum*
5. Ascospores 1-septate6
6. Thallus ell-developed, continuous7

- 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, a small areoles among rock crystals *B. sequax*
- 2. Thallus brown or dark green, rarely grayish or lacking; K- 8
- 8. Thallus corticolous or lignicolous
 - 9. Hypothecium brown; paraphyses capitate with conspicuous dark cap *Amandinea*
 - 9. Hypothecium colorless; paraphyses weakly expanded at tips with inconspicuous dark cap *Buellia* sp. 17744
- 8. Thallus saxicolous 10
- 10. Thallus not evident, or traces of thin gray thallus present *Amandinea punctata*
- 10. Thallus well-developed, gray, brown, or greenish 11
- 11. Thallus yellow green, grayish green to dark green, with confluent, rounded, granules and no evident prothallus; spores bacilliform, 3-septate *B. vernicoma*
- 11. Thallus brown, lacking green tints; spores ellipsoid, 1-septate 12
- 12. Thallus continuous, rimose, lustrous, shiny, angular areoles and a well-developed black prothallus *B. tyrolensis*
- 12. Thallus of bullate areoles to squamulose 13
- 13. Thallus C- *B. badia*
- 13. Thallus C+ pink 14
- 14. Apothecia and areoles small, nestled among rockcrystals; medulla I-; ascospores 11-12 x 6-7 µm.. *Buellia* sp. 17597
- 14. Apothecia and areoles larger; thallus bullate areolate; medulla I+ violet; ascospores 11-13(-15) x 7-8 µm *Buellia* sp. 48927 (C+ form of *B. badia* s.l. would key here)
- 1. Apothecia with a well developed thalline margin 16
- 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 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).

***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, 9-12.5 × 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 [= *Buellia erubescens* Arnold]

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 *Amandinea*. 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 available literature. [atranorin? (trace), gyrophoric acid]

CAERULEUM K. Knudsen & L. Arcadia (2012) *Acarosporaceae* pro tem.

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*.

Caeruleum immersum (Fink) K. Knudsen & L. Arcadia [= *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.

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 prevailing >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* and *Juniperus* in wooded uplands and glades.

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 "*Pseudotreboxia*"); 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 Ozark.. [orange species reacting K⁺ magenta contain anthraquinones, usually parietin] References: Wetmore (1994, 1996, 1998).

Caloplaca has recently been split into several segregate genera; these names are provided in the individual species accounts, but temporarily retained in the broad concept of *Caloplaca* here.

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. flavocitrina*

2. Thallus not sorediate, variously colored.
 4. Apothecia K+ magenta, yellow to orange, sessile; thallus K- or K+ magenta.
 5. Thallus well developed, orange, K+ 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 prevailingly >12 µm long *C. flavovirescens*
 9. Thallus orange, areolate; mostly in exposed habitats; spores <12 µm long.
 10. Thallus yellowish orange, 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 and K-, or restricted to a few small yellow areoles associated with the apothecia and K+ magenta.
 11. Thallus evident, gray to whitish; 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. Apothecia K-, black, immersed; thallus K-
 14. On siliceous rocks; ascospores up to $12 \times 6.5 \mu\text{m}$*C. conversa*
 14. On carbonate rocks; ascospores $> 12 \times 6.5 \mu\text{m}$ *C. atroalba*
1. Thallus corticolous.
 15. Apothecia and thallus K-.
 16. Thallus obscurely soresiate *C. obscurella*
 16. Thallus not soresiate.
 17. Apothecia dark brown, not pruinose; thallus brownish*C. brunneola*
 17. Apothecia tan to brown, pruinose; thallus pale *C. camptidia*
15. Apothecia K+ magenta; thallus K- or K+ magenta
 18. Thallus pale to grayish, K-.
 19. Thallus dark grey; apothecia yellow to yellowish or brownish orange, with a pale to gray thalline rim contrasting with the disk
 20. Apothecial disks yellow, with a pale to whitish margin,.....*C. ulmorum*
 20. Apothecia orange to brownish orange, the rim grey, \pm concolorous with to slightly paler than the disk *C. cerina*
 19. Thallus pale to light gray; apothecia brownish to orange, the rim \pm 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*
18. Thallus yellow to orange, K+ magenta.
 22. Thallus soresiate.
 23. Thallus chrome yellow to pale grayish, thin and \pm continuous; in light shade in woodlands *C. chrysophthalma*
 23. Thallus bright orange, areolate; on exposed wood and sometimes bark
*C. microphyllina*
 22. Thallus not soresiate..... *C. flavorubescens*

Caloplaca arenaria (Pers.) Müll. Arg. [= *Rufoplaca arenaria*]

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 their K reaction: K+ magenta in *C. pollinii* and K- in *C. brunneola*.

Caloplaca camptidia (Tuck.) Zahlbr.

Common on lightly shaded boles of hardwood trees in woodlands. 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*.

Ascospores $11.5 \times 6 \mu\text{m}$; isthmus ca. $5.8 \mu\text{m}$.

Caloplaca cerina (Ehrh. ex 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.

Pycnidia \pm immersed, 0.1 mm; conidiospores narrowly bacilliform, ca. $4 \times 1 \mu\text{m}$, sometimes with ampuliform tips.

Caloplaca chrysodeta (Vain. ex Räsänen) Dombr. [= *Leproplaca chrysodeta*]

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. [= *Solitaria chrysophthalma*]

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. It has recently been discovered by Claire Ciafre from an igneous glade in the St. Francois Mountains region of the Missouri Ozarks. The vivid orange-red thallus patches are among the most conspicuous and striking lichens in the Ozarks.

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. [= *Xanthocapsa feracissima*]

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 flavocitrina (Nyl.) H. Olivier [= *Flavoplaca flavocitrina*].

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. This species was long known locally as *Caloplaca citrina*, and entirely granulose-sorediate boreal taxon, whereas *C. flavocitrina*, even when densely sorediate, always has at least portions of some corticate squamules evident.

Caloplaca flavorubescens (Hudson) J. R. Laundon [= *Gyalolechia flavorubescens*]

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. [= *Gyalolechia flavovirescens*]

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.

Parasites: 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.; the largely immersed perithecia form characteristic dark spots ca. 0.1 mm wide on the apothecia, and occasionally the thallus, of the host.

Caloplaca galactophylla (Tuck.) Zahlbr. [= *Squamulea glaactophylla*]

Rare and local on a few massive dolomite exposures in glades and on blufftops in the northern half of the Ozarks.

Caloplaca holocarpa (Hoffm. ex Ach.) M. Wade [= *Athallia holocarpa*]

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 (J. Lahm) 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.

Pycnidia blackish, slightly irregular, laminal, convex, ca. 50% immersed at maturity, ca. 0.10-0.15 mm broad; conidiospores ellipsoid, slightly widened at one end, ca. $3-4 \times 1.2 \mu\text{m}$.

Caloplaca "squamosa" (de Lesd.) Zahlbr. [= *Squamulea squamosa*]

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. $12 \mu\text{m}$ long, with a broad isthmus typically exceeding $4.5 \mu\text{m}$.

Caloplaca subsoluta (Nyl.) Zahlbr. [= *Squamulea subsoluta*]

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 [= *Athallia vitellinula*]

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. Portions of the thallus are typically suffused with yellowish, 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 \times 5-7 μm , with the isthmus 3.5-5 μm broad.

CANDELARIA A. Massal. (1852) Candelariaceae

Small, bright lemon-yellow foliose lichens with a pale lower cortex with pale, mostly simple, rhizines; photobiont *Trebouxia*; apothecia laminal, sessile to stipitate, ultimately shallowly convex, to 1.8 mm broad, initially with a raised, well-developed thalline margin that becomes obscure with age; disks and minutely roughened, darker yellow; exciple poorly developed; epihymenium of yellowish brown to orangish, KOH-persistent, granules; hypothecium pale, paraphyses elongate, ca. 2 μm wide, mostly simple or with a few branches, the 3-4 subapical cells often slightly swollen, terminal cell globose, unpigmented, and ca. 4 μm wide; asci *Candelaria*-type, with 32+ spores; ascospores broadly ellipsoid to subglobose, usually simple but typically a few obscurely 1-septate, 6-9 \times 3.5-6 μm ; pycnidia within \pm hemispherical thallus protuberances ca. 0.15 mm broad, with pale walls; conidiospores reportedly ellipsoid, ca. 2-3.5 \times 1.5 μm , but in Ozark material typically broadly ellipsoid to globose, 1.5-2.2 \times 1.0-1.4 μm ; 2 species in the Ozarks. Reference: Westberg & Nash (2002).

1. Thallus esorediate; apothecia common.....*C. fibrosa*
1. Thallus sorediate; apothecia rare*C. concolor*

Similar taxa with lemon-yellow thalli:

- Candelariella* species can appear minutely lobed, but are crusts lacking rhizines and a well-developed lower cortex
- Piccolia nannaria* has a yellow thallus that reacts KOH+ magenta (anthraquinones); it has ≥ 100 spherical spores per ascus, each $< 3 \mu\text{m}$ diameter
- Xanthomendoza weberi* can have similar sized lobes and appear yellowish in more shaded sites, but the lobe tips are less dissected and the thallus contains parietin and reacts KOH+ magenta
- Some species of *Caloplaca* have a yellow thallus, but these lack rhizines and a well-developed lower cortex and contain parietin, reacting KOH+ magenta

Candelaria concolor (Dickson) Stein

Thallus of small discrete lobes or irregular rosettes typically to 5 mm broad, with narrow lobes 0.2 (0.4) mm wide and up to 2 mm long, adnate and sometimes loosely ascending at the tips, with dendritic branches; lobe tips becoming fimbriate and developing into granular soredia, the lobes eventually developing marginal soredia and sometimes becoming mostly sorediate masses; soredia granular, yellow, 20-30 μm diameter; apothecia and pycnidia occasional, but not seen on shaded, calycin-deficient specimens.

Chemistry: calycin; all spot tests negative

One of the most common and widely distributed macrolichens in the Ozarks, occurring in exposed to lightly shaded sites and undoubtedly in every Ozark county. This species occurs on boles and branches of a wide variety of hardwood and softwood trees as well as on lightly shaded siliceous and carbonate rocks, lignum, and anthropogenic substrates such as concrete, old rusted iron, asphalt shingles, and even old tires and vinyl. It is common and locally abundant on planted trees in urban and suburban areas, often forming a prominent yellow zone on the sheltered sides of

slightly leaning boles protected from direct wetting. Although not initially apparent, this lichen is also nearly ubiquitous in intact wooded uplands, where it often occurs as scattered, minute, individual thalli < 1 mm long.

In deeply shaded sites this lichen is mostly greenish. Forms with the thallus mostly composed of masses of soredia occur, particularly in urban and disturbed sites. These have been described as var. *effusa* (Tuck.) Burnham, but are one extreme of a range of intergrading morphologies.

***Candelaria fibrosa* (Fr.) Müll. Arg.**

Thallus adnate, forming compact rosettes to 3 cm broad; marginal lobes to 0.4 mm broad, the tips expanded to 0.8 (1.5) mm, lobes in the interior of the rosette short, with stubby, typically imbricated, lateral branches; apothecia usually abundant, often with a fringe of white rhizines to 0.4 mm long on the lower edge of the thalline margin; pycnidia frequent.

Chemistry: calycin; all spot tests negative

Occasional throughout the Ozarks, on exposed branches of hardwoods in woodlands and along glade margins, and on younger trees in light shade. This species occurs rarely on lightly shaded rocks in these same habitats.

CANDELARIELLA Müll. Arg. (1852) Candelariaceae

Small, bright yellow crustose lichens with dispersed, granular, sorediose, or minutely squamulose thalli, often massed into larger aggregations; photobiont chlorococcoid; apothecia ultimately shallowly convex, initially with a raised, well-developed thalline margin (in Ozark taxa) that becomes \pm excluded with age; disks minutely roughened, darker yellow to brownish yellow; exciple poorly developed; epihymenium of yellowish brown to orangish, KOH-persistent, granules; hypothecium pale, paraphyses ca. 2.2 μ m wide, very sparingly branched, the upper few cells somewhat undulate, to 2.8 μ m broad, the apical cell not notably swollen but sometimes pigmented; asci *Candelaria*-type, with 8-32 spores; ascospores oblong, usually simple but sometimes obscurely 1-septate, mostly 10-14 \times 4-5.2 μ m; pycnidia small yellow granules or protuberances on the thallus, with a darker yellow ostiolar area; conidiospores narrowly ellipsoid to oblong, 2.2-3 \times 1.1-1.3 μ m; 3 species in the Ozarks. References: Lendemer & Westberg (2010), Westberg et al. (2011).

Two additional corticolous taxa occur in the Great Plains region west of the Ozarks; both have dark grey thalli and eight spores per ascus. *Candelariella antennaria* Räsänen has apothecia with a yellow to gray thalline margin and clavate paraphyses, while *C. subdeflexa* has apothecia lacking a thalline margin and cylindrical paraphyses.

1. Thallus sorediate, sometimes consisting of patches of soredia with no apparent thallus; spores 8/ ascus *C. xanthostigmoides*
1. Thallus esorediate, although sometimes consisting of aggregations of minute, spherical corticate granules; spores 12-32/ascus.
 2. Thallus subsquamulose, with effigurate margins; usually saxicolous..... *C. vitellina*
 2. Thallus of tiny, spherical, corticate granules; corticolous *C. xanthostigma*

Similar taxa with lemon-yellow thalli:

- Candelaria* species are small foliose lichens with a well-developed lower cortex and pale rhizines
- Piccolia nannaria* has a yellow thallus that reacts KOH+ magenta (anthraquinones); it has ≥ 100 spherical spores per ascus, each $< 3 \mu\text{m}$ diameter
- Xanthomendoza weberi* can have similar sized lobes and appear yellowish in more shaded sites, but the lobe tips are less dissected and the thallus contains parietin and reacts KOH+ magenta
- Some species of *Caloplaca* have a yellow thallus, but these lack rhizines and a well-developed lower cortex and contain parietin, reacting KOH+ magenta

***Candelariella vitellina* (Hoffm.) Müll. Arg.**

Thallus golden yellow to lemon yellow, of small effigurate to subsquamulose areoles to ca. 0.5 mm broad, becoming closely aggregated and somewhat imbricate; apothecia common, typically 1/areole, to 0.8 mm broad, initially with a thick, lumpy to irregularly crenulate thalline margin ca. 0.1 mm broad, this eventually becoming obscure or reduced to a few small, bead-like remnants; ascospores 16-32/ascus, oblong, 10-14 \times 4-5.2 μm ; pycnidia occasional, often resembling apothecial primordia.

Chemistry: calycin, pulvinic acid complex, vulpinic acid; thallus usually KOH+ pale orangish red

Common throughout the Ozarks; on exposed, typically massive, siliceous rocks, especially sandstone, but also on chert and igneous rocks. Occasionally this species occurs on similar substrates in lightly shaded sites, but the thalli are then typically paler, smaller, and less apotheciate.

The classic habitat for the species in the Ozarks is irregularly weathered bedrock exposures in sandstone glades, where it typically occurs with yellow taxa of *Acarospora*, which have paler, slightly greenish-tinged yellow thalli.

Parasites:

- west of the Ozarks in the cross timbers region, *Candelariella vitellina* thalli are infrequently parasitized by *Caloplaca grammae* (Nyl.) H. Olivier, which has tiny apothecia to ca. 0.5 mm diameter, with reddish orange disks and a darker thalline margin.

***Candelariella xanthostigma* (Ach.) Lettau**

Thallus of lemon yellow \pm spherical corticate granules diffusely scattered over a thin pale hypothallus, the granules mostly 20-100 μm diameter; apothecia occasional, scattered among the thallus granules, to 0.8 mm broad, initially with a thick, lumpy to irregularly crenulate thalline margin ca. 0.1 mm broad, this eventually becoming obscure or reduced to a few small, bead-like remnants; ascospores 16-24 (32?)/ascus; pycnidia occasional, resembling thallus granules, but with slightly darker yellow, often slightly depressed apices, these becoming pellucid when wet.

Chemistry: calycin, pulvinic acid complex, vulpinic acid; all spot tests negative (although Westberg [2004] reported that Sonoran material was KOH+ reddish, all Ozark material is KOH-, despite having the same chemistry as *C. vitellina*, which reacts KOH+ pale orangish red; perhaps this indicates that there may be lower concentrations of calycin in *C. xanthostigma*)

Frequent throughout the Ozarks, but seldom abundant, on exposed to moderately shaded hardwoods, typically on mid and upper portions of larger trees in wooded uplands. This species is never abundant, but occurs a single of scattered patches, typically among other lichens on furrowed, irregular bark. Another common habitat for this species is on small exposed branches of trees and shrubs, including *Juniperus virginiana*, associated with glades.

Parasites:

-*Tremella candelariellae* Diederich & Etayo is an occasional parasite; it forms XXXX. See [BLS bull 110: 66-67 (2012)].

***Candelariella xanthostigmoides* (Müll. Arg.) R.W. Rogers**

Thallus initially of scattered, small bright yellow areoles to ca. 0.2 mm broad, often with minute lobules at the margins; areoles soon \pm entirely sorediate; soredia yellow, mostly 15-40 μ m broad; apothecia occasional, scattered, to 0.5 mm broad, the thalline margin thin and often excluded at maturity; ascospores 8/ascus; pycnidia apparently uncommon, but easily overlooked, within small rounded corticate granules ca. 0.1 mm broad.

Chemistry: calycin, pulvinic acid complex, vulpinic acid; all spot tests negative

Frequent on a wide range of exposed to lightly shaded hardwood trees and shrubs, typically on exposed small branches or exposed stems in glades and along woodland edges and openings, as well as on upper canopy branches of mature hardwoods in closed stands; occasionally in more shaded sites.

Sterile thalli of a sorediate *Candelariella* are frequent through the Ozarks, outnumbering fertile material. Sterile material of *C. xanthostigmoides* is identical to that of *C. efflorescens* R.C. Harris & Buck, an eastern species with 32 spores per ascus. Since all fertile material from the Interior Highlands has eight spores per ascus, such material is here defaulted to *C. xanthostigmoides*. Lendemer and Westberg map the closest occurrence of *C. efflorescens* as the Appalachian region of eastern Kentucky.

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
 (stictic acid).....*C. crozalsiana*

***Canoparmelia caroliniana* (Nyl.) Elix & Hale**

Thallus larger, to 15 cm, deep bluish gray, the lobes 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 \times 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 [= *Crespoa crozalsiana*]**

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 \pm 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, sometime in disturbed sites, such as along the margins 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 often overlapping at their margins, to 4 cm long, and 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, 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. (1852) Catillariaceae

Inconspicuous crustose lichens with obscure, thin, or scruffy thalli; photobiont chlorococcoid; apothecia lecideine, brown to dark grey or black, sessile; paraphyses simple to slightly branched, with abruptly expanded, globose apical cells that are dark pigmented in their distal portions; asci cylindrical to narrowly clavate, *Catillaria*-type, with 8 small, narrowly ovoid, 1-septate ascospores <15 µm long; pycnidia immersed, with ellipsoid conidiospores photobiont chlorococcoid; 3 species in the Ozarks. References: Fletcher and Coppins (2009).

- 1. Corticolous; apothecia usually black *C. nigroclavata*
- 1. Saxicolous; apothecia brown to black.
 - 2. On calcareous rocks; apothecia mostly brown; exciple pale except at outer edge *C. lenticularis*
 - 2. On siliceous rocks; apothecia mostly black; exciple dark throughout *C. chalybeia*

Similar taxa:

- Locally, members of several genera resemble *Catillaria* in the field, including *Bacidina*, *Bacidina*, *Fellhanera*, and *Scoliciosporum*; all have longer, 3+ septate ascospores and different asci that contain internal structures staining IKI+ blue.
- Micarea* has more persistently convex apothecia and smaller, often paired, photobiont cells to 7 µm diameter; the epithecium is often KOH+ violet

Catillaria chalybeia (Borrer) A. Massal.

Thallus thin, obscure, indistinct, closely conforming to substrate, continuous to cracked but not clearly areolate, dark grey to brownish grey; photobiont *Myrmecia*; apothecia common, to 0.5 mm broad, ± plane, the disks black to dark grey dark brown, with a well-developed, black, lecideine margin usually elevated above the disks; exciple green-black throughout, the green pigments

KOH-, HNO₃+ reddish purple; epihymenium dark brown, from the apically pigmented, globose terminal cells of the paraphyses; hypothecium brownish;; ascospores ellipsoid, 9-10 × 3.5-4 µm; pycnidia immersed, the upper walls greenish to brownish, with protruding dark apices ca. 60 µm broad; conidiospores bacilliform to narrowly ellipsoid, ca. 2-3 X 0.8-0.9 µm.

Chemistry: no lichen substances

Rare; on exposed to lightly shaded siliceous rocks, typically sandstone, in the southwestern Ozarks.

Although this species is described as having a black prothallus, Ozark material lacks an evident prothallus. Ozark material has a uniformly pale hymenium and is referable to var. *chalybeia*.

Similar taxa:

-Saxicolous populations of *Amandinea punctata* have similar apothecia, but the thallus is paler to not evident, and the ascospores are green to brown

Catillaria lenticularis (Ach.) Th. Fr.

Thallus effuse to obscurely areolate, sometimes scurfy and indistinct, whitish to pale grey or pale brownish grey; photobiont *Dictyochloropsis*; apothecia dispersed, ca. 0.3 mm broad, convex to plane, the disks rich brown to dark brown (rarely black, but then becoming brown when wet), with a concolorous margin becoming less evident at maturity; exciple pale to pale brownish except for the brown outer margin, KOH-, HNO₃-; epihymenium mostly dark brown, from the apically pigmented, globose terminal cells of the paraphyses; hypothecium pale to yellowish; ascospores mostly 1-septate, narrowly ellipsoid, ca. 9 × 3 µm; pycnidia and conidiospores not seen in Ozark material, reportedly similar to those of *C. chalybeia*.

Chemistry: no lichen substances

Occasional, and likely overlooked, on lightly shaded, massive dolomite of bluffs and outcrops, often on sheltered faces under overhangs. A population in Jefferson County, Missouri occurs on exposed sandstone boulders over dolomite bedrock in an extensive dolomite glade.

Catillaria nigroclavata (Nyl.) Schuler

Thallus thin, effuse to minutely verrucose or finely granular, dark grey to olive grey; photobiont *Dictyochloropsis*; apothecia common, black or dark brown, thin and closely appressed to the thallus, plane with elevated lecideine margins, to 0.25 mm broad; exciple greyish to brown throughout; epihymenium dark brown, from the apically pigmented, globose terminal cells of the paraphyses; hymenium pale throughout; hypothecium pale to yellowish brown; ascospores 1-septate, ellipsoid, ca. 7-10 × 2.5-3.5 µm; pycnidia common, with protruding rounded black apices ca. 50-60 µm diameter; conidiospores narrowly bacilliform, ca. 2-3 × 0.7-0.8 µm.

Chemistry: no lichen substances

Locally frequent throughout the Ozarks, on exposed to lightly shaded twigs, branches, and small boles of young trees in thickets. This species can thrive in disturbed sites, and occurs on a variety of hardwoods and conifers, including planted species without close native relatives, such as *Pinus mugo*. This small, cryptic lichen is often overlooked and collected as an admixture.

West of the Ozarks in the Great Plains, some otherwise identical collections have 16-spored asci, but this morph has yet to be found in the Ozarks.

CATINARIA Vain. (Ramalinaceae)

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; thallus usually thin or obscure; 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. Thallus leprose, bright yellow; photobiont *Stichococcus*, the cells elongate, <10 µm wide; apothecia with yellow-green pruina; spores 2-3 µm diameter *C. furfuracea*

1. Thallus inconspicuous; 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 William Buck collection from (Buck 18115, NY) from a mesic site in Carter County, 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. [vulpinic acid]

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; 6 species in the Ozarks.

1. Ascospores 1-septate.
 2. spore septum thin and notably paler than outer spore wall; stalk KOH-; typically associated with chlorophycean algae..... *C. pusilla*
 2. Spore septum thick or thin, colored similarly to outer spore wall; stalk KOH+ red or KOH-; photobiont absent.
 3. Hypothecium pale; stalk KOH+ deep red to red-violet *C. exilis*
 3. Hypothecium brown to greenish brown; stalk KOH ± reddish grey *C. debilis*
1. Ascospores simple.
 4. Thallus whitish; on *Pinus*; photobiont lacking; ascospores ≥3.5 µm broad..... *C. nana*
 4. Thallus obscure to sordid; substrate various; algae present; ascospores to 3.5 µm broad.
 5. Associated with *Trentepohlia*; ascospores 7-9 µm long; ascomata briefly KOH+ red
..... *C. rubescens*
 5. Associated with chlorophycean algae; ascospores 4.7-7 µm long; ascomata KOH-.....
..... *C. savonica*

Chaenothecopsis debilis (Sm.) Tibell

Scattered in the northern portion of the Ozarks, from southwestern Missouri eastward; generally growing on decorticate hardwood.

Chaenothecopsis exilis Tibell

Known only from XXX

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. (1852) Chrysothrichaceae

Crustose lichens with leprose, bright yellow to yellowish green, usually undifferentiated thalli composed of powdery sorediate granules and enveloping hyphae; rhizohyphae sometimes present; photobiont chlorococcoid, the cells to 15 (20) μm diameter; in the Ozarks, all species except *C. caesia* always sterile; 4 species in the Ozarks. Reference: Harris & Ladd (2008), Lendemer & Elix (2010).

Similar taxa:

The following key includes taxa with similar field characters of undifferentiated, granular to leprose, yellow thalli. Additionally, *Lepraria vouauxii*, a species of exposed massive siliceous rocks exposures, has a thallus that is frequently dull deep yellow mixed with grayish hues. The thallus is thick and unevenly thickened, and reacts KOH+ grape purple.

1. Thallus yellowish green (usnic acid); apothecia common *C. caesia*
1. Thallus pale to bright yellow or orangish (usnic acid absent), without greenish tints; sterile.
 2. Photobiont chlorococcoid, the cells \pm isodiametric; thallus chemistry various.
 3. On bark, wood, or acidic siliceous rocks; thallus yellow, KOH- to KOH+ slowly reddish (sometimes with calycin).
 4. Thallus thick, attached by rhizohyphae and usually easily separated from the rock; yellow above, whitish to brown below *C. onokoensis*
 4. Thallus thin, lacking rhizohyphae and rarely separable from substrate, yellow throughout, with no layers discernable.
 5. Thallus KOH+ slowly reddish (calycin), initially forming small rounded patches on rocks, these sometimes coalescing into larger rimose patches with rounded, soraliu-like outliers *C. insulizans*
 5. Thallus KOH- (calycin absent), forming \pm continuous patches.
 6. Thallus bright yellow to bright greenish yellow, UV- (pinastric acid); typically corticolous or lignicolous, rarely saxicolous; frequent *C. xanthina*
 6. Thallus pale yellow to pale greenish yellow, UV+ orange (rhizocarpic acid); typically saxicolous, in shaded crevices or sheltered areas; rare *Psilolechia lucida*
 3. On sheltered calcareous rock; thallus usually orange, instantly KOH+ magenta-purple (parietin) *Caloplaca chrysode*
 2. Photobiont *Stichococcus*, the cells subrectangular to elongate; thallus with vulpinic acid
..... *Chaenotheca furfuracea*

Chrysothrix caesia (Flotow) Ertz & Tehler

Small, granular, pale yellowish green thalli typically ≤ 2 cm broad and ca. 0.1 mm thick, often with a glaucous cast, particularly in older herbarium specimens; thallus granules 20-40 μm diameter, sometimes becoming gelatinized and fusing to appear almost corticate; rhizohyphae absent; apothecia common, \pm evenly scattered over the thallus, shallowly convex, to 0.4 mm broad, purplish brown to darkening, abundantly frosted with blue grey pruina (terpene crystals?), margin not evident; epithecium, and hypothecium yellowish brown, the color suffusing into much of the hymenium; paraphyses much branched and anastomosing, not notably swollen at tips; asci with the inner wall extending into an IKI+ blue tube, with 8 ellipsoid, 3-septate, ascospores 16-24 \times 4-6 μm , these usually with a slight medial constriction and often with one medial cell slightly enlarged; pycnidia unknown.

Chemistry: usnic acid, terpenes; KOH-, C-, KC+ yellow but often faint or unclear, P-, UV-

Common in high light intensities on a variety of corticolous substrates throughout the Ozarks, often in disturbed sites or along edges, growing on twigs, branches, and boles of a variety of native and planted hardwoods and conifers, with a predilection for smooth bark, including on shrubs such as *Rhus glabra*. This species is a regular component of the lichens of native woodlands, where it is usually present at low frequencies and cover levels. It is sometimes abundant on exposed to lightly shaded branches and boles of trees along fencerows and in small towns and suburbs.

This species was until recently included within *Arthonia*. Older herbarium specimens often become better with delicate needle-like terpene crystals, which can exceed 1 mm long. The distinctive green color of the thallus with a chlorococcoid photobiont and blue pruinose ascomata makes it easily recognizable in the field

Similar taxa:

- Lecanora strobilina* frequently occurs with *C. caesia*; both contain usnic acid and have granular, yellowish-green thalli. Especially when sterile, the two taxa are difficult to distinguish, although when fertile the pale yellowish tan disks with well developed thalline margins and simple ascospores of the *Lecanora* are distinctive. *Lecanora strobilina* thalli tend to be more yellowish, and lack the slightly paler, subglaucous hues of *Chrysothrix caesia*.
- Lecanora thysanophora* has a thicker, usually larger, leprose thallus, often with a conspicuous fibrous white prothallus; it occurs on lower and mid boles of trees in mesic habitats.
- Lepraria* species are consistently sterile, with thicker, less compact thalli; while they may be green, yellowish, or bluish, they are seldom yellowish green.

Chrysothrix insulizans R.C. Harris & Ladd

Thallus bright yellow to yellow green, sometimes somewhat golden or locally orangish, to 0.2 mm thick; initially forming rounded to irregular, soralium-like patches, these sometimes coalescing into more continuous, rimose to rimose-areolate patches to XX cm broad and 0.5 mm thick; thallus granules ca. 20-50 μ m diameter; rhizohyphae absent.

Chemistry: calycin, cf leprapinic acid; KOH+ reddish, C-, KC+ reddish, P-, UV-

Uncommon and local, associated with massive exposures of sandstone, igneous rocks, and rarely cherty dolomite, in areas protected from significant direct wetting. This species usually grows in sheltered crevices and faces under overhangs.

The type specimen is from a massive, sheltered, rhyolitic face in Shannon County, Missouri. This lichen typically appears as areas of closely adjacent small patches, with the underlying rock visible between the patches.

Chrysothrix onokoensis (Wolle) R.C. Harris & Ladd

Thallus typically pale yellow to yellow green, loosely attached to and usually easily separable from the substrate, forming extensive, irregular patches to 10 cm wide and 1 mm thick, with an upper

layer of yellow granules and a lower layer of white to brownish rhizohyphae to 0.6 mm thick; thallus granules variable, 20-80 µm diameter.

Chemistry: cf leprapinic acid; KOH-, C-, KC-, P-, UV ±dull orange

Rare in the southern Ozarks in Arkansas, on lightly shaded sandstone XXX.

Chrysothrix xanthina (Vainio) Kalb

Thallus bright yellow to greenish yellow in more shaded sites, of scattered, discontinuous patches sometimes coalescing into large continuous colonies, to 0.1 mm thick; thallus granules ca. 25-40 µm diameter; rhizohyphae absent.

Chemistry: pinastric acid; all spot tests negative, UV-

Frequent and widely distributed throughout the Ozarks; on boles of hardwoods and softwoods in woodlands, often in somewhat mesic sites, in microhabitats with high light intensity but protected from direct wetting, such as on the undersides of leaning boles. This species occurs on both bark on lignum, and rarely on sheltered siliceous rocks and bryophytes. *Acer saccharum*, *Juniperus*, *Pinus echinata*, and older *Platanus occidentalis* seem to be preferred substrates; on the latter tree it is commonly associated with *Mycocalicium*.

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) considers 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 includes 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. Squamules granulose sorediate; apothecia on minute, delicate podetia; thallus K+ deep yellow, P+ yellow (thamnolic acid present, fumarprotocetraric acid absent) *C. parasitica*

4. Squamules esorediate; apothecia sessile; thallus K-, 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. Squamules K+ 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. polycarpha*

7. Stictic acid lacking; squamules usually not brownish *C. symphyocarpa*

5. Squamules K- or K+ persistently yellow (norstictic acid absent).

8. Squamules K+ deep or pale yellow (atranorin or thamnolic acid present).

9. Squamules sorediate, K+ deep yellow (thamnolic acid present) ... *C. ravenelii*

9. Squamules esorediate, K+ 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. Squamules K- (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. Medulla of podetia UV+ blue-white (grayanic acid); terricolous, saxicolous, or corticolous, cups sometimes very irregular and marginally proliferating *C. grayi*

4. Medulla of podetia UV- (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 (“*Cladina*” - reindeer lichens)

2. Podetia white, K+ yellowish (atranorin) *C. rangiferina*

2. Podetia green or greenish gray (rarely gray), K-.

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 often 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 instantly K+ deep yellow (thamnolic acid); restricted to wood and bark of *Pinus* and *Juniperus* *C. ravenelii*

3. Thallus K- or K+ 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 (sometimes with isidioid processes), 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, granular sorediate to isidioid granulose, K+ instantly deep yellow (thamnolic acid) *C. parasitica*
 10. Podetia stouter and larger, usually >10 mm tall, corticate or ecorticate, but lacking soredia and isidia, K-, K+ yellowish, or K+ 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- (squamic acid absent), P+ red (fumarprotocetraric acid present)
 - 13A. Podetia thin, much-branched, forming clustered mats *C. furcata*
 - 13A. Podetia thickened, simple, erect.
 - 13B. Apothecia tan to pale brown (unless infected with *Abrothallus*); squamules XXX *C. peziziformis*
 - 13B. Apothecia dark brown; squamules XXX *C. sobolescens*

13. Podetia UV+ white (squamic acid present), P- or P+ yellow (fumarprotocetraric acid absent).
14. Podetia P+ yellow (baeomycesic and/or barbatic acid present)
..... *C. beaumontii*
14. Podetia P- (squamic acid only) *C. squamosa*
12. Podetia mostly lacking squamules.
15. Podetia and squamules K+ yellow turning red (norstictic acid present)
..... *C. polycarpoides*
15. Podetia and squamules K- or K+ 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 mostly flesh colored to tan;
squamules <2 mm
long..... *C. pezizifera*
19. Apothecia dark brown; squamules large,
mostly >2 mm long..... *C. subcariosa*
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* flora. [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.) Vainio

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 prevalingly corticate and frequently has cups terminating the podetia, while *C. beaumontii* is decorticate, with acicular podetia tips. [baeomycesic & squamatic acids, \pm 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.) Sprengel**

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.) Sprengel**

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) Sprengel**

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, \pm 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, \pm atranorin, \pm 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) Vainio

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 (Hudson) Schrader

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, \pm 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, \pm bellidiflorin, \pm didymic acid]

Cladonia macilenta Hoffm. var. **bacillaris** (Ach.) Schaerer

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, \pm 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, \pm barbatic acid, \pm 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]

The pale bluish podetia with small, imbricated squamules are distinctive. A form with consistently dwarfed podetia < mm tall occurs occasionally, often in shaded clayey soil among mosses; this was formerly called *Cladonia capitata* (Michaux) Sprengel f. *abbreviata* (Vainio) Evans. 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) Schaerer

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. [= *Cladonia subcariosa*]

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. [= *Cadonia subcariosa*]

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 Schaerer

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, \pm 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) states 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. [= *Cladonia subcariosa*]

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 cf. subradiata (Vainio) 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 (Abbeyes) Mattick [= *Cladina subtenuis* (Abbeyes) 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. Rarely this species lacks usnic acid and appears dull grayish without yellow-green tones; this chemotype has been called *f. cinerascens* Abbeyes. [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. Ozark material is referable to ssp. *uncialis*. [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.

Pachyphysis ozarkana R.C. Harris & Ladd (treated later in text) will key here; it has smaller apothecia with brownish tones, with a distinctly purple upper hymenium, K+ violet and warted ascospores.

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 chondrodes (A. Massal.) Clauzade & Cl. Roux

Known only from dolomite in a ravine on a massive glade complex in Ozark County, Missouri.

Clauzadea metzleri (Körber) Clauzade & Cl. 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: Arvidsson (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*.

COENOGONIUM Ehrenb. (Coenogoniaceae)

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; 1 species 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 which sometimes becomes 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; 16 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 wide, 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. Apothecial disks epruinose *C. pulchellum*
 4. Apothecial disks ± densely pruinose *C. pulchellum* var. *leucopelium*
 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 ridged and pustulate; 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 subcuboid.
 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 lacking on lower surface of thallus.....*C. bachmanianum*
15. Thallus brown, suberect; apothecia ≤ 0.3 mm broad, immersed; scattered clusters of white hapters on lower surface of thallus
..... *C. pustulatum*
- t 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-separated, ± sessile*C. texanum*

Collema bachmanianum (Fink) Degel. [= *Enchylium bachmanianum*]

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. This species is very similar to *C. tenax*, except for notably crenulate thalline margins of the apothecia.

Collema coccophorum Tuck. [= *Enchylium coccophorum*]

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. [= *Enchylium conglomeratum*]

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 milligranum*. The vast majority of Ozark material has 1-septate ascospores and is referable to the typical variety. Forms with 3-septate ascospores have been reported from the Ozarks (*i.e.* Hale 1957) as *C. conglomeratum* var. *crassiusculum* (Malme) Degel.

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 [= *Lathagyrum fuscovirens*]

Known only from a specimen from Union County, Illinois, as cited by Degelius (1974).

Collema nigrescens (Hudson) 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 occultulatum Bagl. [= *Rostania occultulata*]

Known only from *Acer saccharum* in a woodland in Crawford County, Arkansas.

Collema polycarpon Hoffm. [= *Enchylium polycarpon*]

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 a mossy sandstone 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. [= *Enchylium tenax*]

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* Hoffm. should be referred here; all Missouri and Arkansas 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, \pm immersed in thalline tissue and appearing perithecioid; asci with a thickened apex, with 8 extremely long, acicular 25+ septate spores with squarish to \pm 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*.

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 & Wulf.) Sarc. & 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, \pm immersed, with short-bacilliform conidia; 1 species 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*, is one of the visual pleasures of old farmsteads in rural regions of the Ozarks.

CYSTOCOLEUS Thwaites (1849) Capnodiales: family unknown

Minute black filamentous lichens consisting of undulate-walled hyphae closely enveloping filaments of *Trentepohlia*; known only in sterile condition throughout its range; conidiomata unknown; a monotypic genus that occurs in the Ozarks.

Cystocoleus ebeneus (Dillwyn) Thwaites

Loose, tangled tufts of filiform, remotely branched, lustrous, black to dark brown filaments 12-20 μm in diameter, the filaments to 2 mm long, with the branches emerging at nearly right angles; 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; the filaments consisting of *Trentepohlia* closely enveloped by elongate hyphal cells ca. $15 \times 4 \mu\text{m}$, with thick, undulate cell walls.

Chemistry: no lichen substances

Local but widely distributed throughout the Ozarks; restricted to sheltered faces of massive siliceous rock formations, in lightly to moderately shaded mesic microhabitats protected from direct wetting or runoff, such as under overhangs and in shelter bluffs. Most occurrences are on sandstone, but also known from granite and rhyolite; typically occurring as scattered patches of small tufts which sometimes coalesce.

Under low magnification, the filaments appear straight, with a distinctive wiry appearance.

Similar taxa:

- *Spilonema* - filaments with irregular margins, <0.3 mm long, with abundant ascending branches; photobiont *Stigonema*; on exposed, typically horizontal, rock surfaces
 - free-living filamentous cyanobacteria in the family Oscillatoriaceae *s.l.* are frequent in moist shaded habitats in the Ozarks; the filaments tend to be shinier and darker, with fewer to no branches, no hypothallus, and are not closely associated with fungal hyphae; in section, the filaments typically have a translucent yellow-brown sheath.
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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 intricatum (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 \pm cylindrical aggregation of cells, rhizinomorphs dark brown to black *D. moulinsii*
 3. Tomentum present, composed of moniliform rhizohyphae, tomentum 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 \times 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 \times

| | |
|--|--|
| (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 | |
| | <i>D. muhlenbergii</i> |
| 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 | |
| | <i>D. muhlenbergii</i> |
| 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..... | <i>D. arenosaxi</i> |
| 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 | <i>D. luridum</i> |
| 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 | |
| | <i>D. luridum</i> var. <i>xerophilum</i> |
| 8. Spores mostly shorter than 15 µm; on acidic or calcareous rock | 10 |
| 10. Substrate known | 11 |
| 11. On calcareous rock, usually dolomite | <i>D. multifolium</i> |
| 11. On acidic rock, usually sandstone | <i>D. arenosaxi</i> |
| 10. Substrate unknown | 13 |
| 13. Thallus distinctly cushion-like with erect to sub-erect lobes or thallus mat-forming with elongate ribbon-like lobes | |
| | <i>D. arenosaxi</i> |
| 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 | <i>D. arenosaxi</i> |
| 14. Thallus not dark-brown to brown black but brown to light brown or greyish brown | 15 |
| 15. Lobes with a conspicuous, usually slightly raised, brown margin; lower surface mostly smooth, or slightly foveolate | |
| | <i>D. multifolium</i> |
| 15. Lobes without conspicuous, raised brown margin; lower surface smooth, wrinkled or foveolate | <i>D. arenosaxi</i> |

Dermatocarpon arenosaxi Amtoft

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

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**

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 hydrophilous.

***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 \pm 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.

A recently described lichenicolous fungus, *Toninia tecta* C.A. Morse & Ladd, produces small, dark brown to black apothecia on the undersides of *Dermatocarpon muhlenbergii* thalli in exposed xeric sites; it has a reddish hypothecia and (0-2)3-septate ascospores.

Dermatocarpon multifolium Amtoft

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 ≤ 1 cm 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 grey to grey-brown. In the field, damp thalli often appear two-toned. The perithecia are mostly globose-pyriform, (182-) 289 - 484 $\mu\text{m} \times$ (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 tomentosum Amtoft

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. tomentosum*. It appears to be locally rare where present. *Dermatocarpon tomentosum* 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, \pm 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.

DICTYOCATENULATA XXX

XXX (monotypic genus??). Reference: Seifert et al. (1987).

Dictyocatenulata alba Finley & E.F. Morris

Thallus

Chemistry: XXX

Umcommon XXX, but possibly overlooked; growing on shaded bases of hardwoods in mesic to wet sites, typically visible only upon close inspection, and appearing as scattered tiny white spots among bryophytes. Ozark substrates include *Fagus grandifolia* and *Quercus alba* XXX.

In North America, this is an eastern species, and the Ozark populations are the western range limit.

Similar taxa: *Xyleborus sporodochifer* appears similar, with larger sporodochia that resemble the synnemata of *Dictyocatenulata*, but *Xyleborus* is restricted to weathered lignin of fallen hardwood logs in more xeric habitats, and the conidiospores are simple.

DIMELAENA Norman (Caliciaceae)

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, \pm 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 [= *Coenogonium luteum*]

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 μ m long.

Dimerella pineti (Ach.) V_nda [= *Coenogonium pineti*]

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 (Graphidaceae)

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]

DIPLATOMMA Flotow

Diplotomma venustum (Körber) Körber (= *Buellia venusta* (Körber) Lettau)

Rare, a single Kansas collection on limestone outcrop in oak-hickory woods. The Ozark collection is at the easternmost edge of the range shown by Nordin (2000). Sequence data supports 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 species 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. (Caliciaceae)

Small, narrow-lobed foliose lichens with a pale gray, K+ 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. (1789) Verrucariaceae

Small brownish to greyish squamules or rimose crusts; rhizines lacking (minute rhizohyphae present in squamulose taxa); photobiont *Stichococcus*; small photobiont cells (2.5-4 µm) abundant in hymenium; perithecia laminal, immersed, dark-walled, with a paler ostiole; asci thick-walled, *Verrucaria* type, with 2 or 8 muriform, pale to brownish ascospores; paraphyses absent; pycnidia immersed, with bacilliform conidia; 3 species in the Ozarks. References: Breuß in Nash (2002), Lendemer (2007). In our region, only *Endocarpon* and *Staurothele* have hymenial photobiont.

1. Thallus continuous, rimose to areolate; spores 8/ascus*E. diffractellum*
2. Thallus squamulose, the squamules separate to aggregated; spores 2/ascus.

2. Squamules grey to tan or brown, usually with well-developed sublobes, typically imbricate to aggregated
 *E. pallidulum*
2. Squamules dark brown to tan, entire to incised or short lobate, separate to aggregated, but not imbricate
 *E. petrolepideum*

Endocarpon diffractellum (Nyl.) Gueidon & Cl. Roux [formerly *Staurothele diffractella*]

Brown to greyish brown polygonally rimose crust, remaining brownish when wet, upper surface smooth and flat, the areoles 0.5-0.7 mm broad, the walls of the cracks becoming black; with a single black-walled perithecium per areole; ascospores 8, to 24 X 12 µm.

Chemistry: no lichen substances

Frequent on lightly shaded dolomite and limestone throughout the Ozarks. This species also occurs on shaded siliceous rocks, including chert, sandstone, and rhyolite, along streams and in other mesic sites.

This taxon was long known as *Staurothele diffractella* (Nyl.) Tuck., but recent work (Gueidon et al. 2007) supports transfer to *Endocarpon*. Lendemer et al. (2013) discuss *E. tenuissimum* (Degel.) Lendemer & E. Tripp., a similar taxon with larger spores and a smaller darker thallus that occurs on acidic rocks in the southern Appalachians, but all Ozark material from siliceous rocks is indistinguishable from typical *E. diffractella* in terms of thallus and ascospore characteristics.

Similar taxa:

- *Verrucaria* - simple ascospores, no hymenial photobiont; areoles of *Endocarpon diffractellum* are smoother and flatter, and the thallus cracks tend to be more angular.

Endocarpon pallidulum (Nyl.) Nyl.

Small, typically somewhat imbricate, pale gray to tan or brown (green when wet) lobate squamules to 1.4 (2.6) mm broad, in well-developed squamules the lobes multiple and sometimes at least as long as broad; individual squamules confluent and difficult to distinguish; squamules centrally attached with +/- free margins; squamules with 1-few dark perithecia; ascospores 2, muriform, pale to ultimately brownish, 25-35 µm long.

Chemistry: no lichen substances

Common, although seldom abundant, on exposed to lightly shaded rocks, tree bases, and occasionally on downed logs throughout the Ozarks. This taxon typically grows on exposed to lightly shaded calcareous substrates of all sizes, including limestone, dolomite, and concrete. It occasionally occurs on siliceous rocks such as sandstone and chert, as well as on shaded tree bases and uncommonly on downed decorticate logs. It is common in urban and suburban environments, including downtown St. Louis, growing on concrete and limestone, where *Caloplaca feracissima*, *C. subsoluta*, and *Lecanora dispersa* are typical associates. This species also occurs on periodically flooded limestone rip-rap along the Mississippi and Missouri rivers.

Distinguishing immature or poorly developed material from *E. petrolepideum* can be difficult. *Endocarpon pallidulum* is typically paler in color, with larger, more aggregated thalli and well-developed lobes on the larger squamules, but poorly developed specimens may be smaller, darker, more dispersed, and less lobate. Previous Ozark reports of *E. pusillum* Hedw. are probably referable here; *E. pusillum* is a rhizinate species of arid soils unknown from the region.

Similar taxa:

- *Placidium* - larger squamules, no hymenial photobiont, simple ascospores, often terricolous
- *Lecidea lurida* - apotheciate, squamules often larger, upper surface sublustrous, lobes suberect, often with a thin dark margin

Endocarpon petrolepideum (Nyl.) Nyl.

Small rounded squamules typically 0.2-0.6 (1) mm broad that are solitary to closely adjacent, but not significantly imbricate, dark brown to tan (green when wet); squamules entire to shallowly incised or with one to few short, poorly developed lobes that are no longer than broad, squamules tightly adnate to the substrate; squamules with 1 (-few) dark perithecia; ascospores 2, muriform, pale to ultimately brownish, 25-35 µm long.

Chemistry: no lichen substances

Occasional on limestone, dolomite, old concrete, and occasionally on siliceous rocks throughout the Ozarks. in both exposed and lightly shaded situations; often on small pebbles or rock fragments. This species occasionally occurs with *E. pallidulum*. It is interesting that, while *E. pallidulum* occurs on corticolous and lignicolous substrates with some regularity, *E. petrolepideum* is known only from saxicolous substrates in the Ozarks. *Endocarpon petrolepideum* has a tendency to have a single perithecium on most squamules, whereas well-developed squamules of *E. pallidulum* typically have several perithecia per squamule.

The degree of adnation appears to be substrate dependent, and populations on friable substrates often appear loosely adnate to centrally attached.

Similar taxa:

- Placidiopsis minor* - grey squamules, simple ascospores, on exposed acidic rocks

Small brown areolate to squamulose lichens; photobiont *Stichococcus*, the photobiont 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 tree bases. 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 (Leighton) A. Massal.

Rare on lightly shaded rock outcrops at a few scattered locations in Arkansas and Missouri.

EOPYRENULA R.C. Harris (Pezizomycotina *insertae sedis*)

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 Coppins

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 to pale brown.

EPIGLOEA Zukal (1890) Epigloeaceae

Scattered perithecia on algal films, typically growing over bryophytes; thallus not apparent; photobiont cf. *Coccomyxa* on/associated with Chlorophycean algae; perithecia subimmersed, dark; asci narrowly clavate, the ascus wall IKI+ blue throughout, with 32 1-septate spores; pycnidia black, with ± ellipsoid conidia; 1 species in the Ozarks. Reference: Buck & Harris (2002).

[illustrations needed: macro shot; microshot of perithecial XS w/spores]

Epigloea pleispora Döbbeler

Virtually invisible when dry; when wet appearing as scattered, tiny, rounded, dark, subimmersed perithecia on a dark green to grayish green slimy algal film; perithecia ca. 100 (150) µm diameter, dark green to blackish above, becoming pale below; asci 32-spored; ascospores 1-septate, 6-9 × 2-3 µm; pycnidia unknown in Ozark material.

Chemistry: no lichen substances

Uncommon, but difficult to detect and undoubtedly overlooked; on moist algal mats overgrowing bryophytes (*Aulacomnium*, *Fissidens*, *Dicranum*, *Leucobryum*) in exposed to lightly shaded habitats such as at the edges of thickets and along glade margins; often in intermittently seepy areas. Known from four sites in the Missouri Ozarks - two in southwestern Missouri, and two in eastern Missouri.

The ascomata of European species are reported to be short-lived and mostly vernal. The exact nature of the fungal/algal association is unknown, and this species is sometimes considered to be an algal parasite. Unless the algae is wet, this taxon is almost invisible.

Similar taxa:

- terrestrial algal films are common on bryophytes and humus in seasonally or intermittently wet areas in the Ozarks,

and careful inspection must be made to determine whether small dark orts are actually the perithecia of *Epigloea*, or merely miscellaneous debris

EVERNIA Ach. (1810) Parmeliaceae

Yellow-green fruticose lichens, with lax, \pm soft branches; cortex often ridged; photobiont chlorococcoid (*Trebouxia*?); apothecia rare, stipitate, with a thalline margin and brownish disk; asci *Lecanora*-type, with 8 simple, ellipsoid spores; pycnidia rare, dark, immersed; conidia acicular; 1 species in the Ozarks.

Evernia mesomorpha Nyl.

Thallus tufted, soft, lax to suberect, to 2 cm in Ozark material (but typically larger elsewhere), cortex with bumpy ridges and channels, angular, irregularly branched from a central holdfast, dull yellowish green with paler yellowish zones; main branches angular to slightly flattened, 2 mm thick; dividing into a series of progressively smaller and narrower branches; soredia abundant, developing on ridges and bumps along the branches, coarse, initially partially corticate, granular; apothecia and pycnidia unknown in Ozark material.

Chemistry: divaricatic & usnic acids

Known only from Rockwoods Conservation Area in St. Louis County, Missouri, growing on exposed dead limbs of *Gleditsia triacanthos* in an open secondary woodland, where it was discovered by David Bruns in 1999. This taxon may be a recent introduction in the Ozarks; Brodo (2001) mapped the nearest location in extreme northern Illinois, and Wilhelm (1995) noted that most or all populations in the Chicago region are probably introduced.

Similar taxa:

Usnea: firmer, terete filaments with a central cord, often abundantly branched and fibrillose

Ramalina: flattened, firm to brittle thallus branches with a distinct upper and lower cortex and scant medullary tissue

FELLHANERA Vězda (1986) Pilocarpaceae

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.

The \pm 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 μ m vs. 3.5-4.5(-5) μ m) 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* R.C. Harris & Lendemer**

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* R.C. Harris & Lendemer]

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 x 3.5-5 µm. Conidia fusiform, 4.5-5 x 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. There is a record from Illinois just outside the Ozark ecoregion (Saline County, *Buck 35950*), and it could well occur in our area.

Fellhanera minnisinkorum R.C. Harris & Lendemer

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 \pm colorless. Hymenium tinted orangish brown, KOH-. Hypothecium brown, with darker masses between hyphae, KOH-. Ascospores ca. $17 \times 4.5 \mu\text{m}$. Conidia not found ($3.5\text{-}5 \times 1.5\text{-}2 \mu\text{m}$ in extra-Ozark material). [no lichen substances?, not tested] μ

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. 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 \pm 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. $11\text{-}12 \times 4\text{-}4.5 \mu\text{m}$. Pycnidia blackish, semi-immersed, globose, ca. $100 \mu\text{m}$ across. Conidia rod-shaped or weakly constricted in middle, $5.5\text{-}7 \times 1.5\text{-}2 \mu\text{m}$. [no lichen substances]

Known from only a single collection on bole of *Carya* from St. Francois County, Missouri.

Among corticolous taxa *F. _missouriensis_* is \pm 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

Thallus on silicate rock, gray-green, olive-green or greenish brown, superficial, thin ($80\text{-}100 \mu\text{m}$), 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. $150 \mu\text{m}$ thick), constricted to weakly constricted at base, $0.4\text{-}0.5 \text{ mm}$ 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 ($2\text{-}4 \mu\text{m}$ 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, $12-14 \times 4-5 \mu\text{m}$. Conidia bacilliform to sublageniform, $5-6 \times 1.5 \mu\text{m}$. (*Buck 31800* has larger pycnidia, opening more broadly and larger bacilliform conidia, $5-9 \times 2-2.5 \mu\text{m}$, 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. Eriks. (Verrucariaceae)

Sterile squamulose lichens with dull, gray-green, suberect, lobate-branched thalli; lobes to 2 mm long and 0.3 mm broad, typically $40-60 \mu\text{m}$ thick, undifferentiated; photobiont chlorococcoid, the closely packed algal cells $7-10 \mu\text{m}$ 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. Eriks.

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.

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* (Gyelnik & F6riss.) 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 very rare, laminal, sessile, the disks brown, plane, with a well-developed thalline margin which is usually densely beset with isidioid pustules; 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, $5-7 \times 1-1.1 \mu\text{m}$. [atranorin, protocetraric & usnic acids, \pm 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 adiastrata*. *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 (1996) 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 (Hooker 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 that forms 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 & V_zda (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. recens*a
- 1. Thallus corticolous; apothecia brown.....*F.* sp #1

Fuscidea recensa (Stirton) Hertel, V. Wirth & V_zda

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.

Known only from Shannon County, Missouri, on hardwood twigs. [unknown substance with R_f value above norstictic acid]

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 \pm plane; perispore without conspicuous attenuate apices *F. leucophaea*

Fuscopannaria leucophaea (Vahl) M. Jørg. [= *Vahliella leucophaea*]

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 apothecia, 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 Adanson (1763) Graphidaceae

Crustose corticolous lichens with pale, thin, continuous thalli; photobiont *Trentepohlia*; apothecia lirelliform, black, somewhat carbonized; exciple opaque dark brown; epihymenium brown; hymenium and asci IKI-; paraphyses unbranched closely parallel, ca. 2 μ m broad, with expanded pigmented apical cells to 5 μ m broad; hypothecium pale to pale yellowish brown; asci splitting apically; ascospores 8, 3+ septate, the lumina lenticular (initially so in *G. sophisticascens*, before development of transverse septae), mature ascospores IKI+ pale violet; pycnidia rare, immersed, not seen in Ozark material; conidiospores bacilliform; 2 species in the Ozarks. References: Morse and Ladd (2015), Staiger (2002).

- . Ascospores with transverse septae only, elongate, ≥ 25 μ m long ; common on a variety of trees *G. scripta*
1. Ascospores muriform, bluntly quadrate, to 23 μ m long; rare and restricted to *Betula nigra* *G. sophisticascens*

Similar taxa:

-*Opegrapha* has similar field appearance and photobiont, but the hymenium is IKI+ orange or blue, with branched paraphyses, and the ascospores have cylindrical lumina.

-several non-lichenized fungi formerly lumped in Hysteriaceae s.l. (*Gloniopsis*, *Hysterium*, *Hysterobrevium*) have black lirellae and frequently occur with *Graphis* taxa in the Ozarks; they differ in their lack of apparent thallus, brown ascospores, and the tendency of their lirellae to be more closely aggregated and aligned. Sometimes these fungi can appear lichenized because of the presence of free-living chlorococcoid terrestrial algae in these habitats.

***Graphis scripta* (L.) Ach.**

Thallus whitish to pale grey or pale greenish grey; lirellae common, initially immersed, straight to variously curved, simple, few-branched, or irregularly stellate, typically to 2 mm long, but occasionally to 10 mm, ca. 0.15 (0.25) mm wide, with lustrous, rounded, non-striate black labia elevated above the disks; disks dark, usually exposed as narrow flat slits, usually covered with fine white pruina; ascospores \pm cylindrical, 5-10+ septate, mostly $25\text{--}50 \times 6\text{--}10 \mu\text{m}$.

Chemistry: no lichen substances

Common and locally abundant in woodlands throughout the Ozarks, with a preference for lightly shaded, smooth, hard bark on lower and mid boles and older branches of trees such as *Acer*, *Amelanchier*, *Carpinus*, *Carya*, and *Quercus* section *Erythrobalanus* (red oaks). This species is especially common in mesic sites such as along streams, in wooded valleys, and on lower slopes below large bluffs, but it also occurs in drier upland woods.

The apothecial disks are usually white pruinose and visible as pruinose slits, but sometimes the labia of the lirellae are closely appressed and obscure the disks. On fast-growing substrates, the lirellae are sometimes in parallel alignment following the circumference of the expanding branch or bole. The overall appearance of well-developed fertile thalli convincingly validates one common name for the species: Fairy Script Lichen.

***Graphis sophisticascens* (Nyl.) Zahlbr.**

Thallus pale grey to greenish grey; areas of thin white prothallus ca. 0.2 mm wide occasionally present; lirellae common, initially immersed, straight to variously curved, to 0.8 (1.7) mm long and ca. 0.15 mm wide, simple or with a short branch; disk mostly exposed as a narrow flat slit, but often with a portion more broadly exposed (to 0.9 mm broad), covered with fine white pruina; ascospores bluntly quadrate to rotund, $17\text{--}23 \times 8.5\text{--}12.5 \mu\text{m}$, initially with 3-5 lenticular cells, these mostly becoming longitudinally once-divided into rounded cells; pycnidia not seen in Ozark material.

Chemistry: no lichen substances

Rare on mid and lower boles of *Betula nigra* in moist woodlands, typically along streams, from a few scattered sites through the Ozarks, on substrates that are not or rarely flooded. This species usually occurs in high quality habitats with *Betula nigra* populations that include large, older trees. It is never abundant or found on many trees within a stand. Morse and Ladd (2016) discuss the history and distribution of this unusual species, which is currently known only from a dozen sites in the Ozarks and adjacent ecoregions to the north and west.

Graphis scripta also occurs rarely on *Betula nigra* and examination of the ascospores is necessary for positive identification. Although the difference is subtle, *G. scripta* tends to have longer lirellae with more prominent, slightly broader, labia, with larger portions of the disks more broadly exposed. A non-lichenized fungus with black lirelliform ascoma, *Hysterium angustatum* Pers., is abundant on *Betula nigra* bark throughout the region, sometimes even occurring on planted trees in landscaped

gardens. It is a constant associate of *G. sophisticascens* from which it differs in its lack of discernable thallus and brown, thin-walled, 4-celled ascospores.

GYALECTA Ach. (Gyalectaceae)

Crustose 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 saxicolous.
 - 2. Thallus greenish to grayish, apothecia pale; paraphyses lacking carotenoids.
 - 3. Thallus olive green; apothecia superficial, some > 0.5 mm broad *G. jenensis*
 - 3. Thallus gray to greenish gray; apothecia immersed in pits in the rock, < 0.4 mm broad.....
..... *G. farlowii*
 - 2. Thallus and apothecia orange; paraphyses with gold to orange carotenoid droplets..... *G. sp #1*
- 1. Thallus corticolous *G. obesispora*

Gyalecta farlowii Nyl. [= *Petractis farlowii*]

Frequent on shaded carbonate rocks, growing on both dolomite and limestone, and often in moist habitats, such as on lower bluff faces. This species has been called *Petractis farlowii* (Tuck. ex Nyl.) V_zda..

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 obesispora R.C. Harris & Lendemer

Rare on exposed to lightly shaded *Juniperus virginiana* in the extreme southern Ozarks, becoming more common westwards in the southern Great Plains.

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 V_zda (Gomphillaceae)

Tiny, very inconspicuous, saxicolous or terricolous crustose lichens with thin, smooth gray green thallus, photobiont chlorococcoid; 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 µmS.

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 chlorococcoid photobiont. It seems to belong in the *G. lecideopsis* complex but the ascospore size is not a good match for any described species.

GYALIDEOPSIS V_zda (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; 3 species in the Ozarks. Reference: Lücking et al. (2007).

- 1. Hyphophores black, acicular or with a narrowly expanded, lacerate apex, >1 mm tall; on hardwood twigs *G. buckii*
- 1. Hyphophores brown to black, short and blunt, <1 mm tall; on conifer wood, mosses, humus or dead vascular litter.
 - 2. Hyphophores >0.5 mm tall; on mosses, humus, or dead vascular litter *G. moodyea*
 - 2. Hyphophores to 0.5 mm tall; on decorticate wood of *Juniperus* and *Pinus* *G. ozarkensis*

Gyalideopsis buckii Lücking, Sérus. & V_zda

Uncommon on upper canopy twigs of hardwoods, especially *Quercus*; typically in extensive, mature woodlands.

Gyalideopsis moodyae Lendemer & Lücking

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.

Gyalideopsis ozarkensis Lücking, Buck & R.C. Harris

Very rare; known only from a few widely scattered localities across the Ozarks in extreme southern Missouri and Arkansas, growing on exposed decorticate twigs and branches of *Juniperus* and *Pinus*, typically in slight shade on open woodlands, glade edges, and bluffs. Apothecia are unknown in this species.

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. Mayrhofer (Leprocaulaceae)

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*
- . 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 Nägeli (Lichinaceae)

Brown squamulose terricolous lichens with closely adnate thalli; photobiont *Scytonema*; apothecia immersed; asci IKI-, with 8 hyaline, ellipsoid, simple spores; pycnidia immersed, with bacilliform to fusiform conidia; 1 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 occular 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 prevailingly yellow to orange, fibrous or cottony 5
 5. Medulla K+ yellow → red (norstictic acid); lower surface darkening to purplish black towards center, K- *H. casarettiana*
 5. Medulla k- or persistently K+ yellow (norstictic acid absent); lower surface persistently yellow to orangish throughout, K+ purplish *H. obscurata*
 4. Lower surface white to tan, appearing corticate.
 6. Medulla K+ yellow (atranorin); soralia strongly labriform and concentrated on lobe tips
..... *H. speciosa*
 6. Medulla K+ 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 that extend around the lobe tips and sometimes become 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 up to 2 mm broad, laminal, with plane brown disks and well developed thalline margins with projecting, \pm 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 shaded, mossy, siliceous rocks, especially sandstone, in somewhat mesic habitats. All of the Ozark material contains norstictic acid, although this substance is absent in some populations outside of the Ozarks. [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 that is corticate internally and extends up 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 can appear soralia-like. The isidia can become partially ecorticate and appear coarsely sorediate. In addition to the isidia, the thallus can also become lobulate. Lower surface corticate, lustrous, initially pale but becoming tan, with scattered slender brown rhizines that become 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, \pm 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, prevailing marginal rhizines that become abundantly branched. Apothecia common, laminal, sessile, basally constricted, with a tall-rimmed, internally ecorticate thalline margin that extends to 1 mm above the apothecial disk and is 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 fenestrated in age. Rhizines prevailing 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 have a tendency 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 lower 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 og 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. (1894) Physciaceae

Small greenish or brownish grey to brown foliose lichens with thin, narrow lobes closely confluent to and appearing to flow over and difficult to separate from the substrate, lobes tightly adjacent, usually <0.5 mm broad; lower surface poorly differentiated, pale, sometimes darkening towards central portions of thallus, indistinctly prosoplectenchymatous; rarely with short, ecorticate, rhizine-like projections; photobiont *Trebouxia*; apothecia sessile, to 1.3 mm broad, with a well-developed thalline margin forming an elevated rim above the plane to shallowly convex dark brown disk; epithecium brown, hymenium I+ blue, hypothecium pale, paraphyses slender, to 1.5 µm broad, simple to sparingly branched, with expanded, brown-tipped apical cells to 3 µm broad; asci *Lecanora*-type, with 8 ellipsoid, brown, 1-septate, thick-walled spores typically 13-18 ×6.5-8.5 µm, with rounded to angular lumina about 4 µm broad; pycnidia laminal, immersed, with protruding dark brown apices ca. 0.05 mm broad; conidiospores filiform, straight to curved, (10) 15-24 ×≤1 µm long; 3 species in the Ozarks. Reference: Esslinger at al. (2012).

- 1. Thallus esorediate; apothecia common.....*H. syncolla*
- 1. Thallus sorediate; apothecia rare.
 - 2. Soredia laminal, irregular to rounded, ±excavate; common.....*H. adglutinata*
 - 2. Soredia prevailingly marginal, often elongated, convex; uncommon, mostly in western Ozarks

Hyperphyscia adglutinata (Flörke) H. Mayrhofer & Poelt

Small, irregular thalli; lobes closely adjacent to slightly overlapping, 0.2-0.3 (0.4) mm broad, with erose to apically expanded tips to 0.8 mm broad; soralia rounded or somewhat elongate, to 0.2 × 0.4 mm, ± erose, prevailingly laminal, sometimes extending to margins; apothecia and pycnidia rare.

Chemistry: no lichen substances

Occasional on a wide variety of hardwoods and occasionally on conifers throughout the region, in relatively high light intensities, often in disturbed sites or along habitat edges.

Parasites: Immediately west of the Ozarks, as close as adjacent Jackson County, Missouri, *Hyperphyscia adglutinata* is sometimes parasitized by an *Opegrapha* which develops irregularly rounded black ascoma on the surface of the host thallus, with 4-spored asci and 3-5-celled ascospores 18.5-23 × 4-6 µm.

Similar taxa:

- *Phaeophyscia insignis* can appear similar, and has similar coloration of the underside when young, but the lower cortex is paraplechtenchymatous, and the thallus lobes are slightly thicker, less confluent, and more easily separable from the substrate, with more uniformly rounded soralia. If pycnidia are present, it is easily distinguished by the ellipsoid conidiospores.

-Very young thalli of *Physciella chloantha* can be closely appressed; they are less adnate to the substrate and have at least a few well-developed whizines, as well as ellipsoid conidiospores if pycnidia are present.

Hyperphyscia confusa Essl., C.A. Morse & S. Leavitt

Thallus resembling the previous species, but often appearing slightly thicker, the lobe tips sometimes less appressed to the substrate; soralia prevailingly marginal, irregular to elongate or weakly labriform, sometimes extending onto the thallus surface; apothecia uncommon; pycnidia occasional..

Chemistry: no lichen substances

Rare; known from exposed boles of *Quercus palustris* and decorticate logs in the western Ozarks, usually in regions where tallgrass prairie was a significant component of the local vegetation. This is primarily a Great Plains species of the grassland ecoregions west of the Ozarks.

Similar taxa:

-See discussion under *H. adglutinata* above.

Hyperphyscia syncolla (Tuck. ex Nyl.) Kalb

Thallus typically forming continuous round patches to 5 cm diameter, becoming dark grey to blackish in extremely exposed situations; lobes closely adjacent, 0.2 (0.3-0.4 (0.5) mm broad, abundantly branched, especially towards the apices, the tips to 1.6 mm broad; lower surface occasionally with widely scattered rhizine-line projections to 0.1 mm long; apothecia common, pycnidia typically abundant.

Chemistry: no lichen substances

Common and locally abundant throughout the Ozarks, especially on lightly shaded branches of hardwoods in floodplains and along streambanks, as well as on branches and boles of hardwoods of young secondary woodlands in old fields and low clearings; *Celtis* and *Ulmus* are common substrates. The thin dark grey to brownish thallus is confluent with the bark surface and is easily overlooked. This species also occurs on conifers and rarely on rocks and even old shaded bricks.

Similar taxa:

- A species that often occurs with *H. syncolla*, *Phaeophyscia ciliata*, has similar thallus color and pattern and frequency of apothecia and pycnidia, but the thallus lobes are thicker and slightly wider, with well-developed rhizines and a black, paraplechtenchymatous lower cortex.
- some corticolous taxa of *Rinodina* can appear similar, but have even thinner, less distinctly foliose thalli that are sometimes isidiate.

HYPOCENOMYCE M. Choisy (Ophioparmaceae)

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. [= *Carbonicola anthracophila*]

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. [= *Xylopsora friesii*]

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 (Vainio) Hale (Parmeliaceae)

Pale gray foliose lichens with moderate lobe widths and squarish, truncate lobe tips that are not much expanded; lower surface corticate, black with a narrow brown marginal zone, lustrous, with dichotomously branched rhizines which become 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; 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 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 notable 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 taxa

of 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, prevailing simple rhizines, and usually a few short axillary cilia, as opposed to the narrower, squarish lobes, UV+ bluish white medulla, dichotomously branched rhizines, and complete absence of marginal cilia in *Hypotrachyna*.

IMSHAUGIA S.F. Meyer (Parmeliaceae)

Narrow-lobed pale gray foliose lichens, our 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, prevailing 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.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 μ m. [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 occasionally 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 (Trypetheliaceae)

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 (A. Massal.) Coppins

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*.

KEPHARTIA R.C. Harris & Lendemer (2013) Lecideaceae

Crustose saxicolous lichens with gray, immersed thalli; apothecia black, to 0.5 mm broad; epithecium not apparent; upper hymenium infused with violet, K+ purple; hypothecium pale; asci clavate, with 8 ascospores or empty and often pigmented; ascospores ellipsoid minutely ornamented, to 11.5×7.5 μm ; pycnidia brown, immersed; conidiospores narrowly ellipsoid, to 5.5×1.7 μm ; 1 species in the Ozarks. Reference: Lendemer et al. (2013).

Kephartia spinadiaboli R.C. Harris & Lendemer

Worldwide, known only from two massive dolomite outcrops in the southern Ozarks in Arkansas.

KOZARUS (Porpidiaceae)

Saxicolous crustose lichens with a thick, pale grayish, \pm 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 monotypic.

Kozarus thelommopsis

Thallus to 200 μm thick, areolate, with broadly flattened marginal lobes, whitish to pale grayish, \pm 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-, HNO₃ + reddish; hymenium colorless or purple streaked above, IKI+ deep blue; hypothecium pale to yellowish brown; ascospores halonate, $12-16 \times 5.5-7.5$ μm ; pycnidia mostly pale, with a dark apex; conidia bacilliform, $6-7 \times 0.7$ 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. (Ramalinaceae)

Saxicolous crustose lichens with thin greenish to olive thalli; photobiont chlorococoid; 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 Auct. Amer.

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; 27 species in the Ozarks. References: Brodo (1984), Printzen (2001).

1. Saxicolous.

2. Thallus K-, 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.

5A. Medulla loose, appearing somewhat hollow; upper cortex in section appearing unevenly thickened.

5B. Gyrophoric acid present *L. gyrophorica*

5B. Gyrophoric acid absent *L. muralis*

5A. Medulla dense, appearing solid; upper cortex in section appearing evenly thickened

..... *Rhizoplaca opiconensis*

5. Thallus mostly covered with dense white pruina, on carbonate-rich substrates; zeorin and triterpenoids absent *L. valesiaca*

2. Thallus K+ 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. saxigenia*
 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. subimmersens*
 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, prothallus present or absent.
 12. Thallus K- (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. Thallus K+ yellow or red (atranorin present, sometimes with norstictic acid); usnic and isousnic acids absent.
 15. Sorediate, sterile.
 - 15A. Thallus appearing leprose, arising from individual soralia that coalesce; thin, lustrous, typically dark, marginal prothallus present.
 - 15B. Stictic acid present *L. layana*
 - 15B. Stictic acid absent *L. nothocaesiella*
 - 15A. Thallus, although often appearing entirely sorediate, consisting of initially corticate areoles, these extending to the thallus margin; marginal prothallus, if present, white and fibrous *L. appala*
 15. Without diaspores, fertile.
 16. Apothecia often >1.2 mm broad, disks pruinose; thallus or apothecia K+ 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 in K 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 interspersed 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 interspersed.
21. Margins of apothecia thick, white, ecorticate, and \pm 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* (Ach.) Nyl.**

Known only from one collection made by William Buck on *Carpinus caroliniana* in a mesic woodland in Oregon County, Missouri. [atranorin, \pm triterpenoids]

***Lecanora appalachensis* Lendemer & R.C. Harris**

Relatively common throughout the Ozarks, occurring on bark of hardwoods and *Juniperus*, particularly in disturbed or somewhat open sites, such as intensively grazed woodlands and along woodland edges bordering pastures. [atranorin & zeorin]

***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, \pm 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 dispersa* (Pers.) Sommerf. [= *Myriolecis dispersa*]**

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. Some populations are reported to have pannarin (P+ orange) in the apothecial margins.

Lecanora gyrophorica Lendemer [= *Protoparmeliopsis gyrophorica*]

Frequent in exposed glades, particularly in the western Ozarks; typically on chert fragments over dolomite or limestone exposures. There are no apparent ecological or morphological distinctions between this species and *L. muralis*, which is less common in the Ozarks. The chemotype with usnic acid and triterpenoids occurs in the western Ozarks. [gyrophoric acid, ±usnic acid & triterpenoids].

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 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 layana Lendemer

Rare, but recently described and perhaps overlooked, known from three widely scattered sites in the western and southern Ozarks, occurring on *Gleditsia* and *Quercus* in open woodlands. This species is morphologically identical to *L. nothocaesiella*. [atranorin, stictic acid, zeorin]

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. [= *Protoparmeliopsis muralis*]

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 obscures the thallus of *L. valesiaca*. Although *L. muralis* reportedly contains psoromic and usnic acids and sometimes fumarprotocetraric acid, Ozark material has usnic acid and triterpenoids. [usnic acid &

triterpenoids]

Lecanora nothocaesiella R.C. Harris & Lendemer

Common on boles of hardwoods in open woodlands and along woodland edges, often in sites with a history of disturbance, such as intensively grazed woodlands. This species appear to require high light intensities, and is not found in closed woodlands. See also *L. layana*. [atranorin & zeorin]

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, confluent 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 saxigena Lendemer & R.C. Harris

Uncommon on shaded siliceous rocks, usually sandstone; sometimes growing on massive bluff faces. The type of this variety is from Newton County, Arkansas. This taxon was formerly known as *Lecanora cinereofusca* H. Magn. var. *appalachensis* Brodo. [atranorin, pannarin, roccellic 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, \pm zeorin]

Lecanora subimmergens Vain.

Locally frequent on shaded sandstone and less commonly, 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

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, ± porphyritic 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 [= *Lecanora pallidochlorina*?]

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. (Lecideaceae)

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 *Xyleborus*
 - 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. Apothecial disks essentially concolorous with the rims; apices of paraphyses brownish and notably expanded *L. berengeriana*
 - 5. Apothecial disks initially brown, with distinct blackish raised margins; apices of paraphyses colorless and not notably expanded
 - *L. hypnorum*

- 1. Thallus saxicolous.

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*
6. Thallus of thick brown areoles; apothecia brown; on carbonate rocks *L. lurida*

Lecidea ahlesii (Hepp) Nyl. [= *Bryobilimbia ahlesii*]

Known from sandstone in and along small shaded intermittent streams in Franklin County Arkansas and Jackson County Illinois.

Lecidea berengeriana (A. Massal.) Nyl. [= *Mycobilimbia berengeriana*]

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 [= *Bryobilimbia hypnorum*]

Occasional on lightly shaded humus derived from *Juniperus* needles; known from scattered localities mostly in the eastern hlf of the region.

Lecidea lurida (Ach.) DC. [= *Romjularia lurida*]

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*.

LECIDELLA Körber (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 isoioid in *L. asema*).
 2. Thallus corticolous *L. euphorea*
 2. Thallus saxicolous.
 3. Apothecia remaining immersed *L. enterolucella*
 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. [xanthonenes]

Lecidella enterolucella (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. [xanthonenes, ± 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.

Lecidella scabra (Taylor) Hertel & Leuckert s. lat.
Known only from a sterile collection from the western Ozarks on Sequoyah County, Oklahoma. [atranorin (?), xanthone, zeorin]

Lecidella stigmathea (Ach.) Hertel & Leuckert
Uncommon at scattered locations, mostly in the southeastern half of the Ozarks. Although this species is considered to be a strong calciphile, most local populations occur on sandstone. [atranorin & zeorin]

LEMPHOLEMMA Körber (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. (1803) Stereocaulaceae

Sterile crustose lichens with a felty or powdery, leprose thallus lacking cortical development in all stages (sometimes developing a gelatinized pseudocortex), consisting entirely of an entirely superficial hyphal prothallus and granules of photobiont cells and enveloping hyphae - these are identical to soredia, but do not originate from a cortex; photobiont chlorococcoid; 12 or 13 species (one with two chemotypes) in the Ozarks. References: Knudsen et al. (2007), Lendemer (2010, 2011 - OP, 2013).

Included here are several taxa containing usnic acid that are not *Lepraria sensu strictu*, but are retained in

Lepraria pending further data. This key includes both spot tests (as much as possible) and chemistry. As discussed by Lendemer (2013), spot tests can produce inconsistent results in *Lepraria*, and TLC is required for definitive identification. Spot tests in this group are best done by extracting the thallus constituents onto filter paper with acetone, then applying the reagent. Two other leprose genera, each represented by a single species in the Ozarks, are included in the key for convenience. Lendemer (2011 - Lichenologist) discusses in detail thallus morphology and terminology for this genus.

1. Thallus KC+ yellow gold (usnic acid), often slightly yellowish green; P-; UV+ white or orangish, uncommonly UV- (barbatic acid or xanthones).
 2. Thallus UV+ white (barbatic acid)*L. barbatica*
 2. Thallus UV+ orange to dull orange, occasionally UV- (xanthones).
 3. Thiophaninic acid present; usually on calcareous rocks.....*L. disjuncta*
 3. Norlichexanthone present; on trees and siliceous rocks*L. xanthonica*
1. Thallus KC- or KC+ pinkish, red, or dull brownish yellow (usnic acid absent), sometimes yellowish but never yellowish green; P- or P+ yellow, orange or red; UV- or UV+ white (barbatic acid and xanthones absent).
 4. Thallus UV+ white to blue-white (divaricatic acid), KC- or KC+ pinkish (usnic acid lacking).
 5. Thallus thin and granular aggregated, mostly <0.1 mm thick, zeorin present; corticolous.....
.....*L. hodkinsoniana*
 5. Thallus thick and placodioid, 0.2-0.7 mm thick; zeorin absent; usually saxicolous, occasionally corticolous*L. cryophila*
 4. Thallus UV- (divaricatic acid absent).
 6. Thallus P- or P+ yellow (atranorin, pannaric acid complex, protocetraric acid & fumarprotocetraric acid lacking).
 7. Thallus KC+ red (alectorialic acid); on siliceous rocks *L. neglecta* chemotype 1
 7. Thallus KC- (usnic and alectorialic acids absent); substrate various.

8. Thallus KOH+ yellow (atranorin); zeorin present; usually corticolous, rarely saxicolous.
 9. Thallus thin, granular aggregate, to 0.1 mm thick, unstratified; substrate various but uncommon on conifers; widespread *L. caesiella*
 9. Thallus thick, placodioid, 0.2-0.4 mm thick, distinctly bilayered.; usually on conifers; confined to eastern Ozarks..... *L. harrisiana*
8. Thallus KOH- (atranorin absent); zeorin absent (other terpenes present); saxicolous or terricolous in crevices and underhangs of sheltered calcareous rocks..... *Botryolepraria lesdainii*
6. Thallus P+ orange or red (pannaric acid complex, or protocetraric and/or fumarprotocetraric acids).
 10. Thallus P+ red (fumarprotocetraric and/or protocetraric acid).
 11. Thallus KOH- (atranorin absent); on conifers [*L. friabilis*]
 11. Thallus KOH+ yellow (atranorin); saxicolous (in our region).
 12. Thallus thin, granular and aggregate, <0.1 mm thick, unstratified and not notably pseudolobate *L. neglecta* chemotype 3
 12. Thallus thick, placodioid, 0.2-0.5 mm thick, the margins notably thickened, rounded, and pseudolobate.
 13. Fumarprotocetraric acid present (with traces of protocetraric acid) *L. oxybapha*
 13. Fumarprotocetraric acid absent (protocetraric acid present) *L. normandinoides*
 10. Thallus P+ orange (stictic acid or pannaric acid complex).
 14. Thallus KOH+ yellow (stictic acid); common, on diverse substrates..... *L. finkii*
 14. Thallus KOH- or KOH+ purple (pannaric acid complex); prevailing on siliceous rocks.
 15. Thallus thick, placodioid, bilayered, often dull yellow to dull golden and KOH+ purplish, otherwise yellowish grey and KOH-; zeorin absent *L. vouauxii*
 15. Thallus thin, aggregate, unstratified, lead grey to dull bluish grey, sometimes locally brownish; KOH-; zeorin present *Leprocaulon adhaerens*

Lepraria barbatica Lendemer

Thallus thin, diffuse, light greenish white to pale bluish grey, to 0.3 mm thick, with irregular margins; prothallus not evident.

Chemistry: barbatic & usnic acids; C \pm yellow-orange, KC+ yellow-golden, UV+ whitish

Known only from shaded sheltered sandstone under large overhangs at the southern edge of the Ozark region in Cleburne and Franklin counties, Arkansas. The Franklin County site is the type locality.

The chemistry of this species indicates it is not a true *Lepraria* in the strict sense (Lendemer 2012).

Lepraria caesiella R.C. Harris

Thallus blue-grey, aggregate, thin and unstratified, <0.1 mm thick, of scattered granules developing into a \pm continuous, persistently fluffy, granular crust; white hyphal prothallus persistent.

Chemistry: atranorin, zeorin, \pm pallidic acid; KOH+ yellow, P \pm pale yellow

Relatively uncommon in the Ozarks; known from a few sites in rocky woodlands, where it occurs mostly on

lightly shaded, siliceous rocks, typically in areas with relatively high light intensities but protected from direct wetting. It also occasionally occurs on lightly shaded hardwood boles at these sites (?).

This taxon, long misidentified locally as *L. incana* (L.) Ach., is common through much of eastern North America, but most previous Ozark reports are referable to chemically similar, sorediate taxa of *Lecanora* (see below).

Similar taxa:

-*Lecanora appalachensis* looks similar in the field and has similar chemistry; it has weakly corticate areoles that become sorediate and dissolve into sorediate masses, although some remnants of cortex remain; it usually has a prominent fibrous white prothallus

-*Lecanora nothocaesiella* and *L. layana* closely resemble *Lepraria caesiella* and have similar chemistry, but the *Lecanora* taxa have partially immersed, initially soraliolate thalli with a thin, shiny, sometime locally dark marginal prothallus

***Lepraria cryophila* Lendemer**

Thallus pale bluish white, placodioid, 0.2-0.7 mm thick, with a distinct layer of continuous granules over a hypothallus of loose hyphae; thallus margins lacking a distinct, well-defined edge.

Chemistry: divaricatic & nordivaricatic acids; C+ & KC+ pink to red; UV+ white

Uncommon in the southeastern half of the Ozarks, typically on massive, shaded, sheltered siliceous rocks in humid microhabitats; more rarely on shaded lower boles and bases of trees (*Betula nigra*, *Liriodendron tulipifera*) at these sites.

***Lepraria disjuncta* Lendemer**

Thallus XXX, 0.3-0.5 mm thick, the hypothallus of loosely woven hyphae.

Chemistry: usnic, xanthonic, zeorin; C ± weakly yellow; KC+ yellow-golden, UV ± faint dark reddish orange

Apparently occasional; at scattered sites across the Ozarks, usually on sheltered, shaded carbonate rocks on bluffs and large outcrops. It has been documented from limestone, dolomite, and sandstone - the latter often in close association with carbonate rocks and presumably influenced by their chemistry, but occasionally found on acidic sandstones.

Although included here pending further data, based on its chemistry this taxon is not a *Lepraria* in the strict sense (Lendemer 2013).

***Lepraria finkii* B. de Lesd.) R.C. Harris**

Thallus greenish, greenish grey, or dull bluish green, placodioid, to 1.1 mm thick, with a distinct layer of continuous granules over a hypothallus of tightly adjacent hyphae; thallus margins lacking a distinct, well-defined edge.

Chemistry: atranorin, stictic acid, zeorin, ± two spots bracketing stictic acid in solvent C; K+ & KC+ dull yellow brown, P+ orange

Abundant and widely distributed in shaded, somewhat sheltered sites throughout the Ozarks, in locally humid microhabitats, even within surprisingly exposed and xeric natural communities, such as deep

bedrock crevices in exposed glades. This species grows on a wide variety of native and introduced or planted hardwoods and conifers, typically in large crevices or at near the bases. It also occurs on lignin, including old lumber, siliceous and calcareous rocks, stable, sheltered soil faces in ravines, bryophytes, foliose lichens, and even old shaded bricks and concrete. It is the only species of *Lepraria* regularly occurring in urban and suburban areas in the Ozarks.

This species was previously known as *L. lobificans* auct. It is readily recognizable by the thick, often large and well-developed, felty thallus, which is typically darker greenish than other species in the genus. This species and *Botryolepraria lesdainii* are the most shade tolerant leprose lichens in the Ozarks.

[*Lepraria friabilis* Lendemer, K. Knudsen & Elix]

Thallus pale dull bluish to greenish grey, aggregate, thin and unstratified, <0.1 mm thick, of scattered granules developing into a diffuse, persistently fluffy, granular crust; white hyphal prothallus persistent

Chemistry: fumarprotocetraric & protocetraric acids; P+ orange-red

Rare and local immediately south of the Ozarks in the Ouachita highlands of central Arkansas, and in Clay County, Arkansas - the Missouri border county adjacent to the Ozarks. This taxon undoubtedly occurs the the extreme southern Ozarks as well. It grows in the lower boles and bases of conifers - *Juniperus*, *Pinus*, and *Taxodium*. See comments under *L. harrisiana*.

***Lepraria harrisiana* Lendemer**

Thallus greenish blue to bluish white, sometimes with a yellowish tint in older herbarium specimens (Lendemer 2013), placodioid, 0.2-0.4 mm thick, with a distinct layer of continuous granules over a thin, protruding hypothallus of loose hyphae; thallus margins lacking a distinct, well-defined edge.

Chemistry: atranorin, pallidic acid, zeorin; K+yellow, P+ weak yellow

Uncommon in the eastern and southeastern Ozarks in Illinois, Missouri, and Arkansas; typically growing on shaded bases and lower boles of conifers (*Juniperus virginiana* and *Pinus echinata*) in mesic woodlands. Elsewhere in eastern North America this is typically a species of coniferous wetlands, and also occurs uncommonly on hardwoods in these habitats. Lendemer (2013) mentions that this species commonly occurs intermixed with *L. friabilis*.

***Lepraria hodkinsoniana* Lendemer**

Thallus pale greenish blue, aggregate, thin and unstratified, <0.1 mm thick, of scattered granules developing into a ± continuous, crust, the granules becoming gelatinized and aggregated into a pseudocortex; white hyphal prothallus persistent.

Chemistry: divaricatic acid, zeorin, ± atranorin; KC- or weakly + pink, UV+ blue white

Locally on lightly shaded tree boles and bases in the extreme eastern Ozarks of southwestern Illinois, growing on *Liriodendron tulipifera*, *Pinus*, and *Sassafras albidum*. These populations represent the southwestern range limit for the species,

***Lepraria neglecta* (Nyl.) Erichsen [= *L. zonata* Brodo]**

Thallus pale grey to bluish white, aggregate, thin and unstratified, <0.1 mm thick, of scattered granules developing into a ± continuous, thin granular crust, becoming gelatinized and developing a

pseudocortex, sometimes creating an appearance of rounded subareoles; prothallus persistent but often obscure.

Chemistry:

chemotype 1: alectorialic acid, roccellic/anagardianic acid, \pm atranorin; K+ yellow, KC+ red, P+ yellow

chemotype 3: atranorin, fumarprotocetraric acid, \pm roccellic/anagardianic acid, \pm rangiformic/jackinic acid; K+ yellow, P+ orange-red

Locally frequent throughout the Ozarks; on exposed to lightly shaded, often somewhat sheltered, siliceous rocks associated with major bedrock exposures in natural habitats such as glades, bluffs, and open rocky woodlands with prominent bedrock. Substrates include granite, rhyolite, rhyolitic ash flow tuffs, and sandstone.

Within the Ozarks, there do not appear significant ecological, distributional, or abundance differences between the two chemotypes, which also have similar North American distributions (Lendemer 2013).

Lepraria normandinoides Lendemer & R.C. Harris

Thallus white to pale grey or pale blue grey, placodioid, 0.2-0.5 mm thick, with a distinct layer of continuous granules over a hypothallus of loose hyphae; thallus margins rounded and pseudolobate, with a distinctly thickened lip.

Chemistry: atranorin, roccellic/anagardianic acid, \pm protocetraric acid; K+ yellow, P+ orange-red

Common throughout the Ozarks; on exposed to lightly shaded, massive siliceous rocks, usually on near-vertical faces and under slight overhangs. This species grows on sandstone and igneous rocks. Although Lendemer (2013) attributes this species to “high humidity low-light” habitats, locally it tends to favor higher light intensities in more xeric natural communities.

The smoothly rounded, pseudolobate thallus margins are distinctive and at a distance are evocative of foliose lichens or even a pale *Normandina*. Although all Ozark populations are saxicolous, elsewhere in its range this species is also corticolous. North of the Ozarks, some populations lack protocetraric acid. Except for chemistry, this species is analogous to *L. oxybapha*.

Lepraria oxybapha Lendemer

Thallus white to pale grey or pale blue grey, placodioid, 0.2-0.5 mm thick, with a distinct layer of continuous granules over a hypothallus of loose hyphae; thallus margins rounded and pseudolobate, with a distinctly thickened lip.

Chemistry: atranorin, roccellic/anagardianic acid, fumarprotocetraric acid; K+ yellow, P+ orange/red

Common throughout the Ozarks; on exposed to lightly shaded, massive siliceous rocks, usually on near-vertical faces and under slight overhangs. This species grows on chert, sandstone, and igneous rocks.

All Ozark populations are saxicolous, but this species is also corticolous elsewhere. See comments under *L. normandinodes*, which closely resembles this species in morphology, ecology, and local distribution.

Lepraria vouauxii (Hue) R.C. Harris

Thallus grayish yellow to dull yellow or dull orange, placodioid, 0.2-0.6 mm thick, with a distinct layer of continuous, persistently fuzzy, granules over a hypothallus of densely arranged hyphae, sometimes forming large patches; thallus margins with a \pm irregular edge.

Chemistry: pannaric acid complex, \pm atranorin, \pm roccellic/anagardianic acid, \pm unknown pigment; KOH + purplish (pigmented portions), P+ orange

Locally frequent on massive siliceous rocks, usually sandstone, in natural areas such as bedrock exposures in glades, massive bluffs, and large outcrops in sparsely wooded uplands. This species occurs in areas with relatively high light exposures in microhabitats affording rapid drainage and protection from frequent direct wetting. This species sometimes occurs on protected xeric soil pockets and on boles of hardwoods in these habitats.

Many local populations have distinct orange tints and react KOH+ purplish; this element is known only from the Ozark and Ouachita regions of the Interior Highlands.

Lepraria xanthonica Lendemer

Thallus XXX, diffuse, 0.2-0.4 mm thick

Chemistry: 5,7-dichloro-3-O-methylnorlichexanthone, usnic acid, zeorin; KC+ yellow-golden, UV+ dull orange

Uncommon on lightly shaded sandstone and carbonate rocks in the western Ozarks from southwestern Missouri south to Pope County, Arkansas, usually in high humidity microclimates; rarely on bases of hardwoods in these habitats.

The chemistry of this species indicates it is not a true *Lepraria* in the strict sense (Lendemer 2012).

LEPROCAULON Nyl. ex Lamy (1878) Sterocaulaceae

Sterile crustose lichens with a leprose thallus that often develops a secondary thallus of minute, fuzzy, granulose pseudopodetia; photobiont trebouxoid; 1 species in the Ozarks. References: Knudsen et al. (2007); Lendemer & Hodkinson (2013).

Leprocaulon adhaerens (K. Knudsen, Elix & Lendemer) Lendemer & Hodkinson

Thallus lead grey to dark bluish grey, thin, diffuse, lacking well-defined margins; of small leprose granules typically 40-60 μ m broad, these becoming gelatinized and fusing into larger areolate masses.

Chemistry: pannarin, zeorin; P+ orange

Uncommon, mostly in the Missouri portion of the Ozarks, growing on massive, usually siliceous, rock faces, as well as on hardwood boles in these same habitats. Known substrates include sandstone, rhyolite, *Ulmus alata*, *Ulmus americana*, and a single report from sheltered dolomite. This species sometimes grows on bryophytes or algae in these microhabitats, but also grows on the primary substrate.

The thalli of Ozark populations are typically less thick and dense than depicted in Knudsen et al. (2007), and

usually lack bluish hues.

Similar taxa:

-Many species of *Lepraria* have similar appearance, but the thalli are lighter in color and more bluish or greenish, as opposed to the distinctive lead-grey thalli of *Leprocaulon adhaerens*; the chemistry of pannarin and zeorin is unique among Ozark leprose lichens.

LEPTOGIUM (Ach.) Gray (Collemataceae)

Gelatinous lichens with \pm lustrous, lead gray to brown, foliose or occasionally crustose, 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; 13 species in the Ozarks. Reference: Sierk (1964).

1. Thallus densely white tomentose beneath *L. hirsutum*
2. Thallus lead to slate grey, sometimes becoming darker on older lobes; smooth; lobe tips thin, locally with fine white hairs, these typically in areas lacking isidia, thin; isidia typically patchy, with large isidia-free zones on some lobes, isidia ranging from granular to cylindrical and becoming coralloid, some isidia $>3\times$ longer than wide *L. hirsutum*
2. Thallus black to dark olive brown; usually with a few obscure longitudinal wrinkles on older lobes; lobe tips slightly thickened, glabrous; isidia usually abundant and \pm uniformly distributed, granular, occasionally becoming coralloid and appearing as aggregations of plump granular segments, these $<3\times$ longer than wide [*L. saturninum*]
1. Thallus not tomentose.
 3. Thallus mostly crustose, granular; terricolous.....*L. byssinum*
 3. Thallus foliose; rarely terricolous.
 4. Thallus not isidiate; lobe margins and apices not fimbriate-dissected into isidioid segments.
 5. Upper surface notably wrinkled.
 6. Thallus gray; lobes distinct; apothecia prevailingly laminal *L. corticola*
 6. Thallus brown; lobes anastomosing; apothecia prevailingly marginal to submarginal
..... *L. chloromelum*
 5. Upper surface not wrinkled.
 7. Lobes linear, the larger apothecia usually broader than the lobes on which they are located; on massive carbonate rock escarpments..... *L. apalachense*
 7. Lobes rotund, prevailingly broader than the apothecia; on mossy rocks and tree bases
..... *L. juniperinum*
 4. Thallus isidiate and/or lobe apices and margins fimbriate-dissected into isidioid segments.
 8. Upper cortex with distinct longitudinal wrinkles or ridges.
 9. Thallus lead gray, \pm flattened, with fine, low wrinkles, the lobe tips rounded.....

- *L. austroamericanum*
9. Thallus brown to gray-brown, often irregularly convolute at lobe tips, with coarse ridge-like wrinkles and elevated margins.
10. Thallus with fused overlapping lobes prevailing more than 1 mm broad; lobe tips entire, isidia granular, mostly laminal *L. milligranum*
10. Thallus with narrow, discrete lobes <1 mm broad; lobe tips lacerate-fringed with narrow cylindrical isidia *L. lichenoides*
8. Upper cortex essentially smooth.
11. Thallus minutely foliose, the central portions appearing subcrustose; lobes < 1 mm broad; rare *L. subtile*
11. Thallus distinctly foliose throughout; lobes mostly > 1 mm broad; common.
12. Thallus lead gray; apothecia very rare; lobes typically >1.5 mm wide *L. cyanescens*
12. Thallus brown to dark blackish gray; apothecia frequent; lobes mostly to 1.5 mm wide *L. dactylinum*

Leptogium apalachense (Tuck) Nyl. [= *Scytinum apalachense*]

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.) Zwach ex 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 in intact habitats, such as along glade margins.

Leptogium corticola (Taylor) Tuck.

Occasional on shaded hardwoods in woodlands, and less commonly on *Juniperus* or even shaded rocks in mesic sites.

Leptogium cyanescens (Rabenh.) Körber

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. [= *Scytinum dactylinum*]

Occasional and widely distributed through the Ozarks, sometimes locally abundant; 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 mossy dolomite in woodlands and along borders of glades. This species is very similar to and often confused with *L. saturninum*, which lacks the well-defined zone of fine white hairs on some isidia-free lobe tips that characterizes *L. hirsutum*.

Leptogium juniperinum Tuck. [= *Scytinum juniperinum*]

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. [= *Scytinum lichenoides*]

Frequent on lightly shaded, mossy outcrops of carbonate bedrock, and rarely on shaded tree bases or lightly shaded, mossy, siliceous rocks.

Leptogium milligranum 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 saturninum (Dicks.) Nyl.]

Not yet known from the Ozarks, this is a more boreal taxon that has been previously reported from the region, but these reports are based on *L. hirsutum*.

Leptogium subtile (Schrader) Torss. [= *Scytinum subtile*]

Known only from mosses over dolomite bedrock in a small stream ravine in an extensive dolomite glade in Ozark County, Missouri.

LEUCODECTON Massal.

Leucodecton subcompunctum (Nyl.) A. Frisch

Known only from *Fagus grandifolia* in shaded mesic ravines along the Buffalo River in Arkansas. This species was formerly known as *Myriotrema subcompunctum*.

LICHENOTHELIA D. Hawksw. (Lichenotheliaceae)

Saxicolous fungi forming extensive black stains on moist rock, mostly sterile?; ascomata perithecioid; asci fissitunicate with 8 brown 1-septate spores; ? species in the Ozarks. Reference: Henssen, 1987.

Lichenothelia is included 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. stipulata*
- 1. Thallus ± foliose or umbilicate.
 - 2. Thallus foliose-squamulose with ± erect lobes usually in umbilicate clumps; surface of older lobes granular *L. nigritella*
 - 2. Thallus umbilicate, forming distinct cushions, without deeply dissected lobes; lobe surfaces mostly smooth *L. cf. minnesotensis*

Lichinella cf. minnesotensis (Fink) Essl.
Known only from lightly shaded dolomite in a small ravine within a massive dolomite glade in southwestern Missouri.

Lichinella nigritella (Lettau) P.P. Moreno & Egea
Common on massive dolomite exposures on glades, bluffs, and exposed outcrops, often occurring as scattered individual thalli.

Lichinella stipulata Nyl.
Known only from low sandstone bluffs along a small stream in Cherokee Couny, 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 up 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, K+ 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 [= *Lepra pustulata*]

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. (1856) Fuscideaceae

Corticolous crustose lichens with small, superficial, thalli; photobiont *Trebouxia*; apothecia sessile, with well-developed thalline margins and dark disks; exciple pale to yellowish; epihymenium reddish brown to brown; paraphyses branched, especially towards the tips and usually darkening at tips, easily separable; hypothecium pale; asci Fuscidea-type, with 32+ spores/ascus; ascospores small, globose to ellipsoid; pycnidia immersed; conidiospores bacilliform to filiform; 1 species in the

Ozarks. Reference: Harris (2006).

Maronea polyphaea H. Magn.

Thalli mostly occurring as small separate patches to 1.5 cm broad, occasionally fusing, green to greyish or brownish green, matt, continuous, rugose or \pm bullate areoles, to 150 μm thick; thin white prothallus often present; apothecia with well-developed thalline margins elevated as a 0.1-0.2 mm thick rim above the disks, the disks to 0.5 (1.0) mm broad, dark brown to nearly black, often with sparse, coarse white pruina; exciple pale to brown; eiphymenium brown; hypothecium pale to grey and \pm opaque; ascospores usually $>60/\text{ascus}$, narrowly ellipsoid, sometimes slightly contracted medially, $4\text{-}6 \times 2.5\text{-}4 \mu\text{m}$; pycnidia pale, ca. 0.1 mm broad; conidiospores narrowly ellipsoid, $3 \times 1.5 \mu\text{m}$.

Chemistry: alectorialic acid; medulla KC+ red (sometimes spotty)

Common in the extensively wooded regions of the Ozarks and sporadically westward into Oklahoma; on exposed twigs and branches of a variety of hardwoods, and boles and branches of trees in open woodlands and along woodland edges, glade margins, bluff summits and in openings. It occurs in uplands, often on *Carya texana*, *Quercus* section *Erythrobalanus*, and *Ulmus alata*. Another habitat is wooded wetlands, such as fens and seeps, where it occurs on smooth-barked hardwoods including *Acer rubrum*, *Alnus serrulata*, and *Carpinus caroliniana*. This species is also occasional on decorticate small branches of *Juniperus virginiana*.

Similar taxa:

-some corticolous species of *Rinodina* have similar thalli, but no corticolous *Rinodina* in the Ozarks has a KC+ red medullary reaction _____

MEGASPORA (Clauz. & Roux) Haffelner & V. Wirth (Megasporaceae)

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.) Haffelner & 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. (Melaspileaceae)

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 which are somewhat constricted at the septum; pycnidia with elongate, \pm straight conidia; 1 species in the Ozarks.

Melaspilea urceolata (Fr.) Ertz & Diederich [formerly *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. (Pilocarpaceae)

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).

1A. Epthecium with olive tones, K+ violet *M. peliocarpa*

1A. Epithecium at least partially greenish or blue-green, K- *M. globulosella*

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 dark orange brown; hypothecium yellow to pale brown *M. lithinella*

2. Corticolous or lignicolous; hypothecium pale.

4. Pycnidia black, often stipitate; thallus thin, \pm immersed *M. misella*

4. Pycnidia pale to grayish, sessile or immersed; thallus often granular to subsiliate *M. prasina*

Micarea erratica (Körb.) Hertel, Rambold & Pietschm. [= *Leimonis erratica*]

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.

MICAREOPSIS R.C. Harris & Lendemer (2013) Ramalinaceae

Sorediate crustose lichens; thallus initially areolate, developing into a \pm continuous leprose crust; areoles small, light green, breaking down into soredia; apothecia sometimes present, purplish brown to black, to 0.5 mm broad; epithecium pale to greenish blue; hypothecium brownish, K⁺ violet; asci Lecanora-type, with 8 fusiform, 1-2(4)-celled ascospores; pycnidia rare, immersed; conidiospores bacilliform; a monotypic genus that occurs in the Ozarks. Reference: Lendemer et al. (2013)

Micareopsis irrugata R.C. Harris & Lendemer

Rare on sheltered, shaded sandstone faces in mesic habitats in the Buffalo River region of the Arkansas Ozarks.

MONOBLASTIA

Monoblastia 44399

MONOBLASTIOPSIS R.C. Harris & C.A. Morse

Small crustose pyrenolichens with endolithic thalli and small, globose, black perithecia; asci initially 8-spored, but typically with only 4 spores maturing; ascospores ellipsoid, weakly ornamented, to $29 \times 13 \mu\text{m}$; pycnidia common, globose, black; conidiospores bacilliform, ca. $3 \times 15 \mu\text{m}$.

Monoblastiopsis konzana R.C. Harris & C.A. Morse

Apparently rare, but possibly overlooked; known from shaded dolomite in an open oak woodland in Ozark County.

MYCOCALICIUM Vainio (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, \pm isodiametric cells 8-13 μm diameter

-*M. albonigrum*
2. Tissue at base of exciple with thick-walled, cylindrical to isodiametric cells 4-6 μ m diameter.
3. Capitulum K+ dirty reddish changing to yellowish; on *Juniperus* or rarely *Pinus**M. ozarkanum*
3. Capitulum K-; 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 be 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 which forms 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, HNO₃-. Exciple dark brown, usually well developed; hyphae indistinct with \pm elongated 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 \pm 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, \pm obliquely arranged spores; apex uniformly thickened, without canal. Ascospores dark brown, broadly fusiform to almost ellipsoid, with ends usually \pm pointed, 7-8.5(-10) \times 3.5-4(-4.5) μ m; no ornamentation seen. Associated pycnidia with colorless, curved or uncinat conidia, 8-12 \times ca. 1.0 μ m

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.) Szatala**

Frequent on weathered, well-drained, decorticate logs and standing decorticate snags of both hardwoods and softwoods, growing on sound wood, as well as on sheltered bark of large hardwoods. This species typically occurs in wooded uplands.

MYCOGLAENA Höhnelt (Micropeltidaceae)

Corticolous crustose non-lichenized fungi with thin, pale, silvery thalli; photobiont absent; ascomata perithecium-like, with blue-green walls; asci with truncated 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 Flotow 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 pale to brownish, ellipsoid, septate to muriform spores; conidiomata unknown; at least 4 species in the Ozarks.

- 1. Ascospores 2(4) celled, lacking longitudinal septa.
 - 1A. Ascospores < 7 µm broad, to 2.5 × as long as broad..... *M. eschweileri*
 - 1A. Ascospores ≤ 7.5 µm broad, 2.5-4 × as long as broad..... *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 eschweileri (Müll. Arg.) R.C. Harris

Known only from exposed twigs of *Quercus imbricaria* along the edge of a grazed woodland in Moniteau County, missouri.

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 (1987) Parmeliaceae

Pale grey foliose lichens; thallus adnate, with small to medium lobes; short, dark marginal cilia sometimes present near lobe axils; upper cortex with atranorin; medulla commonly pale yellow, at least locally; lower cortex black with a brown marginal zone; rhizines abundant, simple to squarrosely branched; photobiont *Trebouxia*; apothecia sessile, laminal, initially cupuliform but ultimately ± plane, with brown disks and thalline margins; epithecium brown; hypothecium pale; paraphyses XXX; asci *Lecanora*-type, ascospores 8, simple, broadly ellipsoid, with slightly thickened walls, ca. 10 × 6 µm; pycnidia laminal, immersed, with dark apices < 0.1 mm broad; conidiospores linear, ca. 6-7 × < 1 µm; 3 species in the Ozarks. Reference: Nash and Elix (2002).

- 1. Thallus without diaspores; apothecia common *M. galbina*
- 1. Thallus isidiate or sorediate; apothecia rare.
 - 2. Thallus sorediate; lobe tips often >3 mm broad *M. aurulenta*
 - 2. Thallus isidiate; lobe tips < 2 mm broad *M. obsessa*

Myelochroa aurulenta (Tuck.) Elix & Hale

Thallus adnate, to 15 cm broad, primary 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 grey or brown-tinged, with distinct, lustrous, dark margins; a few short dark cilia typically present near some of the lobe axils; medulla white to pale yellow; rhizines prevailing simple to apically furcate, usually with a few on the older portions of the thallus with distinct squarrose branches; soredia abundant, laminal, in irregularly rounded soralia, arising from single to massed, friable, subpustulate cortical eruptions, with a whitish to yellowish grey cast; apothecia and pycnidia not seen on Ozark material.

Chemistry: atranorin, terpenes, usually with secalononic acid A; cortex KOH+ yellow, pigmented portions of medulla KOH XXX, KC+ slowly dark yellow

Common in shaded habitats throughout the Ozarks, usually in 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 material is often white nearly throughout, but usually there is at least a thin yellowish layer immediately under the soralia. Depending on their degree of development, the soredia range from farinose to pustulate. Older herbarium specimens often become brownish.

Similar taxa (all with uniformly white medullas):
Hypotrachyna pustulifera can resemble individuals of *M. aurulenta* with pustulate soredia, but *Hypotrachyna* has a UV+ bluish white medulla, simple rhizines, and narrower lobes.
Canoparmelia - narrow, eciliate lobes, simple rhizines, and contain divaricatic or stictic acids and lack secalononic acid A.
Parasites: *Oviculispora parmeliae*

Myelochroa galbina (Ach.) Elix & Hale

Thalli compact, closely adnate, pale grey, to 7 cm broad; lobes 1-2-mm broad, closely juxtaposed to slightly overlapping, creating the appearance of a continuous thallus, lobes much branched and slightly expanded distally, dividing at their apices into short, rounded to subtruncate tips, rarely with a few short dark cilia near the lobe apices; upper cortex smooth to slightly rugulose; medulla pale yellow to white, usually pale yellow at least in the medulla of the thalline margins and beneath the apothecia; lower cortex with abundant short, dark, simple to apically furcate or coalescing rhizines; apothecia abundant, sessile, basally constricted, with a thin thalline margin not forming a significant rim above the 2-6 mm broad brown disks; pycnidia common, prevailing near the lobe tips.

Chemistry: atranorin, galbinic acid, terpenes, secalonic acid A in pigmented portions of medulla; cortex KOH+ yellow, medulla KOH+ yellow to dull reddish, pigmented portions of medulla KC+ slowly dark yellow

A common and characteristic lichen of canopy branches of hardwoods in intact woodlands throughout the Ozarks, with a predilection for red oaks (*Quercus coccinea*, *Q. marilandica*, *Q. rubra*, *Q. shumardii*, *Q. velutina*). Very rarely, this species occurs on lightly shaded siliceous rocks in wooded uplands.

Similar taxa:

Hypotrachyna livida - larger, paler grey thallus with smooth upper cortex, uniformly white medulla reacting KOH+ lavender purplish, and at least some rhizines with sparse dichotomous branching

Myelochroa obsessa (Ach.) Elix & Hale

Thallus closely adnate, to 8 cm broad, grey to bluish grey, 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 sublobes, marginal lobules often present; upper cortex sometimes wrinkled on the lobes; medulla pale yellow, at least locally in areas immediately below the upper cortex; rhizines abundant, short, simple to apically furcate or coalescing; isidia common, cylindrical, to 0.6 mm tall, ca. 0.1 mm broad, with blunt, brownish tips, occasionally branched or furcate; apothecia rare, to 1.5 mm broad, the thalline margin typically isidiate; pycnidia usually present, solitary and widely separated.

Chemistry: atranorin, galbinic acid, terpenes, secalonic acid A in pigmented portions of medulla; cortex KOH+ yellow, medulla KOH+ yellow to dull reddish, pigmented portions of medulla KC+ slowly dark yellow

Characteristic of massive, lightly shaded siliceous rocks in intact woodlands throughout the Ozarks, occurring on chert, granite, orthoquartzite, rhyolite, and sandstone. Common associates include *Flavoparmelia baltimorensis*, *Lecanora subimmergens*, *Pertusaria plittiana*, and *Variolaria pustulata*. *Myelochroa obsessa* also occurs rarely on 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 included in this species; the type collection is corticolous

Similar taxa:

Hypotrachyna minarum - medulla white throughout, medulla KOH-, C+ and KC+ reddish (gyrophoric acid), isidia slightly narrower.

NADVORNIKIA Tibell (Graphidaceae)

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. (1809) Nephromataceae

Loosely adnate brown foliose lichens; lower cortex pale to dark, tomentose, lacking rhizines; photobiont Nostoc; apothecia sessile and \pm immersed on the undersides of the lobe tips, with a brown disk and thin thalline margin; paraphyses unbranched; epithecium brown; hypothecium pale; asci resembling *Peltigera*-type asci; ascospores 8, brownish, fusiform, 3-septate; pycnidia dark, \pm immersed, not seen in Ozark material; conidiospores bacilliform; 1 species in the Ozarks.

Similar taxa:

- Peltigera* - rhizines present and usually prominent
- Pannaria* - isidia lacking, apothecia laminal on upper cortex
- Sticta* - lower surface with prominent round cyphellae; rare in the Ozarks, but sometimes occurs with Nephroma

Nephroma helveticum Ach.

Thallus deep brown to less commonly greyish brown; upper cortex smooth and lustrous; lobes rounded, usually to 3 mm broad, with frequent short branches; lobe margins slightly thickened and undulate to crenate, often lobulate-dissected; lobulate isidia abundant on thallus margins and typically also scattered on the upper cortex, to 0.3 mm tall, occasionally branched or proliferating; lower cortex tan at the margins, becoming dark brown to black centrally, finely tomentose, the tomentum locally sparse on central portions of older thalli, apothecia common, to 5 mm broad, on the undersides of lobe tips, these often upturned, mostly immersed and nearly level with the surface of the lower cortex; ascospores $18-22 \times 6-7 \mu\text{m}$.

Chemistry: triterpenoids; all spot tests negative

Uncommon; mostly in the southern and eastern Ozarks. This species typically occurs in light to medium shade in mesic habitats such as in canyons and ravines, and in mesic woodlands in stream valleys. Most Ozark populations occur on massive, mesic, often mossy faces of sandstone or rhyolite, but this species also occurs less commonly on lower boles and bases of mature hardwoods in similar habitats. *Leptogium cyanescens* is a consistent associate.

XXX discuss varietal status

NORMANDINA Nyl. (1855) Verrucariaceae

Delicate lichens forming discrete, rounded, squamules with upturned margins and a distinct medullary layer; sometimes soresdiate; upper cortex indistinct and poorly developed; lower surface ecorticate, white tomentose; photobiont *Nannochloris* (?); perithecia immersed, dark-walled; hymenial gel IKI+ pinkish, paraphyses disappearing, periphyses persistent; asci saccate, IKI-, with a broad, poorly defined ascal chamber, with ca. 7-septate ascospores, but all local material is sterile (XX Buck 24211, Reynolds MO is listed as ‘with ascoma’); conidiomata unknown; 1 species in the Ozarks. Reference: Aptroot (1991)

Similar taxa:

Lepraria normandinioides and *L. oxybapha* can appear to form rounded squamules, but the thalli are grey without strong blue coloration, and with no true thallus organization or medulla.
Cladonia squamules can have similar coloration, but are more erect and have well-developed upper and lower cortices and lack raised margins.

Normandina pulchella (Borrer) Nyl.

Squamules grey to greenish or bluish grey, to 1.2 (2) mm diameter, nearly or incompletely circular in outline, often forming loose aggregations, sometimes with small rotund lobes which develop into attached squamules; upper surface dull, sometimes with a ± obscure series of fine, minutely raised concentric ridges; margins of the squamules with a uniform raised, rounded rim ca. 0.1 mm thick, the rim concolorous or lighter than the squamules and appearing minutely fuzzy under magnification; soredia occasional, mostly in loose irregular mounds on the squamules, less commonly marginal, ca. 25-50 µm diameter.

Chemistry: zeorin reported (Aptroot 1991); all spot tests negative

Rare, local, and never abundant in any location, at widely scattered sites through the densely wooded portions of the Ozarks. Usually found on shaded, lichenose boles of old growth *Juniperus virginiana* and hardwoods in intact woodlands, growing on and among lichens and bryophytes; also on moist shaded mossy ledges of both carbonate and siliceous rocks in mesic sites and along streams._____

OCHROLECHIA A. Massal. (Ochrolechiaceae)

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 soresdiate; apothecia absent*O. arborea*
- 1. Thallus esoresdiate, 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 Vainio

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, \pm 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 soredia fluoresce 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 (Vainio) 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 Vainio

Uncommon on exposed to lightly shaded siliceous boulders and outcrops in uplands; known from both the western and eastern Ozarks. [gyrophoric acid]

OPEGRAPHIA Ach. *nom. cons.*

Crustose lichens with thin or obscure thalli; photobiont *Trentepohlia*; 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 or filiform, straight to curved, conidia; 10 lichenized and ca. 6 lichenicolous species in the Ozarks.

| | |
|--|--------------------------------------|
| 1. Photobiont <i>Trentepohlia</i> ; not lichenicolous | 2 |
| 2. Thallus saxicolous on carbonate rocks | 3 |
| 3. Ascospores 5- 7-septate | 4 |
| 4. Thallus endolithic, brownish, C- | <i>O. mougeotii</i> |
| 4. Thallus epilithic, finely rimose, C+ pink | <i>Opegrapha sp.</i> 37218 |
| 3. Ascospores 3-septate | <i>O. rupestris</i> |
| 2. Thallus corticolous | 5 |
| 5. Thallus sorediate | 6 |
| 6. Soredia greenish, C- | <i>O. corticola</i> |
| 6. Soredia brownish, C+ pink | <i>Opegrapha sp.</i> 49437 |
| 5. Thallus not sorediate | 7 |
| 7. Ascospores 9+ septate, many >45 µm long; epithecium pale | <i>O. viridis</i> |
| 7. Ascospores 3-7(-8)-septate, to 40 µm long; epithecium brown | 8 |
| 8. Hymenium interspersed; ascospores (6-)7(-8)-septate,
(26)32-36 x 5.5-6.5 µm | <i>Opegrapha sp.</i> 44363 |
| 8. Hymenium not interspersed; ascospores 3-5(-6)-septate | 9 |
| 9. Ascospore (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 | <i>O. varia</i> |
| 3. Apothecial disk hidden, not pruinose; spores to 4.5 µm
wide; spores of about the same width along their length
..... | <i>O. vulgata</i> |
| 9. Ascospores 3-septate; slender, pointed at both ends
(<i>rufescens</i> -type) | 10 |
| 10. Ascospores 21-26 x 4-5 µm; on decorticate juniper
branches and trunks | <i>O. "juniperi"</i> |
| 10. Ascospores 24-28 x 5-6.5 µm; on soft bark of
hardwoods | <i>Opegrapha sp.</i> 51047 |
| 1. Photobiont absent; lichenicolous | 11 |
| 11. Ascospores 5-6-septate, 18-20 × 3.5-4 µm, on thallus of <i>Bacidina assulata</i>
..... | <i>Opegrapha sp.</i> (not treated) |
| 11. Ascospores 3-septate | 12 |
| 12. Growing on thallus and apothecia of <i>Bacidia diffracta</i> (and possibly <i>B. polychroa</i>
and <i>B. suffusa</i>) | <i>O. diffracticola</i> |
| 12. Growing on other lichens | 13 |
| 13. Growing on/with saxicolous Verrucariaceae | <i>O. rupestris</i> |
| 13. Growing on various corticolous or terricolous lichens
..... | <i>Opegrapha spp.</i> (not treated). |
| 1) on squamules of <i>Cladonia caespiticia</i> | |
| 2) on thallus of <i>Myelochroa aurulenta</i> | |
| 3) on thallus of <i>Punctelia rudecta</i> | |

***Opegrapha corticola* Coppins & P. James**

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**

Ascomata lirelliform, growing on thallus and apothecia of *Bacidia diffracta*, sessile, fusiform to ± oblong,

undivided to once branched, $0.3-0.5 \times 0.2$ 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 $8 \pm$ biserially arranged spores. Ascospores remaining colorless, 3-septate, with thin halo, $13-15-4-4.5$ μm . Pycnidia brown, \pm 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 \pm 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. [= *Alyxoria mougeotii*]**

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. [= *Alyxoria varia*]**

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 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 trunk 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 trunk of *Juniperus* in Missouri.

Opegrapha viridis (Pers. ex Ach.) Behlen & Desberger [= *Zwackia viridis*]

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 comm on character in *Opegrapha*)

Opegrapha sp. 49437

Thallus pale tan, thin, with discrete, mostly rounded, erose soralia with small granular sores which 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 (2007) Porpidiaceae

A monotypic genus of saxicolous crustose lichens with endolithic thalli, black, lecedeine apothecia, subglobose ascospores, and bacilliform conidiospores. Reference: Harris & Ladd.

Pachyphysis ozarkana R.C. Harris & Ladd

Thallus endolithic, typically not evident but sometimes appearing as thin whitish effusion; photobiont chlorococcoid; apothecia black, lecedeine, often with some diffuse white pruina, initially plane with a raised margin, but becoming rounded with no evident margin, \pm constricted basally, to 1.2 mm broad; exciple all or locally with purple, KOH+ reddish purple pigment; epihymenium greyish to olive or green, KOH-, HNO₃+red, with small crystals; hymenium brownish to purplish; hypothecium dark brown to blackish purple, KOH intensifying, HNO₃+ red; paraphyses branches and anastomosed, often gelatinized and difficult to distinguish, some clavate, to 10 μm thick; asci *Porpidia*-type, \pm clavate, with 8 irregularly arranged spores; ascospores simple, broadly ellipsoid to globose, 10-13 \times 8-12 μm ; pycnidia occasional, mostly immersed, to 0.1 mm broad, the walls blue-green; conidiospores simple, bacilliform, sometimes \pm tapered at one or both ends, 6-8 \times 1-1.5 μm .

Chemistry: no lichen substances

Frequent on exposed dolomite and limestone throughout the Ozarks, growing on both small pebbles and cobbles

and on massive boulders and outcrops; typically on \pm horizontal surfaces. A typical habitat is on dolomite rubble lying on flat dolomite bedrock exposures in glades.

The type specimen is from a dolomite glade in Roaring River State Park in Barry County, Missouri.

Parasites: A specimen from XXX, *Buck 32057 (NY)*, is parasitized by *Muellerella cf pygmaea* (Körber) D. Hawksw. XXX

Similar taxa:

-*Lecidella stigmata* is uncommon in the Ozarks; it has epruinose apothecia and a pale hypothecium, with atranorin in the thallus (detectable with TLC, sometimes reacting KOH+ yellow)

-*Clauzadea* species are relatively rare in the region; they have , and lack pruina on the apothecia; the epihymenium is purplish to reddish brown

-*Sarcogyne regularis* is common in similar habitats, but typically has much better developed pruina on the apothecia, which are reddish brown when wet as opposed to *Pachyphysis* apothecia, which remain dark when wet; *Sarcogyne* also lacks non-brown pigments in the apothecia and has polysporous asci with minute ascospores

PANNARIA Delise (Pannariaceae)

Brown foliose lichens with dense, tomentose hypothallus on lower surface; photobiont *Nostoc*; apothecia sessile, with thalline margins that are 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; 4 species in the Ozarks. Reference: Jørgensen (2001).

[two additional species recently collected in the southern Ozarks are not included in this key: *P. tavaresii*, with XXX, and *P. subrubiginosa* Brodo *ined.*, with XXX.

1. Thallus lobes to 0.5 mm broad, smooth, with narrow, divided tips; apothecia to 1 mm broad; medulla P- (pannarin absent) *P. subfusca*

1. Thallus lobes >0.8 mm broad, distinctly wrinkled, 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 [= *Hypotrachyna horrescens*]
 Rare; known only from a single collection on a small hardwood in Carter County. [atranorin, hiasic acid complex]

Parmelinopsis minarum (Vain.) Elix & Hale [= *Hypotrachyna minarum*]
 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; 19 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. Medulla K- (protocetraric acid)..... *P. submarginale*
 - 2. Medulla K+ 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 loosely 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 always K- 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 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-; lower cortex mostly brown; rhizines of two distinct lengths, the shorter ones extending nearly to the margins of the lower cortex.....*P. haitiense*
 7. Medulla C-, K+ and P+ yellow or red to orange (salazinic or stictic acid).
 11. Medulla K+ persistently yellow (stictic acid).....*P. crinitum*
 11. Medulla K+ yellow turning red (salazinic acid).
 12. Medulla UV+ yellow (lichexanthone).....*P. ultraluscens*
 12. Medulla UV- (lichexanthone absent).
 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. Medulla K-.
 15. Medulla C+ red or P+ red; rhizines essentially similar.
 16. Medulla C+ and KC+ 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. Medulla K+ 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, prevailing 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 prevailing 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 up to 0.5 mm thick, the soredia pale and farinose; lower cortex black and rhizinate centrally, with a broad bare brown margin that usually has 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 \pm 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 [formerly *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 lacinate-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 \times or greater magnification) creating a pattern of \pm 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 developed 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 μ m 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 [formerly *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; lobes 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 \pm uniform stubble of short, dark, prevailing 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. [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, prevailing 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:

| <i>P. despectum</i> | <i>P. eurysacum</i> |
|--|---|
| 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 | inal 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, prevailing 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, $10-15 \times 0.8-1 \mu\text{m}$. [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 of which develop rounded capitate soralia typically to 2 mm broad, with farinose soredia; soralia sometimes become elongate and marginal; rounded laminal soralia sometimes present on older portions of thallus; lower surface black centrally, with a brown marginal zone which is 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 [formerly *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; lobes margins with \pm 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, prevailing 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. [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 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 0.2-0.4 mm tall, sometimes tipped with erect black cilia; isidia frequently breaking down into granular soredia, but this feature is 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 lacinate, 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 which can vary 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, \pm straight, $11-13 \times < 1 \mu\text{m}$. [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 [formerly *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 \times or greater magnification) creating a pattern of \pm 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 subsidiosum (Müll. Arg.) Hale [= *Rimelia subsidiosa* (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 breaking 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, prorocetraric 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 [formerly *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; lobes margins with \pm 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, prevailing 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. [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 \pm 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 ultraluscens (Krog) Hale

Rare, known from the Botson Mountain region of the extreme southern Ozarks; growing on massive sandstone walls in lightly shaded, mesic habitats. [atranorin, lichexanthone, salazinic acid]

Parmotrema xanthinum (Müll Arg.) 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 typically abundant, prevailing 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. Our material contains gyrophoric acid and was formerly segregated as *Parmotrema madagascariaceum* (Hue) Hale. [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.

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, growin on dolomite bedrock in a small creek bordering Caney Mountain.

PELTIGERA Willd. (Peltigeraceae)

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; 7 species in the region. References: Brodo et al. (2001 photos!), Goffinet & Hastings (1994), Goffinet & Miadlikowska (1999), Miadlikowska & Lutzoni (2000), Vitikainen (1994).

- A. Thallus with laminal soredia in round soralia..... *P. didcatyla*
- A. Thallus esorediate,
 - 1. Lobe tips tomentose or tomentose-scabrid; veins raised; rhizines pale and simple at margin, darker and ± squarrose or fasciculate inward2
 - 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 laminal3
 - 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 not tomentose; shiny or weakly pruinose; 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 distinct5
- 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, black6
6. Phyllidia absent; apothecia sometimes present, short and tooth-like, often blackish
..... *P. neckeri*
6. Phyllidia present; apothecia usually absent *P. phyllidiosa*

Peltigera didactyla (With.) J.R. Launson

Known only from a lightly shaded embankment in rocky soil along a woodland edge in Morgan county, in the northern Missouri Ozarks. In the northern United States, this is a common species on well-drained soil with minimal competition from vascular plants.

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 & Miadl

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 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)

Squamulose or large-areolate saxicolous lichens with discrete, thick, round peltate 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; 5 species and 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; \pm adnate.

5. On carbonate 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 ex Ozenda & Clauzade

Uncommon and local, usually associated with massive exposures of dolomite, sandstone, and chert, often in areas receiving intermittent seepage or runoff. The species in the Ozarks may actually be *P. bolanderi* (Tuck.) Wetmore, but according to Wetmore (1970), *Peltula euploca* has immersed apothecia lacking a thalline margin, while *P. bolanderi* has sessile apothecia with a thalline margin; unfortunately, all Ozark 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 that are 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)
 - 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 instantly K+ golden yellow or C+ red.
 - 6. Wart C+ red, K- (lecanoric acid); spores 1 per ascus, mostly more than 175 um long *P. velata*
 - 6. Wart C-, K+ golden yellow (thamnolic acid); spores 0(1) or 2 per ascus, less than 175 um long
 - 5. Wart K- (or K+ more slowly pale yellow in *P. amara*) 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 K+ yellow turning red (norstictic acid); cortex UV-; warts open and appearing lecanorine, often pale or white in the center *P. propinqua*
 - 12. Medulla K-; 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 prevailing 3 or 4.
15. Medulla K- (stictic acid absent); spores smooth; rare *P. globularis*
15. Medulla K+ yellow (stictic acid); spores ornamented; occasional
..... *P. tetrathalamia*
14. Spores 2.
16. Medulla K+ 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 K- or K+ 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 K-; warts usually with rounded apices *P. tetrathalamia*

***Pertusaria amara* (Ach.) Nyl. [= *Lepra amara*]**

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 which become 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, \pm 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. [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 are 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 [= *Lepra hypothamnolica*]

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, which itself is bordered by the cortical margin of the wart, this margin is typically well developed, slight constricted at the base, and often extends 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. The type specimen is from Randolph County, in the Illinois portion of the Ozarks.

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 date 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 mineral gray thallus of *P. hypothamnolica*.

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 [= *Lepra multipunctoides*]

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, 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 1996). 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, 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, \pm sublustrous, sometimes finely rugulose, occasionally with a narrow pale marginal zone; warts amplariate, 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 in 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, 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 northwesternmost known for this woodland endemic of eastern North America. Although Dibben (1980) describes 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 per ascus, with conspicuous, fine reticulate sculpting on the outside, and sometime also on the inside, of the inner wall. [stictic acid, xanthonex]

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) lists 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, amplariate, 0.4-0.7 mm broad, with 1(-3) small pale brown ostioles surrounded by a distinct pale zone which is usually yellowish tinted. [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 of 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 rotund, two-celled, brown conidiospores ca. $6 \times 4 \mu\text{m}$. 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 [= *Lepra trachythallina*]**

Thallus apple to medium gray, typically somewhat rugulose and roughened, creating a dull appearance except near

the margins, narrow plane marginal zones often present; warts common to sparse, usually well separated, irregularly rounded, 0.4 - 1 mm broad, usually covered with coarse white pruina and appearing soresiate, 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, 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 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 amplariate 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. [= *Varicellaria velata*]**

Thallus uniformly pale gray, often rugose and convoluted, with a narrow pale tan marginal zone; warts abundant, lecanorine, discrete and \pm 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 compact white pruina; spores usually 1, smooth. [lecanoric acid, \pm 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 amplariate, 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; 2 species in the Ozarks.

- 1. On thalli of polypores (*Trichaptum biforme*); spore septum pale.....*P. polyporaeum*
- 1. On twigs of *Juglans*; spore septum ± concolorous with spore wall *P. sp.*

***Phaeocalicium polyporaeum* (Nyl.) Tibell**

Frequent in woodlands, growing on thalli of the polyporous fungus *Trichaptum biforme*, which inhabits rotting logs and bases of standing dead snags. The *Trichaptum* appears to be especially common on *Quercus*.

***Phaeocalicium* sp.**

Known only from young twigs of *Juglans nigra* in a small grove in an overgrown old field adjacent to an extensive woodland in Texas County, Missouri. According to Steve Selva (pers. com.), this species closely resembles *Phaeocalicium boreale* (Nyl.) Tibell, a species known in North America only from Montana, on *Salix* bark (McCune et al. 2014). It is likely that the Ozark material is a new species, but additional study is needed. In addition to the Texas County record, Bill Buck (pers. com.) observed an unusual Calicioid lichen on twigs of *Juglans* in Laclede County, Missouri that is likely this species.

PHAEOPHYSCIA Moberg (Physciaceae)

Small, narrow lobed dark gray to brownish foliose lichens, upper cortex K-, lower cortex usually dark, occasionally pale, paraplechtenchymatous, 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, \pm immersed, with ellipsoid conidia; 8 species in the Ozarks. References: Esslinger (1978).

1. Thallus sorediate.
 2. Medulla prevailing 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. adiastrum*
 5. Soredia farinose, in well-defined, rounded soralia; thallus lobes mostly up to 0.5 mm wide.
 6. Soralia strongly capitate and elevated, usually terminal or on small secondary lobes; thallus loosely adnate; larger lobes up to 0.5 mm broad..... *P. pusilloides*
 6. Soralia orbicular, sessile, usually laminal; thallus closely adnate; larger lobes up 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 adiastrum (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 with pale tips 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 on 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 hirsuta* 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 A. Massal. (1852) Phlyctidaceae

Crustose lichens with continuous to rimose, white to pale grey, ecorticate or corticate thalli, often with rounded pale leprose eruptions on the thallus surface; photobiont *Symbiochloris s.l.*; apothecia immersed or absent; paraphyses mostly unbranched, closely adjacent; asci thin-walled, not notably thickened at apex, tholus IKI-, with an I+ blue outer layer; pycnidia immersed; conidiospores ellipsoid; 2 species in the Ozarks. Reference: Muscavitch, Lendemer & Harris (2017).

1. Thallus saxicolous, KOH+ red (norstictic acid) *P. petraea*
1. Thallus corticolous, KOH- (psoromic acid) *P. boliviensis*

Similar taxa: XXX

Phlyctis boliviensis Nyl.

Thallus pale bluish grey, matte, weakly corticate, granular, usually somewhat rimose, the sections to 0.5 mm on their longest axes; thallus with abundant, irregularly rounded, white leproid eruptions of medullary tissue to 0.8 mm; ascoma rare or overlooked, immersed in rounded, often leproid, verrucae; ascospores 1/ascus, ca. $\geq 85 \times 30 \mu\text{m}$, 13+ septate; pycnidia not seen.

Chemistry: psoromic acid (often in low concentrations and rarely lacking); KOH-, P+ yellow

Known from the southern half of the Ozarks; uncommon on boles of smooth-barked hardwoods, usually in mesic habitats, such as along streams. Most Ozark collections are from *Carpinus caroliniana*, but this species also occurs on other smooth-barked substrates, including *Ilex decidua* and *Carya cordiformis*.

Phlyctis petraea R.C. Harris, Muscavitch, Ladd & Lendemer

Thallus typically bright white to pale grey, matte, sometimes minutely pebbled, continuous to more often incompletely to fully rimose, the irregularly polygonal segments to ca. 1 mm on their longest axis and ca. 0.25 mm thick, ecorticate, with sparse to abundant rounded warts; narrow, fibrous white prothallus sometimes present; medulla white, with abundant crystals persistent in KOH, I+ orangish; schizidia sparse to occasional, globose to flattened, to 0.5 mm, loosely attached, often aggregated into rounded soralia-like clusters that leave round white spots on the thallus as they dehisce; apothecia absent; pycnidia not seen, but reportedly immersed, multilocular, with a dark ostiole; conidiospores narrowly ellipsoid, to $4 \times 1.4 \mu\text{m}$ (Muscavitch et al. 2017).

Chemistry: chemotype 1: norstictic & connorstictic acids; KOH+ red, P+ yellow; chemotype 2: norstictic & stictic acids; KOH+ red, P+ orange

Frequent in the central and southern Ozarks, on lightly shaded, typically massive, siliceous rocks in woodlands; often in sheltered microhabitats protected from significant direct wetting. Most common on sandstone, but also occurring on igneous rocks and cherts, as well as rarely on limestone and dolomite. All Ozark populations are chemotype 1, but a single collection of chemotype 2 is known in Arkansas from the Ouachitas, just south of the Ozark region.

Thalli on carbonate rocks tend to be more continuous and lack regular cracks. Older herbarium specimens typically become darker grey, sometimes with reddish spots or zones, presumably from decomposition of the norstictic acid.

PHOEBUS R.C. Harris & Ladd (2007) Roccellaceae

A monotypic genus of saxicolous lichens with orange placoid thalli, black, opegraphoid apothecia, and 3-septate, \pm ellipsoid ascospores; pycnidia unknown. Reference: Harris & Ladd (2007).

Phoebus hydrophobius R.C. Harris & Ladd

Thallus placoid, forming rounded patches to ca. 2 cm, but often coalescing into larger patches, of irregular, \pm bullate, thick, epruinose areoles, dull orange to orangish brown, the pigment KOH+ violet-black, marginal lobules occasionally slightly elongated and sublobate; medulla of thick, IKI+ blue green hyphae; photobiont *Trentepohlia*; apothecia black, typically with inconspicuous, thin, orange pruina, sessile on and between the areoles, irregularly rounded to short lirelliform, with a prominent raised, black leccedine margin, to 1.2 mm long; exciple black to brown; epihymenium brown, with orange, KOH+ brown granules; hymenium at least partially brownish to orange brown, upper portions IKI+ dark blue green, the lower portions IKI+ reddish orange; hypothecium dark orange brown to brown; paraphyses branched and anastomosed, not apically expanded; asci clavate, with 8 \pm biseriate spores; ascospores simple, ellipsoid to narrowly ovoid, often with the apical half slightly wider, halonate, $16-20 \times 5-6.5 \mu\text{m}$ (excluding halo), becoming brownish and roughened in age.

Chemistry: unknown; TLC (solvent A) with two yellow spots and one purple spot; cortex KOH+ dark violet to almost black; medulla negative for all spot tests

Known from a few sites in the southwestern Ozarks. Restricted to massive calcareous rocks, typically on vertical faces of dolomite and limestone in areas of moderately high light intensity that are protected from direct runoff or wetting. A typical habitat is the face of a massive bluff in a zone where a bedding plane of less resistant rock has weathered more rapidly than adjacent bedrock, creating a slightly sheltered zone protected by the overhanging rock immediately above. This species also occurs occasionally on large boulder faced on steep slopes.

The type specimen is from a vertical dolomite bluff in the Buffalo National Scenic River, in Searcy County, Arkansas. Phoebus is known from the Ozarks, eastern Kansas, and the Edwards Plateau. 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).

Similar taxa:

- some placoid species of *Caloplaca* have orange thalli, but these contain parietin and react KOH+ magenta; the apothecia are orange, with 2-celled, polarilocular ascospores.
- Xanthoria* and *Xanthomendoza* can have orange thalli, again with parietin and reacting KOH+ magenta; these are foliose lichens with a distinct pale lower surface, usually with rhizines, and ascospores as in *Caloplaca*.

PHYLLOPSORA Müll. Arg. (Ramalinaceae)

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; 2 species in the Ozarks. Reference: Brako (1991).

- 1. Thallus lobes ≥0.5 mm broad; “isidia” fimbriate, cylindrical*P. corallina*
- 1. Thallus lobes ≤0.4 mm broad; “isidia” globose..... *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) Michaux (1803) Physciaceae

Small to medium sized light grey foliose lichens with radiating, convex to flat, narrow (usually <2 mm) lobes; upper cortex with atranorin (KOH+ yellow); lower surface typically corticate and pale (except in *P. atrostriata*), usually with scattered, mostly simply to sparsely furcate rhizines; photobiont trebouxoid; apothecia laminal, with a well-developed thalline margin and dark disk, this sometimes obscured by whitish pruina; epithecium brownish; hypothecium pale, asci *Lecanora*-type, with 8 ellipsoid, brown, 1-septate, thick-walled spores with rounded to angular lumina; pycnidia immersed, pale, with a dark ostiole, with bacilliform conidiospores; 15 species in the Ozarks. References: XXXX.

Several corticolous taxa of *Physcia* are hosts for lichenicolous fungi. *Nectriopsis parmeliae* has fuzzy, globose, pinkish orange perithecia laminal on the host thallus, with two distinct sizes of 1-septate ascospores

in each ascus. It occurs on a variety of foliose lichens containing cortical atranorin, including *Physcia americana*. *Marchandiomyces corallinus* has vivid pink XXX; it occurs on *Physcia millegrana* and *P. stellaris*.

1. Thallus sorediate and/or blastidiolate.

2. Lobes >0.7 mm broad, usually with the main lobes >= 1 mm broad; soredia distinct, usually in well-defined laminal, terminal or marginal soralia.

3. Soralia terminal, hooded, suberect; thallus margins with long pale cilia; medulla KOH-

.....*P. adscendens*

3. Soralia exposed, marginal or laminal, sessile; cilia lacking; medulla KOH+ yellow.

4. Lower surface ecorticate and fibrous, dark except towards tips; soredia marginal

.....*P. atrostriata*

4. Lower surface corticate and smooth, mostly pale to tan; soredia laminal or marginal.

5. Thallus pale grey throughout; +/- emaculate; zeorin absent (other triterpenoids sometimes present); usually corticolous.

6. Soralia farinose, in well-defined orbicular soralia*P. americana*

6. Soredia coarse and mixed with isidiate pustules, diffuse*P. clementei*

5. Thallus, at least the soredia and lobe tips, dark grey, with abundant and conspicuous white maculae; zeorin present; saxicolous [*P. caesia*]

2. Lobes to 0.5) mm broad, soredia blastidiolate or coarse and lobulate, mostly marginal, lacking well-defined soralia.

7. Thallus saxicolous on siliceous rocks; lobes prevailing to 0.2 mm broad and elongate, more than twice as long as wide.

8. Thallus tightly appressed to adnate, the lobe structure evident throughout the thallus; lower cortex present essentially throughout the thallus.

9. Lobes mostly <0.2 mm broad, appearing closely appressed to substrate; medulla paraplechtenchymatous.....*P. subtilis*

9. Main lobes usually >0.2 mm broad, closely adnate, but under magnification with distinct space visible between thallus and substrate, and the lobe tips sometimes ascending; medulla mostly prosoplectenchymatous

.....*P. thomsoniana*

8. Thallus tightly appressed, becoming subcrustose in central portions; lower cortex not evident or poorly developed, hyphal, and mostly near the lobe tips.....[*P. dakotensis*]

7. Usually corticolous, very rarely on rocks and concrete in highly disturbed or ruderal areas; lobes prevailing to >0.3 mm broad, short and usually less than twice as long, with abundant side branches*P. millegrana*

1. Thallus lacking diaspores.

10. Thallus lobes <0.3 mm broad; saxicolous on siliceous rocks*P. halei*

10. Thallus lobes mostly >0.4 mm broad; substrates various but not on siliceous rocks.

11. Medulla KOH-, zeorin and other triterpenoids absent.

12. Upper cortex not pruinose or locally pruinose, especially near lobe tips (but the upper cortex typically with prominent white spots), pale grey; lobes typically 1 mm or less broad, the tips rounded to subtruncate; common throughout the Ozarks.....

.....*P. stellaris*

12. Upper cortex +/- completely pruinose; pale grey to distinctly whitish; lobes often >1.5 mm broad, the tips rounded; rare.....*P. biziana*

11. Medulla KOH+ yellow, zeorin and/or other triperpenoids present.

13. Saxicolous.

14. Apothecia not notably pruinose; lobes mostly <1mm broad, elongate and somewhat parallel and separated, with +/- widely spaced lateral lobes along the median portions; in natural habitats

.....*P. phaea*

14. Apothecia usually with abundant pale grey pruina; some lobes usually >1mm broad, sprawling and often

confluent or overlapping, with closely spaced lateral lobes, especially near the lobe tips; usually in disturbed areas *P. aipolia*

13. Corticolous.

15. Lobes thin and +/- flat throughout; thallus essentially emaculate; spores with rounded lumina (*Pachysporaria*-type); zeorin absent (but other triterpenoids present); rare..... *P. neogaea*

15. Main lobes convex; thallus distinctly white maculate; spores with angular lumina (*Physcia*-type); zeorin (+/- other triterpenoids) present; common.

16. Main lobes >1 mm broad, +/- confluent to overlapping; spores >= 19um long..... *P. aipolia*

16. Main lobes <1 mm broad, usually separated; spores <18 um long *P. pumilior*

***Physcia adscendens* (Fr.) H. Olivier**

Small, irregularly rounded rosettes; lobes to 1 mm broad, the margins with scattered, pale to dark tipped cilia to 1 mm long, the lobes terminating in prominent ascending hooded soralia; apothecia absent in local populations.

Chemistry: atranorin [cortex KOH+ yellow; medulla KOH-]

Known only from exposed old marble tombstones in a cemetery in Ste. Genevieve County in the southeastern Missouri Ozarks. This is a typically corticolous species of wooded ecoregions well north of the Ozarks, and local populations are almost certainly recent introductions. This lichen is also known from marble tombstones at a few other sites in northern Missouri and central Illinois.

Similar taxa:

- some forms of *Physciella chloantha* have slightly hood-like labriform soralia, but lack marginal cilia and have a KOH- upper cortex.

***Physcia aipolia* (Ehrh ex Humb.) Fűrnr.**

Medium-sized, moderately appressed rosettes with the main lobes >1 mm wide and typically confluent to overlapping, with abundant side branches; upper cortex with prominent white maculations, these sometimes somewhat protruding and appearing pruina-like; apothecia common, often densely pale grey pruinose.

Chemistry: atranorin, zeorin, +/- other triterpenoids [cortex & medulla KOH+ yellow]

Occasional south and eastward in the Ozarks, becoming common in the more intensively farmed and ranched areas of the northern and western Ozarks. It is common on a variety of hardwoods, particularly *Fraxinus* and *Maclura*, as well as less commonly on *Juniperus* and rarely on lightly shaded siliceous rocks in disturbed uplands. This lichen is characteristic of pastured regions, where it is common and sometimes dominant on lightly shaded boles and larger branches of trees along roadsides and fencerows, occasionally occurring on smaller branches as well. It is notably absent from larger intact woodland systems, and seems to be associated in part with areas having significant windblown dust. Ozark material is var. *aipolia*.

Similar taxa:

- *Physcia stellaris* - narrower lobes, KOH- medulla
- *Physcia pumilior* - narrower lobes, usually in intact woodlands

***Physcia americana* G. Merr**

Small to medium, compact appressed thalli with adnate lobes to XX mm broad, the upper cortex lacking

conspicuous maculae, with frequent, round laminal soralia and finely granular, pale soredia; apothecia very rare.

Chemistry: atranorin, triterpenoids [cortex & medulla KOH+ yellow]

Common in intact, open and closed woodland systems throughout the Ozarks, on lightly shaded boles and large to medium branches of a wide variety of hardwoods and *Juniperus*; consistently among the dominant lichens on boles of *Quercus alba*, *Q. muelenbergii*, and *Q. stellata*. This species also occasionally occurs on lightly shaded dolomite, especially along glade margins.

Similar taxa:

- *Physcia clementei* - extremely rare taxon with more diffuse, coarser soredia mixed with isidia-like pustules
- *Pyxine* sp. - pigmented medulla, more prominent and delineated pruina on lobe tips, lower surface mostly dark
- *Heterodermia speciosa* - thalli less adnate, with elongate marginal soralia

***Physcia atrostriata* Moberg**

Thalli with many short, blocky-branched side lobes, with abundant marginal soredia giving the margins a somewhat uneven appearance, lobe tips and margins pruinose; lower surface ecorticate and fibrous, white near the lobe tips, becoming black inward, with fine black lines extending into the pale areas.

Chemistry: atranorin, triterpenoids, zeorin [cortex & medulla KOH+ yellow]

Rare; a southeastern coastal plain species known only from mossy bases of hardwoods in the extreme southern Arkansas Ozarks.

Similar taxa:

- *Heterodermia casarettiana* & *H. obscurata* - lobe tips more rounded and apically expanded; soralia more lip-like, uniform, and prominent, as well as more conspicuously terminal; lower surface with yellowish or orangish to dark purple pigmented zones

***Physcia biziana* (A. Massal.) Zahlbr.**

Small pale grey thalli with a +/- uniform layer of coarse pruina on the upper cortex; main lobes >1.5 mm broad; the medulla lacking atranorin.

Chemistry: atranorin [cortex KOH+ yellow, medulla KOH-]

Extremely rare in the Ozarks; restricted to exposed hardwood branches at a few scattered locations, typically in somewhat xeric microhabitats. Ozark populations are somewhat disjunct east of the primary range of this western taxon.

Similar taxa:

- *Physcia stellaris* - upper cortex white-spotted, but epruinose or with small areas of diffuse +/- inconspicuous pruina, especially near the lobe tips.
- *Physcia aipolia* - upper cortex white spotted and sometimes somewhat pruinose, but not evenly and coarsely pruinose; medulla KOH+ yellow.

[*Physcia caesia* (Hoffm.) Hampe ex Föhrn.]

Small pale to darkish grey rosette-forming thalli with frequently branched lobes to 2 mm broad, the upper cortex with abundant small white maculae; soredia laminal, round, +/- strongly convex, the soredia containing a mixture of pale and dark bluish grey granules.

Chemistry: atranorin, zeorin, +/- other triterpenoids [cortex and medulla KOH+ yellow]

This lichen, which typically occurs on exposed siliceous rocks, is not known from the Ozarks, despite previous literature reports (e.g. Berry [1936]) and numerous older herbarium specimens so named - most of which turn out to be saxicolous specimens of *P. americana*. *Physcia caesia* occurs north and west of the Ozarks in the Great Plains and Great Lakes regions, but not within ca. 200 miles of the ecoregion.

Similar taxa:

- *Physcia americana* - mostly corticolous, upper cortex white-spotted, soredia uniformly pale grey

Physcia clementei (Sm.) Lynge

Adnate grey thalli with lobes to 1 mm broad, with irregularly rounded laminal soralia that sometimes coalesce in diffuse patches, the soredia granular and mixed with friable isidiate pustules.

Chemistry: atranorin, triterpenoids (often in trace amounts) [cortex and medulla KOH+ yellow]

A western lichen that is rare locally; known only from a single location each in the Arkansas and Missouri Ozarks, occurring on both *Juniperus* and lightly shaded dolomite.

Similar taxa:

- *Physcia americana* - soralia discrete and uniformly rounded, with fine soredia lacking isidiate pustules

[Physcia dakotensis Ess]

Occasional on exposed siliceous rocks in the Great Plains west and north of the Ozarks, usually in full sunlight in habitats such as prairie openings and sandstone bluff systems. Reports of this taxon from the Ozarks are referable to *P. thomsoniana*. [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 [= *Physcia tenuis*]

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 K 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.) Nyl.

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 K+ yellow medullary reaction, but all Ozark material examined reacts K-. Esslinger and Egan (1996) point out that the medulla of *P. subtilis* is actually K- but the lower cortex may be K+ yellow. The taxonomy of this complex in the region is problematical: Thomson (1963) indicates 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]

Physcia thomsoniana Esslinger

Common throughout the Ozarks, usually on massive, exposed to lightly shaded siliceous bedrock in glades and on bluffs and large outcrops.

PHYSCIELLA Essl. (Physciaceae)

Narrow lobed, pale gray foliose lichens with a K- 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 K-.

[Physciella melanchra (Hue) Essl.]

Questionably present in the Ozarks, based on a few specimens 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*. In the Great Plains, this taxon is frequently fertile and lightly pruinose, but Ozark specimens are neither.

PHYSCONIA Poelt (Physciaceae)

Narrow-lobed, brown or grayish, often pruinose, sorediate, 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; rare species*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. detera* (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.

PICCOLIA (A. Massal. (1856) *Lecanoromycetes insertae sedis*

Small corticolous crustose lichens with thin, granular thalli; photobiont chlorococcoid; apothecia lacking a thalline margin; hypothecium pale to light gray; asci polysporous; ascospores globose.

Piccolia nannaria (Tuck.) Lendemer & Beeching

Rare; known from hardwood boles at two Ozark sites - one in Arkansas and one in Missouri. At a distance, the bright yellow thalli are evocative of a *Candelariella*.

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 Harris (1979) points out, at first glance this species resembles an *Acarospora*.

PLACIDIUM A. Massal. (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 4
 - 4. Asci clavate; ascospores ± biseriate *P. umbrinum*
 - 4. Asci cylindrical; ascospores initially uniseriate *P. lacinulatum*

Placidium arboreum (Schwein. ex E. 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 to subfoliose 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 up to 5 mm broad with undulate margins that are free from the substrate, a medulla which is sharply delimited from the lower cortex, laminal pycnidia with short cylindrical conidia ($3-4 \times 1-1.3 \mu\text{m}$), and small spores ($10-14 (-16) \times 5-6 \mu\text{m}$). (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 \pm 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 [= *Claviscidium lacinulatum*]

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.

Placidium umbrinum (Breuß) Prieto & Breuß [= *Claviscidium umbrinum*]

Apparently rare in Missouri, but potentially overlooked; occurring in similar habitat, and appearing identical to, *P. lacinulatum*.

PLACYNTHIELLA Elenkin (Trapeliaceae)

Lignicolous crustose lichens with dark brown thalli composed of tiny coralloid-isidiate granules; 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. Saxicolous; 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 in the Ozarks from a single collection from a rhyolite glade in Missouri. Distribution is unclear,

as the species was only recently described from southern California (Lendemer 2004)

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 (Hudson) 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, \pm 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. (Verrucariaceae)

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 V_zda (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 (Taylor) V_nda

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; 2 species in the Ozarks.

- 1. Thallus isidiate; ascospores 8-celled *P. scabrida*
- 1. Thallus not isidiate; ascospores 10+ celled *P. heterospora*

Porina heterospora (Fink ex J. 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.

Porina scabrida R.C. Harris

Seldom collected, but likely overlooked, on tree bases and logs at scattered sites through the Ozarks.

PORPIDIA Körb. (Lecideaceae)

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 thin, whitish; apothecia sessile, jet black, epruinose
 - 2. Margin radially cracked; exciple carbonaceous throughout; hyphae not discernable in exciple; occasional *P. subsimplex*
 - 2. Margin not radially cracked; outer exciple greenish; hyphae discernable in exciple; rare *P. crustulata*
- 1. Thallus thick, gray; apothecia mostly immersed, blue-gray, densely gray pruinose *P. albocaerulescens*

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 subsimplex (H. Magn.) Fryday
Occasional on lightly shaded siliceous rocks, especially sandstone, in wooded uplands.

PROTOBLASTENIA (Zahlbr.) J. Steiner (Psoraceae)

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 chlorococcoid, 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 4-5.5µm 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 sits 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 \pm radiating hyphae. Hypothecium colorless to pale buff or orangish, without granules, sometimes extending stipe-like into the thallus. Ascospores ellipsoid to broadly ellipsoid, $11\text{--}(12.2)\text{--}13 \times 6\text{--}(7.1)\text{--}8 \mu\text{m}$. Pycnidia rare, inconspicuous, immersed, very pale orangish (KOH+ weakly red), ca. 50-100 μm in diameter. Microconidia rod-shaped, $6\text{--}7.5 \times 1.5 \mu\text{m}$. 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*, a small peritheciate lichenicolous fungus with eight 2-celled brown spores per ascus, occasionally parasitizes this species, as does *Muellerella lichenicola*, which has dark perithecia with polysporous asci and septate brown ascospores.

PSEUDOCYPHELLARIA Vainio (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. [= *Crocodia aurata*]

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 (Porinaceae)

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; frequent.
 - 2. Corticolous; ascospores 8-13 celled, $38\text{--}50 \times 5.5\text{--}7.5 \mu\text{m}$ *P. cestrensis*
 - 2. Saxicolous; ascospores 8(9) celled, $32\text{--}45 \times 5\text{--}6 \mu\text{m}$ *P. guentheri*

Pseudosagedia cestrensis (Tuck.) 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) Hafellner & Kalb

Apparently rare, 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 bases and shaded lower boles of hardwoods at a single site each in Arkansas and Missouri and several sites in Illinois.

PSORA Hoffm. (1796) Psoraceae

Saxicolous or terricolous squamulose lichens with white margins; lower surface pale to tan, appearing minutely roughened from interwoven hyphae; photobiont chlorococcoid; apothecia marginal or laminal, ultimately emarginate and convex; epithecium yellowish to reddish brown, with small yellowish to brownish orange parietin crystals, KOH+ magenta; hypothecium pale, with abundant calcium oxylate crystals, asci *Porpidia*-type, with 8 simple, ellipsoid spores typically to $16 \times 7 \mu\text{m}$; pycnidia not seen in Ozark material, laminal, immersed, the ostiole pale, with bacilliform conidia; 4 species in the Ozarks. References: Timdal (1986, 2002).

Similar taxa:

- *Lecidea lurida* - uniformly brown, more lobate squamules with thin dark margins; epithecium KOH-
- *Peltula* - smaller, more erect squamules with dark marginal soredia
- *Placidium* - brown peritheciate thalli with concolorous margins
- *Psorula* - smaller, dark-margined squamules with a dark lower surface; epithecium greenish

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 grey to brown; medulla UV-; on soil and rocks associated with carbonate substrates.
 2. Thallus saxicolous *P. pseudorussellii*
 2. Thallus terricolous.
 3. Squamules brown to chocolate brown; medulla KOH+ yellow turning orange-red (norstictic acid); apothecia prevailingly laminal, reddish brown *P. russellii*
 3. Squamules pinkish to reddish brown; medulla KOH-; apothecia prevailingly marginal or submarginal, black *P. decipiens*

Psora decipiens (Hedwig) Hoffm.

Pinkish tan to brick red or reddish brown adnate squamules to 6 mm broad, irregularly rounded to sublobed, with a prominent white erose margin; upper surface often pruinose, especially near the margins, the upper cortex sometimes fissured; apothecia common, typically 1-2(4)/squamule, prevailingly marginal to submarginal, dark reddish brown to black, sometime with white or yellowish pruina, to 1.3 mm broad; epithecium deep reddish brown, the pigmentation suffusing into the hymenium.

Chemistry: no lichen substances

Occasional on exposed, seasonally xeric, high-base soils over both limestone and dolomite in glades throughout the Ozarks. This species is almost always associated with *Placidium laciniatum* and/or *P. squamulosum*; other associates include *Collema coccophorum* and, less commonly, *Heppia adglutinata* and *Psora russellii*.

Psora icterica (Mont.) Müll. Arg.

Squamules green to yellowish green, to 8 mm broad, usually sublobate and sometimes appearing almost foliose, with narrow, well-defined involute white margins; upper surface occasionally with cracks and a marginal zone of faint pruina; medulla pale yellow, particularly in the upper portions; apothecia common, typically 1-3(6)/squamule, prevailingly laminal, brown to black, occasionally with thin yellowish pruina, to 1.4 mm broad; epithecium yellowish brown.

Chemistry: rhizocarpic acid

Rare and restricted to thin exposed soil pockets over sandstone, most commonly on Pennsylvanian channel sandstones on glades in the Springfield Plains subsection of the western Missouri Ozarks, where it is consistently associated with a characteristic vascular cohort that includes *Geocarpon minimum*, *Sedum nuttallianum*, and *Selenia aurea*. These sandstones were formed in braided freshwater streams, and have an unusual composition including the presence of several heavy metals.

Psora pseudorussellii Timdal

Squamules tan to brown, greyish brown in more shaded sites, to 7 mm broad, rounded to sublobate, loosely adnate, with free or upturned thick white margins; upper cortex lustrous, rarely pruinose, sometimes fissured; apothecia common, prevailingly laminal, reddish brown, to 1.5 mm broad, usually ≤ 3 /squamule.

Chemistry: no lichen substances

Frequent and characteristic on exposed dolomite in glades, on bluff summits, and on exposed large outcrops and boulders throughout the Ozarks. Less frequently, this species also occurs on limestone glades. It has been collected twice on old, weathered concrete. Found throughout the Ozarks, but extensive exposures of carbonate bedrock are limited in the southern Ozarks, so this species is most common in the northern two thirds of the region.

Psora pseudorussellii sometimes survives in shaded overgrown glades, and remnants of dead thalli can sometimes persist for years after being overshadowed, testifying to the formerly more open character of these habitats.

Psora russellii (Tuck.) A. schneider

Squamules chocolate brown to occasionally more greyish brown, round to convolute or lobate, to 6 mm broad, loosely adnate, with the prominent thick white margins frequently upturned; individual squamules often massing into \pm continuous mats; upper surface sometimes pruinose; apothecia common, to 9/squamule, prevailingly laminal, reddish brown to black, to 1.5 mm broad, frequently with thin yellow pruina.

Chemistry: norstictic acid

Uncommon and sporadic throughout the northern two thirds of the Ozarks, but often locally abundant, on exposed thin soils over extensive dolomite bedrock in glades; often associated with *Placidium laciniatum* and/or *P. squamulosum*, *Psora decipiens*, 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 (Orange) H. Harada

Known only from an old log in a woodland in the northern Ozarks.

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. Schneider (Psoraceae)

Small lichenicolous squamules; photobiont chlorococcoid; apothecia marginal, black; asci *Porpidia*-type, with 8 simple, ellipsoid spores; pycnidia marginal, dark to greenish, with ellipsoid conidia; a monotypic genus that occurs in the Ozarks..

Psorula rufonigra (Tuck.) Gotth. Schneid.

Squamules solitary to more commonly aggregated and imbricate, to 2.5 mm broad, rounded to crenate or short-lobate, brown to greyish or olive brown, with thickened, distinctly grey margins; lower surface dark, frequently with a pale zone near the margin on unattached portions of the thallus, the attached portions with dark tomentum-like filaments to 80 µm long; apothecia common, marginal to submarginal, black, round to sublobate with age, to 1.5 mm broad, ultimately plane, with slightly thickened margins; epithecium dark bluish to greenish grey, KOH-, hypothecium pale to purplish grey; ascospores 8, irregularly ellipsoid, ca. 10-14 × 5-7 µm; pycnidia not seen in Ozark material.

Chemistry: no lichen substances

Occasional throughout the Ozarks, on exposed to slightly shaded siliceous rocks, associated with cushions of *Spilonema revertens*, usually where moisture and a thin layer of fine silty soil accumulate, on flat surfaces, small depressions, or in crevices. This species occurs in areas with large exposures of siliceous bedrock, such as sandstone, igneous, and chert glades and bluffs, and on sandstone and chert rocks in dolomite glades.

Psorula rufonigra is an obligate parasite of *Spilonema revertens*, a minute, subfruticose cyanobacterial lichen, and all Ozark collections are associated with the dense cushions of short, branched, brown filaments characteristic of *Spilonema*.

Similar taxa:

- *Psora* sp. - larger squamules with pale margins and pale lower surface; not lichenicolous, epithecium KOH+ magenta, lacking greenish or bluish tints
- Toninia submexicana* - more distinctly lobate, not lichenicolous, epithecium purplish, KOH+ purple, ascospores 4-celled

PUNCTELIA Krog (Parmeliaceae)

Large, 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), 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..... *P. missouriensis*
 - 4. Soredia farinose; thallus not markedly lobulate.
 - 5. Thallus smooth; soredia often in round laminal soralia..... *P. caseana*
 - 5. Thallus foveolate-ridged to scrobiculate; soredia prevailing 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 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 sometime associated. The medulla of both species is often very faintly yellowish-dingy.

***Punctelia graminicola* (B. de Lesd.) Egan**

Thallus large, to 15 cm broad, pale gray to bluish gray, lobes apically expanded and \pm 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 \pm 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, $4-7 \times 1-1.3 \mu\text{m}$. [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 cronia*, *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 $> 10 \mu\text{m}$ long. Adding to the confusion, *P. graminicola* was long known as *P. semansiana* (W.L. & 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* (NY), is a mixture of typical *P. graminicola* and a morphologically identical thallus with distinctly curved, filiform conidia $7-11 \mu\text{m}$ 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 \pm 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 $5-5.5 \times 0.8 \mu\text{m}$. [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* 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) describes the morphology of the diaspores in detail, and includes *P. missouriensis* within *P. punctilla* (Hale) Krog, but Van Herk and Aptroot (2000) consider the species to be distinct; Wilhelm and Ladd (1992) provide 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 to become elongate linear masses of farinose soredia; apothecia unknown in Ozark material; pycnidia very rare; conidia narrowly bacilliform, $6-8 \times \leq 1 \mu\text{m}$. [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 the 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 up to 0.2 mm broad on older portions of the thallus; cylindrical isidia abundant, typically to $0.2 \times 0.1 \text{ mm}$, 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 numbers 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 *Oviculispora parmeliae* (Berk. & M.A. Curtis) Etayo [formerly *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 *O. parmeliae* in the Ozarks include *Flavoparmelia caperata*, *Myelochroa aurulenta*, *Physcia americana*, *Punctelia missouriensis*, *Pyxine soorediata* and rarely, *Heterodermia obscurata*, *Lecanora hybocarpa*, and *Xanthoparmelia*. The host thallus becomes necrotic in the region of the *Nectriopsis* infestation.

***Punctelia caseana* Lendemer & Hodkinson**

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.

Local material was long referred to as *Punctelia subrudecta* (Nyl.) Krog, which does not occur in North America..

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 (*insertae sedis*)

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 assymetrical, spores; pycnidia with bacilliform to ellipsoid conidia; two taxa 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. prosperellum*

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 so that the dry ascoma resembles 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 seasonal stream in ravine, on dolomite in streambed, 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 prosperellum (Nyl.) R.C. Harris
Rare, known only from dolomite above Table Rock Lake.

PYRENULA A. Massal. (1814) Pyrenulaceae

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; conidiospores filiform; 9 species in the Ozarksregion. References: Harris (1989. 1995).

- 1. Ascospores 3-septate (rarely submuriform in *P. subelliptica*)2
- 2. Ascospores with a layer of endospore separating lumen of terminal locules from the outer spore wall3
- 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

- 4. Hymenial gel I-; ascospores with a dark cap at ends, 36-45 x 12-17 μm ; thallus usually UV+ yellow; on *Carya* *P. caryae*
- 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 elongated, occasionally submuriform, 24-35 x 10-15 μm ; hymenium inspersed *P. subelliptica*
- 5. Ascospores with median lumina not elongated, 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
- 6. Ostiole \pm lateral; ascospores with terminal locules elongated *P. cuyabensis*
- 6. Ostiole apical; ascospores with terminal locules not elongated 7
- 7. Hymenium inspersed, hymenial gel IKI+ blue.
 - 7A. Thallus UV+ yellow (lichexanthone); perithecia ≥ 0.5 mm broad; ascospores elliptical; common *P. pseudobufo*
 - 7A. Thallus UV-; perithecia 0.3-0.6 mm broad; ascospores \pm citriform; rare *P. fetivica*
- 7. Hymenium not inspersed, hymenial gel IKI-..... *P. nitidula*
- 1. Ascospores muriform, 40-60 x 16-27 μm 8
- 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. pseudobufo*, 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. [\pm lichexanthone]

***Pyrenula cuyabensis* (Malme) R. C. Harris**

Rare on boles of hardwoods. The orientation of the ostiole is not always clear but the elongated terminal lumina are diagnostic.

***Pyrenula fetivica* (Kremp.) Müll. Arg. [formerly *Pyrenula citriformis* R.C. Harris]**

Extremely rare on boles of hardwoods in mesic to moist woodlands.

***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 nitidula* (Bres.) R.C. Harris [formerly *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 [= *Ramboldia russula*]

Rare and scattered, on exposed small branches of hardwoods near permanent humidity sources, such as perennial streams and rivers. *Ulmus alata* is a common ubstrate. 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. [= *Lecidea varians*]

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*. Pycnidia are brown, laminal, irregularly rounded, to 0.1 mm broad; conidiospores are filiform, gently curved, 20-26 × 1-1.2 μm 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) suggests interim placement in *Lecidea*, although a new segregate genus may be a more appropriate final disposition. [xanthone]

PYXINE Fr. (1825) Physciaceae

Medium-sized, primarily corticolous, light grey to bluish grey, sorediate foliose lichens with grey to bluish grey thalli and narrow lobes that are only slightly expanded at the apices; lobe edges with small, narrow, white pseudocyphellae; upper cortex with pruina towards lobe tips; lower surface black, corticate, prosoplectenchymatous, with simple to furcate or tufted rhizines; medulla (at least the upper portions) yellow to salmon or orangish; photobiont *Trebouxia*; apothecia rare, sessile, to 2 mm broad, with black disks and well-developed margins that appear thalline but usually lack algae; epithecium blue-black, KOH+ purple; hypothecium brown, asci *Lecanora*-type, with 8 brown, ellipsoid, 1-septate, thick-walled spores; pycnidia rare, laminal, immersed, with protruding, thick, dark ostiole margins ca. 80 μm broad; conidiospores narrowly bacilliform, ca. 4 ×1 μm; 2 species in the Ozarks. References: Imshaug (1957); Amtoft (2002).

- 1. Upper cortex UV+ yellow (lichexanthone); well-defined patches of fine white pruina present near the lobe tips, but not extending to lobe margins; pruina appearing continuous within a patch even at 15× magnification ...*P. subcinerea*
- 1. Upper cortex UV-; diffuse patches of coarse granular pruina near the lobe tips, these extending to lobe margins, the pruina readily distinguishable at 15× magnification..... *P. sorediata*

- Similar taxa:
- Physcia species have a white medulla, pale lower surface, pale hypothecium, and KOH- epithecium
 - Dirinaria species have a white medulla and lack rhizines
 - Myelochroa species have a yellow medulla, but broader lobes, squarrosely branched rhizines, and pale simple ascospores
 - Phaeophyscia rubropulchra has a distinctly red medulla and a brownish to dark grey thallus

Pyxine sorediata (Ach.) Mont.

Thallus to 6 (11) cm broad, the lobes 1-1.5 (-2) mm broad, moderately sublobed, upper surface mostly smooth

except for patches of diffuse, coarse pruina at the lobe tips, the patches extending to the edges of the lobes, the pruina crystals to 50 μm broad; soredia abundant, lead grey, finely granular, in rounded to sublabriform, mostly marginal soralia; elongate white pseudocyphellae along lobe edges, these sometimes appearing almost continuous; medulla dull mustard yellow to dingy orangish yellow; lower cortex densely rhizinate, with abundant, short, often tufted, rhizines; apothecia very rare, to 2 mm broad. The thallus sometimes has locally brown tinted zones, and is often paler grey towards the lobe tips.

Chemistry: atranorin, terpenes, unknown medullary pigment; cortex KOH+ yellow (sometimes obscure); medulla KC+darkening, becoming tardily brownish or reddish

Common throughout the Ozarks, especially in wooded uplands where it occurs on a wide variety of hardwoods as well as lightly shaded siliceous rocks, especially sandstone, and occasionally on mossy dolomite. This is a characteristic species of mid-boles of oaks.

Similar taxa:

-In the field, particularly when growing on rocks, this species can resemble *Heterodermia speciosa*, which has a white medulla and paler soredia

Parasites: *Oviculispora parmeliae* can form small, fuzzy pink ascoma on the thalli, causing local bleaching and necrosis of the host; see discussion under *Punctelia rudecta*.

Pyxine subcinerea Stirton

Thallus tightly appressed, typically to 5 cm broad, the lobes much branched, to 1 mm broad; upper cortex smooth, except the lobe tips usually with discrete patches of continuous fine white pruina with crystals ca. 20 μm broad, these patches separated from the margins of the thallus by a distinct zone of bare cortex; soredia abundant, pale, farinose, in orbicular to sublabriform, laminal to marginal soralia near the lobe margins, the individual soralia typically 0.5 mm broad; pseudocyphellae indistinct, mostly marginal; lower cortex with scattered, simple to furcate rhizines usually >0.2 mm long.

Chemistry: lichexanthone, terpenes, unknown pigment; cortex UV+ yellow, all spot tests negative

Abundant in woodlands throughout the Ozarks, occurring at all level son trees in wooded uplands, but seldom detected in the canopy unless the branches are assayed with UV light, since these thalli are typically minute and fragmentary. The species has been documented from most Ozark hardwood species, and is common on oaks in both the red and white groups, as well as commonly occurring on *Juniperus*. It rarely occurs on lightly shaded rocks in the Ozarks, where it is known from sandstone and dolomite.

A related species with a UV+ yellow cortex, *Pyxine caesiopruinosa* (Tuck.) Imshaug, occurs just to the south in the Ouachita region of Arkansas and should be looked for in the extreme southern Ozarks; it has coarser soredia and pruina, with 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; 5 species in the Ozarks. Reference: LaGreca (1999).
- 1. Thallus esorediate; corticolous.
 - 2. Containing usnic acid only; uncommon *R. americana*
 - 2. Containing some combination of divaricating, evernic, or lecanoric acids in addition to usnic acid; common *R. culbersoniorum*
 - 1. Thallus soreciate; 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 along glade margins.
[usnic acid (often present in low concentrations)]

Ramalina culbersoniorum LaGreca

Occasional in the upper half 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 local *Ramalina* populations is problematical; there is almost certainly more than one species represented in the confusing complex of morphologies in the Ozark region. *Ramalina americana* Hale, containing usnic acid only, is morphologically similar to *R. culbersoniorum*.
[usnic acid, plus divaricatic and/or lecanoric acids]

Ramalina petrina Bowler & Rundel

Rare on lightly shaded sandstone exposures at a few sites in the Arkansas portion of the souther Ozarks, typically occurring in sheltered microhabitats with high light intensities that are protected from much direct wetting. [atranorin(?), protocetraric & usnic acids]

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 Ozarks. Previous reports of *R. intermedia* (Delise *ex* Nyl.) Nyl. should be referred here. [evernic & usnic acids]

RAMONIA Stitzenb.(Gyalectaceae)

Minute crustose lichens with immersed thallus, photobiont *Trentepohlia*, immersed, deeply cup-shaped apothecia opening by a broad pore, 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 region.

References: V_zda, 1966, Folia Geobot. Phytotax. Bohemoslov. 1: 154-175; V_zda, 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* V_zda**

Thallus immersed, light green-gray. Apothecia initially immersed and closed, breaking open to 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 \pm 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 of 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 \pm 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 trunk of *Carya*, 3 Nov 2000, *Harris 44770-A* (NY).

This specimen seems to be a member of the *R. luteola* V_zda 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 than 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. Reference: Fryday (2000).

- 1. Cortex and medulla C+ pink (gyrophoric acid); spores greenish to brown *R. grande*
- 1. Cortex and medulla C-; spores hyaline (sometimes becoming pale brownish in age).
 - 2. Spores 2-celled.
 - 3. Exciple dark internally, without crystals; medulla K- *R. hochstetteri*
 - 3. Exciple pale internally, obscured by small crystals; medulla K+ yellow or red
..... *R. cinereovirens*
 - 2. Spores muriform
 - 4. Medulla I+ violet *R. distinctum*
 - 4. Medulla I- *R. reductum*

Rhizocarpon cinereovirens (Müll. Arg.) Vainio

Rare locally, on lightly shaded sandstone in woodlands; slightly more common just north of the region. [two chemotypes: 1) norstictic acid; 2) stictic acid \pm norstictic acid]

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 (Körb.) Vainio

Rare; on siliceous rocks in open woodlands.

Rhizocarpon reductum Th. Fr.

Known only from lightly shaded to exposed siliceous rocks in Shannon County. At one site, in a massive igneous canyon system, it occurs on lightly shaded, mesic, igneous talus, associated with *Ochrolechia yasudae* and *Fuscopannaria leucosticta*. [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).

- 1. Apothecia orange-pinkish, typically pruinose; thallus of closely adjacent bullate areoles *R. subdiscrepans*
- 1. Apothecia greenish tan, epruinose; thallus placoid *R. opiconensis*

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]

Rhizoplaca opiconensis (Brodo) Leavitt, Zhao Xin & Lumbsch [formerly *Lecanora opiconensis*]

Known only from exposed hematite in the glade/historic mine complex atop Pilot Knob in Iron County, Missouri.

RINODINA (Ach.) Gray (Physciaceae)

Nat. Arrang. Brit. Plants 1: 448. 1821.

Small crustose lichens with continuous to areolate to obscure thalli, apothecia sessile to subimmersed, with thalline margin well-developed or absent, photobiont *Trebouxia*, 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 bark2
 2. On bryophytes; apothecia biatorine; ascospores \pm *Physcia*-type, 17.5-19.5 x 9.5-11 μ m*Rinodina* sp. 42859
 2. On bark3
 3. Thallus blastidiate4
 4. Blastidia marginal, ciliate (fuzzy looking); thallus areolate, \pm shiny; ascospores *Pachysporaria*-type, 16-19 x 9-10 μ m*R. papillata*
 4. Blastidia/small warts laminal, not “fuzzy”; thallus rimose, matt; ascospores *Pachysporaria*-type, ca. 14-17 x 7.5-9 μ m*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 μ m*Rinodina* sp. 24165
 5. Apothecia with persistent thalline margin or \pm immersed6
 6. Thallus subsquamulose-areolate; ascospores *Pachysporaria*-type, 22-24(-30) x 10-14 μ m, zeorin present*R. dolichospora*?
 6. Thallus not subsquamulose; ascospores smaller, <20 μ m long7
 7. Thallus whitish, not areolate; ascospores *Physcia*-type, 15-20 x 9-11 μ m; zeorin present*R. subminuta*
 7. Thallus olive or gray; zeorin absent8

8. Thallus olive, with flattened \pm shiny areoles; ascospores *Pachysporaria*-type, 16-19 x 8-9.5 μ m very common *R. maculans*
8. Thallus gray, rough, matt; ascospores *Pachysporaria*-type, 16-19.5 x 9-11 μ m; rare *R. pachysperma*
1. Thallus saxicolous 9
9. Apothecia without evident thalline margin; margin \pm concolorous with disk; thallus not evident 10
10. Ascospores with pigmented band around septum (*Bischoffii*-type), 15-21 x 9-12 μ m; hymenium
10. ascospores *Physcia*-type, 19-22 x 11-12 μ m; 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 μ m *Rinodina* sp. 35992
12. Thallus KOH+ yellow, C \pm pink; ascospores *Physcia*- or *Mischoblastia*-type 13
13. Thallus C-; epihymenium brown but exciple may be green; ascospores *Mischoblastia*-type 14
14. Thallus \pm continuous, rimose-areolate; ascospores <20 x 12 μ m; very common *R. oxydata*
14. Thallus of scattered subsquamulose areoles; ascospores >20 x 12 μ m; very rare *R. destituta*
13. Thallus C+ pink; epihymenium dark green; apothecia immersed to emergent; ascospores *Physcia*-type, 18-21 x 9.5-12 μ m *Rinodina* sp. 47558
11. Thallus dark, KOH-, C \pm or not evident 15
15. Ascospores with pigmented band around septum (*Bischoffii*-type), 15-21 x 9-12 μ m; hymenium inspersed; on carbonate rock *R. bischoffii*
15. Ascospores *Mischoblastia*- or *Pachysporaria*-, or *Physcia*-type; hymenium not inspersed; on HCl- rock 16
16. Ascospores *Pachysporaria*-type, 13-16 x 7-8.5 μ m; thallus C- *Rinodina* sp. 44440
16. Ascospores *Mischoblastia*- or *Physcia*-type; thallus C \pm pink 17
17. Ascospores *Physcia*-type, 17-24 x 8-14 μ m; thallus C \pm pink *R. tephrae*
17. Ascospores *Mischoblastia*-type, 18-22 x 9-12 μ m; 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 μ m. [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 μ m. [no lichen substances]

Frequent on moist, HCl- rock. Giralt (2001) indicates 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 destituta (Nyl.) Zahlbr [formerly *Rinodina vezdae* H. Mayrh.]

Thallus of scattered, whitish, subsquamulose areoles, KOH+ yellow. Apothecia initially \pm 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].

Rinodina dolichospora Malme ?

Thallus subsquamulose-areolate, gray, \pm shiny. Apothecia sessile with \pm persistent thalline margin. Ascospores *Pachysporaria*-type, large, 22-24(-30) x 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 \pm shiny or \pm 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 x 8-9.5 μm . [no lichen substances]

Common, on branches but also boles of hardwoods. The small thalli with flat, \pm 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 (A. Massal.) A. 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 \pm 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 \pm concolorous with thallus. Ascospores *Pachysporaria*-type, 16-19.5 x 19.5 x 9-11 μm . [no substances?, not tested]

Known from a single collection on bole of *Acer saccharinum* in disturbed floodplain woods along Lamine River.

***Rinodina papillata* H. Magn.**

Thallus of scattered to rarely aggregated, flat, gray, \pm 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 tephrae* (Tuck.) Herre**

Thallus variable, gray to brownish, well developed and \pm 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.

Known from a single site on top of sandstone bluff. *Rinodina vezdae* is a member of the *R. oxydata* complex and there is 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, \pm shiny. Apothecia initially with thalline margin but soon lost, becoming swollen. Ascospores *Pachysporaria*-type, small, 14-17 x 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 \pm thick, raised. Outer exciple blackish green, with inner part colorless. Hymenium not interspersed. Ascospores *Pachysporaria*-type?, 19-22 x 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 tephrae* 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 the rusted top of 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, Texas County, Missouri 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; 1 species in the Ozarks. Reference: Jørgensen (2001).

Santessoniella crossophylla (Tuck.) P.M. Jørg.

Thallus initially pale gray, with slender lobes that are 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 that ultimately disappears; disk pinkish tan; proper margin poorly developed, of \pm oblong radiating cells becoming more isodiametric centrally; hymenium IKI+ bluish becoming sordid olivaceous; ascospores broadly fusiform, with a thin, weakly warty epispore, $18-21 \times 8.5-11 \mu\text{m}$.

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 Flot. (Acarosporaceae)

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; 4 species in the Ozarks, although the genus is poorly worked out and several unknown entities require further study. Magnusson (1934).

1. On HCl+ (carbonate) rock; disks pruinose *S. regularis*
1. On HCl- (siliceous) rock; disks not pruinose.
 2. Exciple edge dark but not carbonized; apothecial margins becoming obscure; apothecia often dividing and thus appearing clustered *S. similis*
 2. Exciple brittle and carbonized; apothecia with persistent, well-defined margins; apothecia generally not proliferating.
 3. Most apothecia > 1.5 mm broad, narrowed at base; hypothecium dark *S. clavus*
 3. Apothecia to 1 mm broad, not basally narrowed; hypothecium pale *S. privigna*

Sarcogyne clavus (DC.) Kremp.

Known from a single Arkansas record on a massive sandstone bluff.

Sarcogyne hyphophaea (Nyl.) Arnold [formerly *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 Flotow & Körber *ex* A. Massal. (Roccellaceae)

Corticolous crustose lichens with thin, \pm continuous thalli, or thalli not evident; photobiont Trentepohlia; apothecia somewhat elongated, usually with white pruina; asci apically thickened, with I+ blue apical ring and 8 hyaline, 4+ celled, bacilliform spores; pycnidia dark, \pm 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, 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. (Scoliciosporaceae)

Small crustose lichens with thin, scurfy, often obscure thalli; photobiont chlorococcoid and reported as often forming gonocysts; apothecia and tiny, sessile, ultimately convex, black or brown; asci *Lecanora*-type, with 8 hyaline, fusiform to acicular, multi-septate spores which are 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 μ m broad..... *S. chlorococcum*
- 1. Saxicolous; ascospores \pm twisted, 2-3 μ m broad..... *S. unbrinum*

Scoliciosporum chlorococcum (Stenh.) V_zda

Occasional on shaded boles and branches of *Juniperus* 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 (Leprocaulaceae)

Saxicolous foliose lichens with narrow, imbricated 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 monotypic 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, $12-14 \times 3-4.5 \mu\text{m}$; pycnidia occasional, brownish, globose to subconical, about 0.2 mm broad; conidia bacilliform, $2.5-4 \times 0.8-1 \mu\text{m}$.

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, \pm ornamented spores; 3 species in the Ozarks.

- 1. Ascospores 1-septate; on *Pertusaria velata**S. benmargana*
- 1. Ascospores simple; on other species of *Pertusaria*.
 - 2. Ascospores citriform, $> 9 \mu\text{m}$ long*S. tubaeformis*
 - 2. Ascospores broadly ellipsoid to subspherical, 5-8 μm long*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 tubaeformis 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, found once each on *P. neoscotica*, *P. plittiana*, and *P. propinqua*. Interestingly, all of these hosts contain norstictic acid.

SPILONEMA Bornet (1856) Coccocarpiaceae

Minutely subfruticose dark brown to black lichens with a hyphal hypothallus; photobiont *Stigonema*; apothecia sessile, black, concave, lecideine; asci similar to *Lecanora*-type, with a cylindrical I+ blue apical dome, with 8 simple ellipsoid spores; pycnidia black, globose, sessile, with narrowly ellipsoid conidia; 1 species in the Ozarks. References: Henssen (1963).

Spilonema revertens Nyl

Brown to black cushions or subareolate mats to 0.5 mm thick, of +/- terete, tangled, lustrous, +/- erect filaments, originating from small, flattened lobules on a black to purplish brown hypothallus, the hypothallus of aggregated photobiont with abundant reddish pigmentation and bluish green hyphae ca. 5 μm in diameter; filaments consisting of sheathed photobiont loosely associated with pale to bluish green sparingly branched capillary hyphae, typically < 0.2 mm long, to 50 μm in diameter, with frequent short ascending branches and somewhat irregular margins; apothecia and pycnidia very rare on Ozark material.

Chemistry: no lichen substances

Occasional throughout the Ozarks, on exposed to slightly shaded siliceous rocks, usually on +/- horizontal

surfaces or in small crevices or depressions where moisture and a thin layer of aeolian silt accumulates. Typical habitats include weathered rocks along glade edges and low outcrops in woodland openings and along bluffs.

All Ozark records are associated with the lichenicolous lichen *Psorula rufonigra*, which is an obligate parasite of *Spilonema revertens*. Whether free-living populations of *Spilonema* are overlooked or whether all local populations are parasitized by *Psorula* is unknown.

Similar taxa:

- *Cystocoleus* - more sparsely branched filaments to 1 mm long; photobiont *Trentepohlia*; hypothallus lacking; on sheltered vertical surfaces protected from direct wetting
- free-living filamentous cyanobacteria are frequent in moist shaded habitats in the Ozarks; the filaments tend to be shinier and darker, with fewer branches, no hypothallus, and are not closely associated with fungal hyphae

STAUROTHELE Norman (Verucariaceae)

Saxicolous crustose lichens with brown, rimose-areolate thalli; photobiont *Stichococcus*; perithecia dark, immersed; asci lacking an ocular chamber, ours with 2 hyaline to brownish, muriform spores; pycnidia laminal, conidia bacilliform; 2 species in the Ozarks. Reference: Thomson (1991).

1. Thallus endolithic, scant or lacking except for the subspherical perithecia; on calcareous rocks *S. elenkenii*
1. Thallus rimose to rimose-areolate, dark brown; on siliceous rocks.....*S. fissa*

Staurothele elenkenii Oxner

Rare in the Ozarks; reported by Thomson (1991) from Pine Hills in 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

Local and 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 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.

- 1. Isidia cylindrical, often branched *S. beauvoisii*
- 1. “Isidia” (actually phyllidia) flattened and lobule-like, rarely branched..... *S. carolinensis*

Sticta beauvoisii Delise
Rare;

Sticta carolinensis T. McDonald
Uncommon, known from a handful of collections from the Boston Mountains. 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, from recently described *S. fragilinata* McDonald in the KOH- medulla (not KOH+ purplish).

STRANGOSPORA Körb. (Strangosporaceae)

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 [= *Piccolia ochrophora*]
Rare and inconspicuous; on hardwoods and *Juniperus* in wooded uplands at a few scattered sites through the Ozarks.

STRIGULA Fr. (Strigulaceae)

Minute crustose lichens with immersed thallus, *Trentepohlia* photobiont, black perithecioid ascomata, unbranched paraphyses, I- hymenial gel, thin-walled, ± thin-tipped, cylindrical asci with 8 colorless, 1-septate to muriform spores, usually with black pycnidia 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* 2
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, 17-30 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 trunks of hardwoods in mesic woodlands and floodplain forest. It has been collected on *Carya*, *Fagus*, *Fraxinus*, *Nyssa* and *Ulmus*. *Strigula americana* is endemic to eastern North America, originally described from Iowa, 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 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, $11-15 \times 3-4 \mu\text{m}$. Pycnidia black, conical to hemispherical, 0.1-0.2 mm across. Microconidia not found. Macroconidia cylindrical, 1-septate, $11-15 \times 3.5-4 \mu\text{m}$.

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, invisible to normal mortals). It is close to the saxicolous *S. bermudana* 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, \pm 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 \pm spherical or pyriform, with an adherent or \pm spreading, dark brown clypeus, pale below, 0.2-0.35 mm across (incl. clypeus). Asci cylindrical or slightly clavate, ca. $70-80 \times 10 \mu\text{m}$, with 8 (fewer by abortion) biseriate spores. Ascospores fusiform, often tapered at one end, 4-celled, $15-20 \times 4-6 \mu\text{m}$. Pycnidia 0.1-0.15 mm across. Microconidia oblong, $4-5 \times 1.5 \mu\text{m}$. Macroconidia not found in American material, $14-17 \times 3 \mu\text{m}$ from Scotland.

Occasional on soft bark (*Fraxinus*, *Juniperus*, *Quercus alba*) in moist microhabitats in acid and dolomitic glades. 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, $80-110 \times 13-15 \mu\text{m}$. with eight biseriate or subbiseriate arranged spores. Ascospores fusiform, 7-septate, $24-42 \times 5-7.5 \mu\text{m}$. Macroconidia 7-septate, $23-30 \times 3.5-5 \mu\text{m}$.

Known from a single collection on base of *Quercus rubra* in a mesic canyon. 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, $75-95 \times 13-16 \mu\text{m}$, with eight biseriately or subbiseriately arranged spores. Ascospores fusiform, 5-7 transversely septate, often with 1-2 cells longitudinally septate, $20-27 \times 6-7.5 \mu\text{m}$. Pycnidia black, \pm 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 \pm 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, \pm 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 trunks 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 \pm obclavate, 80 x 12-15 μm , with eight \pm uniseriate spores. Ascospores fusiform or short clavate, 4-celled, 19-22 x 5-6.5 μm . Microconidia not found. Macroconidia cylindrical, 5-septate, 25-27 x 3-4 μm in globose, immersed pycnidia, 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, \pm

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 (Riddle) 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, K+ 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 that are 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 $14 \times 7 \mu\text{m}$, 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 culbertsoniorum* 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*, 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 \pm straight, filiform conidia; 1 species in the Ozarks.

Tephromela atra (Hudson) Hafellner

Thallus crustose, gray, adnate, \pm 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, with a well-developed thalline margin that is 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 | <i>T. muscorum</i> |
| 2. Growing on bark; 8 spores in the ascus | <i>T. pertusariella</i> |
| 1. Growing on rock | 3 |
| 3. Ascospores 20-32 x 9-13 | <i>T. brasiliensis</i> |

3. Ascospores 30-45 x 12-19 *T. nlbifera*

***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 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). The substrate and reduced number of ascospores are diagnostic and referable to var. *muscorum*. An 8-spores variety, var. *octospora* (Nyl.) Coppins & Fryday, has not been found in the Ozarks.

***Thelenella nubifera* C.A. Morse [local material was formerly called *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 pertusariella* (Nyl.) Vainio**

Rare 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.

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* Nyl. ex 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 in the northern and western Ozarks that has not yet been documented from our region.

***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 a stream.

THELOCARPON Nyl. *ex* Hue (Thelocarpaceae)

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 $8-12 \times 3-5 \mu\text{m}$ *T. superellum*
- 1. Lignicolous, corticolous or saxicolous; ascospores $1.5-5 \times 1-2 \mu\text{m}$.
 - 2. Paraphyses absent; ascospores bacilliform, $3-4 \times 1-1.5 \mu\text{m}$; thallus pale yellowish *T. intermediellum*
 - 2. Paraphyses present; ascospores globose, $1.5-5 \times 1.5-2 \mu\text{m}$; 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*.

***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. (1855) Stictidaceae

Minute crustose lichens with immersed thallus, photobiont *Trentepohlia*, perithecioid ascomata, periphysoids, unbranched paraphyses, hymenial gel I+ greenish blue becoming dirty orangish, thin-walled asci without apical structures, with numerous, colorless, nonseptate, transversely septate or submuriform ascospores, halonate or not; 2 species our region. References: V_zda, Folia Geobot. Phytotax. 3: 363-406. 1968; Harris, Bryologist 82: 77,78. 1979.

- 1. Ascomata pallid to brownish; pore region whitish; ascospores nonseptate, globose or slightly elongated, halonate, 6-7

- µm across or 5-6 x 7-7.5 µm; on bark.....*Thelopsis flaveola*
 1. Ascomata reddish; ascospores 3(-5)-septate, 12-18(-21) x 5-6 µm; on bark or sandstone*Thelopsis 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, elongated cells. Periphyses embedded in colorless gel. Asci cylindrical with pointed tip, 140-170 x 10-12 µm (V_zda, 1968). Ascospores globose or slightly elongated, 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 dryish oak or oak-hickory woods. 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 muriform ascospores eight/ascus. The ascospores of American collections are larger than those reported by V_zda, 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 (V_zda, 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, found once on a moist, vertical sandstone face along a stream in Cherokee County, Oklahoma, from *Juniperus ashei* in Stone County, Missouri and on *Tilia americana* in Arkansas. *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 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. American populations apparently consistently deviates from the European population which has (1-)3-septate ascospores.

THELOTREMA Ach. (Graphidaceae)

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.

Very rare on exposed, well-drained, stabilized sandy soils, growing in sites 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. This name is applied to local material with extreme trepidation, and 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. (Ramalinaceae)

Small squamulose or crustose 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. Additionally, a non-lichenized species occurs as a parasite on *Dermatocarpon* - see discussion under *D*.

muhlenbergii. Reference: Timdal (1991). Reference: Timdal (1991).

***Toninia submexicana* B. 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.

Uncommon, 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 squamulose thallus, epithecium and exciple KOH+ purple, colorless hypothecium and 3-septate ascospores (ca. 17-20 × 4.5 µm in Ozark collection). It differs from the Mexican specimens in having a paraplectenchymatous hypothecium with thick walled cells. Timdal (1991) indicates 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. & V_zda (Stictidaceae)

Tiny crustose lichens with thin, inconspicuous, grayish thallus; photobiont *Trentepohlia*; immersed perithecioid ascomata, periphysoids, slender unbranched paraphyses, hymenial gel I+ greenish blue becoming dirty orangish, thin-walled asci 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 & V_zda, Beih. Nova Hedwigia 79: 501-511. 1984.

***Topelia aperiens* P. M. Jørg. & V_zda**

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, elongated 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 × 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 (Trapeliaceae)

Saxicolous crustose lichens with pale gray, areolate thalli; photobiont *Chlorella*; apothecia small, sessile, brown to blackish, with obscure thalline margins which sometimes disappear 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; 1 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. The thalline margins of the apothecia are persistent, but eventually become excluded. 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.

TRAPELIOPSIS Hertel & Gotth. Schneider (Trapeliaceae)

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, 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 less commonly in similar habitats in the Ozarks, 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 of which are rhomboid to elliptical; conidiospores bacilliform, ca. 5 × 1µm; 1 species in the Ozarks.

Trypethelium virens Tuck. ex E. Michener

Uncommon and local in mesic habitats, growing on shaded boles of trees 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*.

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 prevailing 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, prevailing 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 of 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. [olivetric 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 Dill. *ex* Adanson (1763) Parmeliaceae

Slender, terete, abundantly branched, yellowish green fruticose lichens, with cortex and medulla surrounding a central cord, if fertile with pale tan terminal apothecia, 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 is gratefully acknowledged in the untangling of *Usnea*.

- 1. Thallus lacking soredia and isidia; often with terminal apothecia2
 - 2. Central cord dark, reddish or brownish; thallus normally pendent *U. trichodea* Ach.
 - 2. Central cord pale; thallus shrubby3
 - 3. Ascospores 7-9 x 5-6 µm; medulla sometimes red pigmented but more often white or pale pink; chemistry various (see discussion) but norstictic acid not as yet known in Ozark material *U. rubiginea*
 - 3. 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 with abundant soredia or isidia4
 - 4. Thallus pendent; main branches markedly ridged *U. angulata*
 - 4. Thallus shorter, shrubby or subpendent; main branches terete5
 - 5. Medulla red pigmented (pigment sometimes patchy) *U. mutabilis*
 - 5. Medulla without red pigment6
 - 6. Cortex orange-red mottled; medulla white *U. rubicunda*
 - 6. Cortex not orange-red mottled; medulla white to faint pink7
 - 7. Medulla rapidly KOH+ red (galbinic acid agg.)8
 - 8. Isidiomorphs on soralia, not clustered, or singly on cortex, often black tipped; soralia punctiform, very numerous;

| | |
|---|-----------------------|
| on rock | <i>U. amblyoclada</i> |
| 8. Isidiomorphs mostly on soralia, clustered, not black tipped;
soralia larger and less numerous; on trees, rarely rock | <i>U. dasaea</i> |
| 7. Medulla KOH- | 9 |
| 9. Medulla CK-; (protocetraric acid); cortex thick, glassy;
soralia not excavate, small | <i>U. subscabrosa</i> |
| 9. Medulla CK+ orange (diffractaic acid), pinkish; cortex thinner,
not glassy; soralia excavate, often reaching ½ or more the branch
diameter | <i>U. entoviolata</i> |

***Usnea amblyoclada* (Müll. Arg.) Zahlbr.**

Sporadically distributed on 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.**

Extinct?, known from a single Ozark site from which it has disappeared. *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. 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 rubicunda* Stirton [formerly *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 2004). 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. [= *Usnea strigosa* ssp. *rubiginea*]

Locally abundant in extensive woodlands; probably the most common *Usnea* in the Interior Highlands as preliminarily it seems more common than *U. strigosa* ssp. *strigosa*. It and *U. strigosa* are major components of the canopy lichen vegetation in intact woodlands and frequently may be picked up on fallen branches. 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. This species is often sparsely branched, and has highly variable development of isidiosoredia. 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 Schrad. (Verrucariaceae)

Crustose, mostly saxicolous lichens with endolithic, continuous, or areolate thalli; photobiont various unicellular algae, including *Myrmecia*, *Trebouxia*, and chlorococcoid taxa; perithecia immersed to subsessile, which in some species inhabiting carbonate rock (*Bagliettoa*) are imbedded in pits in the rock; periphyses absent; hymenial gel I+ bluish becoming orange; asci fissitunicate, with 8 hyaline, ellipsoid, simple spores; at least 12 species in the Ozarks. The following treatment is tentative and flawed; species concepts for local taxa are still fluid, so habitat, distribution, and

abundance information is sketchy.

1. On carbonate rocks (HCl+ effervescent)2.
2. Thallus reddish or purplish; ascomata embedded in pits in the rock *V. marmorea*
2. Thallus white, gray, or brown3
3. Thallus pale (white, light gray, or tan), endolithic to epilithic, continuous to rimose or weakly rimose-areolate4
4. Exciple colorless; clypeus black; dark perithecial wall lacking at base; ascospores large, $26-32 \times 11-16 \mu\text{m}$ *V. muralis*
4. Exciple and/or clypeus black, forming a complete dark perithecial wall5
5. Perithecia mostly half immersed, with a dome-like clypeus in addition to the thin black exciple *V. calkinsiana*
5. Perithecia wholly or partially immersed, etching pits in the rock.
 6. Involucrellum present; thallus thin or endolithic *V. baldensis*
 6. Involucrellum absent; thallus not evident *V. calciseda*
3. Thallus dark (gray, brown, or greenish), epilithic, \pm continuous, rimose, or rimose areolate, or of dispersed areoles7
7. Black prothallus evident at thallus margin and/or areoles with well-developed black medulla.8
8. Thallus brown to dark brown, sometime with black mottling; ascospores $19-28 \times 8-16 \mu\text{m}$; areoles without distinct black edges; bottom half of areoles pale
..... *V. nigrescens*
8. Thallus gray to brownish gray; ascospores $< 20 \mu\text{m}$ long9
9. Ascospores $11-14 \times 6-7 \mu\text{m}$; perithecia, pycnidia and sterile columns of black tissue visible as many black dots per areole; thallus thick, rimose-areolate, pale to medium brownish gray; areoles flat, often black-edged *V. fayettensis*
9. Ascospores $10-19 \times 6-8 \mu\text{m}$; areoles with 1-few larger black perithecia, but not otherwise black-spotted; thallus brown
..... *V. fuscella*
7. Black marginal prothallus and back medulla essentially lacking10
10. Ascospores large, $19-24 \times 9-16 \mu\text{m}$; perithecia large and readily visible; thallus dark brown *V. nigrescens s. lat.*
10. Ascospores small, to $15 \times 7 \mu\text{m}$; perithecia small, to 0.2 mm broad, immersed, difficult to see or visible only as small black dots on surface of areole11
11. Thallus dark brown, strongly areolate *V. compacta*

11. Thallus olive to brown-gray, granulose to minutely areolate
..... *V. nigrescentoidea*

1. On siliceous rocks (HCl-) or bark..... 12
 12. saxicolous *V. sp. # 1*
 12. Corticolous *V. phloeophila*

Verrucaria baldensis A. Massal. [= *Bagliettoa baldensis*]

Common on lightly to moderately shaded massive dolomite exposures, and on dolomite and limestone boulders in similar habitats. It has previously been confused with *V. calciseda*, so local abundance and distribution are uncertain.

Verrucaria calciseda DC. [= *Bagliettoa calciseda*]

This species occurs on well-drained or sheltered, exposed to lightly shaded, massive dolomite. See comments under *V. baldensis*.

Verrucaria calkinsiana Servít

Locally 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 [= *Heteroplacidium compactum*]

Areoles contiguous or occasionally solitary, irregular, thick, basally narrowed and easily detached from rock; marginal squamules usually not notably thinned; thallus with a thick, \pm continuous white medulla; perithecia completely immersed, the small black ostioles obscure; perithecial wall colorless except near ostiole; ascospores ca. $13-15 \times (5)7-8 \mu\text{m}$.

Known from three glades in the Missouri Ozarks; two on dolomite glades and one on rhyolite.

In the field, this species could be confused with a *Staurothele*. Because of the thick thallus it was once placed in *Dermatocarpon*.

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. iowensis* Fink.

Verrucaria fuscella (Turner) Winch s. lat. [= *Placopyrenium fuscillum*]

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 [= *Bagliettoa marmorea*]

Uncommon on massive dolomite exposures in glades and bluff exposures, 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.

Occasional throughout the Ozarks; on exposed dolomite in glades and on very lightly shaded ledges and outcrops.

Verrucaria nigrescens Pers.

Known from lightly to moderately shaded dolomite in the carbonate bedrock regions of the Ozarks.

Verrucaria nigrescentoidea Fink

Apparently 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 on these substrates. This species occurs in the eastern half of the Ozarks, but other populations occur west of the region in the Great Plains.

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 20-25 × 7.5- 12 µm; they are contained in broadly rounded asci that are typically 60 × 35 µm.

VEZDAEA Tsch.-Woess & Poelt (Vezdeaceae)

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) V_zda

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 J.-E. 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.) J.-E. 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 convoluted, 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, \pm thick-walled, to $8 \times 6 \mu\text{m}$; pycnidia abundant, black, laminal and marginal, rounded, to 0.12 mm broad; conidia citriform, $2.5\text{--}3.5 \times 1.5 \mu\text{m}$. [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 S.Y. Kondr. & Kärnefelt (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, XXX). 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*.

1. Thallus esorediate *X. hasseana*
1. Thallus sorediate.
2. Thallus lobes <0.5 mm broad, prevailingly ca. 0.2 mm broad; soralia marginal and terminal, <0.4 mm long; thallus often loosely adnate, with \pm erect lobe tips *X. weberi*
2. Thallus lobes prevailingly >0.6 mm broad; soralia primarily labriform and marginal, >0.5 mm long; thallus closely or loosely adnate.
3. Thallus closely adnate, with appressed lobe tips; soredia farinose, in labriform soralia produced in marginal slits between the upper and lower cortex *X. fallax*
3. Thallus \pm loosely adnate, the lobes loose to locally ascending; soredia granular, arising marginally and laminally from the upper cortex *X. ulophyllodes*

Xanthmendoza fallax (Hepp ex Arnold) Söchting, Kärnefelt & S.Y. Kondr.

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 hasseana (Räsänen) Söchting, Kärnefelt & S.Y. Kondr.
Rare; known from hardwood branches from a single collection in the Arkansas Ozarks.

Xanthomendoza ulophyllodes (Räsänen) Söchting, Kärnefelt & S.Y. Kondr.
Apparently rare in the Ozarks; known only from the reports by Lindblom (199X).

Xanthomendoza weberi (S.Y. Kondr & Kärnefelt) L. Lindblom
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 K+ deep magenta cortex of *Xanthoria*, versus the K- (or weakly orange-reddish) cortex of *Candelaria*. Local reports of *X. fulva* (Hoffm.) Söchting, Kärnefelt & S.Y. Kondr. refer to this species. [parietin]

XANTHOPARMELIA (Vainio) Hale (Parmeliaceae)

Large yellowish green foliose lichens containing usnic acid in the upper cortex; 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 ascoma 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 rotund lobe tips and a less lustrous upper cortex].
 - 2. Lower surface whitew to tan, sometimes becoming brownish centrally.
 - 3. Medulla K- to sordid brownish, P+ red (fumarprotocetraric acid); common.....*X. subramigera*
 - 3. Medulla K+ yellow to orange or reddish, P+ orange (salazinic or stictic acid); rare.
 - 4. Medulla K+ dark red (salazinic acid)*X. mexicana*
 - 4. Medulla K+ yellow or eventually orangish (stictic acid).....*X. plittii*
 - 2. Lower surface dark brown to black, occasionally with a paler marginal zone.
 - 5. Medulla K+ dark red (salazinic acid).....*X. australasiaca*
 - 5. Medulla K+ 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 without isidia.
 - 7. Lower surface dark brown to black, occasionally with a paler marginal zone.
 - 8. Medulla K- to sordid brownish,, P+ red (fumarprotocetraric acid); frequent *X. hypomelaena*

8. Medulla K+ yellow to orange or reddish, P+ orange (salazinic or stictic acid); rare.
 9. Medulla K+ dark red (salazinic acid) *X. hypofusca*
 9. Medulla K+ yellow or eventually turning orangish (stictic acid) *X. angustiphylla*
7. Lower surface white to tan or becoming pale brown centrally.
 10. Medulla K+ dark red, P+ orange (salazinic acid)..... *X. stenophylla*
 10. Medulla either K+ yellow or P+ yellow.
 11. Medulla K+ yellow → orange-red, P+ yellow (norstictic acid as major component, stictic acid lacking) *X. californica*
 11. Medulla K+ yellow, P+ orange (stictic acid with minor norstictic acid).
 12. Lobes apically broadened, often imbrocate and laciniately divided
 *X. cumberlandia*
 12. Lobes linear throughout, not imbricate or laciniately divided

***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 glade complex in Dade County, Missouri. [salazinic & usnic acids; \pm traces of norstictic & protocetraric acids]

***Xanthoparmelia californica* Hale**

Known from exposed siliceous rocks in dolomite and limestone glades in the White River Hills region of southwestern Missouri, as well as from exposed chert in a limestone glade in the northeastern Ozarks. The lower surface of the thallus in Ozark material is dark brown. Whether this difference is one of population or species is unknown. [cornorstictic, norstictic & usnic acids]

***Xanthoparmelia conspersa* (Ehrh. *ex* 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 southern Illinois. It occurs on exposed to lightly shaded, usually massive, siliceous rocks, particularly sandstone and igneous substrates. [norstictic, stictic & usnic acids]

***Xanthoparmelia cumberlandia* (Gyelnik) 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 hypofusca* (Gyelnik) Hodgkinson & Lendemer [formerly *Xanthoparmelia tasmanica* (Hook. f. & Taylor) Hale]**

Occasional on exposed to lightly shaded siliceous boulders. [salazinic & usnic acids, \pm consalazinic acid, \pm norstictic acid, \pm traces of protocetraric acid]

***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, \pm 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. [contictic, norstictic, stictic & usnic acids]

***Xanthoparmelia mexicana* (Gyelnik) 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 bewildering array of degrees of adnation that appear to be somewhat controlled by substrate characteristics. [constictic, norstictic, stictic, & usnic acids]

Xanthoparmelia plittii (Gyeln.) Hale

Apparently rare in the Ozarks, except for the extreme eastern Ozarks of southwestern Illinois, where it is locally frequent. This species occurs on exposed to lightly shaded sandstone. [constictic, norstictic, stictic & usnic acids]

Xanthoparmelia subramigera (Gyelnik) 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 Ozarks. [fumarprotocetraric & usnic acids, ± physodalic acid, ± succinprotocetraric acid]

Xanthoparmelia viriduloumbrina (Gyeln.) Lendemer

Occasional 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. somloënsis* (Gyelnik) 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 that lack well-developed rhizines but sometimes has 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) S.Y. Kondr. & Kärnefelt Th. Fr. [= *Rusavskia elegans*]

Known only from massive, xeric limestone exposures in the extreme eastern Ozarks of southwestern Illinois. [parietin]

XYLEBORUS R.C. Harris & Ladd (2007) Stereocaulaceae

Crustose lichens; thallus with conspicuous, pale sporodochia, endophlodeal and visible as a pale discoloration, areolate, the areoles brownish and sometimes coalescing; photobiont chlorococcoid; apothecia lecedeine, with dark, ± pruinose disks; asci *Micareia*-type, with 8 irregularly arranged, simple, ± fusiform ascospores; sporodochia pale, rounded, typically abundant on thallus surface; conidiospores, simple, globose, in irregular chains or clusters; 1 species in the Ozarks.

References: Harris & Ladd (2007), Harris & Lendemer (2015).

***Xyleborus sporodochifer* R.C. Harris & Ladd**

Thallus brownish to olive, of small rounded areoles ca. 0.1-0.2 mm, these sometimes coalescing into larger ± continuous patches; apothecia often present, brown to nearly black, initially plane with a darker margin, becoming rounded and the margin disappearing, sometimes with thin white pruina, 0.2-0.5 (0.8) mm diameter; exciple brown at least inward, sometimes with pockets of KOH soluble crystals; epihymenium with KOH soluble crystals, brown at least in part, the coloration usually suffusing into the hymenium; hypothecium dark brown; asci clavate; ascospores simple, fusiform to narrowly ovoid, 7-10.5 × 3.5-4.5 µm; sporodochia common, ± evenly scattered on the thallus and often intermixed with apothecia, pale yellowish to off-white, shallowly rounded to hemispherical, typically to 0.3 mm broad but rarely larger; conidiospores globose, 2.5-4 µm diameter.

Chemistry: no lichen substances detected, although the sporodochia are usually KOH+ pale yellow

Infrequent in intact woodlands throughout the Ozarks, in intact woodlands, growing on shaded, weathered, hard, solid lignum of old stumps and fallen decorticate logs; usually on a single log or stump, and seldom common at a site. In all cases where the substrate identifiable it is a species of *Quercus*. *Xyleborus sporodochifer* is mostly a species of dry to dry-mesic wooded uplands, but occasionally occurs in more mesic sites along small or intermittent streams. Host logs usually have some bryophytes associated with the *Xyleborus*, but lack the dense carpets of bryophytes and/or *Cladonia squamules* found on some decorticate logs.

The type specimen is from Piney Creek Wilderness in the Mark Twain National Forest in Barry County, Missouri.

Similar taxa:

-The pale sporodochia are distinctive; the only lichen in the region that appears similar is *Dictyocatenulata alba*, with sporodochia-like synnemata that are smaller (typically ca. 0.15 mm diameter), whiter, and have globose, multiseptate conidiospores; it occurs on hardwood bark at the bases of often large trees in mesic to wet woodlands.

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