Lichenized, lichenicolous, and allied fungi of Northeast Ohio: the first comprehensive checklist with identification keys

Tomás J. Curtis
tcurti12@kent.edu

Abstract. Since the latter months of 2016, the author has studied the lichenized, lichenicolous, and allied fungi of NE Ohio extensively and is presenting, here, the first comprehensive baseline list of lichens for the region. So far, 405 recognized species are being reported, as well as many other seemingly undescribed species.

Introduction

Despite the footprint that development and industrialization has made on the landscape over several centuries, a surprising amount of biodiversity hides beneath a veil of obscurity (Feuerer and Hawksworth, 2007). Lichenized, lichenicolous, and allied fungi are one such group that has received minimal recognition in Northeast Ohio among many areas worldwide (Stewart and Rowell, 1977). Though baseline data has been provided for Macrolichens in the past (Showman and Flenniken, 2004), the lichen diversity of Northeast Ohio, in a comprehensive sense, had never been formally studied before. Given the scale of habitat loss and fragmentation of natural habitats within Northeast Ohio counties, knowledge of the status of sensitive lichen communities in the region is urgently needed. However, it has scarcely been a topic of discussion, perhaps due to the overall lack of published information.

Because of this disparity in knowledge, the author began to inventory lichens extensively throughout Northeast Ohio in an effort to produce new and accurate information. This study began in late 2016 and is ongoing, with the goal of compiling a comprehensive list of lichenized, lichenicolous, and allied fungi for the region. The results of this study to date are presented here in order establish baseline data that can be built upon in the future.

Materials and Methods

For these purposes, NE Ohio is defined as comprising the following 13 counties: Ashtabula, Columbiana, Cuyahoga, Geauga, Lake, Loraine, Mahoning, Medina, Portage, Stark, Summit, Trumbull, and Wayne. While most of this area is within the Glaciated Alleghany Plateau, sections of Unglaciated Allegheny Plateau and the Huron-Erie Lake Plain are also included.

Voucher specimens of noteworthy records and new county records have been collected periodically by the author throughout the 13 counties (through the use of collecting permits when necessary). For this study, lichens have been collected from various substrates (bark, wood, soil, detritus, rock, etc.) primarily through the use of wood chisels and rock chisels. A piece of the substrate with the lichens was taken and labeled with appropriate information (name, date, lat., lon., locality, habitat, substrate, collector, determiner, and notes) in preparation for storage. Most specimens have been deposited at the Tom S. and Miwako K. Cooperrider Herbarium at Kent State University where the author has had much influence in digitally databasing and physically cataloging them as well. Though the work of databasing specimens is incomplete, it is estimated that there are at least 2,500 lichen specimens from this study represented in the Tom S. and Miwako K. Cooperrider Herbarium.

Results and Discussion

Through conducting numerous surveys of every natural habitat found within the region, 405 recognized species are reported here in the first comprehensive checklist for the region. In addition, several other seemingly undescribed species have been collected throughout the study area. Over one hundred species have been reported for the first time in Ohio during this study, including 11 macrolichens. All these species have been included, here, in a comprehensive list, and incorporated in a technical key for use of experienced individuals.

Checklist (* denotes saprophytic "allied" fungi, ** denotes lichenicolous fungi, ? denotes an uncertain occurrence)

Absconditella lignicola Vězda & Pišút
Acarospora canadensis H. Magn.
Acarospora fuscata (Schrader) Arnold
Acarospora moenium (Vainio) Räsänen
Acarospora strigata (Nyl.) Jatta
Agonimia flabelliformis Halda, Czarnota & Guzow-KremiÕska
Agonimia gelatinosa (Ach.) Brand & Diederich
Alyxoria varia (Pers.) Ertz & Tehler
Amandinea dakotensis (H. Magn.) P. May & Sheard
Amandinea polyspora (Willey) E. Lay & P. May
Amandinea punctata (Hoffm.) Coppins & Scheid.
Anaptychia palmulata (Michaux) Vainio
Anisomeridium biforme (Borrer) R.C. Harris
Anisomeridium carinthiacum (J. Steiner) R. C. Harris
Anisomeridium distans (Willey) R. C. Harris
Anisomeridium leucochlorum (Müll. Arg.) R. C. Harris
Anisomeridium polypori (Ellis & Everh.) M. E. Barr
Arthonia apatetica (A. Massal.) Th. Fr.
**Arthonia caudata* Willey
Arthonia helvola (Nyl.) Nyl.
Arthonia lapidicola (Taylor) Branth & Rostrup
**Arthonia punctiformis* Ach.
**Arthonia quintaria* Nyl.
Arthonia radiata (Pers.) Ach.
Arthonia ruana A. Massal.
Arthonia susa R. C. Harris & Lendemer
**Arthopyrenia cerasi* (Schrader) A. Massal.?
Aspicilia laevata (Ach.) Arnold
Athallia holocarpa (Hoffm.) Arup, Frödén & Søchting
Athallia pyracea (Ach.) Arup, Frödén & Søchting
Bacidia circumspecta (Nyl. ex Vainio) Malme
Bacidia granosa (Tuck.) Zahlbr.
Bacidia sorediata Lendemer & R. C. Harris
Bacidina arnoldiana (Körber) V. Wirth & Vězda
Bacidina assulata (Körber) S. Ekman?
Bacidina brittoniana (Riddle) LaGreca & S. Ekman?
Bacidina delicata (Leighton) V. Wirth & Vězda
Bacidina egenula (Nyl.) Vězda
Bacidina inundata (Fr.) Vězda
Biatora longispora (Degel.) Lendemer & Printzen
Biatora pontica Printzen & Tønsberg
Biatora printzenii Tønsberg
Bilimbia sabuletorum (Schreber) Arnold
Botryolepraria lesdainii (Hue) Canals, Hernández-Mariné, Gómez-Bolea & Llimona
Brianaria bauschiana (Körber) S. Ekman & M. Svensson

Bryobilimbia ahlesii (Körber) Fryday, Printzen & S. Ekman
Bryoria furcellata (Fr.) Brodo & D. Hawksw.
***Buellia badia* (Fr.) A. Massal.
Buellia erubescens Arnold
Caeruleum heppii (Nägeli ex Körber) K. Knudsen & L. Arcadia
Calicium tigillare (Ach.) Pers.
Caloplaca ahtii Søchting
Caloplaca albovariegata (B. de Lesd.) Wetmore
Caloplaca atroalba (Tuck.) Zahlbr.
Caloplaca cerina (Ehrh. ex Hedwig) Th. Fr.
Caloplaca microphyllina (Tuck.) Hasse
Caloplaca pratensis Wetmore
Caloplaca reptans Lendemer & Hodkinson
Caloplaca sideritis (Tuck.) Zahlbr.
Caloplaca soralifera Vondrák & Hrouzek
Caloplaca ulcerosa Coppins & P. James
Caloplaca ulmorum (Fink) Fink
Candelaria concolor (Dickson) Stein
Candelariella aurella (Hoffm.) Zahlbr.
Candelariella efflorescens R. C. Harris & W. R. Buck
Candelariella lutella (Vainio) Räsänen
Candelariella vitellina (Hoffm.) Müll. Arg.
Candelariella xanthostigma (Ach.) Lettau
Canoparmelia caroliniana (Nyl.) Elix & Hale
Canoparmelia texana (Tuck.) Elix & Hale
Catillaria nigroclavata (Nyl.) Schuler
Catinaria neuschildii (Körb.) P. James
Cetraria arenaria Kärnefelt
Cetrelia chicitae (W. L. Culb.) W. L. Culb. & C. F. Culb.
Chaenotheca brunneola (Ach.) Müll. Arg.
Chaenotheca ferruginea (Turner ex Sm.) Mig.
Chaenotheca furfuracea (L.) Tibell
Chaenotheca xyloxena Nádv.
**Chaenothecopsis debilis* (Turner & Borrer ex Sm.) Tibell
**Chaenothecopsis nana* Tibell
**Chaenothecopsis nigra* Tibell
**Chaenothecopsis ochroleuca* (Körb.) Tibell & K. Ryman?
**Chaenothecopsis perforata* Rikkinen & Tuovila
**Chaenothecopsis pusilla* (Ach.) A.F.W. Schmidt
**Chaenothecopsis pusiola* (Ach.) Vainio
**Chaenothecopsis savonica* (Räsänen) Tibell
Chrismofulvea dialyta (Nyl.) Marbach
Chrysothrix caesia (Flotow) Ertz & Tehler
Chrysothrix xanthina (Vainio) Kalb
Cladonia apodocarpa Robbins
Cladonia caespiticia (Pers.) Flörke
Cladonia chlorophaea complex
Cladonia coniocraea (Flörke) Sprengel
Cladonia conista (Nyl.) Robbins
Cladonia cristatella Tuck.
Cladonia cylindrica (A. Evans) A. Evans
Cladonia fimbriata (L.) Fr.
Cladonia furcata (Hudson) Schrader
Cladonia incrassata Kristinsson
Cladonia macilenta Hoffm. var. *bacillaris* (Ach.) Schaerer
Cladonia macilenta var *macilenta* Hoffm.
Cladonia mateocyatha Robbins
Cladonia ochrochlora Flörke
Cladonia parasitica (Hoffm.) Hoffm.
Cladonia peziziformis (With.) J. R. Laundon
Cladonia piedmontensis G. Merr.
Cladonia pleurota (Flörke) Schaerer
Cladonia polycarpoides Nyl.
Cladonia pyxidata (L.) Hoffm.
Cladonia ramulosa (With.) J. R. Laundon
Cladonia rangiferina (L.) F. H. Wigg.

Cladonia rei Schaerer
Cladonia sobolescens Nyl. ex Vainio
Cladonia squamosa (Scop.) Hoffm.
Cladonia strepsilis (Ach.) Grognot
Cladonia subtenuis (Abbayes) Mattick
Cladonia uncialis (L.) F. H. Wigg.
Cladonia verticillata (Hoffm.) Schaerer
***Clypeococcum hypocenomycis* D. Hawksw.
Coenogonium pineti (Ach.) Lücking & Lumbsch
Collema subflaccidum Degel.
***Cornutispora pyramidalis* Etayo
Crespoa crozalsiana (B. de Lesd. ex Harm.) Lendemer & Hodkinson
Cresponea chloroconia (Tuck.) Egea & Torrente
**Cryptodiscus pallidus* (Pers.) Corda.
Cystocoleus ebeneus (Dillwyn) Thwaites
Dermatocarpon luridum (With.) J. R. Laundon
Dermatocarpon muhlenbergii (Ach.) Müll. Arg.
Dibaeis baeomyces (L. f.) Rambold & Hertel
Dictyocatenulata alba Finley & E. F. Morris
***Diploschistes muscorum* (Scop.) R. Sant.
Diploschistes scruposus (Schreber) Norman
**Distopyrenis americana* Aptroot
Enchylium bachmanianum (Fink) Otálora, P. M. Jørg. & Wedin
Enchylium tenax (Sw.) Gray
Endocarpon pallidulum (Nyl.) Nyl.
Endocarpon petrolepideum (Nyl.) Nyl.
***Endococcus perpusillus* Nyl.
***Epicladonia stenospora* (Harm.) D. Hawksw.
Evernia mesomorpha Nyl.
Fellhanera fallax R. C. Harris & Lendemer
Fellhanera granulosa R. C. Harris & Lendemer
Fellhanera minnisinkorum R. C. Harris & Lendemer
Fellhanera silicis R. C. Harris & Ladd
Flavoparmelia baltimorensis (Gyelnik & Fóriss) Hale
Flavoparmelia caperata (L.) Hale
Flavoplaca flavocitrina (Nyl.) Arup, Frödén & Søchting
Flavopunctelia flaventior (Stirton) Hale
Flavopunctelia soredica (Nyl.) Hale
Fuscidea arboricola Coppins & Tønsberg
Fuscidea recensa (Stirton) Hertel, V. Wirth & Vězda
Graphis scripta (L.) Ach.
Gyalolechia flavovirescens (Wulfen) Søchting, Frödén & Arup
Halecania pepegospora (H. Magn.) van den Boom
Halecania rheophila R.C. Harris & Ladd ined.
Herteliana schuyleriana Lendemer
Heterodermia albicans (Pers.) Swinscow & Krog
Heterodermia casarettiana (A. Massal.) Trevisan
Heterodermia obscurata (Nyl.) Trevisan
Heterodermia speciosa (Wulfen) Trevisan
Hydropunctaria rheitrophila (Zschacke) C. Keller, Gueidan & Thüs
Hyperphyscia adglutinata (Flörke) H. Mayrhofer & Poelt
Hyperphyscia confusa Essl., C. A. Morse & S. Leavitt
Hyperphyscia syncolla (Tuck. ex Nyl.) Kalb
Hypocenomyce scalaris (Ach. ex Lilj.) M. Choisy
Hypogymnia physodes (L.) Nyl.
Hypotrachyna afrorevoluta (Krog & Swinscow) Krog & Swinscow
Hypotrachyna livida (Taylor) Hale

Hypotrachyna minarum (Vainio) Krog & Swinscow
Hypotrachyna revoluta (Flörke) Hale
Hypotrachyna showmanii Hale
Imshaugia aleurites (Ach.) S. F. Meyer
Imshaugia placorodia (Ach.) S. F. Meyer
Ionaspis alba Lutzoni
Ionaspis lacustris (With.) Lutzoni
Japewiella dollypartoniana J. L. Allen & Lendemer
**Julella fallaciosa* (Arnold) R. C. Harris
Lecania croatica (Zahlbr.) Kotlov
Lecania naegelii (Hepp) Diederich & van den Boom
Lecanora appalachensis Lendemer & R. C. Harris
Lecanora caesiorubella Ach.
Lecanora cinereofusca H. Magn.
Lecanora hybocarpa (Tuck.) Brodo
Lecanora layana Lendemer
Lecanora minutella Nyl.
Lecanora nothocaesiella R. C. Harris & Lendemer
Lecanora polytropa (Ehrh.) Rabenh.
Lecanora pulicaris (Pers.) Ach.
Lecanora saligna (Schrader) Zahlbr.
Lecanora strobilina (Sprengel) Kieffer
Lecanora subimmergens Vainio
Lecanora subpallens Zahlbr.
Lecanora symmicta (Ach.) Ach.
Lecanora thysanophora R. C. Harris
Lecidea cyrtidia Tuck.
Lecidea erythrophaea Flörke ex Sommerf.
Lecidea fuscoatra (L.) Ach.
Lecidea varians Ach.
Lecidella stigmatea (Ach.) Hertel & Leuckert
Leimonis erratica (Körber) R. C. Harris & Lendemer
Lepra pustulata (Brodo & W. Culb.) Lendemer & R. C. Harris
Lepraria caesiella R. C. Harris
Lepraria cryophila Lendemer
Lepraria disjuncta Lendemer
Lepraria elobata Tønsberg
Lepraria finkii (B. de Lesd.) R. C. Harris
Lepraria harrisiana Lendemer
Lepraria hodkinsoniana Lendemer
Lepraria neglecta (Nyl.) Erichsen
Lepraria normandinoides Lendemer & R. C. Harris
Lepraria vouauxii (Hue) R. C. Harris
Lepraria xanthonica Lendemer
Leprocaulon adhaerens (K. Knudsen, Elix & Lendemer) Lendemer & Hodkinson
Leptogium cyanescens (Rabenh.) Körber
***Lichenoconium erodens* M.S. Christ. & D. Hawksw.
***Lichenoconium pyxidatae* (Oudem.) Petrak & H. Sydow
***Marchandiobasidium aurantiacum* Diederich & Schultheis
***Marchandiomyces corallinus* (Roberge) Diederich & D. Hawksw.
Melanelixia glabratula (Lamy) Sandler & Arup
Melanelixia subaurifera (Nyl.) O. Blanco et al.
Menegazzia subsimilis (H. Magn.) R. Sant.
Micarea denigrata (Fr.) Hedl.
Micarea melaena (Nyl.) Hedl.
Micarea peliocarpa (Anzi) Coppins & R. Sant.
Micarea prasina Fr.
Micarea soralifera B. Guzow-Krzemińska, P. Czarnota, A. Łubek & M. Kukwa
Multiclavula corynoides (Peck) R. H. Petersen
Multiclavula mucida (Fr.) R. H. Petersen
Mycobilimbia berengeriana (A. Massal.) Hafellner & V. Wirth
**Mycocalicium subtile* (Pers.) Szatala
Myelochroa aurulenta (Tuck.) Elix & Hale
Myelochroa galbina (Ach.) Elix & Hale

Myelochroa metarevoluta (Asahina) Elix & Hale
Myelochroa obsessa (Ach.) Elix & Hale
Myriolecis dispersa (Pers.) Śliwa, Zhao Xin & Lumbsch
Myriolecis hagenii (Ach.) Śliwa, Zhao Xin & Lumbsch
Myriolecis sambuci (Pers.) Clem.
Nadvornikia sorediata R. C. Harris
Ochrolechia arborea (Kreyer) Almb.
***Ovicuculispora parmeliae* (Berk. & M. A. Curtis) Etayo
Parmelia squarrosa Hale
Parmelia sulcata Taylor
Parmotrema austrosinense (Zahlbr.) Hale
Parmotrema gardneri (C. W. Dodge) Sérus.
Parmotrema hypotropum (Nyl.) Hale
Parmotrema margaritatum (Hue) Hale
Parmotrema perforatum (Jacq.) A. Massal.
Parmotrema perlatum (Hudson) M. Choisy
Parmotrema reticulatum (Taylor) M. Choisy
Parmotrema subisidiosum (Müll. Arg.) Hale
Parmotrema ultralucens (Krog) Hale
Peltigera canina (L.) Willd.
Peltigera didactyla (With.) J. R. Laundon
Peltigera evansiana Gyelnik
Peltigera polydactylon (Necker) Hoffm.
Peltigera praetextata (Flörke ex Sommerf.) Zopf
Peltigera rufescens (Weiss) Humb.
Pertusaria plittiana Erichsen
Pertusaria pustulata (Ach.) Duby
**Phaeocalicium curtisii* (Tuck.) Tibell
**Phaeocalicium polyporaeum* (Nyl.) Tibell
**Phaeocalicium populneum* (Brond. ex Duby) A.F.W. Schmidt
Phaeophyscia adiastola (Essl.) Essl.
Phaeophyscia ciliata (Hoffm.) Moberg
Phaeophyscia decolor (Kashiw.) Essl.
Phaeophyscia hirsuta (Mereschk.) Essl.
Phaeophyscia hirtella Essl.
Phaeophyscia insignis (Mereschk.) Moberg
Phaeophyscia orbicularis (Necker) Moberg
Phaeophyscia pusilloides (Zahlbr.) Essl.
Phaeophyscia rubropulchra (Degel.) Essl.
***Phaeopyxis punctum* (A. Massal.) Rambold, Triebel & Coppins
Phlyctis petraea R. C. Harris, Muscavitch, Ladd & Lendemer
Physcia adscendens (Fr.) H. Olivier
Physcia aipolia (Ehrh. ex Humb.) Fürnr.
Physcia americana G. Merr.
Physcia dubia (Hoffm.) Lettau
Physcia millegrana Degel.
Physcia phaea (Tuck.) J. W. Thomson
Physcia pumilior R. C. Harris
Physcia stellaris (L.) Nyl.
Physcia thomsoniana Essl.
Physciella chloantha (Ach.) Essl.
Physciella melanchra (Hue) Essl.
Physconia detersa (Nyl.) Poelt
Physconia leucoleiptes (Tuck.) Essl.
***Piccolia nannaria* (Tuck.) Lendemer & Beeching
Placidiopsis minor R. C. Harris**
Placynthiella dasaea (Stirton) Tønsberg
Placynthiella icmalea (Ach.) Coppins & P. James
Placynthiella oligotropha (J. R. Laundon) Coppins & P. James
Placynthium nigrum (Hudson) Gray
Platismatia tuckermanii (Oakes) W. L. Culb. & C. F. Culb.
***Polysporina subfuscescens* (Nyl.) K. Knudsen & Kocourk.
Porpidia albocaerulescens (Wulfen) Hertel & Knoph

Porpidia crustulata (Ach.) Hertel & Knoph
Porpidia soredizodes (Lamy ex Nyl.) J. R. Laundon
Porpidia subsimplex (H. Magn.) Fryday
Protoblastenia rupestris (Scop.) J. Steiner
Protoparmelia hypotremella Herk, Spier & V. Wirth
Protoparmeliopsis muralis (Schreber) M. Choisy
Pseudosagedia aenea (Wallr.) Hafellner & Kalb
Pseudosagedia cestrensis (Tuck. ex E. Michener) R. C. Harris
Psoroglaena dictyospora (Orange) H. Harada
Psorotichia schaereri (A. Massal.) Arnold
Punctelia bolliana (Müll. Arg.) Krog
Punctelia borreri (Sm.) Krog
Punctelia caseana Lendemer & Hodkinson
Punctelia missouriensis G. Wilh. & Ladd
Punctelia rudecta (Ach.) Krog
Pyrenopsis polycocca (Nyl.) Tuck.
Pyrenula laevigata (Pers.) Arnold
Pyrenula punctella (Nyl.) Trevisan
Pyxine sorediata (Ach.) Mont.
Pyxine subcinerea Stirton
Ramalina americana Hale
Ramalina complanata (Sw.) Ach.
Ramalina intermedia (Delise ex Nyl.) Nyl.
Ramalina labiosorediata Gasparyan, Sipman & Lücking
Rhizocarpon reductum Th. Fr.
Rhizocarpon rubescens Th. Fr.
Rinodina buckii Sheard
Rinodina destituta (Nyl.) Zahlbr.
Rinodina freyi H. Magn.
Rinodina maculans Müll. Arg.
Rinodina oxydata (A. Massal.) A. Massal.
Rinodina papillata H. Magn.
Rinodina subminuta H. Magn.
Rinodina subparieta (Nyl.) Zahlbr.
Rinodina tephraspis (Tuck.) Herre
Ropalospora viridis (Tønsberg) Tønsberg
Rusavskia elegans (Link) S. Y. Kondr. & Kärnefelt
Sarcogyne regularis Körber
Sarcogyne similis H. Magn.
***Sarcopyrenia calcarea* Lendemer & R. C. Harris
**Sarea difformis* (Fr.) Fr.
**Sarea resinae* (Fr.) Kuntze
Scoliciosporum chlorococcum (Stenh.) Vězda
Scoliciosporum pensylvanicum R. C. Harris (Harris 2009)
Scoliciosporum umbrinum (Ach.)
Scytinium dactylinum (Tuck.) Otálora, P. M. Jørg. & Wedin
Scytinium juniperinum (Tuck.) Otálora, P. M. Jørg. & Wedin
Scytinium lichenoides (L.) Otálora, P. M. Jørg. & Wedin
Segestria lectissima Fr.
***Sphinctrina anglica* Nyl.
Squamulea subsoluta (Nyl.) Arup, Søchting & Frödén
Staurothele drummondii (Tuck.) Tuck.
Steinia geophana (Nyl.) Stein
**Stenocybe pullatula* (Ach.) Stein
Stereocaulon saxatile H. Magn.
Strangospora moriformis (Ach.) Stein
Strigula jamesii (Swinscow) R. C. Harris
Thelidium minutulum Körb.
Thelidium pyrenophorum (Ach.) Mudd
Thelidium zwackhii (Hepp) A. Massal.
Thelocarpon intermediellum Nyl.
Thelocarpon laureri (Flotow) Nyl.
Trapelia coarctata (Turner) M. Choisy
Trapelia glebulosa (Sm.) J. R. Laundon
Trapelia placodioides Coppins & P. James

Trapeliopsis flexuosa (Fr.) Coppins & P. James
Trapeliopsis granulosa (Hoffm.) Lumbsch
Trapeliopsis viridescens (Schrader) Coppins & P. James
***Tremella cladoniae* Diederich & M. S. Christ.
Trimmatothelopsis dispersa (H. Magn.) K. Knudsen & Lendemer
Tuckermanella fendleri (Nyl.) Essl.
Tuckermannopsis americana (Sprengel) Hale
Tuckermannopsis ciliaris (Ach.) Gyelnik
Tuckermannopsis sepincola (Ehrh.) Hale
Umbilicaria mammulata (Ach.) Tuck.
Usnea cornuta Körber
Usnea dasaea Stirton
Usnea glabrata (Ach.) Vainio
Usnea hirta (L.) Weber ex F. H. Wigg.
Usnea mutabilis Stirton
Usnea pensylvanica Motyka
Usnea strigosa (Ach.)
Usnea subfloridana Stirton
Usnea subgracilis Vainio
Usnocetraria oakesiana (Tuck.) M. J. Lai & C. J. Wei
Verrucaria calkinsiana Servit
Verrucaria cernaensis Zschacke
Verrucaria dolosa Hepp
***Verrucaria latericola* Erichsen
Verrucaria muralis Ach.
Verrucaria myriocarpa Hepp
Verrucaria nigrescens Pers.
Verrucaria nigrescentoidea Fink
Verrucaria praetermissa (Trevisan) Anzi
Verrucaria sublobulata Eitner ex Serv.
Verrucaria umbrinula Nyl.
Vezdaea leprosa (P. James) Vězda
Vezdaea schuyleriana Lendemer
Viridothelium virens (Tuck. ex Michener) Lücking, M. P. Nelsen & Aptroot
Willeya diffractella (Nyl.) Müll. Arg.
Xanthocarpia feracissima (H. Magn.) Frödén, Arup & Søchting
Xanthomendoza fallax (Hepp ex Arnold) Søchting, Kärnefelt & S. Y. Kondr.
Xanthomendoza hasseana (Räsänen) Søchting, Kärnefelt & S. Y. Kondr.
Xanthomendoza ulophyllodes (Räsänen) Søchting, Kärnefelt & S. Y. Kondr.
Xanthomendoza weberi (S. Y. Kondr. & Kärnefelt) L. Lindblom
Xanthoparmelia conspersa (Ehrh. ex Ach.) Hale
Xanthoparmelia cumberlandia (Gyelnik) Hale
Xanthoparmelia plittii (Gyelnik) Hale
Xanthoria parietina (L.) Th. Fr.
Xylopsora friesii (Ach.) Bendiksby & Timdal

Identification Keys

Key to Keys

3. Thallus lacking lichenized diaspores, producing sexual fruiting structures, often with inspersed conidiomata, or not producing fruiting structures at all 4
4. Thallus an algal film, producing scattered club-shaped mushrooms (*Multiclavula*) 5
4. Thallus variable, producing perithecia, apothecia, or no sexual fruiting structures 6
5. Basidiomata orange, blunt at tips, growing on exposed soil; rare, known from a single site in Portage County ..... *Multiclavula corynoides*
5. Basidiomata mostly pallid; tips of clubs pointed, typically turning dark brown to black; growing on decaying wood or more rarely on soil or moist rock; not uncommon ..... *Multiclavula mucida*
6. Thallus producing perithecia..... Key to Peritheciate Crusts (Pg. 18)
6. Thallus sterile or producing apothecia..... 7
7. Apothecia present, sessile or immersed in the substrate ..... Key to Apotheciate Crusts (Pg. 21)
7. Apothecia absent or raised on tiny pin-like stalks or pseudopodetia 8
8. Apothecia present, raised on tiny stalks, pin-like; apothecia black, brown, or yellow, pruinose or not, typically on lignum, bark, polypores, or detritus; thallus variable .....Key to Calicioid Fungi (Pg. 31)
8. Apothecia absent or raised on pseudopodetia. If present, produced from a terricolous or saxicolous crust 9
9. Thallus saxicolous, composed of corticate whitish-gray granules; apothecia usually absent, dark brown, produced on pseudopodetia covered with phyllocladia; rare, known from a single site in Lake County .....*Stereocaulon saxatile*
9. Thallus terricolous, composed of a thin gray crust with abundant schizidia; apothecia often present, pink, produced on short pink pseudopodetia (an extension of the hypothecium); rare, known from a single Geauga County collection ..... *Dibaeis baeomyces*
10. Primary thallus squamulose, with or without fruticose podetia as a secondary thallus; colonies consisting of many small uniform squamules..... Key to Squamulose Lichens (Pg. 32)
10. Thallus foliose, fruticose, or filamentous, lacking a secondary thallus 11
11. Thallus filamentous, black, with *Trentepohlia* as the photobiont; rare, known from a single Geauga County collection on a sheltered sandstone rock face ..... *Cystocoleus ebeneus*
11. Thallus foliose or fruticose..... 12
12. Thallus foliose; lobes with a distinct upper and lower surface.....Key to Foliose Lichens (Pg. 34)
12. Thallus fruticose; branches without a distinct upper or lower surface Key to Fruticose Lichens (Pg. 42)

Key to Lichenicolous Fungi

1. Fruiting structures strictly pycnidia 2
1. Fruiting structures apothecia, perithecia, or basidiomata; thalli with or without inspersed pycnidia .. 10
2. Conidia brown-pigmented, broadly-ellipsoid to globose, simple..... 3
2. Conidia hyaline, variable in shape 4
3. Lichenicolous on apothecia of Cladonia (typically C. caespiticia); conidia >5 um long; uncommon..... ..... *Lichenoconium pyxidatae*
3. Lichenicolous on other species; conidia <5 um long; not uncommon ..... *Lichenoconium erodens*
4. Pycnidia orange, K+ reddish-purple; common..... *Piccolia nannaria*
4. Pycnidia black, K-..... 5
5. Conidia pyramidal; uncommon.....*Cornutispora pyramidalis*
5. Conidia filiform, bacilliform, or ellipsoid..... 6

6. Conidia thin, long, filiform; parasitic on *Lecanora hybocarpa*; uncommon .. unknown pycnidiate fungus
6. Conidia ellipsoid to bacilliform; hosts variable 7
7. Thallus indiscernible, within the host (host may be discolored) 8
7. Thallus visible, growing where the host has been removed; hosts variable 9
8. Thallus lichenicolous on *Cladonia sp.*; rare, known from a single Portage County collection ..... *Epicladonia stenospora*
8. Thallus lichenicolous on *Scoliciosporum pensylvanicum*; not uncommon .... unknown pycnidiate fungus
9. Thallus thin, greenish-gray, essentially the photobiont of the host; conidia bacilliform; uncommon..... unknown pycnidiate fungus
9. Thallus grayish brown, comprised of a clear hyphal layer along with the photobiont of the host; conidia ellipsoid; rare, known from a single Summit County collection ..... unknown pycnidiate fungus
10. Fruiting structures apothecia 11
10. Fruiting structures perithecia or basidiomata 17
11. Spores hyaline, simple 12
11. Spores brown to gray-pigmented, simple or with longitudinal and/or transverse septate 14
12. Spores 8/ascus; lichenicolous on *Cladonia* squamules; rare, known from a single Portage County collection ..... *Phaeopyxis punctum*
12. Asci polysporous; never lichenicolous on *Cladonia* 13
13. Apothecial disks orange, K+ reddish-purple, not irregular or gyrose, growing from corticolous lichens; common ..... *Piccolia nannaria*
13. Apothecial disks black, irregular, gyrose, K-, growing from saxicolous lichens; not uncommon ..... *Polysporina subfuscescens*
14. Apothecia sessile or immersed and urceolate, growing from saxicolous or terricolous lichens; spores septate 15
14. Apothecia raised on tiny pin-like stalks, growing from corticolous lichens; spores simple 16
15. Apothecia immersed, mostly urceolate; spores muriform; thallus parasitic on *Cladonia*; rare, known from a single Geauga County collection ..... *Diploschistes muscorum*
15. Apothecia sessile; spores 1-septate; thallus parasitic on saxicolous crusts (*Myriolecis dispersa* in Ohio specimens); uncommon ..... *Buellia badia*
16. Lichenicolous on *Lecanora thysanophora*; not uncommon ..... *Chaenothecopsis ochroleuca?*
16. Lichenicolous on *Protoparmelia hypotremella*; rare, known from a single Geauga County collection ... *Sphinctrina anglica*
17. Fruiting structures perithecia 18
17. Fruiting structures basidiomata 23
18. Spores brown, 1-septate 19
18. Spores hyaline 20
19. Thallus lichenicolous on *Hypocenomyce scalaris*; not uncommon ..... *Clypeococcum hypocenomycis*
19. Thallus lichenicolous on *Porpidia albocaerulescens*; seemingly uncommon ..... *Endococcus perpusillus*
20. Thallus immersed within dead or dying tissue of host, lichenicolous on other species 21
20. Thallus composed of distinct squamules or areoles apart from the host thallus 22
21. Perithecia pinkish-orange, covered with a fine, white tomentum, growing from corticolous or lignicolous lichens; known from a single Mahoning County collection where it was parasitic on *Cladonia* ..... *Ovicuculispora parmeliae*

21. Perithecia black, smooth, growing from saxicolous lichens; rare, known from a single Stark County collection where it was parasitic on *Caloplaca albovariegata* ..... *Sarcopyrenia calcarea*
22. Thallus composed of small distinct squamules growing in blackened zones on the host, lichenicolous on *Trapelia placodioides*; spores 1-septate; uncommon..... *Placidiopsis minor*
22. Thallus composed of brownish areoles where the host once was, lichenicolous on Lecanoraceae or Teloschistaceae (*Myriolecis dispersa* in Ohio specimen); spores simple; rare, known from a single Stark County collection ..... *Verrucaria latericola*
23. Llichenicolous on *Cladonia*; basidiomata brownish; uncommon ..... *Tremella cladoniae*
23. Lichenicolous on members of Physciaceae; basidiomata pale orange to bright pink; not uncommon24
24. Basidiomata pale orange ..... *Marchandiobasidium aurantiacum*
24. Basidiomata bright pink ..... *Marchandiomyces corallinus*

Key to Crusts with Asexual Reproductive Structures

1. Thallus leprose or producing soredia or pustules 2
1. Thallus producing isidia, blastidia, granules, goniocysts, or strictly conidiomata (pycnidia or synnemata) 63
2. Thallus bright yellow or orange 3
2. Thallus not bright yellow or orange, colors variable 7
3. Thallus K+ reddish-purple (anthraquinones present) 4
3. Thallus K- 5
4. Thallus lignicolous; rare, known from a single Wayne County collection ..... *Caloplaca microphyllina*
4. Thallus saxicolous; uncommon ..... *Flavoplaca flavocitrina*
5. Thallus growing on detritus, often producing stalked apothecia (NE Ohio collection is sterile); photobiont *Stichococcus*; rare, known form a single Geauga County collection .... *Chaenotheca furfuracea*
5. Thallus corticolous or lignicolous, apothecia never stalked; photobiont Chlorococcoid 6
6. Thallus producing coarse soredia, often fertile and producing small areoles; common .... *Candelariella efflorescens*
6. Thallus a thin, fine, continuous leprose crust; rare, known from a single Columbiana County collection ..... *Chrysothrix xanthina*
7. Thallus entirely green, KC- or KC+ red (usnic acid absent) 8
7. Thallus with other colors; usnic acid absent or present (when present, thallus KC+ yellow) 18
8. Thallus C+ red or KC+ reddish-orange (gyrophoric acid or xanthones present) 9
8. Thallus C- and KC- 12
9. Thallus saxicolous, typically growing on sheltered sandstone cliff faces; uncommon ..... *Micarea sp.*
9. Thallus corticolous or growing on decaying wood 10
10. Thallus growing on decaying wood; apothecia often present, dark brown to black; spores simple, hyaline; rare, known from single Lake County collection ..... *Trapeliopsis viridescens*
10. Thallus growing on bark of living trees; apothecia absent (*Biatora*) 11
11. Thallus P+ orange (argopsin present), C+ red (gyrophoric acid present); common ..... *Biatora printzenii*
11. Thallus P-, C+ dirty reddish-orange or C- (xanthones present); uncommon ..... *Biatora pontica*
12. Thallus saxicolous 13
12. Thallus corticolous or lignicolous 14
13. Thallus corticate to immersed, producing small laminal soralia; uncommon ..... Undescribed crust

13. Thallus completely leprose ..... *Botryolepraria lesdainii*
14. Thallus typically K+ yellow (atranorin present); soralia large, diffuse; uncommon ..... *Bacidia sorediata*
14. Thallus P-, K-; soralia small, though often merging to form large sorediate masses 14
15. Thallus often forming a distinct whitish prothallus; soralia UV+ blue-white (perlatolic acid present) ..... *Ropalospora viridis*
15. Thallus lacking a distinct prothallus; soralia UV- 15
16. Thallus fertile; spores very thin, acicular; soralia actually patches of underdeveloped goniocysts; uncommon ..... *Bacidina assulata*
16. Thallus typically sterile, with true soredia; spores ellipsoid 16
17. Thallus typically growing on hardwoods, lacking secondary metabolites (TLC required); apothecia pale brown to dark brown, typically marginate, lacking K+ violet sedifolia-gray pigment; spores narrowly ellipsoid, becoming 3-septate ..... *Lecania croatica*
17. Thallus typically growing at the bases of conifers or on decaying wood or bark, producing micareic acid (TLC required); apothecia emarginate, pallid or with K+ violet sedifolia-gray pigment in the epihymenium (absent in Ohio specimens); spores ellipsoid, simple to 1-septate ..... *Micarea soralifera*
18. Thallus leprose, lacking any smooth episubstratal surface or areoles, without distinct soralia 19
18. Thallus with at least some smooth episubstratal surface or areoles or with distinct soralia 39
19. Thallus saxicolous or terricolous 18
19. Thallus corticolous 27
20. Thallus comprised of light gray, shiny, nearly corticate granules that often form zoned rings; not uncommon ..... *Lepraria neglecta*
20. Thallus not as above 21
21. Thallus terricolous, C+ red (gyrophoric acid present); uncommon ..... *Placynthiella dasaea*
21. Thallus saxicolous, C- 22
22. Thallus P- 23
22. Thallus P+ orange or red (stictic acid or pannarin present) 25
23. Thallus thin, hypothallus lacking; rare, known from a single Columbiana County collection ..... *Lepraria xanthonica*
23. Thallus thick, with a well-developed cottony hypothallus 24
24. Thallus KC+ yellow (usnic acid present), UV-, yellow-green in color, typically on sheltered sandstone rock outcroppings with at least some calcareous influence; rare, known only from Columbiana Count ..... *Lepraria disjuncta*
24. Thallus KC+ pink, UV+ blue-white (nordivaricatic acid and divaricatic acid present), blueish-gray in color, often forming erect lobes, typically on non-calcareous sandstone cliff faces; not uncommon ..... *Lepraria cryophila*
25. Thallus dark lead-blue, thin, without a hypothallus; rare ..... *Leprocaulon adhaerens*
25. Thallus thick, placodioid, with a well-developed hypothallus (*Lepraria*) 26
26. Thallus with distinctly lipped margins, resembling lobes; rare, known only from Columbiana County ..... *Lepraria normandinoides*
26. Thallus without distinctly lipped margins; common ..... *Lepraria finkii*
27. Thallus P+ orange (reaction may be weak) 28
27. Thallus P- or P+ weak yellow 31
28. Thallus lacking a distinct hypothallus 29
28. Thallus thick, with a distinct cottony hypothallus, typically on hardwoods (*Lepraria*) 30

29. On conifers; P reaction strong; thallus blueish-gray, truly leprose; uncommon ..... *Lepraria elobata*
29. On hardwoods; P reaction weak; thallus whitish-gray, with a pale immersed prothallus; common ..... *Lecanora layana*
30. Thallus distinctly yellowish, K+ yellow or fleeting purple to dirty yellow-brown (pannaric acid 6-methyl ester present); not uncommon, typically present in floodplains ..... *Lepraria vouauxii*
30. Thallus blueish-green or blueish-gray, K+ yellow (stictic acid, atranorin, and zeorin present); common ..... *Lepraria finkii*
31. Thallus fertile, with biatorine apothecia and long, transversely-septate, acicular spores (40-45um long); rare, known from a single Columbiana County collection ..... *Bacidia sp.*
31. Thallus sterile, or if fertile, with lecanorine apothecia and simple, ellipsoid spores (<15um long) 32
32. Thallus UV+ blue-white (divaricatic acid present) or KC+ yellow (usnic acid present) 33
32. Thallus neither UV+ blue-white nor KC+ yellow (may be K+ yellow) 36
33. Hypothallus lacking; (*Lepraria*) 34
33. Hypothallus immersed in substrate and visible as a faint whitish cast or forming a distinct fibrous marginal prothallus; common (*Lecanora*) 35
34. Thallus KC-, UV+ blue-white (divaricatic acid present); common ..... *Lepraria hodkinsoniana*
34. Thallus KC+ yellow, UV- (usnic acid present); uncommon ..... *Lepraria sp.*
35. Prothallus becoming distinct and fibrous; thallus more greenish than yellow .. *Lecanora thysanophora*
35. Prothallus immersed, not becoming fibrous; thallus more yellowish than green ..... *Lecanora sp.*
36. Hypothallus immersed, forming a pale cast below the soredia; thallus K+ strong yellow (atranorin present); uncommon ..... *Lecanora nothocaesiella*
36. Hypothallus lacking a or episubstratal and comprised of loose fuzzy hyphae underneath the thalline granules; thallus truly leprose, K+ weak yellow (*Lepraria*) 37
37. Hypothallus distinct, especially visible at the thallus margins as fuzzy hyphae protruding from underneath the granules; growing strictly on conifers; not uncommon ..... *Lepraria harrisiana*
37. Hypothallus lacking; growing on hardwoods or conifers 38
38. Thallus distinctly blueish, growing on a variety of hardwoods and conifers; common *Lepraria caesiella*
38. Thallus light greenish-gray, favoring bark of mature *Quercus alba*; not uncommon ..... *Lepraria sp.* (a form of *L. caesiella*?)
39. Thallus corticolous/lignicolous 40
39. Thallus saxicolous or terricolous 55
40. Thallus K+ yellow to red (norstictic acid present); rare, known from a single Geauga County collection ..... *Japewiella dollypartoniana*
40. Thallus K- or K+ yellow 41
41. Thallus P+ red or orange (pannarin, stictic acid, fumarprotocetraric acid, or thamnolic acid present)... 42
41. Thallus P- or P+ weak yellow 46
42. Photobiont *Trentepohlia*; uncommon ..... *Nadvornikia sorediata*
42. Photobiont coccoid 43
43. Thallus dirty greenish-brown, K- (fumarprotocetraric acid or pannarin present) 44
43. Thallus light blueish-gray, K+ yellow (stictic or thamnolic acids present) 45
44. Thallus forming a bumpy continuous crust, often forming radiating patches on smooth-barked hardwoods; common ..... *Fuscidea arboricola*

44. Thallus composed of distinct areoles, discontinuous, not forming radiating patches; rare, known from a single Portage County collection ..... *Rinodina buckii*
45. Thallus producing fine soredia; P reaction weak (stictic acid present); common ..... *Lecanora layana*
45. Thallus producing pustules; P reaction strong (thamnolic acid present); uncommon .... *Lepra pustulata*
46. Thallus C+ red or KC+ red (gyrophoric acid present) 47
46. Thallus C- 49
47. Thallus whitish-gray, UV+ bright yellow (lichexanthone present), typically forming small circular patches on bark; common ..... *Ochrolechia arborea*
47. Thallus variable in color, UV-, typically forming irregular colonies on lignum (occasionally bark) 48
48. Thallus light gray to pinkish, often mottled; uncommon ..... *Trapeliopsis granulosa*
48. Thallus lead-gray to dark blueish-green; common ..... *Trapeliopsis flexuosa*
49. Thallus K+ yellow (atranorin present) 50
49. Thallus K- 52
50. Thallus comprised of small, flat, squarish areoles with marginal soredia; Soredia sometimes obscuring the areoles; rare ..... *Rinodina subparieta*
50. Thallus mostly immersed or comprised of small round convex areoles; soredia laminal, often overwhelming thallus and appearing leprose; not uncommon 51
51. Thallus mostly immersed ..... *Lecanora nothocaesiella*
51. Thallus episubstratal, comprised of small round convex areoles that are initially discontinuous but often become fused together centrally to form a bullate surface ..... *Lecanora appalachensis*
52. Thallus completely crustose; apothecia, when present, bright orange (*Caloplaca*) 53
52. Thallus comprised of tiny flat lobes; apothecia, when present, blackish to brownish (*Hyperphyscia*) 54
53. Thallus shades of gray; soralia concolorous with thallus, hard to discern; uncommon ... *Caloplaca ahtii*
53. Thallus light brown; soralia easily noticed, green; rare, known from a single Lake County collection .... *Caloplaca ulcerosa*
54. Soredia produced in laminal, flat to excavate soralia; common ..... *Hyperphyscia adglutinata*
54. Soredia produced along the lateral lobe margins; rare, known from a single Summit County collection ..... *Hyperphyscia confusa*
55. Thallus C+ pink or red (gyrophoric acid present) 56
55. Thallus C- 57
56. Thallus saxicolous, sterile; common ..... *Trapelia placodioides*
56. Thallus terricolous, often fertile; uncommon ..... *Trapeliopsis granulosa*
57. Thallus P+ yellow (norstictic acid present) or orange (stictic acid present) 58
57. Thallus P- 59
58. Thallus K+ yellow to red, becoming thick, bright whitish-gray; not uncommon ..... *Phlyctis petraea*
58. Thallus K- or K+ weak yellow, thin to endosubstratal, gray; uncommon ..... *Porpidia soredizodes*
59. Thallus thin, UV+ blue-white (divaricatic acid present); rare, known from a single Portage County collection ..... *Fucidea recensa*
59. Thallus thick, UV- 60
60. Thallus growing on sheltered non-calcareous sandstone rock outcroppings, comprised of brown to greenish-brown lobate areoles; soralia becoming excavate; rare, known from a single Medina County collection ..... *Caloplaca reptans*
60. Thallus growing on exposed concrete or other exotic calcareous substrates, light to dark gray in color; soralia excavate or not 61

61. Thallus a continuous, gray, areolate crust with laminal soralia, often fertile, with blackish apothecia that are K-; rare, known from a single Summit County collection..... *Caloplaca pratensis*
61. Thallus comprised of thick, light gray, pruinose, scattered to clustered areoles producing marginal soralia, sterile, or if fertile, with bright orange apothecia that are K+ reddish-purple (anthraquinones present); uncommon 62
62. Soredia produced on the undersurface of raised margins of areoles; thallus always sterile..... ..... *Acarospora moenium*
62. Soredia produced marginally, but not on the undersurface; thallus sometimes fertile, with bright orange apothecia that are K+ reddish-purple..... *Caloplaca soralifera*
63. Pycnidia present, clustering into distinct discolored patches; thallus smooth, growing on smooth barked hardwoods (*Fagus*, *Carpinus*, young *Carya*); not uncommon ..... *Viridotheium virens*
63. Pycnidia present or absent, never clustering into distinct discolored patches 64
64. Thallus dark green to bright green, even when dry..... 65
64. Thallus other colors (blueish-gray, greenish-gray, brownish-gray, gray, blackish-green, brownish-green, brown, blackish-brown, or black), at least when dry 80
65. Apothecia and/or pycnidia present; spores transversely septate, thin, acicular; spore length to width ratio at least 5:1 respectively; conidia filiform (*Bacidina*) 66
65. Apothecia, perithecia, and/or pycnidia present or absent; spores simple, transversely septate or muriformly septate, ellipsoid; spore length not exceeding 5 times the width; conidia not filiform..... 71
66. Apothecia ghost white, completely unpigmented..... 67
66. Apothecia pale brown to blackish, with at least some pigmentation of the exciple, epihymenium, hymenium, and/or hypothecium..... 68
67. Thallus smooth or developing coarse goniocysts with age; rare, known from a single Summit County collection..... *Bacidina brittoniana?*
67. Thallus comprised of fine goniocysts; common..... *Bacidina delicata*
68. K+ violet pigment narrowly present along lateral exciple; upper hymenium (or entire hymenium) often blue-green-pigmented; mostly on limestone or concrete; common..... *Bacidina egenula*
68. K+ violet pigment lacking; exciples colorless or with brown K- to K+ intensifying pigment; upper hymenium unpigmented or brown-pigmented; lignicolous, corticolous, or on non-calcareous rocks 69
69. Thallus semiaquatic, growing periodically inundated substrates; uncommon ..... *Bacidina inundata*
69. Thallus terrestrial, not growing on periodically inundated substrates..... 70
70. Thallus mostly smooth or forming small “soralia-like” patches of goniocysts; Hypothecium unpigmented or faintly brown pigmented; pigment not turning greenish; uncommon . *Bacidina assulata?*
70. Thallus comprised of goniocysts; hypothecium reddish “arnoldiana”-brown, turning greenish-brown in K; rare on lignum of standing snags in wetlands ..... *Bacidina arnoldiana*
71. Thallus continuous, producing laminal blastidia or lacking lichenized diaspores 72
71. Thallus comprised completely, or nearly completely, of minute globose to isidioid or flabelliform granules/goniocysts (need ascomata to continue)..... 76
72. Thallus with laminal blastidia (*Fellhanera*) 73
72. Thallus smooth to areolate, without blastidia or with short pseudoblastidia forming along the margins of areoles, only pycnidia present..... 74
73. Thallus thin, typically revealing a thin webby hypothallus in patches throughout the thallus; uncommon..... *Fellhanera minnisinkorum*

73. Thallus thick, often areolate; hypothallus not visible beyond thallus margins; rare, know from a single Medina County collection ..... *Fellhanera granulosa*
74. Conidia ellipsoid; pycnidia large; thallus on basal bark of *Quercus rubra*; uncommon ..... Unknown pycnidiate crust
74. Conidia bacilliform; pycnidia small; substrate variable (*Fellhanera*) 75
75. Conidia>5um long; growing on bark and rock; not uncommon ..... *Fellhanera silicis*
75. Conidia<5um long; growing on the bark of conifers in plantations; uncommon ..... *Fellhanera fallax*
76. Ascomata apothecia; spores simple to transversely septate; uncommon 77
76. Ascomata perithecia; spores muriform or submuriform 78
77. Thallus comprised of corticate granules, growing on bark of living trees; uncommon ..... *Biatora sp.*
77. Thallus mostly comprised of tiny goniocysts, typically growing on decaying wood; common ..... *Micarea prasina*
78. Perithecia reddish-brown to tannish; uncommon ..... *Psoroglaena dictyospora*
78. Perithecia black, often with pale tips (*Agonimia*) 79
79. Thallus comprised of isidioid and finger-like to flabelliform goniocysts; uncommon ..... *Agonimia flabelliformis*
79. Thallus comprised of round, globular goniocysts; common ..... *Agonimia sp.*
80. Thallus producing strictly conidiomata (synnemata or pycnidia), lacking lichenized diaspores 81
80. Thallus producing lichenized diaspores or comprised entirely of granules 82
81. Thallus synnematous, with small, white, scattered conidiomata that are often raised by a pallid stalk, completely immersed within substrate, corticolous on tree bases or rarely lignicolous in moist conditions, always sterile; common ..... *Dictyocatenulata alba*
81. Thallus pycnidiate, episubstratal, smooth to areolate; not uncommon ..... *Fellhanera silicis*
82. Thallus isidiate or goniocystate 83
82. Thallus granular (blastidiate or comprised entirely of granules) 85
83. Photobiont a cyanobacteria; uncommon ..... *Placynthium nigrum*
83. Photobiont a green alga; not uncommon 84
84. Thallus lignicolous or terricolous, brownish to greenish-brown, C+ red (gyrophoric acid present) ..... *Placynthiella icmalea*
84. Thallus saxicolous on non-calcareous substrates, blackish-green (goniocysts giving thallus a greenish color in more mature portions), C- ..... *Verrucaria sp.*
85. Thallus corticolous/lignicolous 86
85. Thallus saxicolous; uncommon 88
86. Thallus bright yellow; uncommon ..... *Candelariella xanthostigma*
86. Thallus gray, gray-brown, brown, or greenish-brown 87
87. Thallus comprised of bullate granules, gray to grayish-brown, UV+ blue-white (lobaric acid present); rare, known from a single Geauga County collection ..... *Protoparmelia hypotremella*
87. Thallus producing small blastidia from a thin continuous crust or flattened areoles; blastidia often overwhelming the thallus; brown to greenish-brown, UV-; common ..... *Rinodina papillata*
88. Thallus blackish, greenish-black, or brownish-black, resembling a cyanobacterial colony, P+ red (argopsin present), often fertile; apothecia lecanorine ..... *Halecania pepegospora*
88. Thallus light blueish-gray or greenish-gray, P- or P+ yellow (atranorin present) rarely fertile; apothecia biatorine ..... *Herteliana schuyleriana*

Key to Peritheciate Crusts

1. Spores muriform, submuriform, or transversely septate 2
1. Spores simple 28
2. Spores muriform or submuriform 3
2. Spores transversely septate 11
3. Thallus saxicolous (or terricolous) 4
3. Thallus corticolous 8
4. Thallus comprised of several distinct, often overlapping areoles (*Endocarpon*) 5
4. Thallus comprised of a continuous areolate to rimose-areolate crust 6
5. Areoles often overlapping, almost squamulose, often slightly raised from the substrate; common ..... *Endocarpon pallidulum*
5. Areoles never overlapping, clearly crustose, adnate; uncommon ..... *Endocarpon petrolepideum*
6. Thallus with radiating areoles along the margins; spores brown, 2/ascus; rare, known from a single Stark County collection ..... *Staurothele drummondii*
6. Thallus without radiating areoles; spores hyaline, 4-8/ascus; uncommon 7
7. Perithecia sessile; thallus greenish, subgelatinous, without areoles ..... *Agonimia gelatinosa*
7. Perithecia mostly immersed; thallus brownish to grayish-brown, areolate ..... *Willeya diffractella*
8. Thallus saprophytic, white, favoring bark of *Quercus alba* and *Acer saccharum*; common ..... *Julella fallaciosa*
8. Thallus lichenized, green; substrates variable 9
9. Perithecia reddish-brown to tannish; thallus smooth or with abundant goniocysts, on *Ulmus* bark; uncommon ..... *Psoroglaena dictyospora*
9. Perithecia black, often with pale tips; thallus comprised completely of globose or flabelliform to coralloid goniocysts, on the bases of a variety of hardwoods (*Agonimia*) 10
10. Thallus comprise of flabelliform to coralloid goniocysts; uncommon ..... *Agonimia flabelliformis*
10. Thallus comprised of round globose granules; common ..... *Agonimia sp.*
11. Spores completely hyaline 12
11. Spores faintly to heavily brown-pigmented; uncommon 26
12. Spores mostly 1-septate 13
12. Spores >1-septate 20
13. Thallus saxicolous 14
13. Thallus corticolous (*Anisomeridium*) 18
14. Thalli minute scattered areoles, growing in disturbed areas; uncommon ..... *Placidiopsis minor*
14. Thalli immersed to rimose, continuous, habitat variable 15
15. Paraphyses absent (*Thelidium*) 16
15. Paraphyses abundant and branching; uncommon (*Anisomeridium*) 17
16. Involucrellum absent; uncommon ..... *Thelidium minutulum*
16. Involucrellum present; rare ..... *Thelidium pyrenophorum*
17. Thallus a visible greenish crust covering the substrate; perithecia partially immersed in thallus; typically associated with waterways ..... *Anisomeridium carinthiacum*
17. Thallus completely immersed; perithecia sessile; habitat variable ..... *Anisomeridium distans*
18. Thallus mostly immersed, dull; perithecia sessile, not at all immersed; spores narrowly-ellipsoid, shoe-shaped, with cells being uneven in size and shape; common ..... *Anisomeridium polypori*

18. Thallus episubstratal, at least centrally, forming bright whiteish-gray patches on smooth bark of hardwoods; perithecia partially or mostly immersed in thallus; spores relatively even in size and shape 19
19. Thallus smooth throughout, typically not forming round patches, on various hardwoods (*Tilia americana* in Ohio specimen); spores broadly-ellipsoid, blunt at ends; rare, known from a single Summit County collection ..... *Anisomeridium biforme*
19. Thallus becoming weakly areolate in mature portions, typically forming small round patches on smooth bark of young *Acer rubrum*; spores ellipsoid, somewhat pointed; not uncommon ..... *Anisomeridium leucochlorum*
20. Thallus saxicolous..... 21
20. Thallus corticolous 22
21. Perithecial walls with an intense reddish-purple pigment internally; ascospores narrowly ellipsoid; uncommon..... *Segestria lectissima*
21. Perithecial walls pale to dark brown throughout; ascospores broadly ellipsoid; not uncommon..... *Thelidium zwackhii*
22. Thallus saprophytic, immersed within branches of *Quercus*; rarely collected, likely overlooked ..... *Arthopyrenia cerasi?*
22. Thallus lichenized, episubstratal, thin to thick..... 23
23. Spores 3-septate 24
23. Spores >3-septate 25
24. Thallus light brown to reddish-brown; ascospores >20um long, roughly 4-5 times longer than the wide; uncommon, seemingly restricted to northern counties..... *Pseudosagedia aenea*
24. Thallus gray; ascospores <20um long, roughly 3 times longer than wide; uncommon but widespread . ..... *Strigula jamesii*
25. Perithecia grouped within pseudostroma; ascospores narrowly ellipsoid; growing primarily on smooth bark of *Fagus* and *Carya*; not uncommon ..... *Viridothelium virens*
25. Perithecia solitary, not grouped within pseudostroma; ascospores narrow, clavate, tapering at one end; typically growing on the bases of hardwoods in humid areas; uncommon.. *Pseudosagedia cestrensis*
26. spores 1-septate; saprophytic on bark of *Betula alleghaniensis* ..... *Distopyrenis americana*
26. spores 3-septate; lichenized (*Pyrenula*)..... 27
27. Thallus ecorticate, thin, pale grayish or indiscernible; perithecia small..... *Pyrenula laevigata*
27. Thallus corticate, smooth, thin to thick, typically greenish to brown-green (though quite variable); perithecia large ..... *Pyrenula punctella*
28. Spores 8/ascus (*Verrucaria*, key heavily influenced by Orange, 2013 and Krzewicka, 2012)..... 29
28. Spores >8/ascus (asci polysporous) 46
29. Medulla black or with a distinct black basal layer; black layer continuous throughout thallus or patchy and forming broadly around perithecia from joined involucrella 30
29. Medulla white, brownish, or indiscernible 33
30. Growing on calcareous substrates (ex. concrete, limestone); uncommon ..... *Verrucaria nigrescens*
30. Growing on non-calcareous and siliceous substrates (ex. sandstone, granite)..... 31
31. Thallus dark brown, scabrous, growing on exposed dry rocks; uncommon..... *Verrucaria umbrinula*
31. Thallus light brownish or greenish, mostly smooth, not scabrous, semiaquatic, growing on rocks occurring along waterways..... 32
32. Thallus brownish (when dry); spores averaging <18 um long; perithecia at least partially elevated and exposed; rare, known from a single Summit County collection..... *Verrucaria sp.*

32. Thallus greenish; spores averaging >18 um long; perithecia completely immersed within thallus or very slightly elevated; uncommon ..... *Verrucaria praetermissa*
33. Involucrellum absent 34
33. Involucrellum present 35
34. Growing on basal bark of hardwoods in humid areas; perithecia semi-immersed within thallus; spores averaging <18 um long ..... *Verrucaria trabalis*
34. Growing on rocks; perithecia sessile; spores averaging >18 um long ..... *Verrucaria sp.*
35. Thallus producing abundant cylindrical goniocysts; uncommon ..... *Verrucaria sp.*
35. Thallus lacking goniocysts 36
36. Thallus immersed to thinly superficial, light gray in color 37
36. Thallus thin to thick, shades of brown or green 39
37. Spores ellipsoid, averaging <9 um wide; thallus becoming faintly to heavily maculate; rare, known from a single Lake County collection ..... *Verrucaria myriocarpa*
37. Spores broadly-ellipsoid, averaging >9 um wide; thallus lacking maculae; not uncommon 38
38. Perithecial wall dark around entire perithecium ..... *Verrucaria calkinsiana*
38. Perithecial wall becoming pale towards lower half of perithecium ..... *Verrucaria muralis*
39. Thallus thin, faintly to heavily maculate; rare, known from a single Lake County collection ..... *Verrucaria myriocarpa*
39. Thallus variable, lacking maculae (though may form flecks) 40
40. Thallus shades of brown (when dry) 41
40. Thallus greenish or yellowish-green 44
41. Thallus semiaquatic, growing on rocks (mostly granite) occurring in waterways; uncommon ..... *Verrucaria cernaensis*
41. Thallus terrestrial 42
42. Thallus lichenicolous; rare, known from a single Stark County collection ..... *Verrucaria latericola*
42. Thallus not lichenicolous 43
43. Growing on calcareous substrates, typically in disturbed sites; common ..... *Verrucaria dolosa*
43. Growing on granite boulders; not uncommon ..... *Verrucaria nigrescentoidea*
44. Perithecia completely immersed within thallus or very slightly elevated; uncommon ..... *Verrucaria praetermissa*
44. Perithecia distinctly elevated (though may be enveloped by a thin thalline layer); common 45
45. Thallus semiaquatic, occurring in streams on siliceous and non-calcareous rocks, thin and smooth or with few cracks in mature portions of thallus ..... *Verrucaria sublobulata*
45. Thallus terrestrial or semiaquatic, typically growing on concrete or limestone, thin to moderately thick and rimose, often forming flecks ..... *Verrucaria dolosa*
46. Spores 12-32/ascus; photobiont a cyanobacterium with a reddish gelatinous sheath; thallus blackish; rare, known only from a single Portage County collection ..... *Pyrenopsis polycocca*
46. Spores >100/ascus; photobiont Chlorococcoid or absent; thallus brown, yellowish green, or immersed and indistinct 47
47. Perithecia reddish in color, mostly immersed within thallus; thallus thick, comprised of scattered areoles, typically on granite boulders in mature forests; uncommon ..... *Trimmatothelopsis dispersa*
47. Perithecia yellow, exposed; thallus thin, weakly areolate to immersed within substrate, terricolous, lignicolous, or saxicolous (*Thelocarpon*) 48
48. Thallus saxicolous or lignicolous; uncommon ..... *Thelocarpon laureri*

48. Thallus terricolous, very inconspicuous; rare, known from a single Portage County collection ..... *Thelocarpon intermediellum*

Key to Apotheciate Crusts

1. Photobiont a green alga or absent 2
1. Photobiont a cyanobacteria; thallus blackish 148
2. Spores hyaline 3
2. Spores brown-pigmented 132
3. Spores simple 4
3. Spores muriform, transversely septate, or polarilocular 68
4. Mature apothecia lecanorine or buried in elevated thalline warts with an ostiole 5
4. Mature apothecia lecideine, biatorine, or aspicilioid (immersed) 30
5. Thallus corticolous or lignicolous 6
5. Thallus saxicolous or terricolous 23
6. Apothecia 8/ascus 7
6. Apothecia not 8/ascus, fewer or more numerous 19
7. Thallus and/or apothecia margins P- or P+ weak yellow 8
7. Thallus and/or apothecia margins P+ red (various substances present); rare 16
8. Thallus lignicolous or on pinecone scales 9
8. Thallus corticolous 15
9. Thallus completely or mostly immersed 10
9. Thallus not immersed, thin to thick 13
10. Apothecia bright yellow; rare on lignum ..... *Candelariella aurella*
10. Apothecia other colors, typically shades of brown 11
11. Spores <8um long; apothecia rims often becoming concolorous with disks; growing on conifer lignum or pinecone scales; rare, known from a single Portage County collection ..... *Lecanora minutella*
11. Spores >8um long; apothecia rims remaining distinct from disks or becoming physically obscured by the disks with age; growing on lignum of hardwoods and conifers, never pinecone scales; uncommon . 12
12. Apothecial rims whitish-gray (secondary metabolites absent) ..... *Myriolecis hagenii*
12. Apothecial rims yellow-green (isousnic acid present) ..... *Lecanora saligna*
13. Thallus yellow-green (usnic or isousnic acid present), K- 14
13. Thallus white, K+ weak yellow (atranorin present); common ..... *Lecanora hybocarpa*
14. Thallus KC+ yellow (usnic acid present); rims of apothecia ecorticate; common ..... *Lecanora strobilina*
14. Thallus KC-; rims of apothecia corticate; rare, known from a single Portage County collection ..... *Lecanora saligna*
15. Thallus yellow-green, K-, KC+ yellow (usnic acid present); apothecia margins ecorticate; common ..... *Lecanora strobilina*
15. Thallus whiteish-gray, K+ weak yellow, KC- (atranorin present); apothecia margins corticate; common ..... *Lecanora hybocarpa*
16. Apothecia densely pruinose, pale blueish-gray to pinkish 17
16. Apothecia epruinose, dark reddish brown to brown 18
17. Thallus K- or K+ yellow (atranorin present); rare, known from a single Portage County collection ..... *Lecanora caesiorubella*

17. Thallus K+ yellow to red (norstictic acid present); rare, known from a single Summit County collection ..... *Lecanora subpallens*
18. Apothecia rims quite thick, bumpy, uneven; rare, known from a single Stark County collection ..... *Lecanora cinereofusca*
18. Apothecia rims thin to moderately thick, smooth, even; rare, known from a single Trumbull County collection ..... *Lecanora pulicaris*
19. Apothecia buried in thalline warts, tipped with a dark ostiole; spores large, typically 2/ascus; thallus usually UV+ bright orange (thiophanic acid present in varying concentrations); rare .. *Pertusaria pustulata*
19. Apothecia not buried in thalline warts, exposed; spores small, 12-32/ascus; thallus UV- 20
20. Apothecia shades of brown, with white margins; thallus mostly immersed, whitish-gray ..... *Myriolecis sambuci*
20. Apothecia and margins bright yellow; thallus producing yellow or greenish-yellow areoles or granules (*Candelariella*) 21
21. Thallus comprised of small scattered to crowded corticate granules; uncommon ..... *Candelariella xanthostigma*
21. Thallus composed of flattened to convex areoles 22
22. Apothecia tiny, <0.4mm in diameter; areoles typically dull greenish-yellow, duller than the apothecia; uncommon ..... *Candelariella lutella*
22. Apothecia larger, becoming >0.4mm in diameter; areoles bright yellow, concolorous with apothecia; rare ..... *Candelariella vitellina*
23. Apothecia bright yellow; common on concrete ..... *Candelariella aurella*
23. Apothecia other colors, typically shades of brown, gray, or yellow-green 24
24. Thallus and/or medulla K+ yellow or K+ yellow to red (atranorin, zeorin, stictic acid, and/or norstictic acid present) 25
24. Thallus and medulla K- 27
25. Apothecia buried in thalline warts; medulla K+ yellow to red (norstictic acid present); uncommon ..... *Pertusaria plittiana*
25. Apothecia not buried in thalline warts, sessile or immersed; medulla K+ yellow (atranorin, zeorin, and/or stictic acid present) 26
26. Apothecia immersed within thallus, at least initially; apothecia disks dark gray; common ..... *Aspicilia laevata*
26. Apothecia always sessile; apothecia disks reddish-brown; rare, known from a single Columbiana County collection ..... *Lecanora subimmergens*
27. Spores tiny, >100/ascus; uncommon ..... *Acarospora canadensis*
27. Spores 8/ascus 28
28. Thallus areolate, becoming marginally lobate ..... *Protoparmeliopsis muralis*
28. Thallus immersed or areolate, never becoming lobate 29
29. Thallus completely immersed within substrate, only apothecia visible; apothecia shades of brown or gray, with white margins, KC- (usnic acid absent); common ..... *Myriolecis dispersa*
29. Thallus immersed to areolate and yellow-green; apothecia yellow-green, KC+ yellow (usnic acid present); apothecial margins concolorous with disks; uncommon ..... *Lecanora polytropa*
30. Thallus saxicolous 31
30. Thallus corticolous, lignicolous, terricolous, or resinicolous 53
31. Hypothecium with brown to blackish-brown pigmentation 32

31. Hypothecium hyaline or indistinct 38
32. Medulla C+ or KC+ red (gyrophoric acid present); thallus areolate, light brown; rare, known from a single Stark County collection ..... *Lecidea fuscoatra*
32. Medulla C-, KC- (may be K+ yellow); thallus variable, gray, whiteish-gray, green, or immersed 33
33. Spores >10um long 34
33. Spores <10um long 37
34. Apothecium margins cracked; exciple heavily carbonized; thallus white or immersed; not uncommon ..... *Porpidia subsimplex*
34. Apothecium margins smooth; exciple not carbonized (though may be dark); thallus variable, never immersed 35
35. Thallus greenish; not uncommon ..... *Bryobilimbia ahlesii*
35. Thallus whitish-gray, blueish-gray, or brownish-gray; common (*Porpidia*) 36
36. Apothecia black, sometimes forming concentric rings on the thallus ..... *Porpidia crustulata*
36. Apothecia with gray margins and densely to lightly pruinose disks; pruina bright blueish-gray ..... *Porpidia albocaerulescens*
37. Epihymenium brownish or colorless, often indistinct from hymenium; hymenium yellowish-brown; common ..... *Lecidea cyrtidia*
37. Epihymenium dark blueish-green; hymenium colorless or pigmented from bleeding of epihymenium or hypothecium; common in disturbed and open habitats ..... *Leimonis erratica*
38. Asci not polysporous, with 8 spores/ascus 39
38. Asci polysporous, with many more than 8 spores/ascus 46
39. Apothecia immersed within thallus 40
39. Apothecia sessile 42
40. Apothecia dark gray; medulla K+ yellow, P+ orange (stictic acid present); common ..... *Aspicilia laevata*
40. Apothecia pallid, pinkish, brownish, or reddish; medulla K-, P- (*Ionaspis*) 41
41. Thallus light brown to reddish-brown; apothecia brownish to reddish; epihymenium granulose; closely associated with waterways; uncommon ..... *Ionaspis lacustris*
41. Thallus light gray, greenish-gray, or brownish gray; apothecia pallid to pinkish-brown; epihymenium lacking granules; typically on granite boulders in forests; common ..... *Ionaspis alba*
42. Apothecia orange to brownish-orange, K+ reddish-purple (anthraquinones present); typically growing on calcareous substrates; uncommon ..... *Protoblastenia rupestris*
42. Apothecia variable in color, K- 43
43. Apothecia reddish; thallus C+ red (gyrophoric acid present) (*Trapelia*) 44
43. Apothecia black, brownish, greenish, or pale; thallus C- 45
44. Thallus smooth and continuous; apothecia with loose excipular tissue attached to the margins ..... *Trapelia coarctata*
44. Thallus areolate and discontinuous; apothecia without loose excipular tissue ..... *Trapelia glebulosa*
45. Apothecia black, flat, with clear margins; spores >10um long; rare, known from a single Columbiana County collection ..... *Lecidella stigmatea*
45. Apothecia greenish, brownish, blueish, or pale, convex, emarginate; spores small, <10um long; uncommon ..... *Brianaria bauschiana*
46. Apothecia immersed within thallus or substrate 47
46. Apothecia sessile 51
47. Growing on calcareous substrates (concrete, limestone, etc.); uncommon 48

47. Growing on non-calcareous substrates (sandstone, granite, etc.) 49
48. Thallus poorly developed, quite inconspicuous; ascus tips I+ blue ..... *Caeruleum heppii*
48. Thallus well developed, at least around apothecia; ascus tips I-..... *Acarospora canadensis*
49. Thallus white-pruinose; uncommon ..... *Acarospora strigata*
49. Thallus light brown to brown; not uncommon 50
50. Upper cortex C+ red (best observed under a compound microscope) (gyrophoric acid present); apothecia not perithecioid..... *Acarospora fuscata*
50. Upper cortex C-; apothecia perithecioid, exposed narrowly by an ostiole .. *Trimmatothelopsis dispersa*
51. Apothecial disks irregular, gyrose; thallus actually lichenicolous; host almost completely dissolved; not uncommon ..... *Polysporina subfuscescens*
51. Apothecial disks mostly flat, smooth, discoid; thallus lichenized (*Sarcogyne*) 52
52. Apothecia typically with weak or strong blueish-gray pruina (not visible when wet); thallus typically evident, shades of gray; growing on concrete or limestone; not uncommon ..... *Sarcogyne regularis*
52. Apothecia mostly epruinose, black; thallus immersed within substrate, not visible; growing on sandstone or other non-calcareous substrates; uncommon..... *Sarcogyne similis*
53. Asci not polysporous, with 8 spores 54
53. Asci polysporous, with more than 8 spores 64
54. Thallus C+ red or KC+ red (gyrophoric acid present) (*Trapeliopsis*) 55
54. Thallus C- 56
55. Thallus whitish-gray to beige, often mottled; uncommon ..... *Trapeliopsis granulosa*
55. Thallus dark greenish-gray, blueish-gray, or lead gray; common..... *Trapeliopsis flexuosa*
56. Apothecia lecideine; hypothecium brown 57
56. Apothecia biatorine; hypothecium hyaline 59
57. Thallus terricolous, growing on sandy soil, comprised of course brown granules (brown when dry); rare, know from a single Ashtabula County collection ..... *Placynthiella oligotropha*
57. Thallus corticolous or lignicolous, smooth, bumpy, or areolate, grayish or green; uncommon 58
58. Epihymenium brownish; thallus green, growing on tree bases ..... *Mycobilimbia berengeriana*
58. Epihymenium blueish-green; thallus gray to blueish-gray, on lignum or rock ..... *Leimonis erratica*
59. Thallus terricolous, on moist exposed clay soil; apothecia pallid; rare ..... *Vezdaea schuyleriana*
59. Thallus corticolous or lignicolous; apothecia variable 60
60. Thallus resembling a free-living algal colony, typically producing abundant goniocysts, green, growing on decaying logs or more rarely bark; apothecia pallid to blueish-gray; not uncommon.... *Micarea prasina*
60. Thallus not resembling an algal colony, lacking goniocysts, growing on tree boles and branches 61
61. Spores narrowly ellipsoid, 17-22X3-5 um; apothecia orangish or more rarely pallid; thallus greenish; not uncommon ..... *Biatora longispora*
61. Spores ellipsoid to fusiform, 8-13X3-7 um; apothecia and thallus variable 62
62. Spores fusiform, tapering to a point at each end; epihymenium greenish (at least in Ohio specimen); rare, known from a single Ashtabula County collection ..... *Lecidea erythrophaea*
62. Spores ellipsoid, blunt at ends; epihymenium brownish, yellowish, or colorless 63
63. Apothecia quickly loosing margins, becoming fussed together, epruinose; common .... *Lecanora symmicta*
63. Apothecia with thin but intact margins, solitary or aggregating but never fussing together, pruinose or not; common ..... *Lecidea varians*
64. Apothecia non-lichenized, resinicolous on conifer resin (*Sarea*) 65

64. Apothecia lichenized, corticolous or lignicolous 66
65. Apothecia and pycnidia bright orange; common ..... *Sarea resinae*
65. Apothecia and pycnidia black; uncommon ..... *Sarea difformis*
66. Apothecia immersed within thallus; spores ellipsoid; uncommon ..... *Caeruleum heppii*
66. Apothecia sessile; spores globose 67
67. Thallus terricolous or lignicolous, membranous or indiscernible; spores 12-16/ascus; epihymenium brown; uncommon ..... *Steinia geophana*
67. Thallus corticolous, thin and whitish; spores >100/ascus; epihymenium blueish-green; rare, known from a single Summit County collection ..... *Strangospora moriformis*
68. Spores transversely septate or polarilocular 69
68. Spores muriform 129
69. Spores ellipsoid, oblong-ellipsoid, fusiform, or clavate, length not exceeding 5 times the width 70
69. Spores thin, acicular or twisted, length to width ratio at least 5:1 respectively 117
70. Spores 1-septate or polarilocular 71
70. Spores >1-septate 95
71. Spores polarilocular (Teloschistaceae) 72
71. Spores not polarilocular 83
72. Thallus and/or apothecia orange, K+ reddish-purple (anthraquinones present) 73
72. Thallus and apothecia other colors, K- (*Caloplaca*) 81
73. Thallus episubstratal, thin to areolate or subsquamulose 74
73. Thallus immersed, indiscernible or visible as a whitish cast on the substrate 79
74. Thallus gray, K-, saxicolous or corticolous (*Caloplaca*) 75
74. Thallus orange or yellow, K+ reddish-purple (anthraquinones present), saxicolous 78
75. Thallus saxicolous; uncommon ..... *Caloplaca sideritis*
75. Thallus corticolous or lignicolous 76
76. Apothecia margins orange, concolorous with disks; thallus forming very inconspicuous excavate soralia; rare, known from a single Columbiana County collection ..... *Caloplaca ahtii*
76. Apothecia margins gray, at least in part; thallus lacking soralia 77
77. Thallus strongly areolate; apothecia disks with a yellowish pruina; rare, known from a single Geauga County collection ..... *Caloplaca ulmorum*
77. Thallus thin and smooth to weakly areolate, typically growing on branches of *Populus*; apothecia disks epruinose; common ..... *Caloplaca cerina*
78. Thallus yellow, thin, smooth to areolate, clearly crustose; not uncommon .. *Gyalolechia flavovirescens*
78. Thallus orange to yellow-orange, subsquamulose; uncommon ..... *Squamulea subsoluta*
79. Thallus saxicolous; common on concrete in disturbed areas ..... *Xanthocarpia feracissima*
79. Thallus corticolous or lignicolous (rarely saxicolous on siliceous rocks) (*Athallia*) 80
80. Thallus lignicolous (rarely saxicolous on siliceous rocks); uncommon ..... *Athallia holocarpa*
80. Thallus corticolous, typically on *Populus*; common ..... *Athallia pyracea*
81. Thallus corticolous; uncommon .....
..... *Caloplaca cerina*? (a form lacking anthraquinones in the epihymenium)
81. Thallus saxicolous, typically on concrete 82
82. Thallus thick, areolate, gray to blue-gray when dry, shiny; areoles becoming raised and stipitate, tapering towards base; uncommon ..... *Caloplaca albovariegata*

82. Thallus thin to moderately thick, areolate, tan-gray to gray when dry, dull; areoles not stipitate, flattened against substrate; rare, known from a single Stark County collection ..... *Caloplaca atroalba*
83. Thallus saprophytic, very thin, forming whitish patches on smooth bark of hardwoods; apothecia blotch-like (*Arthonia*) 84
83. Thallus lichenized 85
84. Spores large (>15 um long), broadly-ellipsoid; not uncommon ..... *Arthonia sp.*
84. Spores small (<15 um long), ellipsoid; known from a single Portage County collection on a landscape ornamental tree ..... *Arthonia sp.*
85. Apothecia lecanorine; thallus saxicolous; uncommon (*Halecania*) 86
85. Apothecia not lecanorine, without thalline margins; substrates variable 87
86. Thallus blackish, greenish-black, or brownish-black, bumpy and blastidiate, resembling a cyanobacterial colony ..... *Halecania pepegospora*
86. Thallus brownish-gray to brownish-green, smooth, lacking blastidia ..... *Halecania rheophile*
87. Apothecia minutely stipitate, appearing distinctly papillate (due to asci protruding outwards from hymenium), pallid or orangish; rare, known from a single Geauga County collection ..... *Vezdaea leprosa*
87. Apothecia not stipitate, not appearing distinctly papillate 88
88. Thallus comprised of corticate granules or producing minute goniocysts 89
88. Thallus continuous to areolate, smooth to rough in texture, not comprised of corticate granules or producing minute goniocysts 90
89. Thallus comprised of corticate granules, growing on bark of living trees; uncommon ..... *Biatora sp.*
89. Thallus producing abundant tiny goniocysts, typically growing on decaying wood; common ..... *Micarea prasina*
90. Apothecia pallid, pale orangish, or orange 91
90. Apothecia not as above 92
91. Photobiont *Trentepohlia*; apothecia tiny, <0.5mm in diameter, pallid; spores ellipsoid, 10-15X3-4um; typically growing on moist tree bases; uncommon ..... *Coenogonium pineti*
91. Photobiont Chlorococcoid; apothecia larger, >0.5mm in diameter, pale orange to brownish-orange; spores narrowly ellipsoid, 17-22X3-4um; typically growing on tree boles; not uncommon ..... *Biatora longispora*
92. Thallus saxicolous or lignicolous 93
92. Thallus corticolous 95
93. Apothecia marginate; paraphyses markedly swollen and dark brown to black-pigmented at tips; common, though typically corticolous ..... *Catillaria nigroclavata*
93. Apothecia emarginate; paraphyses not as above 94
94. Thallus saxicolous; hypothecium pale brown to reddish-brown; spores notably constricted at septum; epihymenium K-; uncommon ..... *Arthonia lapidicola*
94. Thallus lignicolous; hypothecium hyaline; spores not notably constricted; epihymenium K+ violet (gyrophoric acid present); rare, known from a single Mahoning County collection ..... *Micarea denigrata*
95. Apothecia emarginate; spores notably constricted at septum ..... *Arthonia apatetica*
95. Apothecia typically with intact margins; spores not notably constricted 96
96. Spores 8/ascus; paraphyses swollen and pigmented dark brown at tips; thallus smooth to immersed; common ..... *Catillaria nigroclavata*
96. Spores 16/ascus; paraphyses not swollen at tips; thallus typically granulose; rare *Catinaria neuschildii*
97. Apothecia rounded and discoid or blotch-like 98

97. Apothecia linear and lirellate or branched, irregular, and somewhat star-shaped 114
98. Apothecia reddish-orange, blotch-like, K+ purple (anthraquinones present); spores 2-septate; not uncommon ..... *Arthonia helvola*
98. Apothecia other colors, not K+ purple; spores >2-septate 99
99. Hypothecium pale brown to blackish 100
99. Hypothecium hyaline or indistinct 108
100. Thallus saxicolous or overgrowing bryophytes 101
100. Thallus corticolous or lignicolous 104
101. Spores becoming ornamented with scattered punctations; thallus often (but not always) overgrowing bryophytes; uncommon ..... *Bilimbia sabuletorum*
101. Spores unornamented; thallus growing directly on rock 102
102. Conidia filiform, >8um long; not uncommon ..... *Bacidia granosa*
102. Conidia bacilliform, <8um long; (*Fellhanera*) 103
103. Conidia >5um long; uncommon ..... *Fellhanera silicis*
103. Conidia <5um long; rare, known only from Mogadore Reservoir in Portage County where it grows on the bases of *Picea* and *Pinus* in old plantations ..... *Fellhanera fallax*
104. Apothecia emarginate 105
104. Apothecia marginate 106
105. Apothecia C+ pink (best observed under a compound microscope) (gyrophoric acid present), blackish, epruinose; thallus typically lignicolous; rare, known from a single Geauga County collection ..... *Micarea melaena*
105. Apothecia C-, light blueish to dark blueish-green, typically heavily white-pruinose; thallus corticolous; common ..... *Chrysothrix caesia*
106. Exciples carbonized; photobiont *Trentepohlia*; rare, known from a single Columbiana County collection ..... *Cresponea chloroconia*
106. Exciples not carbonized; photobiont coccoid (*Fellhanera*) 107
107. Conidia >5um long; not uncommon ..... *Fellhanera silicis*
107. Conidia <5um long; rare, known only from Mogadore Reservoir in Portage County where it grows on tree bases of *Picea* and *Pinus* in old plantations ..... *Fellhanera fallax*
108. Thallus and apothecia C+ pink (gyrophoric acid present); uncommon ..... *Micarea peliocarpa*
108. Thallus and apothecia C- 109
109. Thallus lignicolous on decaying wood; common, though quite inconspicuous 110
109. Thallus corticolous, saxicolous, or growing over bryophytes 111
110. Apothecia urceolate, immersed in the substrate; thallus saprophytic ..... *Cryptodiscus pallidus*
110. Apothecia flat to slightly concave, sessile to semi-immersed; thallus lichenized ..... *Absconditella lignicola*
111. Thallus saprophytic; apothecia emarginate, blotch-like; uncommon 112
111. Thallus lichenized; apothecia mostly marginate, discoid 113
112. Growing on branches of deciduous trees and shrubs; spores blunt at ends; rare, known from a single Summit County collection ..... *Arthonia punctiformis*
112. Growing on branches of *Pinus strobus*; spores tapering to a point at one end; not uncommon ..... *Arthonia caudata*
113. Thallus corticolous, favoring *Populus*; common, especially in northern counties ..... *Lecania naegelii*
113. Thallus saxicolous or overgrowing bryophytes; uncommon ..... *Bilimbia sabuletorum*

114. Apothecia linear and lirellate, sometimes becoming star-shaped, marginate; exciple laterally or fully carbonized 115
114. Apothecia irregular, becoming branched and star-shaped, emarginate; exciple indistinct (*Arthonia*) 116
115. Thallus well developed, whitish-gray; apothecia long and skinny, disks narrowly exposed; exciples only laterally carbonized; common ..... *Graphis scripta*
115. Thallus poorly developed, mostly immersed, gray; apothecia football-shaped to more elongate, discs broadly exposed; exciples fully carbonized; uncommon ..... *Alyxoria varia*
116. Thallus lichenized; spores mostly 3-septate; rare, only known from a single Ashtabula County collection, likely restricted to northern counties bordering Lake Erie ..... *Arthonia radiata*
116. Thallus saprophytic; spores mostly 5-septate; rare, only known from a single Columbiana County collection, perhaps restricted to southern counties ..... *Arthonia quintaria*
117. Thallus corticolous 118
117. Thallus saxicolous or lignicolous 124
118. Epihymenium and/or hymenium green to blueish 119
118. Epihymenium colorless 121
119. Apothecia soon becoming emarginate and convex; spores >2.5um wide; common ..... *Scoliciosporum chlorococcum*
119. Apothecia mostly flat and marginate; spores <2.5um wide 120
120. Epihymenium blueish; hymenium hyaline below epihymenium; uncommon, typically on smooth bark of hardwoods ..... *Bacidia circumspecta*
120. Upper hymenium or entire hymenium dirty blue-green to green pigmented (pigment often sparse and in vertical columns along hymenium); thallus typically saxicolous with a single known instance where it was growing at the base of a large *Platanus* near the Cuyahoga River ..... *Bacidina egenula*
121. Apothecia with at least some pigmentation of the hypothecium and/or exciple; uncommon ..... *Bacidina assulata*
121. Apothecia pallid, unpigmented in section 122
122. Thallus grayish-green, brownish-green, or yellowish-green, granulose, lacking goniocysts, UV+ blue-white (lobaric acid present); apothecia soon becoming emarginate ..... *Scoliciosporum pensylvanicum*
122. Thallus green, often producing goniocysts, UV-; apothecia marginate 123
123. Thallus smooth or developing coarse goniocysts with age; rare, known from a single Summit County collection ..... *Bacidina brittoniana*
123. Thallus producing fine goniocysts; common ..... *Bacidina delicata*
124. Thallus bumpy, coarsely granulose, or areolate, lacking goniocysts 125
124. Thallus smooth or producing goniocysts throughout or in paler “soralia-like” patches 126
125. Spores twisted and curved; apothecia mostly emarginate; uncommon ..... *Scoliciosporum umbrinum*
125. Spores straight; apothecia mostly marginate ..... *Bacidia granosa*
126. Apothecia ghost white, completely unpigmented; common ..... *Bacidina delicata*
126. Apothecia pale brown to blackish, with at least some pigmentation of the exciple, hymenium, and/or hypothecium 127
127. K+ violet pigment present, restricted along lateral exciple; hymenium often greenish pigmented; saxicolous, mostly on calcareous substrates; common ..... *Bacidina egenula*
127. K+ violet pigment lacking; exciples colorless or with brown K- to K+ intensifying pigment; hymenium never greenish; lignicolous or saxicolous on non-calcareous rocks 128

128. Thallus semiaquatic, growing on periodically inundated substrates; hypothecium brown, K- or K+ intensifying; uncommon ..... *Bacidina inundata*
128. Thallus terrestrial, not growing on periodically inundated substrates; hypothecium turning from a reddish "arnoldiana"-brown to a greenish-brown in K; rare ..... *Bacidina arnoldiana*
129. Thallus corticolous; apothecia blotch-like (*Arthonia*) 130
129. Thallus saxicolous; apothecia discoid (*Rhizocarpon*) 131
130. Photobiont chlorococcoid; thallus whitish; uncommon, typically on smooth barked hardwoods in successional forests ..... *Arthonia susa*
130. Photobiont *Trentepohlia*; thallus grayish, grayish-brown, or light brown; not uncommon, typically on smooth barked hardwoods in mature floodplain forests ..... *Arthonia ruana*
131. Thallus whitish, K+ yellow to red (norstictic acid present); rare ..... *Rhizocarpon rubescens*
131. Thallus gray to dark brown, K- (lacking substances) or K+ yellow (stictic acid present); not uncommon ..... *Rhizocarpon reductum*
132. Thallus corticolous or lignicolous 133
132. Thallus saxicolous 142
133. Thallus yellow, typically on lignum; apothecia mazaedial; asci dissolving to form a mass of loose ascospores; rare ..... *Calicium tigillare*
133. Thallus whitish-gray, gray, greenish-gray, brownish, or greenish-brown, typically corticolous; apothecia non-mazaedial; spores contained within persistent asci 134
134. Thallus forming thin appressed lobes; uncommon ..... *Hyperphyscia syncolla*
134. Thallus completely crustose, smooth to cracked or areolate 135
135. Apothecia lecideine; hypothecium typically brown-pigmented 136
135. Apothecia lecanorine; hypothecium typically hyaline 139
136. Thallus K+ yellow to red or P+ orange, whitish-gray 137
136. Thallus K-, P-, gray, brownish-gray, greenish-gray, or immersed; common (*Amandinea*) 138
137. Thallus K+ yellow to red, P- or P+ weak yellow (norstictic acid present); apothecia marginate; not uncommon ..... *Buellia erubescens*
137. Thallus K-, P+ orange (fumarprotocetraric acid present); apothecia emarginate; rare, known from a single Geauga County collection ..... *Chrismofulvea dialyta*
138. Asci polysporous, with 12-32 spores/ascus ..... *Amandinea polyspora*
138. Asci not polysporous, with 8 spores/ascus ..... *Amandinea punctata*
139. Lumina of spores large and rounded, filling the cell; spores slightly constricted at the septum, averaging <15um long; hypothecium sometimes brown; uncommon ..... *Amandinea dakotensis*
139. Lumina of spores becoming angular or somewhat rounded with maturity, not filling the cell; spores not constricted at the septum, averaging >15um long; hypothecium always hyaline (*Rinodina*) 140
140. Apothecia erumpent; uncommon ..... *Rinodina subminuta*
140. Apothecia not erumpent 141
141. Thalli typically on branches and twigs of hardwoods; spores averaging <17um long; uncommon ..... *Rinodina freyi*
141. Thalli typically on boles of hardwoods; spores averaging >17um long; rare, known from a single Portage County collection ..... *Rinodina maculans*
142. Spores 1-septate 143
142. Spores muriform 147
143. Apothecia lecideine, without thalline margins; hypothecium brown; rare 144

143. Apothecia lecanorine, with thalline margins; hypothecium hyaline; uncommon 145
144. Thallus on sun-exposed rocks, lichenicolous or closely associated with other lichens, establishing independent lichenized thalli with age; uncommon ..... *Buellia badia*
144. Thallus on sheltered shaded sandstone, never lichenicolous; rare on saxicolous substrates ..... *Amandinea punctata*
145. Thallus K- ..... *Rinodina tephraspis*
145. Thallus K+ yellow (atranorin present) 146
146. Spores averaging >20um; thallus typically whitish-gray and areolate; apothecia clearly lecanorine, with margins that are concolorous with the thallus and that contrast with the disks..... *Rinodina destituta*
146. Spores averaging <20um; thallus typically brownish-gray to greenish-gray, smooth to bumpy or becoming areolate; margins of apothecia often becoming concolorous with disks and not clearly lecanorine ..... *Rinodina oxydata*
147. Thallus whitish-gray, becoming thick; apothecia urceolate; spores brown at maturity; uncommon..... *Diploschistes scruposus*
147. Thallus thin, gray-brown; apothecia sessile; spores only becoming brown when postmature, mostly hyaline; not uncommon ..... *Rhizocarpon reductum*
148. Thallus terricolous, typically growing on exposed clay soil, gelatinous, becoming squamulose; spores submuriformly septate; uncommon ..... *Enchylium bachmanianum*
148. Thallus saxicolous, typically growing on exotic calcareous rocks or concrete in disturbed areas, truly crustose; spores simple..... 149
149. Asci polysporous, with 12-32 spores/ascus; apothecia becoming perithecioid; rare, known only from a single Portage County collection ..... *Pyrenopsis polycocca*
149. Asci not polysporous, with 8 spores/ascus; apothecia flat, discoid; uncommon... *Psorotichia shaereri*

Key to Calicioid Fungi

1. Apothecia non-mazaedial; asci persistent; spore masses black; thallus saprophytic (to continue, analyses of pigmentation and spot tests must be performed under a compound microscope) 2
1. Apothecia mazaedial; asci dissolving; spore masses brown or yellow; thallus lichenized (*Chaenotheca*) 13
2. Spores 1-3 septate 3
2. Spores simple 10
3. Pins growing from twigs and branches of *Alnus*, *Rhus*, or *Populus* or from polypores 4
3. Pins growing from lignum or on bark of mature hardwoods (may be associated with algal colonies) ... 7
4. Pins growing from twigs and branches of *Alnus* or *Rhus*; uncommon 5
4. Pins growing from twigs and branches of *Populus* or from polypores (*Phaeocalicium*) 6
5. Pins growing from twigs and branches of *Alnus incana* ..... *Stenocybe pullatula*
5. Pins growing from twigs and branches of *Rhus typhina* ..... *Phaeocalicium curtisii*
6. Pins growing from twigs and branches of *Populus*; not uncommon ..... *Phaeocalicium populneum*
6. Pins growing from the polypore *Trichaptum biforme*; common ..... *Phaeocalicium polyporaeum*
7. Stalks with faint reddish-purple-pigmented; pigment intensifying in K; pins restricted to lignum; common ..... *Chaenothecopsis debilis*
7. Stalks lacking reddish-purple pigment, K-, K+ yellow-brown, or K+ fleeting red; pins growing lignum or on bark of mature hardwoods 8

8. Stalks K+ fleeting red; pins restricted to lignum; uncommon..... *Chaenothecopsis pusiola*
8. Stalks K- or K+ yellow-brown; pins growing from lignum or on bark of mature hardwoods; not uncommon..... 9
9. Spores with a faint septum that is lighter than the spore walls; growing on lignum or forming a whitish cast on bark from which the pins occur; stalks pale brown .....*Chaenothecopsis pusilla*
9. Spores with a clear septum that is as bold or bolder than the spore walls; typically growing in between furrows of mature *Liriodendron*, *Tilia*, or *Populus* and among algal colonies; stalks gray ....*Chaenothecopsis nigra*
10. Pins growing from resin of *Rhus typhina*; rare, known from a single Columbiana County collection..... .....*Chaenothecopsis perforata*
10. Pins growing from lignum or mature bark of hardwoods 11
11. Stalks relatively thick and tall; pycnidia, if present, forming conspicuous black dots among the stalks; spores mostly fusiform, football-shaped..... *Mycocalicium subtile*
11. Stalks relatively thin, tall or short; pycnidia tiny and inconspicuous; spores ellipsoid, rounded at ends (*Chaenothecopsis*)..... 12
12. Stalks tall and narrow, growing from lignum; rare, known from a single Trumbull County collection.... .....*Chaenothecopsis savonica*
12. Stalks short, often becoming veiled by capitulum in older apothecia, typically growing from mature bark of hardwoods; uncommon .....*Chaenothecopsis nana*
13. Thallus immersed, forming a pale blueish-white cast on lignum; uncommon..... 14
13. Thallus clearly visible, episubstratal, typically growing on bark of mature hardwoods or on detritus; rare..... 15
14. Photobiont *Stichococcus*, comprised of cylindrical, sausage-shaped cells.....*Chaenotheca xyloxena*
14. Photobiont *Dictyochloropsis*, comprised of spherical cells.....*Chaenotheca brunneola*
15. Thallus whitish-gray to blueish-gray, becoming thick and areolate, often producing abundant to sparse reddish-orange patches that react K+ reddish-purple (anthraquinones present); stalks black; mazaedium brown; photobiont *Trebouxia*..... *Chaenotheca ferruginea*
15. Thallus bright yellow to greenish-yellow, leprose, uniform in color, K-; stalks mostly yellow-pruinose; photobiont *Stichococcus*..... *Chaenotheca furfuracea*

Key to Squamulose Lichens

1. Thallus producing conspicuous fruticose podetia (*Cladonia*).....2
1. Thallus lacking a fruticose component 27
2. Podetia producing brown apothecia and/or pycnidia or lacking apothecia and pycnidia 3
2. Podetia producing red apothecia and/or pycnidia 24
3. Podetia not forming distinct cups, branched to blunt-tipped, hollow tipped, or pointed.....4
3. Podetia forming distinct broadened and rimed cups 18
4. Podetia surface smooth and corticate.....5
4. Podetia surface sorediate, granular, or densely microsquamulose 10
5. Podetia abundantly branched; not uncommon.....*Cladonia furcata*
5. Podetia not abundantly branched, simple and stubby to irregular in form.....6
6. Medulla C+ green (strepsilin present)..... *Cladonia strepsilis*
6. Medulla C-.....7

7. Thallus bright yellow-green, KC+ strong yellow (usnic acid present); uncommon..... ..... *Cladonia piedmontensis*
7. Thallus green, blueish-green, or brownish-green, KC-; common 8
8. Squamules small, somewhat appressed and overlapping each other like scales; apothecia large and swollen atop slender podetia ..... *Cladonia peziziformis*
8. Squamules large and standing erect; apothecia atop somewhat stubby and peg-like podetia.....9
9. Thallus K+ yellow to red (norstictic acid present)..... *Cladonia polycarpoides*
9. Thallus K-..... *Cladonia sobolescens*
10. Podetia lacking soredia, covered in corticate microsquamules 11
10. Podetia producing coarse or farinose soredia 12
11. Thallus lignicolous on decaying wood; podetia P+ orange (thamnolic acid present), UV-; common ....*Cladonia parasitica*
11. Thallus saxicolous or on bryophytes growing over rock, rarely corticolous or lignicolous; podetia P-, UV+ blue-white (squamatic acid present); not uncommon, though typically without podetia..... .....*Cladonia squamosa*
12. Podetia tall, > 1 cm, forming a small star-shaped cup often tipped with small brown apothecia; common .... *Cladonia rei*
12. Podetia tall or short, typically lacking a small star-shaped cup 13
13. Podetia producing corticate isidioid granules at base or throughout, typically short and blunt; common ..... *Cladonia cylindrica*
13. Podetia lacking corticate isidioid granules at base 14
14. Podetia P-; common..... *Cladonia macilenta* var. *bacillaris*
14. Podetia P+ orange or red (fumarprotocetraric acid or thamnolic acid present).....15
15. Podetia with a corticate margin around base (of all podetia) and often patchily throughout; common ..... *Cladonia ochrochlora*
15. Podetia ecorticate throughout (except for, perhaps, a very narrow ring at base).....16
16. Podetia K+ deep yellow (thamnolic acid present); know from a single collection, though probably underreported .....*Cladonia macilenta* var. *macilenta*
16. Podetia K- or K+ dingy yellow brown 17
17. Podetia short, often deformed; soredia coarse and granular; uncommon..... *Cladonia ramulosa*
17. Podetia slender; soredia farinose to minutely granular; known from a single collection, though probably underreported .....*Cladonia coniocraea*
18. Podetia smooth and corticate throughout 19
18. Podetia at least partially sorediate 20
19. Podetia proliferating from the center of the cups; uncommon ..... *Cladonia verticillata*
19. Podetia typically proliferating from margins of cups, never centrally; rare, known from a single Portage County collection..... *Cladonia mateocyatha*
20. Inside of cups plastered with tiny corticate squamules; common .....*Cladonia pyxidata*
20. Inside of cups sorediate, lacking squamules; not uncommon.....21
21. Podetia bright yellow-green, KC+ yellow (usnic acid present) .....*Cladonia pleurota*
21. Podetia greenish-gray to yellow-green, KC- 22
22. Podetia relatively tall and thin; cups narrow, flaring out near top of podetia ..... *Cladonia fimbriata*
22. Podetia relatively short and stubby, mostly tapering from rim of cups to the base.....23

23. Soredia confined to the inside of the cups and a margin around the outer rim; podetia corticate on the lower half to two-thirds..... *Cladonia conista*
23. Podetia sorediate and ecorticate throughout (specimens collected during this study belonging to this complex have not been tested with thin-layer chromatography)..... *Cladonia chlorophaea* complex
24. Podetia and squamules esorediate; common ..... *Cladonia cristatella*
24. Podetia and/or squamules producing soredia.....25
25. Podetia forming cups; not uncommon ..... *Cladonia pleurota*
25. Podetia not forming cups, blunt to pointed at tips 26
26. Podetia slender and mostly sorediate; common..... *Cladonia macilenta*
26. Podetia stubby and often obconical, mostly esorediate; uncommon, typically growing on hummocks in bogs..... *Cladonia incrassata*
27. Photobiont a cyanobacteria; uncommon 28
27. Photobiont a green alga.....29
28. Squamules isidiate, thin, even when wet, growing on rocks, among bryophytes, or on basal bark of hardwoods; apothecium margins smooth..... *Scytinium dactylinum*
28. Squamules lacking lichenized diaspores, markedly swollen when wet, deflating when dry, growing directly on exposed clay soil; apothecium margins crenulate..... *Enchylium bachmanianum*
29. Thallus lacking sexual fruiting structures.....30
29. Thallus producing apothecia or perithecia 33
30. Squamules small, <2mm long, corticolous or lignicolous 31
30. Squamules larger, >2mm long, saxicolous, terricolous, or growing over bryophytes; not uncommon (*Cladonia*).....32
31. Squamules with sorediate margins, C+ red (lecanoric acid present); common *Hypocenomyce scalaris*
31. Squamules esorediate, C-; rare, known from a single Lake County collection..... *Xylopsora friesii*
32. Squamules K-, P-, UV+ blue-white (squamatic acid present), typically saxicolous and blueish-gray .... *Cladonia squamosa*
32. Squamules K+ yellow (atranorin present), P+ red (fumarprotocetraric acid present), UV-, typically terricolous and dark green, crisp ..... *Cladonia apodocarpa*
33. Thallus producing apothecia; substrate and appearance variable.....34
33. Thallus producing perithecia; colonies saxicolous, comprised of adnate, and often overlapping squamules.....36
34. Margins of squamules becoming finely to deeply incised; apothecia pale to dark brown, emarginate an often appearing swollen; not uncommon .....*Cladonia caespiticia*
34. Margins of squamules entire (or not well defined immature squamules); apothecia gray to black, marginate, not swollen 35
35. Squamules with sorediate margins, C+ red (lecanoric acid present); common *Hypocenomyce scalaris*
35. Squamules esorediate, C-; rare, known from a single Lake County collection..... *Xylopsora friesii*
36. Squamules small, <4 mm wide, terrestrial, growing on dry or moist rocks (typically calcareous rocks) that are not periodically inundated; spores muriform, 2/ascus; common ..... *Endocarpon pallidulum*
36. Squamules larger, >4 mm wide, semiaquatic, growing on periodically submerged non-calcareous rocks along waterways; spores simple, 8/ascus; uncommon.....*Dermatocarpon luridum*

Key to Foliose Lichens

1. Photobiont a green alga; thallus variable in color; lower surface contrasting with upper surface, lacking veins 2
1. Photobiont a cyanobacteria; thallus dark gray, dark blueish-gray, dark brown, or blackish; lower surface concolorous with upper surface or initially pale and with conspicuous veins 105
2. Thallus producing lichenized diaspores (soredia, isidia, or hollow pustules) 3
2. Thallus lacking lichenized diaspores 76
3. Thallus producing soredia or hollow pustules 4
3. Thallus producing isidia 61
4. Lower surface becoming black centrally or black throughout 5
4. Lower surface white or pale to dark brown throughout 40
5. Upper cortex K+ yellow (atranorin present) or K+ yellow to red (from an overwhelming medullary reaction) 6
5. Upper cortex K- 27
6. Medulla K+ yellow or K+ yellow to red 7
6. Medulla K- 16
7. Thallus with conspicuous pattered ridging and cracking throughout upper cortex; common 8
7. Thallus smooth or with faint patterned ridging 9
8. Soralia produced in distinct pale patches throughout the thallus..... *Crespoa crozalsiana*
8. Soralia linear, produced marginally and/or along cracks in the thallus ..... *Parmelia sulcata*
9. Lobes hollow, with scattered circular perforations on the upper cortex; rare, known from a single population in Portage County that has since been destroyed, extirpated?..... *Menegazzia subsimilis*
9. Lobes not hollow, without perforations 10
10. Thallus with conspicuous marginal cilia; medulla without yellow pigment (*Parmotrema*) 11
10. Marginal cilia absent or very tiny and inconspicuous; medulla often producing patchy yellow pigment (secalonic acid present), especially near the soredia/pustules (*Myelochroa*) 15
11. Medulla K+ yellow (stictic acid present); rare ..... *Parmotrema perlatum*
11. Medulla K+ yellow to red (norstictic or salazinic acid present) 12
12. Lobes (especially lobe tips) with strong reticulate maculae 13
12. Lobes faintly or strongly maculate; maculae not reticulately patterned, blotchy 14
13. Soredia coarse, forming from the breakdown of isidia; uncommon..... *Parmotrema subisidiosum*
13. Soredia fine, never becoming subisidiate; common..... *Parmotrema reticulatum*
14. Thallus suberect, mature thalli with broad white erhizinate zones on the undersurface, immature thalli with large pale brown erhizinate zones; common ..... *Parmotrema hypotropum*
14. Thallus loosely appressed; undersurface dark brown at lobe tips, quickly becoming black, rarely with small white erhizinate zones; rare, known from a single Portage County collection..... ..... *Parmotrema margaritatum*
15. Medulla P-; soralia laminal, often pustulose; common ..... *Myelochroa aurulenta*
15.Medulla P+ orange (galbinic acid present); soralia capitate, produced atop revolute lobes; uncommon ..... *Myelochroa metarevoluta*
16. Thallus thick, hollow, tubular; uncommon ..... *Hypogymnia physodes*
16. Thallus thin in cross section, not hollow 17
17. Medulla C+ or KC+ red or pinkish (divaricatic, alectoronic, gyrophoric, lecanoric, or physodic acid present) 18
17. Medulla C-, KC- 24

18. Thallus producing soredia 19
18. Thallus producing round, hollow pustules 23
19. Soredia produced along the lobe margins 20
19. Soredia laminal or produced atop revolute lobes 21
20. Upper cortex with abundant punctate pseudocyphellae; rare, known from a single Columbiana County collection ..... *Cetrelia chicitae*
20. Upper cortex lacking pseudocyphellae; uncommon ..... *Parmotrema austrosinense*
21. Upper cortex with abundant punctate pseudocyphellae; rare ..... *Punctelia borreri*
21. Upper cortex lacking pseudocyphellae 22
22. Soredia produced in small laminal soralia; not uncommon ..... *Canoparmelia texana*
22. Soredia produced atop revolute lobes, farinose; rare, known from a single Trumbull County collection ..... *Hypotrachyna revoluta*
23. Lobes (especially lobe tips) weakly maculate, dull; uncommon ..... *Hypotrachyna showmanii*
23. Lobes emaculate, shiny; rare, known from a single Portage County collection ..... *Hypotrachyna afrorevoluta*
24. Medulla P+ orange (protocetraric acid present); thallus ruffled ..... *Parmotrema gardneri*
24. Medulla P-; thallus appressed 25
25. Lower surface ecorticate, fibrous; soredia produced apically or laterally on the lobe margins; rare, known from a single Portage County collection ..... *Heterodermia casarettiana*
25. Lower surface corticate; soredia/pustules laminal 26
26. Medulla producing patchy yellow pigment (secalonic acid present) that is K+ yellow, especially near the soredia, UV-; thallus often producing pustules; common ..... *Myelochroa aurulenta*
26. Medulla lacking yellow pigment, white throughout, UV+ blue-white (divaricatic acid present); thallus lacking pustules; not uncommon ..... *Canoparmelia texana*
27. Thallus yellow-green; cortex KC+ strong yellow (usnic acid present) 28
27. Thallus brown, blueish-green, dark greenish, blueish, or grayish; cortex KC- 30
28. Soralia crescent-shaped, produced along lobe margins; not uncommon ..... *Flavopunctelia soredica*
28. Soralia marginal or laminal, linear, punctiform, circular, or pustulose and indiscrete (sometimes a combination), not crescent-shaped 29
29. Upper cortex with abundant punctate pseudocyphellae; soredia marginal and/or laminal, punctiform, linear, or circular; lacking pustules; uncommon ..... *Flavopunctelia flaventior*
29. Upper cortex lacking pseudocyphellae; soredia scattered across central thallus; pustules typically present; common ..... *Flavoparmelia caperata*
30. Thallus large and umbilicate, with a single distinct holdfast, without distinct lobes, saxicolous; rare, known from a single Columbiana County collection ..... *Umbilicaria mamulata*
30. Thallus not umbilicate, appressed, forming distinct lobes, substrates variable 31
31. Medulla with bright reddish-orange or yellow pigmentation 32
31. Medulla white 34
32. Medulla with bright reddish-orange pigmentation, K+ reddish-purple (skyrin present); common ..... *Phaeophyscia rubropulchra*
32. Medulla with bright yellow pigmentation, K-; not uncommon 33
33. Lobes with discrete patched of pruina; thallus UV+ bright yellow-orange (lichexanthone present) ..... *Pyxine subcinerea*
33. Lobes often with a dusting of pruina but without discrete patches; thallus UV- ..... *Pyxine sorediata*

34. Medulla C+ red (lecanoric acid present); thallus brown to olive-brown ..... *Melanelixia subaurifera*
34. Medulla C-; thallus variable in color 35
35. Lobes producing abundant colorless cortical hairs along the margins, giving the thallus a hairy appearance; not uncommon ..... *Phaeophyscia hirsuta*
35. Lobes lacking colorless cortical hairs 36
36. Thallus producing conspicuous pruina at lobe apices, quite beautiful; soredia marginal; not uncommon (*Physconia*) 37
36. Thallus epruinose or weakly pruinose, not necessarily beautiful; soredia marginal or not.....38
37. Soralia continuous along lateral lobe margins, K-, KC- ..... *Physconia detersa*
37. Soralia discontinuous along lobe margins and often formed atop small lateral branchlets, typically reacting K+ weak yellow and KC+ yellow-orange (secalonic acid present) ..... *Physconia leucoleiptes*
38. Soredia coarsely granular, becoming nearly isidioid; soralia mostly irregular and indiscrete, often marginal; common.....*Phaeophyscia adiastola*
38. Soredia fine; soralia mostly discrete and round, often becoming capitate, never marginal 39
39. Soralia becoming capitate or even stipitate; thallus typically corticolous; common ....*Phaeophyscia pusilloides*
39. Soralia not becoming capitate or stipitate, flat or slightly convex; thallus saxicolous, typically on cemetery stones; uncommon .....*Phaeophyscia orbicularis*
40. Thallus yellow-green, greenish-gray, blueish-gray, whitish-gray, or gray 41
40. Thallus bright yellow or orange 58
41. Upper cortex K+ yellow (atranorin present) 42
41. Upper cortex K- 52
42. Medulla K+ yellow or K+ yellow to red (salazinic acid, zeorin, or atranorin present) 43
42. Medulla K- 46
43. Soralia laminal and rounded ..... *Physcia americana*
43. Soredia marginal or terminal at the apices of lateral or terminal branchlets (*Heterodermia*) 44
44. Medulla K+ yellow to red (salazinic acid present); soralia absent at lobe tips; rare, known from a single Mahoning County collection.....*Heterodermia albicans*
44. Medulla K+ strong yellow (zeorin present); soralia extending to lobe tips; uncommon 45
45. Lower surface ecorticate, with an orange K+ purplish pigment (unidentified terpene present)..... .....*Heterodermia obscurata*
45. Lower surface mostly white, corticate (beyond extreme lobe tips), without orange K+ purplish pigment ..... *Heterodermia speciosa*
46. Upper cortex with abundant punctiform pseudocyphellae; medulla C+ red (lecanoric acid present); common (*Punctelia*).....47
46. Upper cortex without pseudocyphellae, C- 48
47. Soralia punctiform; soredia coarse, almost isidioid..... *Punctelia missouriensis*
47. Soralia forming circular patches; soredia fine to granular..... *Punctelia caseana*
48. Lower surface ecorticate, becoming dark purplish-brown towards center; rare, known from a single Portage County collection.....*Heterodermia casarettiana*
48. Lower surface corticate, pale whitish-gray to pale brown (*Physcia*).....49
49. Lobes ascending, producing terminal inflated “hoods” from which soredia are produced; common .. ..*Physcia adscendens*
49. Lobes appressed to slightly raised, lacking terminal inflated “hoods”.....50

50. Soredia produced in terminal labriform soralia, fine to granular; thallus saxicolous; uncommon ..... *Physcia dubia*
50. Soredia forming from the breakdown of lobe apices, coarse, blastidiate.....51
51. Lobes faintly to strongly maculate; thallus typically corticolous; common..... *Physcia millegrana*
51. Lobes emaculate; thallus saxicolous; rare, known only from Columbiana County ..... *Physcia thomsoniana*
52. Thallus yellow green, KC+ yellow (usnic acid present) 53
52. Thallus greenish-gray, blueish-gray, or gray, KC-.....54
53. Thallus with small inconspicuous pseudocyphellae, lacking pycnidia; lower surface becoming dark brown centrally; not uncommon .....*Flavopunctelia soredica*
53. Thallus lacking pseudocyphellae, with abundant pycnidia; lower surface pale to light brown throughout; uncommon ..... *Usnocetraria oakesiana*
54. Thallus very appressed, almost crustose; lobes tiny, <0.5mm wide (*Hyperphyscia*) 55
54. Thallus loosely appressed, not at all crustose; lobes >0.5mm wide.....56
55. Soredia produced marginally; rare, known from a single Summit County collection ..... *Hyperphyscia confusa*
55. Soredia produced in laminal, round to irregular and often excavate soralia; not uncommon ..... *Hyperphyscia adglutinata*
56. Lower surface brown to dark brown .....*Phaeophyscia insignis*
56. Lower surface whitish-gray to light tannish (*Physciella*) 57
57. Soralia marginal to terminal and labriform; not uncommon.....*Physciella chloantha*
57. Soralia laminal, round to irregular; uncommon .....*Physciella melanchra*
58. Thallus bright yellow when dry, K-; common ..... *Candelaria concolor*
58. Thallus bright yellow-orange to bright orange, K+ reddish-purple (anthraquinones present) (*Xanthomendoza*).....59
59. Soredia produced in discrete crescent-shaped soralia forming at lobe margins; not uncommon ..... *Xanthomendoza fallax*
59. Soredia produced just under the lobe margins or sometimes becoming laminal centrally in older thalli 60
60. Rhizines sparse or absent; lobes narrow, often suberect, producing terminal “hoods”; soredia mostly terminal; common..... *Xanthomendoza weberi*
60. Rhizines abundant; lobes relatively broad, appressed, lacking terminal “hoods”; soredia produced mostly along the lateral margins; uncommon.....*Xanthomendoza ulophyllodes*
61. Upper cortex K+ yellow (atranorin present) 62
61. Upper cortex K- 71
62. Medulla K+ yellow or K+ yellow to red (salazinic or thamnolic acid present) 63
62. Medulla K- 68
63. Thallus producing black marginal cilia (sometimes inconspicuous) 64
63. Thallus lacking marginal cilia.....66
64. Thallus saxicolous, appressed; medulla producing patchy yellowish or yellow-orange-pigmented (secalonic acid present); rare, known from a single Columbiana County collection...*Myelochroa obsessa*
64. Thallus corticolous, ruffled; medulla white (*Parmotrema*).....65
65. Mature lobes with conspicuous reticulate maculae; Isidia becoming ecorticate, often breaking down into soredia; medulla UV-; uncommon..... *Parmotrema subisidiosum*

65. Mature lobes emaculate or with faint non-reticulate maculae; Isidia remaining fully corticate; medulla UV+ yellow (lichexanthone present); rare, known from a single Stark County collection ..... *Parmotrema ultralucens*
66. Upper cortex with abundant pseudocyphellae that often form reticulate patterning ..... *Parmelia squarrosa*
66. Upper cortex lacking pseudocyphellae 67
67. Lower cortex becoming black; thallus saxicolous; medulla producing patchy yellowish or yellow-orange-pigmented (secalonic acid present); rare, known from a single Columbiana County collection ..... *Myelochroa obsessa*
67. Lower cortex pale to light brown; thallus corticolous or lignicolous; medulla white; uncommon ..... *Imshaugia aleurites*
68. Upper cortex with abundant punctiform pseudocyphellae; common (*Punctelia*) 69
68. Upper cortex without pseudocyphellae 70
69. Isidia ecorticate, paler or concolorous with than thallus in mass ..... *Punctelia missouriensis*
69. Isidia corticate, browner than thallus in mass ..... *Punctelia rudecta*
70. Medulla C+ red (gyrophoric acid present); common ..... *Hypotrachyna minarum*
70. Medulla C-; rare ..... *Canoparmelia caroliniana*
71. Medulla C+ red (lecanoric acid present); thallus dark brown to olive-brown (*Melanelixia*) 72
71. Medulla C- 73
72. Isidia relatively long and branching, not dissolving into soredia; rare, known from a single Wayne County collection ..... *Melanelixia glabratula*
72. Isidia short, never branching, often dissolving into soredia; common ..... *Melanelixia subaurifera*
73. Upper cortex KC-; isidia mostly marginal; not uncommon 74
73. Upper cortex KC+ yellow (usnic acid present), yellow-green in color; isidia laminal; uncommon (*Xanthoparmelia*) 75
74. Thallus producing conspicuous pruina at lobe apices, quite beautiful, typically corticolous; not uncommon ..... *Physconia* (see couplet 37)
74. Thallus epruinose or weakly pruinose, not necessarily beautiful, typically saxicolous ..... *Phaeophyscia adiastola*
75. Lower cortex becoming black ..... *Xanthoparmelia conspersa*
75. Lower cortex pale brown to dark brown throughout ..... *Xanthoparmelia plittii*
76. Thallus peritheciate (*Dermatocarpon*) 77
76. Thallus lacking perithecia, with apothecia or no sexual fruiting structures 78
77. Thalli overlapping and forming thick colonies, growing on periodically inundated non-calcareous rocks, bright green when wet; uncommon ..... *Dermatocarpon luridum*
77. Thalli solitary, scattered, growing on dry or moist rock with at least some calcareous influence, brown to slightly greenish when wet; rare, known from a single Columbiana County collection ..... *Dermatocarpon muhlenbergii*
78. Lower surface pale to dark brown throughout, never black 79
78. Lower surface black throughout or becoming black centrally 99
79. Thallus variable in color, whitish-gray, gray, blueish-gray, greenish-gray, brown, olive-brown, olive, or yellow-green, K- or K+ yellow 80
79. Thallus bright orange to yellow, K+ reddish-purple (anthraquinones present) 97
80. Medulla K- (make sure to separate upper cortex from medulla!) 81

80. Medulla K+ yellow or K+ yellow to orangish-red (norstictic acid, thamnolic acid, or atranorin present) 93
81. Thallus light blueish-gray, whitish-gray, or yellow-green 82
81. Thallus grayish-brown, brown, dark-brown, olive-brown, or olive 87
82. Lobes ascending, suberect 83
82. Lobes tightly to loosely appressed 84
83. Lobes narrow, <4mm wide, producing terminal inflated "hoods," lacking any patterned ridging; common ..... *Physcia adscendens*
83. Lobes broad, >4mm wide, lacking terminal inflated "hoods," with conspicuous reticulate patterned ridging; uncommon ..... *Platismatia tuckermanii*
84. Upper cortex with abundant punctiform pseudocyphellae; thallus often lobulate centrally; rare ..... *Punctelia bolliana*
84. Upper cortex lacking pseudocyphellae and lobules 85
85. Upper cortex K+ yellow (atranorin present); common ..... *Physcia stellaris*
85. Upper cortex K-; uncommon 86
86. Thallus saxicolous, areolate, placodioid, typically with abundant pale brown to brown lecanorine apothecia; upper cortex sometimes KC+ yellow (usnic acid present); spores simple, hyaline ..... *Protoparmeliopsis muralis*
86. Thallus corticolous, with small appressed lobes, not areolate, typically with dark brown to blackish lecanorine apothecia; upper cortex KC-; spores brown, 1-septate; common ..... *Hyperphyscia syncolla*
87. Lobes ruffled and with upturned margins or erect and subfruticose 88
87. Lobes tightly to loosely appressed 91
88. Thallus growing on the ground, among bryophytes and/or *Cladonia* species; rare, known from a single Geauga County collection ..... *Cetraria arenaria*
88. Thallus corticolous or lignicolous; rare, known from a single Portage County collection (*Tuckermanopsis*) 89
89. Medulla C+ red (olivetoric acid present) ..... *Tuckermanopsis ciliaris*
89. Medulla C- 90
90. Medulla KC+ faint orange or pinkish, UV+ blue-white (alectoronic acid present); apothecia occasional, not produced atop revolute lobes ..... *Tuckermanopsis americana*
90. Medulla KC-, UV-; apothecia abundant, produced atop revolute lobes ..... *Tuckermanopsis sepincola*
91. Thallus and apothecial margins lobulate; rare, known from a single Columbiana County collection ..... *Anaptychia palmulata*
91. Thallus and apothecial margins lacking lobules 92
92. Thallus dark brown to olive-brown when dry, appressed to somewhat loose, on lignum or conifer bark; rare, known from a single Portage County collection ..... *Tuckermanella fendleri*
92. Thallus grayish-brown when dry, very tightly appressed, almost crustose, on bark of hardwoods; uncommon ..... *Hyperphyscia syncolla*
93. Thallus saxicolous; uncommon 94
93. Thallus corticolous or lignicolous 95
94. Upper cortex yellow-green, K-, KC+ yellow (usnic acid present); medulla K+ yellow to orangish-red (norstictic acid present) ..... *Xanthoparmelia cumberlandia*
94. Upper cortex whitish-gray, K+ yellow (atranorin present), KC-; medulla K+ yellow (atranorin present) ..... *Physcia phaea*

95. Lobes emaculate; apothecium rims (when present) becoming knobby and uneven; medulla K+ very strong yellow (thamnolic acid present); rare..... *Imshaugia placorodia*
95. Lobes faintly to strongly maculate; apothecium rims thin and even; medulla K+ yellow (atranorin present); uncommon (*Physcia*).....96
96. Thallus faintly maculate; lobes narrow, <1mm wide..... *Physcia pumilior*
96. Thallus strongly maculate; lobes broader, >1mm wide..... *Physcia aipolia*
97. Thallus saxicolous; rare, known only from the Lake Erie shore..... *Rusavskia elegans*
97. Thallus corticolous; uncommon.....98
98. Lobes narrow, not appearing flattened, <1mm wide; thallus favoring *Populus* .... *Xanthomendoza hasseana*
98. Lobes relatively broad and flattened, >1mm wide; thallus on a variety of hardwood trees, especially landscape ornamental trees ..... *Xanthoria parietina*
99. Thallus ruffled to suberect, undersurface with broad pale brown to white erhizinate zones..... 100
99. Thallus appressed; undersurface without broad erhizinate zones..... 101
100. Lobes with conspicuous reticulate-patterned ridging, lacking cilia; medulla K-; quite uncommon..... ..... *Platismatia tuckermanii*
100. Lobes smooth, without reticulate ridging, with conspicuous black marginal cilia; medulla K+ yellow to red (norstictic acid present); rare, known from a single Portage County collection .... *Parmotrema perforatum*
101. Upper cortex K- (*Phaeophyscia*)..... 102
101. Upper cortex K+ yellow (atranorin present)..... 104
102. Lobe margins and apothecia producing abundant colorless cortical hairs, giving the thallus a hairy appearance; uncommon..... *Phaeophyscia hirtella*
102. Lobe margins and apothecia lacking colorless cortical hairs. Smooth in appearance..... 103
103. Thallus saxicolous, typically on cemetery stones; uncommon..... *Phaeophyscia decolor*
103. Thallus corticolous, favoring *Populus*; not uncommon..... *Phaeophyscia ciliata*
104. Medulla P+ orange (galbinic acid present); not uncommon ..... *Myelochroa galbina*
104. Medulla P-; uncommon ..... *Hypotrachyna livida*
105. Lower surface initially pale, often darkening towards center, fibrous and with conspicuous veination (*Peltigera*) 106
105. Lower surface concolorous with upper surface, not fibrous, lacking veination..... 113
106. Thallus producing isidia, soredia, or phyllidia (look very carefully!)..... 107
106. Thallus completely lacking lichenized diaspores 110
107. Thallus producing isidia or soredia; uncommon..... 108
107. Thallus producing phyllidia 109
108. Thallus producing soredia in round laminal soralia..... *Peltigera didactyla*
108. Thallus producing globular to cylindrical or even squamulose isidia throughout the thallus..... ..... *Peltigera evansiana*
109. Lobes narrow, <4mm wide; rare, known from a single Geauga County collection..... *Peltigera sp.*
109. Lobes broad, >4mm wide; uncommon..... *Peltigera praetextata*
110. Lobes suberect, mostly raised from the substrate, with broad erhizinate and faintly veined zones; uncommon..... *Peltigera didactyla*
110. Lobes ruffled but not suberect, mostly in contact with the substrate, rhizines and veins persistent to or nearly to the lobe tips 111

111. Lobes smooth and shiny throughout, lacking tomentum; veins flattened and broad, disappearing along the margins of the lower surface; rare, known from a single Summit County collection ..... *Peltigera polydactylon*
111. Lobes dull, finely tomentose, at least near lobe tips; veins thin and raised, persisting to the lobe tips..... 112
112. Rhizines short and densely fasciculate; lobes brittle, strongly curled inwards; growing in dry conditions; rare, known from a single Summit County collection..... *Peltigera rufescens*
112. Rhizines simple to sparingly fasciculate; lobes flexible, typically with downturned margins; growing in relatively moist conditions; uncommon ..... *Peltigera canina*
113. Thallus isidiate; isidia mostly laminal..... 114
113. Thallus lacking isidia (may produce marginal lobules); uncommon 116
114. Lobes broad, averaging >5mm wide; surface often with a wrinkled appearance; thallus blackish to dark olive-green; rare, known from a single Columbiana County collection ..... *Collema subflaccidum*
114. Lobes narrow, averaging <5mm wide; surface flat; thallus brownish-black, lead-gray, or blueish-gray; uncommon..... 115
115. Lobes short, mostly suberect, almost squamulose, brownish-black to lead gray; apothecia typically present and often abundant..... *Scytinium dactylinum*
115. Lobes longer, mostly appressed, clearly foliose, blueish-gray; apothecia typically absent ..... *Leptogium cyanescens*
116. Lobes markedly swollen when wet..... *Enchylium tenax*
116. Lobes thin, even when wet (*Scytinium*) 117
117. Lobes typically suberect, irregular and with dense, fine to coarse marginal lobules; apothecia typically absent ..... *Scytinium lichenoides*
117. Lobes loosely appressed, rounded and distinct, becoming crenulate to finely lobulate; apothecia present, numerous or sparse..... *Scytinium juniperinum*

Key to Fruticose Lichens

1. Thallus terricolous; forming colonies that do not converge to a single distinct holdfast 2
1. Thallus corticolous or saxicolous; attached to substrate by a single distinct holdfast.....5
2. Branches broad and flattened, sometimes curling in towards themselves, not hollow, lined with short but conspicuous marginal cilia, with laminal pseudocyphellae; rare, known from a single cite in Geauga County..... *Cetraria arenaria*
2. Branches relatively thin and round, hollow, lacking cilia and pseudocyphellae (*Cladonia*).....3
3. Podetia producing sparse or abundant squamules; uncommon..... *Cladonia furctata*
3. Podetia lacking squamules.....4
4. Podetia ashy white, K+ pale yellow, KC- (atranorin present); uncommon.....*Cladonia rangiferina*
4. Podetia yellow-green, K-, KC+ yellow (usnic acid present).....5
5. Podetia thin, ecorticate, dichotomously branching, P+ red (fumarprotocetraric acid present); uncommon..... *Cladonia subtenuis*
5. Podetia thick, corticate, often with >2 branches originating from an axil, P-; rare..... *Cladonia uncialis*
6. Branches with an elastic central cord, circular in cross-section, yellow-green in color (usnic acid present) (*Usnea*) 7

6. Branches without an elastic central cord, flattened to rounded in cross-section, yellow-green or dark brown in color 15
7. Cortex with reddish-orange pigment at base of the main branches or throughout the thallus; uncommon ..... *Usnea pensylvanica*
7. Cortex lacking red pigment (sometimes with a pinkish brown pigment near base of thallus) 8
8. Branches without isidia or soredia, papillate; not uncommon ..... *Usnea strigosa*
8. Branches with isidia and/or soredia, papillate or not 9
9. Isidia dense, often black-tipped, covering branches; soralia absent or very few, developing from degraded isidia; uncommon ..... *Usnea hirta*
9. Isidia dense to absent, not black tipped; soralia abundant, at least near branch tips 10
10. Medulla with a pinkish-red pigment throughout most of thallus; uncommon ..... *Usnea mutabilis*
10. Medulla white throughout 11
11. Branches quite inflated, distinctly constricted at points of attachment 12
11. Branches not inflated or only slightly inflated, not constricted at points of attachment 13
12. Soralia minute, less than half the branch diameter; fumarprotocetraric acid absent; rare ..... *Usnea cornuta*
12. Soralia broad, larger than half the branch diameter, often becoming excavate; fumarprotocetraric acid present; rare, known from a single Portage County collection ..... *Usnea glabrata*
13. Medulla K+ yellow to red (norstictic acid present); fibrils short and packed together near base of thallus, even in length; papillae absent; rare, known from a single Portage County collection ..... *Usnea dasaea*
13. Medulla K- or K+ yellow; fibrils not as described previously; papillae present, abundant or sparse. 14
14.Thallus shrubby; fibrils abundant throughout thallus; uncommon ..... *Usnea subfloridana*
14.Thallus becoming pendent; fibrils sparse; rare, known from a single Trumbull County collection ..... *Usnea subgracilis*
15. Branches dark brown, thin, brittle; spinulose isidia emerging from soralia; uncommon ..... *Bryoria furcellata*
15. Branches green to yellow-green; isidia absent, or if present, not emerging from soralia 16
16. Branches round to irregular in cross-section, covered in granular soredia or isidioid granules; not uncommon ..... *Evernia mesomorpha*
16. Branches flattened in cross-section; soredia absent or confined to clearly delineated soralia (*Ramalina*) 17
17. Thallus producing soredia, saxicolous or corticolous 18
17. Thallus lacking soredia, corticolous 19
18. Soralia becoming labriform, being produced terminally on the lower surface of branches as well as marginally; rare, known from a single Portage County collection ..... *Ramalina labiosorediata*
18. Soralia never labriform, produced along the margins of branches; rare, known from a single Geauga County collection ..... *Ramalina intermedia*
19. Branches broad, with abundant and conspicuous knobby tubercles; only occurring on landscape trees from southern plant nurseries (not naturally occurring in the region) ..... *Ramalina complanata*
19. Branches narrow or broad, lacking tubercles (although small papillae are often present); uncommon, occurring on natural substrates or on landscape trees ..... *Ramalina americana*

References and Literature Cited

Andreas, B.K., Showman, Ray E. and Lendemer, James C. 2007. The 2006 combined Crum/Tuckerman Workshop in Ohio. Evansia.

Brodo, Irwin M. (2016). Keys to Lichens of North America. Ottawa, Ontario: Canadian Museum of Nature

Brodo, Irwin M., Sharnoff, Sylvia Duran, and Sharnoff, Stephen. 2001. Lichens of North America. New Haven, CT: Yale University

Ekman, Stefan. 1996. The corticolous and lignicolous species of *Bacidia* and *Bacidina* in North America. Opera Botanica

Esslinger, T. L. A Cumulative Checklist for the Lichen-forming, Lichenicolous and Allied Fungi of the Continental United States and Canada, Version 22. North Dakota State University.

Feuerer, Tassilo and Hawksworth, David. 2007. Biodiversity of lichens, including a world-wide analysis of checklist data based on Takhtajan's floristic regions. Biodiversity and Conservation

Flenniken, Don G. 1999. The Macrolichens in West Virginia. Sugarcreek, OH: Carlisle Printing

Guzow-Krzemińska, Beata, Czarnota, Paweł, Łubek, Anna, and Kukwa, Martin. 2016. *Micarea soralifera* sp. Nov., a new sorediate species in the *M. prasina* group. British Lichen Society

Harris, Richard C. 2015. LICHENS OF THE STRAITS COUNTIES, MICHIGAN. Bronx, NY: The New York Botanical Garden Press.

Harris, Richard C. 2018. OMNIUM GATHERUM PYRENOLICHENUM II. Eagle Hill

Harris, Richard C. and Ladd, Douglas M. 2001. Lichens of the Ozarks – KEY TO *BACIDIA*, *BACIDINA*, *FELLHANERA*, AND SOME OTHER SPECIES WITH A SIMILAR TYPE OF SPORE. New York Botanical Garden and The Nature Conservancy

Hinds, J. and Hinds, P. (2007). The Macrolichens of New England. Bronx, NY: The New York Botanical Garden Press.

Krzewicka, Beata. 2012. A REVISION OF *VERRUCARIA* S.L. (VERRUCARIACEAE) IN POLAND. Polish Botanical Studies 27

Lendemer, James C. 2009. The *Fellhanera silicis* group in eastern North America. Opuscula Philolichenum

Lendemer, James C. 2009. *Verrucaria thujae* (Verrucariaceae, Lichenized Ascomycetes), a new corticolous species from the Great Lakes Region of North America. Opuscula Philolichenum

Lendemer, James C. 2018. Identification Keys to the Lichens and Allied Fungi of Great Smoky Mountains National Park (Draft)

Lendemer, James C. 2018. The lichens and allied fungi of Pennsylvania: A revised checklist with proposed conservation rankings and identification keys (Draft)

Lendemer, James C. and Barton, Jason. 2014. *Micarea micrococca* and *M. prasina*, the first assessment of two very similar species in eastern North America. The American Bryological and Lichenological Society

Lendemer, James C., Harris, Richard C., and Tripp, Erin A. (2013). The Lichens and Allied Fungi of the Great Smoky Mountains National Park. Bronx, NY: The New York Botanical Garden Press.

Lendemer, James C., Tripp, Erin A., and Sheard, John. 2014. A review of *Rinodina* (Physciaceae) in the Great Smoky Mountains National Park highlights the growing significance of this "island of biodiversity" in eastern North America. The American Bryological and Lichenological Society

McCune, Bruce, Dey, Jonathan P., Peck, JeriLynn E., Neitlich, Peter N., Will-Wolf, Susan, and Cassell, David. 1997. Repeatability of Community Data: Species Richness versus Gradient Scores in Large-Scale Lichen Studies. The American Bryological and Lichenological Society

McMullin, Richard Troy. 2018. New and interesting lichens and allied fungi from British Columbia, Nova Scotia, Nunavut, Ontario, Prince Edward Island, and Quebec, Canada. Opuscula Philolichenum

Nash, T.H., Ryan, B.D., Gries, C., Bungartz, F., (eds.) 2002. Lichen Flora of the Greater Sonoran Desert Region. Vol 1.

Ohio Moss and Lichen Association 2018. A List of the Lichens of THE GREAT STATE OF OHIO

Orange, Alan. 2013. British and Other Pyrenocarpous Lichens. Department of Biodiversity and Systematic Biology, National Museum of Wales. Version 2

Peterson, Eric. 2012. Key of Calicioid Lichens and Fungi For Genera with Members in Temperate Western North America (Draft)

Sheard, John W. 2010. The Lichen Genus Rinodina (Ach.) Gray (Lecanoromycetidae, Physciaceae) in North America, North of Mexico. Ottawa, ON K1A 0R6, Canada: National Research Council of Canada

Showman, Ray E. and Flenniken, Don G. 2004. The Macrolichens of Ohio. Columbus, OH: Ohio Biological Survey.

Showman, Ray E. and Flenniken, Don G. 2008. UPDATES AND CORRECTIONS to The Macrolichens of Ohio. Ohio Moss and Lichen Association.

Stepanchikova, Irina S., Kuznetsova, Ekaterina, and Himelbrant, Dmitry E. 2012. The lichen genera *Thelidium* and *Verrucaria* in the Leningrad Region (Russia). Folia Cryptogamica Estonica

Stewart, W. D. P. and Rowell, P. 1977. Modifications of nitrogen-fixing algae in lichen symbioses. Nature: International Journal of Science