

The Lichen Flora of the Joliet Military Training Area

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ABSTRACT

Sixty-nine species of lichens are reported from the Joliet Military Training Area, near Elwood, Illinois. Thirty-one species are of the crustose growth form, 27 are foliose, 8 are fruticose and 3 are squamulose. Twenty-six species are considered to be rare, 19 are common, 13 are occasional and 11 are frequent. *Crataegus mollis* is the most commonly occupied corticolous substrate, weathered dolomite is the most common saxicolous substrate and weathered wood is the most common lignicolous substrate. Lichens were also found growing on other substrates such as deer bones, prickly pear cactus pads, rusted metal, caulking and aluminum foil. Nearly 2/3 of all lichens known from Will County were found in this study indicating that lichens are a key component of the ecosystem here. A key to the lichen flora of the Joliet Military Training Area is provided as well as information on their habitats, abundance and distribution.

INTRODUCTION

This project was undertaken to document and collect voucher specimens of the lichen flora of the Joliet Military Training Area, develop an identification key to the lichen flora there and provide information on their habitats, abundance and distribution. No previous work has been devoted to the lichen flora of the Joliet Military Training Area.

The Joliet Military Training Area (JMTA) is a Federally owned natural area managed by the United States Army. It is located approximately 80 km southwest of downtown Chicago, near the city of Elwood, in Will County, Illinois (Figure 1). With its' close proximity to the Midewin National Tallgrass Prairie, and other natural areas in Will and surrounding counties, the JMTA lies within the Prairie Parklands Ecosystem Partnership, an area of approximately 382,500 hectares of land largely consisting of agricultural and natural areas (Illinois Department of Natural Resources, 2001).

According to Swink and Wilhelm (1994), the natural divisions described for the Chicago region that occur at the JMTA include the Grand Prairie Section and the Bedrock Valley Section of the Grand Prairie Natural Division. The topography is gently rolling to nearly level. Elevations range from 159 meters to 195 meters above sea level. Jackson Creek and its' tributaries drain the southern half of the JMTA before entering the Des Plaines River in the northwest section.

The climate is considered temperate with cool winters and hot summers (Wood, 2001). The average temperature in January ranges from a high of -1.67°C to a low of -10.6°C . The average July temperature ranges from a high of 28.7°C to a low of 17.0°C . Average precipitation is 91 cm with 97 cm occurring as snow.

DESCRIPTION OF THE STUDY AREA

The JMTA is divided into 6 management units ranging in size from 101 hectares to 405 hectares. These management units serve as tactical areas for military training, pistol ranges for police department target practice and management zones for deer and bird hunting. Two additional management units owned by the United States Forest Service, which abut the JMTA, are also included in this study. Total combined land area of the JMTA and U. S. Forest Service lands is approximately 1,775 hectares.

A brief description of each management unit follows and includes lichen substrates, location and size:

Management Unit 1

Topography is somewhat level with elevations averaging 152 meters to 159 meters above sea level. The woody vegetation consists mainly of thickets of *Crataegus mollis*. Throughout this unit, exposed beds of dolomitic flagstone occur, as well as granitic erratics. Human influences include abandoned buildings, concrete roadbeds and a gravel pit.

Management Unit 2

Topography is gently rising with elevations averaging 168 meters to 183 meters above sea level. The woody vegetation includes second growth woodlands (*Celtis occidentalis*, *Crataegus mollis*, *Maclura pomifera* and *Populus deltoides*) as well as a few groves of oaks (*Quercus alba*, *Q. imbricaria* and *Q. macrocarpa*). In these woodlands however, the ground layer was shaded and lichens were uncommon. The remaining habitat consisted of old fields dominated by a weedy native and alien flora. Along the western edge of this unit, exposed beds of dolomite occur as well as granitic erratics. Human influences include gravel roads and old building foundations.

Management Unit 3

Topography is gently rising with elevations averaging 162 meters to 183 meters above sea level. Some habitats included upland woodlands (*Acer saccharum*, *Carya cordiformis*, *C. ovata*, *Prunus serotina* and *Quercus alba*) and flood plains near ponds and low areas (*Acer saccharinum*, *Juglans nigra* and *Ulmus americana*). The understory of the woodland habitats was shaded and lichens were uncommon. The remaining habitat consisted of old fields dominated by a weedy native and alien flora. Human influences included concrete and dolomite gravel roads.

Management Unit 4

Topography is gently rising with elevations averaging 170 meters to 183 meters above sea level. Exposed beds of dolomitic gravel deposits occur. Mature forests (*Prunus serotina* and *Quercus* spp.) and second growth woodlands (*Acer negundo*, *Crataegus mollis*, *Populus deltoides* and *Ulmus americana*) also occur throughout. Lichens were

more common in sunnier areas along edges of woods or on open grown *Crataegus mollis* and *Rhus glabra*. Human influences include the planting of corn (*Zea mays*) to attract wildlife.

Management Unit 5 North & 5 South

Topography is gently rising with elevations averaging 178 meters to 195 meters above sea level. Jackson Creek flows through parts of Unit 5 dividing it into north and south sections. Old fields dominated by a weedy native and alien flora occur in the northern half of Unit 5. Second growth forests (*Acer negundo*, *Crataegus mollis*, *Gleditsia triacanthos*, *Maclura pomifera*, *Populus deltoides*, *Prunus serotina*, and *Ulmus americana*) cover most of the remainder of this site. Oak woodlands (*Quercus* spp.) occur at the southeast corner. Human influences include the planting of corn (*Zea mays*) to attract wildlife.

Management Unit 6

Topography is relatively level with elevations averaging 186 meters to 189 meters above sea level. Mowed grass fields for military training are found here dominated by alien species (*Poa* spp.). Scattered second growth woodlands (*Acer negundo*, *Celtis occidentalis*, *Crataegus mollis*, *Fraxinus pennsylvanica* var. *subintegerrima*, *Juglans nigra* and *Maclura pomifera*) also occur. Old fields with a weedy native and alien flora dominate much of the remainder of this unit. Lichens were mainly found in a few scattered groves of trees.

Management Unit 7 - U.S. Forest Service Property

Topography is gently rising with elevations averaging 162 meters above sea level. Vegetation in this unit consists mainly of brush thickets (*Crataegus mollis* and *Gleditsia triacanthos*) and abandoned farm fields influenced by a weedy native and alien flora. Some *Acer* / *Quercus* woodlands occur on the east side of Jackson creek.

Management Unit 8 - U.S. Forest Service Property

Topography is gently rising with elevations averaging 182 meters to 194 meters above sea level. Vegetation consisted mainly of second growth woodlands (*Acer negundo*, *A. saccharinum*, *Crataegus mollis* and *Fraxinus pennsylvanica* var. *subintegerrima*) with a mixture of oak forest (*Quercus alba*, *Q. imbricaria*, *Q. macrocarpa*). Human influences include abandoned farm fields and old home sites.

MATERIALS AND METHODS

On 6 occasions during the summer and fall of 2000, 6 occasions during the summer and fall of 2001, and 4 occasions during the fall of 2003, the JMTA was surveyed to document the lichen flora found there. An attempt was made to collect and identify lichens from as many types of habitats as possible, ranging from woodlands and grasslands, to human influenced landscapes. Surveys were conducted by walking each of the management units for 2 hours with all lichens found identified in that period. This technique was repeated at all 8 management units.

To assist in lichen identification, tests for chemical substances produced by lichens were made on specimens with two chemical reagents: calcium hypochlorite [$\text{Ca}(\text{ClO})_2$], abbre-

viated as C] and potassium hydroxide [KOH, abbreviated as K] and follow Hale (1973). Some species of lichens contain acids, which react to these reagents, resulting in color changes of their upper cortex (upper fungal layer) or medulla (middle fungal layer). The presence or absence of reactions between these acids and these reagents were used to identify some lichen species.

The abundance and distribution of the lichen flora was determined by counting the number of management units each lichen was found in and assigning that species an abundance category. Assignment of abundance categories was based on the following criteria: rare (found at 1 management unit), occasional (2-3 management units), frequent (4-5 management units) and common (6-8 management units). These abundance categories refer to values relative to the management units in this study and not necessarily to the rest of Will County.

The growth form of each lichen was determined: *foliose* (leaf-like), *crustose* (crust-like), *fruticose* (shrub-like) or *squamulose* (scale-like). The substrates upon which each lichen was growing were also noted: *terrícolas* (clay or soil), *saxícolas* (concrete, dolomite, or granite), *corticícolas* (the bark of trees or shrubs), *lignícolas* (wood or decorticate logs) or other (rusted metal, animal bones, fungi, mosses, etc.). Nomenclature and species concepts for vascular plants identified as substrates follow Dirr (1998) or Swink and Wilhelm (1994).

All lichen collections are deposited in the herbarium at the Morton Arboretum (MOR), Lisle, Illinois.

RESULTS AND DISCUSSION

Sixty-nine species of lichens in 37 genera are reported for the Joliet Military Training Area. Thirty-one (45%) lichens are crustose, 27 (39%) are foliose, 8 (12%) are fruticose and 3 (4%) are squamulose. Twenty-six species (38%) are considered to be rare, 19 (28%) are common, 13 (18%) are occasional and 11 (16%) are frequent. Eight lichens (*Arthonia caesia*, *Caloplaca cf. crenulatella*, *Candelaria concolor*, *Lecanora dispersa*, *Phaeophyscia pusilloides*, *P. rubropulchra*, *Physcia millegrana* and *P. stellaris*) were found at all management units and are generally common throughout Will County. No lichens found here are threatened or endangered in Illinois.

Of the 26 lichens that are rare, 19 of them, though routinely found in northern Illinois, were rare at the JMTA because substrate material was limited. Field work by the author, and a search of herbarium collections at the Morton Arboretum (MOR), Lisle, Illinois and Field Museum of Natural History (F), in Chicago, Illinois, indicate that the remaining seven species are generally rare or uncommon in northern Illinois: They include: *Flavopunctelia soledica*, *Punctelia missouriensis*, *Usnea strigosa* subsp. *major*, *Verrucaria calciseda*, *V. fayettensis*, *V. fuscilla* and *Xanthoria polycarpa*.

Lichens were found on 44 different species of trees or shrubs (Appendix I). The 5 most common corticícolas substrates included *Crataegus mollis* with a total of 29 lichens, followed by *Fraxinus pennsylvanica* var. *americana* (20), *Populus deltoides* (18), *Acer*

negundo and *Quercus macrocarpa* (15). Between 1 and 14 species of lichens could be found on the remaining trees or shrubs.

Lichens were also found on saxicolous materials such as weathered dolomite (23 species), concrete (16), and granite (13). The saxicolous flora included *Caloplaca* spp., *Endocarpon pallidulum*, *Lecanora dispersa*, *L. muralis*, *Sarcogyne regularis* and *Verrucaria calkinsiana*.

Lignicolous substrates included materials such as weathered wood (11 species) and decorticate logs (10). The lignicolous flora included *Flavoparmelia caperata*, *Phaeophyscia rubropulchra*, *Physcia millegrana* and *Trapeliopsis flexuosa*.

No lichens were found on the soil in any of the old fields, but a few species were found on the gravel roads that traversed these fields. These species included *Bacidia coprodes*, *Caloplaca* cf. *crenulatella* and *Lecanora dispersa*.

Lichens were found growing on other substrates such as deer bones, prickly pear cactus pads, rusted metal, caulking and aluminum foil.

Although Calkins (1896) and Wilhelm (1998) have published lichen floras that included parts of Will County, Illinois, no known lichenological studies have been dedicated to the Joliet Military Training Area. Calkins' flora of Chicago and vicinity comprised about 440,000 hectares of land that included natural features such as morainal deposits of clay and gravel and dolomite outcroppings, as well as woodland and prairie habitats - all of which are found at the JMTA today. The northern boundary of the JMTA borders the southern boundary of Calkins study area, and thus was not included in his study. Of the 125 species of lichens reported by Calkins, however, only 28 were found at the JMTA. Wilhelm reported 222 lichen species when he revisited Calkins' study area 100 years later. Sixty lichen species, including the 28 reported by Calkins, were found here.

Nine species of lichens (*Caloplaca* species #1, #2 and #3 sensu JMTA study, *Caloplaca* cf. *crenulatella*, *Caloplaca subsoluta*, *Candelariella aurella*, *Punctelia missouriensis*, *Usnea strigosa* subsp. *major* and *Verrucaria calciseda*) are reported as not being found in either of the two aforementioned floras.

Nearly 2/3 of all lichens known from Will County were found in this study indicating that lichens are a key component of the JMTA ecosystem. As in other natural areas surrounding the JMTA (e.g. Will County Forest Preserves) the lichen flora here was mainly found on the trunks and lower branches of trees and shrubs growing along sunny paths, or in open situations, where they were able to find sunlight. This growth probably occurs in these habitats due to the fact that the algal component of these organisms is photosynthetic. While the JMTA does have some fine examples of mature oak woodlands, in some areas most of the understory is so shaded that even vascular plants were few in number. In a few circumstances lichens were found only because branches that had been growing in the sunshine of the upper canopy had fallen to the ground.

The most common tree available for lichen colonization was *Crataegus mollis*; a tree armed with thorns and probably passed over by grazers when this land was pastured. Any

attempt by land managers to restore the JMTA to prairie would require the removal of this tree. Based on the author's personal observations, however, *Crataegus mollis* seems to be an important substrate for this lichen flora and removal of this tree could jeopardize the lichen population.

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KEY TO GROUPS & GENERA AND ANNOTATED SPECIES LIST

This section includes a key to the groups and genera of the lichens of the Joliet Military Training Area. Following this, arranged alphabetically by genus and species, is an annotated species list with abundance and distribution information and a brief description of habitat. A key is provided for each genus that is represented at the Joliet Military Training Area by more than one species. All collections were made by the author and are identified with an accession number following the substrate upon which the collection was made (e.g. (*Rhus glabra* (#1234)). Nomenclature and authorities follow Esslinger (2006). At least one representative specimen has been chosen to voucher each reported species.

1. Fruiting bodies at the terminal end of a slender black stalk PHAEOCALICIUM
1. Fruiting bodies sessile to immersed, not at the terminal end of a slender black stalk, or fruiting bodies absent2.
- 2(1). Thallus shrub-like or scale-like, of ascending squamules; fruiting bodies, if present, on simple to slightly branched podetia; podetia resembling resembling cups, or pointed or blunt clubs..... I - FRUTICOSE LICHENS
2. Thallus and fruiting bodies not as above3.
- 3(2). Thallus leaf-like, loosely attached to substrate by rhizines; or umbilicate, attached at a single point; with both an upper and lower cortex present II - FOLIOSE LICHENS
3. Thallus not as above.....4.
- 4(3). Thallus squamulose, of adnate squamules III - SQUAMULOSE LICHENS
4. Thallus crust like, tightly attached to substrate, lacking a lower cortex5.
- 5(4). Fruiting bodies absentIV - STERILE CRUSTOSE LICHENS
5. Fruiting bodies present.....6.
- 6(5). Fruiting body flask-like, embedded in thallus with only apex visible, opening by an apical pore; a perithecium V - CRUSTOSE LICHENS WITH PERITHECIA
6. Fruiting body elongated, rounded or disk-like, sessile with upper cortex; an apothecium..... VI - CRUSTOSE LICHENS WITH APOTHECIA

I - FRUTICOSE LICHENS

1. Thallus branches hollow; squamules present.....CLADONIA
1. Thallus branches solid; squamules absent USNEA

II - FOLIOSE LICHENS

1. Thallus umbilicate, attached to substrate by a central cord or holdfast DERMATOCARPON
1. Thallus usually attached to substrate by rhizines and not a central cord2.
- 2(1). Thallus some shade of orange, yellow, or yellowish green3.
2. Thallus some shade of brown or gray7.
- 3(2). Thallus K+ violet4.
3. Thallus K-5.
- 4(3). Thallus esorediateXANTHORIA
4. Thallus sorediateXANTHOMENDOZA
- 5(3). Thallus yellow (or yellow green when wet), lobes 0.1-0.3 mm wide; lower surface white CANDELARIA
5. Thallus yellow green, lobes 1.5-8 mm wide; lower surface brown to black6.
- 6(5). Upper cortex with white pores; medulla C+ red; lobes 4-8 mm wide FLAVOPUNCTELIA
6. Upper cortex without pores; medulla C-; lobes 2-8 mm wide FLAVOPARMELIA
- 7(2). Thallus brown, brownish gray, greenish gray, or dark gray, K-8.

7. Thallus whitish gray to bluish gray, K+ yellow or rarely K-11.
 8(7). Medulla C+ redMELANELIXIA
 8. Medulla C- 9.
 9(8). Thallus lobes white pruinosePHYSCONIA
 9. Thallus lobes epruinose.....10.
 10(9). Rhizines absent, thallus tightly attached to substrate..... HYPERPHYSCIA
 10. Rhizines present, thallus loosely attached to substratePHAEOPHYSCIA
 11(7). Lower surface brown to black; medulla K+ yellow turning red; thallus soresdiate.....12.
 11. Lower surface white to pale tan; medulla K- or K+ yellow; thallus soresdiate or not.....13.
 12(11).Upper cortex with white angular markings; margins of lobes eciliate, lobes with squared ends, 2-5 mm wide, rhizines to margin PARMELIA
 12. Upper cortex without white angular markings; margins of lobes ciliate, lobes with rounded ends, 6-20 mm wide, wide marginal zone without rhizines
 PARMOTREMA
 13(11).Thallus K- PHYSCIELLA
 13. Thallus K+ yellow14.
 14(13).Upper cortex with white pores; medulla C- or C+ red PUNCTELIA
 14. Upper cortex without white pores; medulla C-..... PHYSCIA

III - SQUAMULOSE LICHENS

1. Fruiting body a perithecium PLACIDIUM
 1. Fruiting body an apothecium, or thallus sterile2.
 2(1). Photobiont a blue-green alga; thallus growing on thin soils over dolomite bedrock; apothecia immersed in upper surface..... HEPPIA
 2. Photobiont a green alga; thallus growing on sandy soil, clay, gravel, or bark; apothecia absent..... sterile CLADONIA

IV - STERILE CRUSTOSE LICHENS

1. Thallus leprose, entirely soresdiateLEPRARIA
 1. Thallus not entirely soresdiate, partially corticated.....2.
 2(1). Thallus lemon yellow, C-..... CANDELARIELLA
 2. Thallus greenish gray, C+ pink..... TRAPELIOPSIS

V - CRUSTOSE LICHENS WITH PERITHECIA

1. Thallus corticolous, thin, whitish or gray; spores 1-3 septate, with one larger cell.....
ANISOMERIDIUM
 1. Thallus saxicolous; thallus and spores not as above2.
 2(1). Thallus brown (or green when wet), squamulose; spores muriform ENDOCARPON
 2. Thallus white or gray, thick or thin, immersed in substrate or superficial; spores simple, non-septate VERRUCARIA

VI - CRUSTOSE LICHENS WITH APOTHECIA

1. Apothecia elongated or irregular; thallus a thin crust or a discoloration of the substrate2.
 1. Apothecia round, disk-like or perithecioid; thallus well developed to absent 3.
 2(1). Apothecial rim absent, apothecia blue pruinose; thallus leprose, entirely soresdiate
ARTHONIA
 2. Apothecia rim present, apothecia black; thallus a thin crust, esoresdiate
 OPEGRAPHA
 3(1). Apothecial rim thalloid, with algal cells4.
 3. Apothecial rim without algal cells9.
 4(3). Spores non-septate5.
 4. Spores polarilocular or 1-3 septate7.

- 5(4). Thallus areolate; apothecia usually immersed, becoming adnate with age, disk pruinose; on acidic rocks ASPICILIA
5. Thallus and apothecia not as above; on calcareous rocks or wood.....6.
- 6(5). Apothecia globose, perithecioid..... THELOCARPON
6. Apothecia disk-like LECANORA
- 7(4). Spores polarilocular; thallus and apothecia K+ violet CALOPLACA
7. Spores 1-3 septate; thallus and apothecia K-8.
- 8(7). Apothecia yellow CANDELARIELLA
8. Apothecia brown LECANIA
- 9(3). Asci with more than 8 spores SARCOGYNE
9. Asci with 8 spores10.
- 10(9). Spores brown, 1-septate AMANDINEA
10. Spores hyaline, 3-7 septate11.
- 11(10). Epithecium green in K; spores curved, acicular, 3-7 septate, 20-35 x 2-3 μm BACIDINA
11. Epithecium not green in K; spores straight, oblong ellipsoid, 3 septate, 11-19 x 3-4 μm BACIDIA

ANNOTATED SPECIES LIST

AMANDINEA M. Choisy ex Scheid. & H. Mayrh.

Amandinea punctata (Hoffm.) Coppins & Scheid.

Occasional on weathered wooden boards (#1684, #1693) and on the lower limbs of *Crataegus mollis* (#1640, #1650, #1672A, #1880).
= *Buellia schaeferi* in Calkins (1896).

ANISOMERIDIUM (Müll. Arg.) M. Choisy

Anisomeridium polypori (Ellis & Everh.) M. E. Barr

Frequent on the lower trunks of *Crataegus mollis* (1859), *Quercus alba* (#1632, #1659), *Q. rubra* and *Ulmus americana*. This species is often present on White Oak and Hawthorn where it gives the trunk its' grayish color.

The conidial state of this lichen is also represented here where it is occasionally found on the lower trunks of *Crataegus mollis* (#1869, #1873, #1876) and *Quercus rubra* (#1878).
= *Anisomeridium nyssigenum* in Wilhelm (1998).

ARTHONIA Ach.

Arthonia caesia (Flotow) Körber

Common on decorticate logs and on the lower trunks and limbs of a variety of trees including *Acer saccharum* (#1622). The blue-gray, pruinose apothecia and green leprose thallus are good diagnostic features of this lichen.

= *Arthonia lecideella* in Calkins (1896).

ASPICILIA A. Massal.

Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold

Rare on weathered granitic boulders (#1863).

BACIDIA De Not.

Bacidia coprodes (Körber) Lettau

Common on a granite boulder, dolomite (#1660, #1860) and a piece of bone in moist, shaded habitats.

BACIDINA Vèzda

Bacidina egenula (Nyl.) Vèzda

Rare on weathered dolomite (#1857), on limestone gravel (#1606) and weathered concrete (#1661) in moist, shaded habitats.

= *Biatora inundata* in Calkins (1896).

CALOPLACA Th. Fr.

References: Hyerczyk (2005)

1. Thallus a thin black or yellow crust, or a lobulate, areolate yellow crust, or not evident (growing within substrate); apothecial disk and margin yellow2.
1. Thallus a thick black, yellow or orange crust, areolate or lobulate4.
- 2(1). Thallus thin, yellow, lobulate or of small cracked areoles, or not evident; spores 14 x 7 μm , isthmus 2.8-4.2 μm *Caloplaca* species #1
- 2 Thallus a thin black or yellow crust, or not evident3.
- 3(2). Spores 14-15.4 μm x 5.6-7.0 μm , isthmus 1.4-2.8 μm *Caloplaca feracissima*
3. Spores 11.2-14.0 μm x 5.6-7.0 μm , isthmus 1.4-2.8 μm *Caloplaca cf. crenulatella*
- 4(1). Thallus yellow, lobed, continuous, but mostly around apothecia, apothecial disk and margin yellow; spores 9-13 μm x 5.5-7.0 μm , isthmus 3.5-4.5 μm *Caloplaca subsoluta*
4. Thallus a thick black, yellow, orange or yellow gray crust, areolate or lobulate5.
- 5(4). Thallus yellow to orange, apothecial disk orange to orange brown, margin orange to yellow; spores 9.8-12.6 μm x 5.6 μm , isthmus 4.2 μm *Caloplaca* species #2
5. Thallus black, yellow, yellow gray, apothecial disk orange, margin yellow to yellow gray; spores 9.8-11.0 μm x 5.6 μm , isthmus 2.8-4.2 μm *Caloplaca* species #3

Caloplaca cf. crenulatella H. Olivier

Common on weathered limestone gravel, pebbles (#1655, #1696), asphalt, dolomite (#1865, #1865A, #1868), concrete and caulking.

Caloplaca cf. feracissima H. Magn.

Rare on weathered dolomite (#1866) and a piece of bone (#1864).

Caloplaca subsoluta (Nyl.) Zahlbr.

Occasional on weathered concrete (#1616, #1638, #1667) and dolomite (#1871, #1871A).

Caloplaca species #1 *sensu* JMTA study

Rare on granite (#1875). Thallus thin, yellow, lobulate or of small cracked areoles, or not evident; spores 14 x 7 μm , isthmus 2.8-4.2 μm . This collection will require additional study before it is given a species name.

Caloplaca species #2 *sensu* JMTA study

Occasional on weathered concrete (#1646, #1670). Thallus yellow to orange, apothecial disk orange to orange brown, margin orange to yellow; spores 9.8-12.6 μm x 5.6 μm , isthmus 4.2 μm . This collection will require additional study before it is given a species name.

Caloplaca species #3 *sensu* JMTA study

Occasional on weathered concrete (#1617) and dolomite (#1877). Thallus black, yellow, yellow gray, apothecial disk orange, margin yellow to yellow gray; spores 9.8-11.0 μm x 5.6 μm , isthmus 2.8-4.2 μm . This collection will require additional study before it is given a species name.

CANDELARIA A. Massal.

Candelaria concolor (Dickson) Stein

Common on the pads of prickly pear cactus (*Opuntia humifusa* (#1855)), rusted metal, weathered asphalt, wood, granite, concrete, dolomite, calcareous gravel, decorticate logs and on the trunks and lower limbs of a variety of trees including *Maclura pomifera* (#1634) and *Ulmus americana* (#1630). Totally sorediate forms of this lichen, referred to as *Candelaria concolor* var. *effusa* (Tuck.) Burnham may intergrade with this species.

= *Teloschistes concolor* in Calkins (1896).

CANDELARIELLA Müll. Arg.

References: Harris & Buck (1978), Thomson (2003).

1. Thallus consisting of round, flattened, sorediate areoles; apothecia rare
..... *Candelariella reflexa*
1. Thallus lacking or not evident (growing within substrate); apothecia common; spores simple, 12.5 x 7.5 μm long, eight per ascus *Candelariella aurella*

Candelariella aurella (Hoffm.) Zahlbr.

Frequent on weathered concrete (#1607). This lichen could be mistaken for another crustose lichen, *Caloplaca cf. feracissima* H. Magn, which has K+ violet apothecia and polarilocular spores.

Candelariella reflexa (Nyl.) Lettau.

Common on weathered wood fence posts (#1671) and on the lower limbs and trunks of *Carya cordiformis*, *Crataegus mollis* (#1623, #1628), *Fraxinus pennsylvanica* var. *subintegerrima* and *Populus deltoides*. *Candelariella reflexa* is a western species that has 8 spores per ascus. *C. efflorescens* R. C. Harris & W. R. Buck, is an eastern species with 32 spores per ascus. Based on thallus characters alone, the two species are virtually indistinguishable in their sterile conditions. Since fertile specimens from the Chicago region have 8 spores per ascus all sterile collections are defaulted to *C. reflexa*. For further discussion see Wilhelm, (1998).

CLADONIA P. Browne

References: Hale (1979), Wilhelm (1998).

1. Podetia occasionally forming cups; podetia mostly sorediate towards upper half
..... *Cladonia subulata*
1. Podetia not forming cups, or podetia absent; podetia, if present, sorediate or not2.
2(1). Podetia absent3.
2. Podetia present4.
- 3(2). Squamules 2-3 mm long, K+ yellow turning to red *Cladonia polycarpoides*
3. Squamules less than 2 mm long, K- *Cladonia macilenta* var. *bacillaris*
- 4.(2) Podetia esorediate5.
4. Podetia sorediate7.
- 5(4). Apothecia red *Cladonia cristatella*
5. Apothecia brown6.
6(5). Podetia and squamules K+ yellow turning to red; podetia 0.5-1.5 cm tall
..... *Cladonia polycarpoides*
6. Podetia and squamules K-; podetia 1-1.5 cm tall *Cladonia peziziformis*
- 7(4). Apothecia red; squamules less than 2 mm long *Cladonia macilenta* var. *bacillaris*
7. Apothecia brown8.
8(7). Squamules 2-5 mm long *Cladonia coniocraea*
8. Squamules 2mm or less long9.
- 9(8). Tips of podetia rounded, club-shaped, or blunt, the base with coarse isidioid granules
..... *Cladonia cylindrica*
9. Tips of podetia pointed, soredia farinose, fine and powdery *Cladonia subulata*

Cladonia coniocraea (Flörke) Sprengel

Rare on a weathered stump in a shaded oak woodland (#1687). The podetia arising from squamules are good field characteristics.
= *Cladonia fimbriata* in Calkins (1896).

Cladonia cristatella Tuck.

Rare on a weathered, moss covered log (#1659A). This is the “British Soldier” lichen.
= *Cladonia cristatella* in Calkins (1896).

Cladonia cylindrica (A. Evans) A. Evans

Rare at the base of *Crataegus mollis* (#1697).

Cladonia macilenta var. *bacillaris* (Genth) Schaerer

Occasional on weathered wood and on the lower trunks and branches of *Crataegus mollis* (#1690) and *Quercus macrocarpa*.
= *Cladonia macilenta* in Calkins (1896).

Cladonia peziziformis (With.) J. R. Laundon

Occasional on sandy and clay soil (#1681) with *Festuca obtusa*, *Fragaria virginiana* and *Trifolium repens* as vascular plant associates.
= *Cladonia mitrula* in Calkins (1896).

Cladonia polycarpoides Nyl.

Rare on gravel and soil with *Asclepias verticillata*, *Melilotus alba* and *Poa compressa* as vascular plant associates (#1673).

Cladonia subulata (L.) F. H. Wigg.

Rare on a lower branch of *Crataegus mollis* (#1691).

DERMATOCARPON Eschw.***Dermatocarpon miniatum*** (L.) W. Mann

Rare on weathered dolomite (#1675, #1856).
= *Endocarpon miniatum* in Calkins (1896).

ENDOCARPON Hedwig***Endocarpon pallidulum*** (Nyl.) Nyl.

Common on weathered granite, dolomite, concrete (#1625A, #1665, #1666), aluminum foil (#1760) and a rusted bolt. This species, which lack rhizines, is similar to *E. pusillum* Hedw., a species with rhizines on the lower surface.

FLAVOPARMELIA Hale***Flavoparmelia caperata*** (L.) Hale

Common on decorticate logs and on the lower limbs and trunks of *Carya ovata*, *Crataegus mollis* (#1618), *Fraxinus pennsylvanica* var. *subintegerrima*, *Gleditsia triacanthos* and *Populus deltoides*.
= *Parmelia caperata* in Calkins (1896).

FLAVOPUNCTELIA (Krog) Hale***Flavopunctelia soledica*** (Nyl.) Hale

Rare on a lower branch of *Crataegus mollis* (#1686). The C+ red reaction of the medulla separates this genus from *Flavoparmelia*.

HEPPIA Nägeli

Heppia adglutinata (Kremp.) A. Massal.

Rare on shallow gravel soil over dolomite (#1609).

= *Heppia despreauxii* in Calkins (1896).

HYPERPHYSICIA Müll. Arg.

Hyperphyscia adglutinata (Flörke) H. Mayrh. & Poelt

Frequent on the lower trunks of *Acer negundo*, *A. saccharinum* (#1658A), *Celtis occidentalis*, *Fraxinus pennsylvanica* var. *subintegerrima*, *Populus deltoides* (#1658), *Quercus macrocarpa*, *Q. velutina*, *Salix nigra*, *Ulmus americana* and *U. pumila*. This foliose species can be mistaken for a crustose lichen as it lacks rhizines and is tightly appressed to the bark.

= *Physcia adglutinata* in Calkins (1896).

LECANIA A. Massal.

Lecania perproxima (Nyl.) Zahlbr.

Occasional on weathered dolomite (#1613) and limestone (#1862). This lichen may be confused with the genus *Lecanora*, which has simple, hyaline spores, while *Lecania* has 1-septate, brown spores.

= *Lecanora perproxima* in Calkins (1896).

LECANORA Ach.

References: Brodo, I.M., S. D. Sharnoff, and S. Sharnoff (2001).

- | | | |
|-------|---|-----------------------------|
| 1. | Thallus saxicolous (rarely corticolous or on miscellaneous substrates) | 2. |
| 1. | Thallus corticolous or lignicolous | 3. |
| 2(1). | Thallus areolate, with lobed margins, yellow green; apothecia 0.5-2 mm in diameter, disk yellow or brown, margin concolorous with thallus | <i>Lecanora muralis</i> |
| 2. | Thallus thin, whitish gray or lacking; apothecia 0.5-1.2 mm in diameter, disk brownish, margin white | <i>Lecanora dispersa</i> |
| 3(1). | Thallus thin, without yellowish tints or lacking; apothecia to 0.5 mm broad, disk often pruinose | <i>Lecanora cf. umbrina</i> |
| 3. | Thallus yellowish green; apothecia 0.8-1 mm broad, disk epruinose | 4. |
| 4(3). | Apothecia irregular, rim disappearing with age | <i>Lecanora symmicta</i> |
| 4. | Apothecia round, rim ecorticate, appearing sorediate or granular | <i>Lecanora strobilina</i> |

Lecanora dispersa (Pers.) Sommerf.

Common on *Opuntia humifusa* (#1881), a rusted screw, sandstone (#1642), weathered dolomite (#1639), weathered concrete, a piece of bone, granite and asphalt.

Lecanora muralis (Schreber) Rabenh.

Rare on weathered concrete (#1637) and weathered dolomite (#1610).

Lecanora strobilina (Sprengel) Kieffer

Occasional on the lower trunks of *Carya ovata* (#1629) and *Quercus macrocarpa* (#1879).

Lecanora symmicta (Ach.) Ach.

Rare on the lower limbs of *Crataegus mollis* (#1627).

= *Lecanora varia* var. *symmicta* in Calkins (1896).

Lecanora cf. umbrina (Ach.) A. Massal.

Rare on weathered wood (#1858).

LEPRARIA Ach.

Reference: Wilhelm (1998).

1. Thallus thick, greenish white *Lepraria lobificans*
1. Thallus thin, bluish *Lepraria* species #1 *sensu* Morton Arboretum Herbarium

Lepraria lobificans Nyl.

Common on mosses and on the lower trunks of a variety of trees including *Crataegus mollis* (#1641, #1874).

***Lepraria* species #1 *sensu* Morton Arboretum Herbarium**

Rare on the lower trunk of *Quercus rubra* (#1619, #1620).

MELANELIXIA O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch***Melanelixia subaurifera*** (Nyl.) O. Blanco et al.

Occasional on the lower limbs of a variety of trees, including *Gleditsia triacanthos* (#1683).
= *Melanelia subaurifera* in Wilhelm (1998).

OPEGRAPHA Ach.***Opegrapha atra*** Pers.

Occasional on the lower trunk of *Ulmus americana* (#1631, #1662).
= *Opegrapha atra* in Calkins (1896).

PARMELIA Ach.***Parmelia sulcata*** Taylor

Common on decorticate logs and wooden fence posts, and on the trunks and limbs of a variety of trees including *Gleditsia triacanthos* (#1624).
= *Parmelia saxatilis* var. *sulcata* in Calkins (1896).

PARMOTREMA A. Massal.

Reference: Hale (1974).

1. Cortex distinctly white maculate; lower surface margin white or mottled brownish white; upper cortex without reticulate cracks *Parmotrema hypotropum*
1. Cortex dull, emaculate; lower surface margin mostly brown or black; upper cortex reticulately cracked *Parmotrema reticulatum*

Parmotrema hypotropum (Nyl.) Hale

Frequent on the trunks and lower limbs of *Acer saccharinum*, *Crataegus mollis* (#1679, #1695) and *Gleditsia triacanthos* (#1682).

Parmotrema reticulatum (Taylor) M. Choisy

Occasional on the lower limbs of *Crataegus mollis* (#1672).
= *Parmelia perlata* in Calkins (1896).
= *Rimelia reticulata* in Wilhelm (1998).

PHAEOCALICIUM A. F. W. Schmidt***Phaeocalicium polyporaeum*** (Nyl.) Tibell

Rare on the polyporous fungus, *Trichaptum bifforme* (Fr.) Ryvarden, which was growing on *Prunus serotina* (#1648).

PHAEOPHYSCIA Moberg

Reference: Esslinger (1978).

- | | | |
|-------|--|----------------------------------|
| 1. | Thallus esorediate | <i>Phaeophyscia ciliata</i> |
| 1. | Thallus soresiate | 2. |
| | 2(1). Medulla orange-red | <i>Phaeophyscia rubropulchra</i> |
| | 2. Medulla white | 3. |
| 3(2). | Lobe tips of thallus with pale, cortical hairs | <i>Phaeophyscia hirsuta</i> |
| 3. | Lobe tips lacking cortical hairs | 4. |
| | 4(3). Soralia capitate; soredia farinose or of fine granules | <i>Phaeophyscia pusilloides</i> |
| | 4. Soredia terminal; soredia coarse granular to isidioid | <i>Phaeophyscia adiaistola</i> |

Phaeophyscia adiaistola (Essl.) Essl.

Rare on weathered dolomite (#1657), moss covered decorticate logs (#1861), and on the lower trunks of *Acer negundo* and *Fraxinus pennsylvanica* var. *subintegerrima*.

Phaeophyscia ciliata (Hoffm.) Moberg

Common on the lower trunks of *Acer negundo* (#1654), *Fraxinus pennsylvanica* var. *subintegerrima* and *Populus deltoides*.

= *Physcia obscura* in Calkins (1896).

Phaeophyscia hirsuta (Mereschk.) Essl.

Frequent on weathered concrete and dolomite and on the lower trunks of *Acer negundo* (#1647), *Fraxinus pennsylvanica* var. *subintegerrima* and *Populus deltoides*. The pale, cortical hairs along the edge of the thallus are good field characteristics.

= *Phaeophyscia cernohorskyi* in Wilhelm (1998).

Phaeophyscia pusilloides (Zahlbr.) Essl.

Common on weathered limestone, granite, dolomite and concrete, and on the lower trunks and limbs of a variety of trees including *Populus deltoides* (#1645) and *Ulmus americana* (#1680).

Phaeophyscia rubropulchra (Degel.) Essl.

Common on decorticate logs and on the lower trunks or bases of a variety of trees including *Crataegus mollis* (#1625). Although the orange-red medulla of this lichen is distinctive, some parts are occasionally white.

PHYSICIA (Schreber) Michaux

Reference: Thomson (1963).

- | | | |
|-------|--|---------------------------|
| 1. | Thallus esorediate | <i>Physcia stellaris</i> |
| 1. | Thallus soresiate | 2. |
| | 2(1). Tips of lobes inflated and hood-shaped, ciliate; soredia under the lobes | <i>Physcia adscendens</i> |
| | 2. Tips of lobes neither hood-shaped nor ciliate; soredia along margins of lobes | 3. |
| 3(2). | Thallus saxicolous; lobes 0.1-0.2 mm wide; medulla KOH+ yellow | <i>Physcia subtilis</i> |
| 3. | Thallus corticolous, rarely saxicolous; lobes up to 1 mm wide; medulla KOH- | <i>Physcia millegrana</i> |

Physcia adscendens (Fr.) H. Olivier

Common on dolomite gravel and on the trunks of a variety of trees including *Populus deltoides* (#1643).

Physcia millegrana Degel.

Common on rusted metal, weathered concrete, granite, wood, decorticate moss covered logs, and on the trunks and limbs of a variety of trees including *Maclura pomifera* (#1635) and *Ulmus americana* (#1669).

= *Physcia tribacia* in Calkins (1896).

Physcia stellaris (L.) Nyl.

Common on dolomite, granite, rusted metal, weathered wood and decorticate logs and on the trunks and limbs of a variety of trees including *Crataegus mollis* (#1621), *Maclura pomifera* (#1636) and *Ulmus americana* (#1668).

= *Physcia stellaris* in Calkins (1896).

Physcia subtilis Degel.

Occasional on granite erratics (#1611) in full sun.

PHYSIELLA Essl.***Physciella chloantha*** (Ach.) Essl.

Common on weathered concrete, dolomite and granite erratics, and on the trunks of a variety of trees including *Acer negundo* (#1652a) and *Fraxinus pennsylvanica* var. *subintegerrima* (#1652, #1664b).

PHYSCONIA Poet***Physconia leucoleiptes*** (Tuck.) Essl.

Frequent on the trunks of a variety of trees including *Acer negundo* (#1633). Easily recognized in the field by the pruinose lobes.

= *Physconia detersa* in Wilhelm (1998).

PLACIDIUM A. Massal. (Breuss)***Placidium lachneum*** (Ach.) Breuss

Rare on shallow soil over dolomite (#1608).

= *Endocarpon hepaticum* in Calkins (1896).

= *Catapyrenium squamulosum* in Wilhelm (1998).

PUNCTELIA Krog

References: Aptroot (2003), Krog (1982), Wilhelm & Ladd (1992).

- | | | |
|-------|---|--------------------------------|
| 1. | Thallus without isidia or soredia; medulla C- | <i>Punctelia bolliana</i> |
| 1. | Thallus isidiate or sorediate; medulla C+ red | 2. |
| 2(1). | Thallus isidiate | <i>Punctelia rudecta</i> |
| 2. | Thallus sorediate | <i>Punctelia missouriensis</i> |

Punctelia bolliana (Müll. Arg.) Krog

Occasional on the lower trunks of *Quercus alba* (#1688) and *Q. macrocarpa*.

Punctelia missouriensis G. Wilh. & Ladd

Rare on the lower trunk of *Crataegus mollis* (#1689).

Punctelia rudecta (Ach.) Krog

Common on a decorticate log and on the lower trunks of *Carya ovata*, *Crataegus mollis*, *Quercus alba* (#1653, #1649), and *Q. rubra*.

= *Punctelia borreri* var. *rudecta* in Calkins (1896).

SARCOGYNE Flotow***Sarcogyne regularis*** Körber

Frequent on weathered dolomite, granite, sandstone, and pebbles (#1651, #1614).
= *Lecanora privigna* var. *pruinosa* in Calkins (1896).

THELOCARPON Nyl. *ex* Hue***Thelocarpon laureri*** (Flotow) Nyl.

Rare on weathered wooden boards (#1685).

TRAPELIOPSIS Hertel & Gotth. Schneider***Trapelopsis flexuosa*** (Fr.) Coppins & P. James

Frequent on decorticate logs and on weathered wood posts (#1644, #1694, #1872).

USNEA Dill. *ex* Adans.***Usnea strigosa*** (Ach.) Eaton subsp. *major* (Michaux) I. Tav.

Rare on a lower limb of *Crataegus mollis* (#1692).

VERRUCARIA Schrader

Reference: Thomson (2003).

- | | | |
|-------|--|-------------------------------|
| 1. | Thallus immersed in rock..... | 2. |
| 1. | Thallus superficial on rocks, areolate | 3. |
| | 2(1). Perithecia embedded in calcareous rock, thallus scant, white; involucrellum scant;
spores 18-28 μm x 9-14 μm | <i>Verrucaria calciseda</i> |
| | 2. Perithecia partly immersed in rock, thallus ashy, involucrellum hemispherical, black;
apex thick; spores 19-24 μm x 11-12 μm | <i>Verrucaria calkinsiana</i> |
| 3(1). | Involucrellum black, merging with black lower layers of thallus; perithecia 1-3 per areole;
spores 12-14 μm x 6-7 μm | <i>Verrucaria fayettensis</i> |
| 3. | Involucrellum thick, spherical; perithecia immersed in centers of areoles; spores 10-16 μm x
5-7 μm | <i>Verrucaria fuscella</i> |

Verrucaria calciseda DC.

Rare on weathered dolomite (#1674).

Verrucaria calkinsiana Servit

Frequent on *Opuntia humifusa* and on weathered limestone, granite, and dolomite (#1615, #1870)
and calcareous pebbles (#1663).
= *Verrucaria muralis* in Calkins (1896).

Verrucaria fayettensis Servit

Rare on weathered dolomite (#1676, #1867).
= *Verrucaria viridula* in Calkins (1896).

Verrucaria fuscella (Turner) Winch

Rare on weathered concrete.

XANTHOMENDOZA S. Kondr. & Kärnefelt

Reference: Lindblom, 2006

1. Thallus cushion-like, often forming extensive colonies; thallus thin, delicate, lobes narrow; rhizines absent or sparse, usually not visible from above; soredia formed at lobe tips, powdery *Xanthomendoza fulva*
1. Thallus rosette-like +/- distinct; rhizines usually abundant, visible from above or not; soredia not as above 2.
- 2(1). Soredia formed in marginal crescent-shaped slits between the upper and lower cortex; lobes adnate to loosely adnate *Xanthomendoza fallax*
2. Soredia marginal or submarginal from cortex, rarely laminal; lobes loosely adnate to raised *Xanthomendoza ulophyllodes*

Xanthomendoza fallax (Hepp ex Arnold) Søchting, Kärnefelt & S. Kondr.

Common on weathered wood fence posts and on the trunks of a variety of trees including *Acer negundo* (#1656).

= *Xanthoria fallax* in Wilhelm (1998).

Xanthomendoza fulva (Hoffm.) Søchting, Kärnefelt & S. Kondr.

Frequent on weathered concrete and on the trunks of *Acer negundo*, *Crataegus mollis* (#1664a), *Fraxinus pennsylvanica* var. *subintegerrima*, *Populus deltoides*, *Quercus alba*, *Q. macrocarpa* and *Ulmus pumila*.

= *Theloschistes lychneus* in Calkins (1896).

= *Xanthoria* sp. #1 in Wilhelm (1998).

Xanthomendoza ulophyllodes (Räsänen) Søchting, Kärnefelt & S. Kondr.

Frequent on the trunks of *Acer negundo*, *Crataegus mollis* (#1664), *Fraxinus pennsylvanica* var. *subintegerrima*, *Populus deltoides*, *Quercus alba*, *Q. macrocarpa* and *Ulmus pumila*.

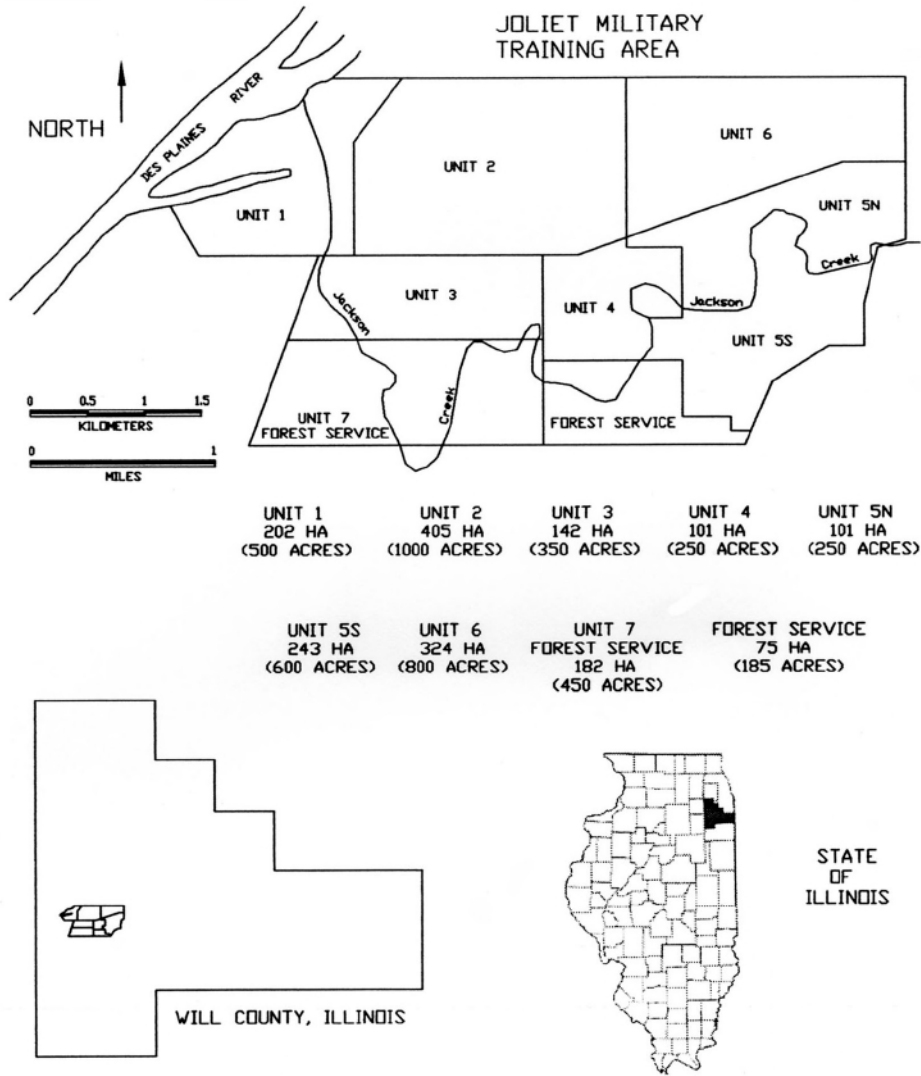
XANTHORIA (Fr.) Th. Fr.

Xanthoria polycarpa (Hoffm.) Th. Fr. ex Rieber

Rare on a lower limb of *Tilia americana* (#1626).

= *Theloschistes parietinus* in Calkins (1896).

Figure 1. Map of the Joliet Military Training Area.



Appendix I. A list of the lichen substrates and the lichens associated with them.

Tree species/substrate	Lichen Species						
	<i>Amandinea punctata</i>	<i>Anisomeridium polypori</i>	<i>Arthona caesia</i>	<i>Aspicilia caesiocinerea</i>	<i>Bacidia coprodes</i>	<i>Bacidina egenula</i>	<i>Caloplaca</i> species #1
<i>Acer negundo</i>			X				
<i>Acer nigrum</i>							
<i>Acer saccharinum</i>			X				
<i>Acer saccharum</i>			X				
<i>Carya cordiformis</i>			X				
<i>Carya ovata</i>			X				
<i>Celtis occidentalis</i>			X				
<i>Cornus stolonifera</i>							
<i>Crataegus crus-galli</i>			X				
<i>Crataegus mollis</i>	X	X	X				
<i>Fraxinus pennsylvanica</i>			X				
var. <i>subintegerrima</i>							
<i>Gleditsia triacanthos</i>			X				
<i>Juglans nigra</i>							
<i>Lonicera</i> species							
<i>Maclura pomifera</i>			X				
<i>Malus pumila</i>			X				
<i>Morus alba</i>			X				
<i>Opuntia humifusa</i>							
<i>Ostrya virginiana</i>							
<i>Parthenocissus quinquefolia</i>			X				
<i>Platanus occidentalis</i>							
<i>Populus alba</i>							
<i>Populus deltoides</i>			X				
<i>Prunus serotina</i>			X				
<i>Prunus virginiana</i>			X				
<i>Quercus alba</i>		X	X				
<i>Quercus coccinea</i>			X				
<i>Quercus imbricaria</i>							
<i>Quercus macrocarpa</i>			X				
<i>Quercus rubra</i>		X	X				
<i>Quercus velutina</i>							
<i>Rhamnus cathartica</i>			X				
<i>Rhus glabra</i>			X				
<i>Rhus radicans</i>							
<i>Ribes missouriensis</i>							
<i>Rosa multiflora</i>			X				
<i>Salix interior</i>			X				
<i>Salix nigra</i>			X				
<i>Trichaptum bifforme</i>							
<i>Tilia americana</i>			X				
<i>Ulmus americana</i>		X					
<i>Ulmus pumila</i>							
<i>Ulmus rubra</i>							
<i>Viburnum</i> species							
<i>Vitis riparia</i>			X				
clay							
moss							
asphalt							
sand and gravel							
sandstone							
limestone					X		
soil over dolomite							
decorticate logs			X				
rusted steel							
bone					X		
aluminum foil							
caulking							
granite				X	X		
wood	X						
concrete					X		X
Dolomite, pebbles, gravel					X	X	

Tree species/substrate	Lichen Species						
	<i>Caloplaca</i> species #2	<i>Caloplaca</i> species #3	<i>Caloplaca</i> <i>cf. crenulatella</i>	<i>Caloplaca</i> <i>cf. feracissima</i>	<i>Caloplaca</i> <i>subsoluta</i>	<i>Candelaria</i> <i>concolor</i>	<i>Candelariella</i> <i>aurella</i>
<i>Acer negundo</i>						X	
<i>Acer nigrum</i>						X	
<i>Acer saccharinum</i>						X	
<i>Acer saccharum</i>						X	
<i>Carya cordiformis</i>						X	
<i>Carya ovata</i>						X	
<i>Celtis occidentalis</i>						X	
<i>Cornus stolonifera</i>						X	
<i>Crataegus crus-galli</i>						X	
<i>Crataegus mollis</i>						X	
<i>Fraxinus</i>						X	
<i>pennsylvanica</i>						X	
var. <i>subintegerrima</i>						X	
<i>Gleditsia triacanthos</i>						X	
<i>Juglans nigra</i>						X	
<i>Lonicera</i> species						X	
<i>Maclura pomifera</i>						X	
<i>Malus pumila</i>						X	
<i>Morus alba</i>						X	
<i>Opuntia humifusa</i>						X	
<i>Ostrya virginiana</i>						X	
<i>Parthenocissus</i>						X	
<i>quinquefolia</i>						X	
<i>Platanus occidentalis</i>						X	
<i>Populus alba</i>						X	
<i>Populus deltoides</i>						X	
<i>Prunus serotina</i>						X	
<i>Prunus virginiana</i>						X	
<i>Quercus alba</i>						X	
<i>Quercus coccinea</i>						X	
<i>Quercus imbricaria</i>						X	
<i>Quercus macrocarpa</i>						X	
<i>Quercus rubra</i>						X	
<i>Quercus velutina</i>						X	
<i>Rhamnus cathartica</i>						X	
<i>Rhus glabra</i>						X	
<i>Rhus radicans</i>						X	
<i>Ribes missouriensis</i>						X	
<i>Rosa multiflora</i>						X	
<i>Salix interior</i>						X	
<i>Salix nigra</i>						X	
<i>Trichaptum bifforme</i>						X	
<i>Tilia americana</i>						X	
<i>Ulmus americana</i>						X	
<i>Ulmus pumila</i>						X	
<i>Ulmus rubra</i>						X	
<i>Viburnum</i> species						X	
<i>Vitis riparia</i>						X	
clay						X	
moss						X	
asphalt			X			X	
sand and gravel						X	
sandstone						X	
limestone			X			X	
soil over dolomite						X	
decorticate logs						X	
rusted steel						X	
bone				X		X	
aluminum foil						X	
caulking			X			X	
granite	X					X	
wood						X	
concrete		X	X		X	X	X
Dolomite, pebbles,		X	X	X	X	X	
gravel						X	

Tree species/substrate	Lichen Species					
	<i>Candelariella reflexa</i>	<i>Cladonia coniocraea</i>	<i>Cladonia cristatella</i>	<i>Cladonia cylindrica</i>	<i>Cladonia mac. var. bac.</i>	<i>Cladonia peziziformis polycarpoides</i>
<i>Acer negundo</i>						
<i>Acer nigrum</i>						
<i>Acer saccharinum</i>						
<i>Acer saccharum</i>						
<i>Carya cordiformis</i>	X					
<i>Carya ovata</i>						
<i>Celtis occidentalis</i>						
<i>Cornus stolonifera</i>						
<i>Crataegus crus-galli</i>						
<i>Crataegus mollis</i>	X			X	X	
<i>Fraxinus pennsylvanica</i>	X					
var. <i>subintegerrima</i>						
<i>Gleditsia triacanthos</i>						
<i>Juglans nigra</i>						
<i>Lonicera</i> species						
<i>Maclura pomifera</i>						
<i>Malus pumila</i>						
<i>Morus alba</i>						
<i>Opuntia humifusa</i>						
<i>Ostrya virginiana</i>						
<i>Parthenocissus quinquefolia</i>						
<i>Platanus occidentalis</i>						
<i>Populus alba</i>						
<i>Populus deltoides</i>	X					
<i>Prunus serotina</i>						
<i>Prunus virginiana</i>						
<i>Quercus alba</i>						
<i>Quercus coccinea</i>						
<i>Quercus imbricaria</i>					X	
<i>Quercus macrocarpa</i>						
<i>Quercus rubra</i>						
<i>Quercus velutina</i>						
<i>Rhamnus cathartica</i>						
<i>Rhus glabra</i>						
<i>Rhus radicans</i>						
<i>Ribes missouriensis</i>						
<i>Rosa multiflora</i>						
<i>Salix interior</i>						
<i>Salix nigra</i>						
<i>Trichaptum bifforme</i>						
<i>Tilia americana</i>						
<i>Ulmus americana</i>						
<i>Ulmus pumila</i>						
<i>Ulmus rubra</i>						
<i>Viburnum</i> species						
<i>Vitis riparia</i>						
clay					X	
moss			X			
asphalt						
sand and gravel						X
sandstone						
limestone						
soil over dolomite						
decorticate logs		X				
rusted steel						
bone						
aluminum foil						
caulking						
granite						
wood	X				X	
concrete						
Dolomite, pebbles, gravel						

Tree species/substrate	Lichen Species						
	<i>Cladonia subulata</i>	<i>Dermatocarpon miniatum</i>	<i>Endocarpon pallidulum</i>	<i>Flavoparmelia caperata</i>	<i>Flavopunctelia sore dica</i>	<i>Heppia adglutinata</i>	<i>Hyperphyscia adglutinata</i>
<i>Acer negundo</i>							X
<i>Acer nigrum</i>							
<i>Acer saccharinum</i>							X
<i>Acer saccharum</i>							
<i>Carya cordiformis</i>							
<i>Carya ovata</i>				X			
<i>Celtis occidentalis</i>							X
<i>Cornus stolonifera</i>							
<i>Crataegus crus-galli</i>							
<i>Crataegus mollis</i>	X			X	X		
<i>Fraxinus pennsylvanica</i>				X			X
var. <i>subintegerrima</i>							
<i>Gleditsia triacanthos</i>				X			
<i>Juglans nigra</i>							
<i>Lonicera</i> species							
<i>Maclura pomifera</i>							
<i>Malus pumila</i>							
<i>Morus alba</i>							
<i>Opuntia humifusa</i>							
<i>Ostrya virginiana</i>							
<i>Parthenocissus quinquefolia</i>							
<i>Platanus occidentalis</i>							
<i>Populus alba</i>							
<i>Populus deltoides</i>				X		X	
<i>Prunus serotina</i>							
<i>Prunus virginiana</i>							
<i>Quercus alba</i>							
<i>Quercus coccinea</i>							
<i>Quercus imbricaria</i>							
<i>Quercus macrocarpa</i>							X
<i>Quercus rubra</i>							
<i>Quercus velutina</i>							X
<i>Rhamnus cathartica</i>							
<i>Rhus glabra</i>							
<i>Rhus radicans</i>							
<i>Ribes missouriensis</i>							
<i>Rosa multiflora</i>							
<i>Salix interior</i>							
<i>Salix nigra</i>							X
<i>Trichaptum bifforme</i>							
<i>Tilia americana</i>							
<i>Ulmus americana</i>							X
<i>Ulmus pumila</i>							X
<i>Ulmus rubra</i>							
<i>Viburnum</i> species							
<i>Vitis riparia</i>							
clay							
moss							
asphalt							
sand and gravel							
sandstone							
limestone							
soil over dolomite						X	
decorticate logs				X			
rusted steel			X				
bone							
aluminum foil			X				
caulking							
granite			X				
wood							
concrete			X				
Dolomite, pebbles, gravel		X	X				

Tree species/substrate	Lichen Species						
	<i>Lecania perproxima</i>	<i>Lecanora dispersa</i>	<i>Lecanora muralis</i>	<i>Lecanora strobilina</i>	<i>Lecanora symmicta</i>	<i>Lecanora cf. umbrina</i>	<i>Lepraria lobificans</i>
<i>Acer negundo</i>							
<i>Acer nigrum</i>							
<i>Acer saccharinum</i>							
<i>Acer saccharum</i>							
<i>Carya cordiformis</i>							
<i>Carya ovata</i>				X			
<i>Celtis occidentalis</i>							
<i>Cornus stolonifera</i>							
<i>Crataegus crus-galli</i>							
<i>Crataegus mollis</i>					X		X
<i>Fraxinus pennsylvanica</i>							
var. <i>subintegerrima</i>							
<i>Gleditsia triacanthos</i>							
<i>Juglans nigra</i>							
<i>Lonicera</i> species							
<i>Maclura pomifera</i>							
<i>Malus pumila</i>							
<i>Morus alba</i>							
<i>Opuntia humifusa</i>		X					
<i>Ostrya virginiana</i>							
<i>Parthenocissus quinquefolia</i>							
<i>Platanus occidentalis</i>							
<i>Populus alba</i>							
<i>Populus deltoides</i>							
<i>Prunus serotina</i>							
<i>Prunus virginiana</i>							
<i>Quercus alba</i>							X
<i>Quercus coccinea</i>							
<i>Quercus imbricaria</i>							
<i>Quercus macrocarpa</i>				X			X
<i>Quercus rubra</i>							X
<i>Quercus velutina</i>							
<i>Rhamnus cathartica</i>							X
<i>Rhus glabra</i>							
<i>Rhus radicans</i>							
<i>Ribes missouriensis</i>							
<i>Rosa multiflora</i>							
<i>Salix interior</i>							
<i>Salix nigra</i>							X
<i>Trichaptum bifforme</i>							
<i>Tilia americana</i>							
<i>Ulmus americana</i>							X
<i>Ulmus pumila</i>							
<i>Ulmus rubra</i>							
<i>Viburnum</i> species							
<i>Vitis riparia</i>							X
clay							X
moss							
asphalt		X					
sand and gravel							
sandstone		X					
limestone	X						
soil over dolomite							
decorticate logs							
rusted steel		X					
bone		X					
aluminum foil							
caulking							
granite		X					
wood						X	
concrete		X	X				
Dolomite, pebbles, gravel	X	X	X				

Tree species/substrate	Lichen Species						
	<i>Lepraria</i> species #1	<i>Melanelixia</i> <i>subaurifera</i>	<i>Opegrapha</i> <i>atra</i>	<i>Parmelia</i> <i>sulcata</i>	<i>Parmotrema</i> <i>hypotropum</i>	<i>Parmotrema</i> <i>reticulatum</i>	<i>Phaeocalicium</i> <i>polyporaeum</i>
<i>Acer negundo</i>							
<i>Acer nigrum</i>							
<i>Acer saccharinum</i>				X	X		
<i>Acer saccharum</i>							
<i>Carya cordiformis</i>							
<i>Carya ovata</i>							
<i>Celtis occidentalis</i>				X			
<i>Cornus stolonifera</i>							
<i>Crataegus crus-galli</i>							
<i>Crataegus mollis</i>		X		X	X	X	
<i>Fraxinus</i>							
<i>pennsylvanica</i>		X		X	X		
var. <i>subintegerrima</i>							
<i>Gleditsia triacanthos</i>		X		X	X		
<i>Juglans nigra</i>				X			
<i>Lonicera</i> species							
<i>Maclura pomifera</i>				X			
<i>Malus pumila</i>							
<i>Morus alba</i>							
<i>Opuntia humifusa</i>							
<i>Ostrya virginiana</i>							
<i>Parthenocissus</i>							
<i>quinquefolia</i>							
<i>Platanus occidentalis</i>				X			
<i>Populus alba</i>							
<i>Populus deltoides</i>				X			
<i>Prunus serotina</i>							
<i>Prunus virginiana</i>							
<i>Quercus alba</i>							
<i>Quercus coccinea</i>							
<i>Quercus imbricaria</i>							
<i>Quercus macrocarpa</i>							
<i>Quercus rubra</i>	X			X	X		
<i>Quercus velutina</i>							
<i>Rhamnus cathartica</i>							
<i>Rhus glabra</i>				X			
<i>Rhus radicans</i>							
<i>Ribes missouriensis</i>							
<i>Rosa multiflora</i>							
<i>Salix interior</i>							
<i>Salix nigra</i>				X			
<i>Trichaptum bifforme</i>							X
<i>Tilia americana</i>							
<i>Ulmus americana</i>			X	X			
<i>Ulmus pumila</i>							
<i>Ulmus rubra</i>							
<i>Viburnum</i> species							
<i>Vitis riparia</i>				X			
clay							
moss							
asphalt							
sand and gravel							
sandstone							
limestone							
soil over dolomite							
decorticate logs				X			
rusted steel							
bone							
aluminum foil							
caulking							
granite							
wood				X			
concrete							
Dolomite, pebbles, gravel							

Tree species/substrate	Lichen Species						
	<i>Phaeophyscia adiastrata</i>	<i>Phaeophyscia ciliata</i>	<i>Phaeophyscia hirsuta</i>	<i>Phaeophyscia pusilloides</i>	<i>Phaeophyscia rubropulchra</i>	<i>Physcia adscendens</i>	<i>Physcia millegrana</i>
<i>Acer negundo</i>	X	X	X	X	X		X
<i>Acer nigrum</i>							X
<i>Acer saccharinum</i>							X
<i>Acer saccharum</i>					X		X
<i>Carya cordiformis</i>							X
<i>Carya ovata</i>					X		X
<i>Celtis occidentalis</i>				X	X		X
<i>Cornus stolonifera</i>							
<i>Crataegus crus-galli</i>							X
<i>Crataegus mollis</i>				X	X	X	X
<i>Fraxinus pennsylvanica</i>	X	X	X	X	X	X	X
var. <i>subintegerrima</i>							
<i>Gleditsia triacanthos</i>							X
<i>Juglans nigra</i>				X	X		X
<i>Lonicera</i> species							X
<i>Maclura pomifera</i>				X			X
<i>Malus pumila</i>						X	X
<i>Morus alba</i>					X		X
<i>Opuntia humifusa</i>							
<i>Ostrya virginiana</i>							X
<i>Parthenocissus quinquefolia</i>							X
<i>Platanus occidentalis</i>							X
<i>Populus alba</i>				X	X	X	X
<i>Populus deltoides</i>		X	X	X	X	X	X
<i>Prunus serotina</i>							X
<i>Prunus virginiana</i>							
<i>Quercus alba</i>				X	X		X
<i>Quercus coccinea</i>							X
<i>Quercus imbricaria</i>							X
<i>Quercus macrocarpa</i>				X	X		X
<i>Quercus rubra</i>					X		X
<i>Quercus velutina</i>							X
<i>Rhamnus cathartica</i>							X
<i>Rhus glabra</i>							X
<i>Rhus radicans</i>					X		X
<i>Ribes missouriensis</i>							X
<i>Rosa multiflora</i>							X
<i>Salix interior</i>							X
<i>Salix nigra</i>				X	X		X
<i>Trichaptum bifforme</i>							
<i>Tilia americana</i>				X			X
<i>Ulmus americana</i>				X	X		X
<i>Ulmus pumila</i>							X
<i>Ulmus rubra</i>							
<i>Viburnum</i> species							X
<i>Vitis riparia</i>							X
clay							
moss	X						X
asphalt							
sand and gravel							
sandstone							
limestone				X			
soil over dolomite							
decorticate logs					X		X
rusted steel							X
bone							
aluminum foil							
caulking							
granite				X			X
wood							X
concrete			X	X			X
Dolomite, pebbles, gravel	X		X	X		X	

Tree species/substrate	Lichen Species						
	<i>Physcia stellaris</i>	<i>Physcia subtilis</i>	<i>Physciella chloantha</i>	<i>Physconia leucoleiptes</i>	<i>Placidium lachneum</i>	<i>Punctelia bolliana</i>	<i>Punctelia missouriensis</i>
<i>Acer negundo</i>	X		X	X			
<i>Acer nigrum</i>							
<i>Acer saccharinum</i>	X						
<i>Acer saccharum</i>	X						
<i>Carya cordiformis</i>							
<i>Carya ovata</i>	X						
<i>Celtis occidentalis</i>	X		X				
<i>Cornus stolonifera</i>	X						
<i>Crataegus crus-galli</i>	X						
<i>Crataegus mollis</i>	X		X	X			X
<i>Fraxinus pennsylvanica</i>	X		X				
var. <i>subintegerrima</i>							
<i>Gleditsia triacanthos</i>	X						
<i>Juglans nigra</i>	X						
<i>Lonicera</i> species							
<i>Maclura pomifera</i>	X		X				
<i>Malus pumila</i>	X						
<i>Morus alba</i>	X						
<i>Opuntia humifusa</i>							
<i>Ostrya virginiana</i>							
<i>Parthenocissus quinquefolia</i>							
<i>Platanus occidentalis</i>			X				
<i>Populus alba</i>	X						
<i>Populus deltoides</i>	X		X	X			
<i>Prunus serotina</i>	X						
<i>Prunus virginiana</i>							
<i>Quercus alba</i>	X		X			X	
<i>Quercus coccinea</i>							
<i>Quercus imbricaria</i>	X						
<i>Quercus macrocarpa</i>	X		X			X	
<i>Quercus rubra</i>	X						
<i>Quercus velutina</i>			X				
<i>Rhamnus cathartica</i>			X				
<i>Rhus glabra</i>	X						
<i>Rhus radicans</i>	X		X				
<i>Ribes missouriensis</i>							
<i>Rosa multiflora</i>							
<i>Salix interior</i>	X						
<i>Salix nigra</i>	X		X	X			
<i>Trichaptum bifforme</i>							
<i>Tilia americana</i>	X		X				
<i>Ulmus americana</i>	X		X				
<i>Ulmus pumila</i>	X						
<i>Ulmus rubra</i>			X				
<i>Viburnum</i> species							
<i>Vitis riparia</i>							
clay							
moss							
asphalt							
sand and gravel							
sandstone							
limestone							
soil over dolomite					X		
decorticate logs	X						
rusted steel	X						
bone							
aluminum foil							
caulking							
granite	X	X	X				
wood	X						
concrete			X				
Dolomite, pebbles, gravel	X		X				

Tree species/substrate	Lichen Species						
	<i>Punctelia rudecta</i>	<i>Sarcogyne regularis</i>	<i>Thelocarpon laureri</i>	<i>Trapeliopsis flexuosa</i>	<i>Usnea strigosa</i>	<i>Verrucaria calciseda</i>	<i>Verrucaria calkinsiana</i>
<i>Acer negundo</i>							
<i>Acer nigrum</i>							
<i>Acer saccharinum</i>							
<i>Acer saccharum</i>							
<i>Carya cordiformis</i>							
<i>Carya ovata</i>	X						
<i>Celtis occidentalis</i>							
<i>Cornus stolonifera</i>							
<i>Crataegus crus-galli</i>							
<i>Crataegus mollis</i>	X				X		
<i>Fraxinus</i>							
<i>pennsylvanica</i>							
var. <i>subintegerrima</i>							
<i>Gleditsia triacanthos</i>							
<i>Juglans nigra</i>							
<i>Lonicera</i> species							
<i>Maclura pomifera</i>							
<i>Malus pumila</i>							
<i>Morus alba</i>							
<i>Opuntia humifusa</i>							X
<i>Ostrya virginiana</i>							
<i>Parthenocissus</i>							
<i>quinquefolia</i>							
<i>Platanus occidentalis</i>							
<i>Populus alba</i>							
<i>Populus deltoides</i>							
<i>Prunus serotina</i>							
<i>Prunus virginiana</i>							
<i>Quercus alba</i>	X						
<i>Quercus coccinea</i>							
<i>Quercus imbricaria</i>							
<i>Quercus macrocarpa</i>							
<i>Quercus rubra</i>	X						
<i>Quercus velutina</i>							
<i>Rhamnus cathartica</i>							
<i>Rhus glabra</i>							
<i>Rhus radicans</i>							
<i>Ribes missouriensis</i>							
<i>Rosa multiflora</i>							
<i>Salix interior</i>							
<i>Salix nigra</i>							
<i>Trichaptum bifforme</i>							
<i>Tilia americana</i>							
<i>Ulmus americana</i>							
<i>Ulmus pumila</i>							
<i>Ulmus rubra</i>							
<i>Viburnum</i> species							
<i>Vitis riparia</i>							
clay							
moss							
asphalt							
sand and gravel							
sandstone		X					
limestone							X
soil over dolomite							
decorticate logs	X			X			
rusted steel							
bone							
aluminum foil							
caulking							
granite		X					X
wood			X	X			
concrete							
Dolomite, pebbles, gravel		X				X	X

Tree species/substrate	Lichen Species					
	<i>Verrucaria fayettensis</i>	<i>Verrucaria fuscella</i>	<i>Xanthomendoza fallax</i>	<i>Xanthomendoza fulva</i>	<i>Xanthomendoza ulophylloides</i>	<i>Xanthoria polycarpa</i>
<i>Acer negundo</i>			X	X	X	
<i>Acer nigrum</i>						
<i>Acer saccharinum</i>						
<i>Acer saccharum</i>						
<i>Carya cordiformis</i>						
<i>Carya ovata</i>			X			
<i>Celtis occidentalis</i>						
<i>Cornus stolonifera</i>						
<i>Crataegus crus-galli</i>						
<i>Crataegus mollis</i>			X	X	X	
<i>Fraxinus pennsylvanica</i>			X	X	X	
var. <i>subintegerrima</i>						
<i>Gleditsia triacanthos</i>			X			
<i>Juglans nigra</i>			X			
<i>Lonicera</i> species						
<i>Maclura pomifera</i>			X			
<i>Malus pumila</i>						
<i>Morus alba</i>			X			
<i>Opuntia humifusa</i>						
<i>Ostrya virginiana</i>						
<i>Parthenocissus quinquefolia</i>						
<i>Platanus occidentalis</i>						
<i>Populus alba</i>						
<i>Populus deltoides</i>			X	X	X	
<i>Prunus serotina</i>			X			
<i>Prunus virginiana</i>						
<i>Quercus alba</i>			X	X	X	
<i>Quercus coccinea</i>						
<i>Quercus imbricaria</i>						
<i>Quercus macrocarpa</i>			X	X	X	
<i>Quercus rubra</i>						
<i>Quercus velutina</i>						
<i>Rhamnus cathartica</i>						
<i>Rhus glabra</i>			X			
<i>Rhus radicans</i>						
<i>Ribes missouriensis</i>						
<i>Rosa multiflora</i>						
<i>Salix interior</i>						
<i>Salix nigra</i>			X			
<i>Trichaptum bifforme</i>						
<i>Tilia americana</i>						X
<i>Ulmus americana</i>			X			
<i>Ulmus pumila</i>				X	X	
<i>Ulmus rubra</i>						
<i>Viburnum</i> species						
<i>Vitis riparia</i>						
clay						
moss						
asphalt						
sand and gravel						
sandstone						
limestone						
soil over dolomite						
decorticate logs						
rusted steel						
bone						
aluminum foil						
caulking						
granite						
wood			X			
concrete		X		X		
Dolomite, pebbles, gravel	X	X				

