Lichens in Lewis and Clark Caverns State Park, Montana

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Abstract

In this study we identified 160 species of lichens among 67 genera from 22 sites in seven vegetation types at Lewis and Clark Caverns State Park, Jefferson County, Montana. Crustose species were the most common (44%), whereas 42 percent were foliose, 5.5 percent were fruticose, 5.5 percent were squamulose and 3 percent were *Cladonia* species. Fifty-six percent occurred on rock, 29 percent on bark or wood, 7 percent on soil, and 8 percent on moss, litter, decaying wood or other lichens. We found the greatest diversity of species in moist Douglas-fir (*Pseudotsuga menziesii*) in which we collected 87 species and in mountain mahogany (*Cercocarpus ledifolius*) sites with 86 collected species. The smallest number of species occurred in the one willow (*Salix* spp.) grassland site in which we collected only 20 species. Others had previously collected 18 species among seven additional genera, so we report a total of 178 lichen species among 74 genera for Lewis and Clark Caverns State Park.

Key words: Lichens, Lewis and Clark Caverns State Park, Montana

Introduction

Lichens are unique organisms formed by the association of a fungus and a photosynthesizing partner: green alga, cyanobacteria, or both. Lichens growing on rock help initiate soil formation by physically or chemically breaking down the rock and trapping blowing soil particles (Longton 1992, Brodo et al. 2001). Large ungulates such as elk and mountain goats feed on lichens. Lichens growing on bare soil help stabilize the surface and those with cyanobacteria usually fix nitrogen that adds to the nitrogen budget of the community. Abundance of certain lichens, usually the bushy (fruticose) forms on trees, indicates high relative humidity and absence of air pollutants. Although lichens can withstand severe weather conditions, they are sensitive to human-caused disturbances. Because lichens grow slowly, their presence indicates a stable, undisturbed environment; therefore, a survey of lichens in an area might provide valuable information about integrity of the landscape.

Lichen flora have been characterized for Glacier (DeBolt and McCune 1993), Yellowstone (Eversman et al. 2002) and Grand Teton National Parks (Eversman 1998). Lichen surveys have been completed for the Anaconda-Pintler and Gates of the Mountain Wilderness Areas and the Elkhorn Mountains (Schubloom 1995), in the Swan Valley and Bitterroot Mountains (McCune 1982, 1984), and Headwaters State Park (Eversman 1996). The general pattern of lichen distribution in Montana indicates that a greater number of lichen species, especially fruticose species, those with cyanobacteria, and those living on tree bark occur west of the Continental Divide rather than east of the Divide (Eversman 2004); because lichens can grow only when they are moist, the distribution patterns can be attributed to more precipitation and higher relative humidity west of the Divide. The objective of this study was to characterize the lichen flora of Lewis and Clark Caverns State Park.

Study Area

Lewis and Clark Caverns State Park is located in the London Hills area of Jefferson County, Montana, north of the Jefferson River and east of the Continental Divide (45°52'N, 111°85'W). The park is 12.3 km^2, with elevations ranging from 1280 to 1797

m. The area receives 21 to 38 cm of annual precipitation of which most falls during May-July (Garcogian 2001). The caverns are in the calcareous Madison limestone that extends in a broad strip from Cave Mountain to the southwestern part of the park (Perry 1946). Three Forks shale (noncalcareous) exists in a narrow band south of Cave Mountain with Jefferson Dolomite (calcareous) occurring in a pear-shaped section to its east. The mostly noncalcareous Belt Arkose (LaHood conglomerate) dominates the landform in the eastern and western parts of the park. Much of the substrate along the roadside is recent alluvium and gravel (Perry 1946).

Vegetation in the park varies from dry grasslands to moist stream banks. We identified seven vegetation types (Pfister et al. 1977, Mueggler and Stewart 1980). In order from driest to the most moist, they were (1) exposed rock above 1584 m with dwarfed mountain mahogany and small forbs (3 collection sites); (2) dry grassland meadows (1295-1420 m) of Idaho fescue (*Festuca idahoensis*) and bluebunch wheatgrass (*Pseudoroegneria spicata*) with forbs and exposed rocks (4 sites); (3) mountain mahogany grasslands (1400-1520 m) with mountain mahogany, Rocky Mountain juniper (*Juniperus scopulorum*), limber pine (*Pinus flexilis*) and bluebunch wheatgrass, with rocky terrain, grasses and forbs (3 sites); (4) Douglas-fir (*Pseudotsuga menziesii*)-grasslands (1490-1600 m) with bluebunch wheatgrass and occasional limber pine and Rocky Mountain juniper (3 sites); (5) one willow (*Salix*) grassland located around an intermittent pond with rock scree surrounding it (1304 m); (6) deciduous cottonwood (*Populus balsamifera*) communities (1343-1500 m) with aspen (*Populus tremuloides*), chokecherry (*Prunus virginiana*), and water birch (*Betula occidentalis*) occurring along small streams (3 sites); and (7) moist Douglas-fir forests on north- and west- facing canyon slopes (1450- 1706 m) with moss understory and moist soils (5 sites).

Methods

Between June 2001 and October 2003, we collected lichen samples from 22 sites in the vegetation types listed above. Sites ranged from 5 to 50 m^2 from which we determined size by either vegetation boundaries or the area needed to collect all lichens present (Nash et al.1993). Sufficient time was spent at each site to adequately collect from all substrates: rock, wood, soil, moss, bark, bone, litter, and other lichens. Identification of specimens followed standard morphological and chemical techniques (Culberson 1972, Thomson 1984, 1997, McCune and Goward 1995, McCune and Geiser 1997, Ryan, unpublished keys, St. Clair 1999). Nomenclature for lichens followed Esslinger (1997), and that for vascular plants followed Dorn (1984) and Lavin and Seibert (2001). Voucher specimens are in the Montana State University Herbarium (MONT).

We used Jaccard's Index of Similarity (IS_J) (Mueller-Dombois and Ellenberg 1974) to compare the similarity of lichen species composition among the seven vegetation types within the park. This index divides the number of species in common between two locations by the number of dissimilar species in both locations and then multiplies by 100 to get a percentage of species in common.

Results and Discussion

We identified a total of 160 species of lichens from the park among 67 genera (Appendix A). Bruce McCune, Jeanne Ponzetti and Roger Rosentreter had previously identified 18 additional species and seven additional genera in the park in 2001 (personal communication, Appendix A). We included these species in the total species count, but not in the quantitative analysis of the species collected in this study.

Crustose lichens were the most prevalent growth form, with 70 species (44% of the total). *Aspicilia*, *Caloplaca*, *Candelariella* and *Lecanora* were the most common crustose genera. We identified 67

foliose species (42% of the total) with the major foliose genera including *Peltigera*, *Physcia*, *Melanelia*, *Xanthoparmelia* and *Xanthoria*. Nine squamulose species (5.5 % of the total) were identified with four species in the genus *Psora*. Nine fruticose species (5.5% of the total) occurred among five genera, *Bryoria*, *Evernia*, *Letharia*, *Nodobryoria*, and *Usnea*. Five *Cladonia* species (3% of the total) were present of which *Cladonia fimbriata* occurred among 13 of 22 sites (Appendix A).

The foliose species *Melanelia elegantula*, *Physcia caesia*, *Rhizoplaca melanophthalma*, and *Xanthoria elegans* were the most widespread in the park and found at 19, 18, 16, and 15 sites, respectively (Appendix A). We documented eight lichen species from all seven vegetation types: *Lecidella stigmatea*, *Melanelia elegantula*, *Physcia caesia*, *Physcia dubia*, *Rhizoplaca chrysoleuca*, *R. melanophthalma*, *Xanthoparmelia mexicana*, and *Xanthoria elegans*. All of these species have a wide distribution in the Rocky Mountains and western temperate forests (Brodo et al. 2001).

Rock substrates were present on all 22 sites. The highest number of species (94) occurred on rock of which the most common included crustose species *Aspicilia cinerea, Candelariella aurella, Lecanora garovaglii, Lecidella stigmatea,* and *Lobothallia alphoplaca,* and foliose species *Physcia caesia, Rhizoplaca chrysoleuca, R. melanophthalma, Xanthoparmelia mexicana,* and *Xanthoria elegans*. Wood/ bark substrates occurred on many of the sites that included the second highest distribution of lichens (68 species). The most common species among these included *Hypogymnia physodes, Letharia vulpina, Melanelia elegantula, M. subolivacea,* and *Physcia adscendens*. On soil, the most common species were *Peltigera rufescens* and *Candelariella terrigena* of which both have broad distributions in the region (Brodo et al. 2001). *Cladonia* species, especially *Cladonia fimbriata*, were abundant on moist decaying wood, soil, moss, and litter.

The moist Douglas-fir forest included the greatest diversity of lichens (87 species) of which 12 species occurred exclusively in this vegetation type: *Arthonia lapidicola, Bryoria fuscescens, Dermatocarpon reticulatum, Evernia prunastri, Hypocenomyce scalaris, Letharia columbiana, Nodobryoria abbreviata, Parmelia saxatilis, Parmeliopsis ambigua, Peltigera praetextata, Rhizocarpon geographicum,* and *Rhizoplaca subdiscrepans* (Table 1). Because of the similar moisture regime and conifer wood substrate, many of these species are characteristic of the Pacific Northwest and northern boreal forests (McCune and Geiser 1997, Brodo et al. 2001).

Eighty-six species were in the mountain mahogany grasslands vegetation (Table 1), with eight species found only in that vegetation type: *Aspicilia desertorum, Lecanora cadubriae, Lecidea plana, Megaspora verrucosa, Phaeophyscia hirsuta, Placynthiella uliginosa, Protoparmelia badia,* and *Pyrrhospora elabens*. The various substrates in this vegetation type include mountain mahogany, limber pine, juniper, big sagebrush (*Artemisia tridentata*), rock, moss and exposed soil.

Exposed rock sites yielded 67 species (Table 1) with ten species found only there: *Buellia elegans, Caloplaca decipiens, Catapyrenium cinereum, Collema fuscovirens, Lecidoma demissum, Lichenella nigritella, Phaeophyscia constipata, Physciella chloantha, Polysporina urceolata,* and *Thyrea confusa*.

Douglas-fir/grasslands (dry Douglas-fir sites) contained 67 species (Table 1) with seven exclusive species: *Amandinea punctata, Bryoria fremontii, Caloplaca jungermanniae, Cladonia cariosa, Diplotomma alboatrum, Rimularia insularis,* and *Umbilicaria krascheninnikovii*.

Sixty-four species were in the dry Idaho fescue/bluebunch wheatgrass grasslands (Table 1), 10 of which were exclusive to this vegetation type: *Caloplaca approximata, C. epithallina, C. holocarpa, C. lactea, Lecidea auriculata, Phaeorrhiza nimbosa, Psora cerebriformis, P. decipiens,*

Literature Cited

Brodo, I. M., S. D. Sharnoff, and S. Sharnoff. 2001. Lichens of North America. Yale University Press, London, UK. 795 pp.

Culberson, C. F. 1972. Identification of lichen products by TLC. Journal of Chromatography 72:113-125.

DeBolt, A., and B. McCune. 1993. Lichens of Glacier National Park, Montana. The Bryologist 96:192-204.

Dorn, R. D. 1984. Vascular plants of Montana. Mountain West Publishing Co., Cheyenne, WY. 276 pp.

Esslinger, T. L. 1997. A cumulative checklist for the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. North Dakota State University, Fargo. http://www.ndsu.nodak.edu.instruct/esslinge/chcklst/chcklst7.htm

Eversman, S. 1998. Lichens of Grand Teton National Park, Wyoming. Pp. 295-308 *in* M. G. Glenn, R. C. Harris, R. Dirig and M. S. Cole, eds., Lichenographia Thomsoniana: North American Lichenology. Mycotaxon, Ithaca, NY.

_____. 2004. Macrolichens of the forests of Montana and Yellowstone and Glacier National Parks. Pp. 213-223 *in* C. Cripps, ed., Fungi in forest ecosystems: systematics diversity and ecology. Memoirs of the New York Botanical Garden, New York, NY. 364 pp.

_____, and R. Schanz. 1996. Lichens and their ecological significance in Headwaters State Park, Gallatin County, Montana. Intermountain Journal of Sciences 2:1-9.

_____, C. M. Wetmore, K. Glew, and J. P. Bennett. 2002. Patterns of Lichen Diversity in Yellowstone National Park. The Bryologist 105:27-42.

Garcogian, D. (ed.). 2001. Weather America: a thirty-year summary of statistical weather data and rankings. Grayhouse Publishing Co., Lakeville, CT. 2013 pp.

Lavin, M., and C. Seibert. 2001. Grasses of Montana. Department of Plant Sciences, Montana State University, Bozeman.

Longton, R. E. 1992. The role of bryophytes and lichens in terrestrial ecosystems. Pp. 32-76 *in* J. W. Bates and A. M. Farme, eds., Bryophytes and lichens in a changing environment. Oxford University Press, New York, NY.

McCune, B. 1982. Lichens of the Swan Valley, Montana. The Bryologist 85:13-21.

_____. 1984. Lichens with oceanic affinities in the Bitterroot Mountains of Montana and Idaho. The Bryologist 87:44-49.

_____, and L. Geiser. 1997. Macrolichens of the Pacific Northwest. Oregon State University Press, Corvallis. 386 pp.

_____, and T. Goward. 1995. Macrolichens of the Northern Rocky Mountains. Mad River Press, Eureka, CA. 208 pp.

Mueggler W. F., and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service, General Technical Report INT-66. Intermountain Forest and Range Experiment Station, Ogden, UT. 155 pp.

Mueller-Dombois, D., and H. Ellenberg. 1974. Aims and methods of vegetation Ecology. John Wiley & Sons, New York, NY.

Nash, T. H., III, C. Wetmore, W. Anderson, C. Bratt, W. Denison, S. Eversman, B. Murray, and L. St. Clair. 1993. Floristics. Pp. 6-15 *in* L. S. Huckaby, ed., Lichens as bioindicators of air quality. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Perry, E. S. 1946. Morrison Cave, Lewis and Clark Caverns State Park Montana. Tom Greenfield, Butte. 18 pp.

Pfister, R. D., B. L. Kovalchik, S. F. Arno, and R. C. Presby. 1977. Forest habitat types of Montana. USDA Forest Service, General Technical Report INT-34. Intermountain Forest and Range Experiment Station, Ogden, UT. 174 pp.

Salix, J. L. 2004. Lichens and their distribution in Lewis and Clark Caverns State Park. M.S. thesis, Montana State University, Bozeman. 72 pp.

Schubloom, L. A. 995. Lichens as air quality indicators in three areas of southwestern Montana: lichen floristics and elemental analysis. M.S. thesis, Montana State University, Bozeman. 129 pp.

St. Clair, L. L. 1999. A color guidebook to common Rocky Mountain lichens. M. L. Bean Life Science Museum, Brigham Young University Press, Provo, UT. 240 pp.

Thomson, J. W. 1984. American Arctic lichens. 1. The macrolichens. Columbia University Press, New York, NY. 504 pp.

_____. 1997. American Arctic lichens. 2. The microlichens. University of Wisconsin Press, Madison. 675 pp.

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Appendix A. List of lichen species identified from Lewis and Clark Caverns State Park, Montana.. Growth form: cr = crustose, sq = squamulose, fo = foliose, fr = fruticose. % sites = percentage of 22 sites where species was found. Rock + = calcareous rock. Rock - = non-calcareous rock. Nomenclature follows Esslinger (1997) as updated on the web site http://www.ndsu.nodak.edu.instruct/esslinge/chcklst/chcklst7.htm. * = species collected by McCune, Rosentreter and Ponzetti, 2001 (personal communication) that were not collected in this study; % Sites for these species do not include their collection sites.

Genus and species	Growth Form	Substrate(s)	% Sites
Acarospora glaucocarpa	sq	Rock +	9
A. strigata	cr	Rock +/-	27
A. veronensis	cr	Rock +/-	14
Arthonia lapidicola	cr	Rock +	5
Aspicilia caesiocinerea	cr	Rock +/-	45
A. calcarea	cr	Rock +	18
A. candida	cr	Rock +	5
A. cinerea	cr	Rock -, Bone, Wood	55
A. contorta	cr	Rock +/-	45
A. desertorum	cr	Rock +/-	5
*A. hispida**	fr	Soil	
*A. mastrucata**	cr	Rock -	
*Bacidia bagliettoana**	cr	Soil, Moss	
Bryoria fremontii	fr	Bark	5
B. fuscescens	fr	Bark	18
Buellia elegans	cr	Moss on soil	5
B. punctata	cr	Bark	5
Caloplaca approximata	cr	Rock +	5
C. arenaria	cr	Rock -	32
*C. citrina**	cr	Rock +/-, Wood, Bone	14
C. decipiens	cr	Rock +	5
C. epithallina	cr	Lichen on rock	9
C. holocarpa	cr	Rock +	5
C. jungermanniae	cr	Soil, Litter	5
C. lactea	cr	Rock +	5
C. saxicola	fo	Rock +/-	18
*C. trachyphylla**	fo	Rock +	
Candelaria concolor	fo	Bark	9
Candelariella aurella	cr	Rock +, Wood, Bark	55
C. dispersa	cr	Rock +	9
C. rosulans	cr	Rock -, Wood	36
C. terrigena	cr	Soil, Moss	27
C. vitellina	cr	Rock -, Wood	14
C. xanthostigma	cr	Bark, Wood	9
Catapyrenium cinereum	sq	Rock +	9
Cladonia cariosa	fr	Soil	5
C. chlorophaea	fr	Wood, Moss, Litter	27
C. fimbriata	fr	Wood, Moss, Litter	59
C. pocillum	fr	Moss, Soil	18
C. pyxidata	fr	Moss, Soil	23
Collema fuscovirens	fo	Rock +	5
C. tenax	fo	Rock +/-,Soil	27
Cyphelium pinicola	cr	Bark, Wood	9
Dermatocarpon miniatum	fo	Rock +/-	18
D. reticulatum	fo	Rock -	5
Dimelaena oreina	cr	Rock -	32
Diploschistes muscorum	cr	Wood, Moss, Soil	27
D. scruposus	cr	Rock -	14
Diplotomma alboatrum	cr	Bark, Wood	5
Endocarpon pusillum	sq	Rock -	9
Evernia prunastri	fr	Bark	5
Flavopunctelia soredica	fo	Bark	5
Fulgensia bracteata	fo	Soil	9
*Helocarpon crassipes**	cr	Moss on rock	
*Heppia lutosa**	sq	Soil	
Hypocenomyce scalaris	cr	Burned bark	5
Hypogymnia austerodes	fo	Bark, Wood	23
H. imshaugii	fo	Bark, Wood	36
H. physodes	fo	Bark,Wood	45
H. tubulosa	fo	Bark	23
Lecanora albellula	cr	Bark	14
L. argopholis	cr	Rock +/-	27
L. cadubriae	cr	Bark, Wood	5
L. cenisia	cr	Wood	9
L. crenulata	cr	Rock +	9
L. dispersa	cr	Rock +	14
L. garovaglii	cr	Rock +/-,Wood, Bone	50
L. hagenii	cr	Bark	9
L. marginata	cr	Rock +	18
L. muralis	cr	Rock +/-	41
L. rupicola	cr	Rock -	9
L. saligna	cr	Bark	14
*L subintricata**	cr	Bark, wood	
Lecidea auriculata	cr	Rock -	5
L. plana	cr	Rock -	5
L. tessellata	cr	Rock +/-	36
Lecidella carpathica	cr	Rock -	9
L. euphorea	cr	Bark, Wood	23
L. patavina	cr	Rock +	14
L. stigmatea	cr	Rock +/-	59
Lecidoma demissum	cr	Moss	5
Letharia columbiana	fr	Bark, Wood	5
L. vulpina	fr	Bark, Wood	64
Lichenella nigritella	fr	Rock +	5
Lobothallia alphoplaca	cr	Rock +/-	50
Megaspora verrucosa	cr	Litter	5
Melanelia disjuncta	fo	Rock -	18
M. elegantula	fo	Bone, Wood, Bark	86
M. exasperatula	fo	Bark	14
M. infumata	fo	Rock -	18

Genus and species	Growth Form	Substrate(s)	% Sites
M. subaurifera	fo	Rock -, Wood	9
M. subolivacea	fo	Bark, Wood	55
M. tominii	fo	Rock +-	32
*M. denigrata**	cr	Wood	
Nodobryoria abbreviata	fr	Bark	5
*Ochrolechia androgyna**	cr	Bark, wood	
O. upsaliensis	cr	Wood, Moss, Soil	32
Parmelia hygrophila	fo	Rock -	18
P. saxatilis	fo	Rock -	5
P. sulcata	fo	Bark, Wood	32
Parmeliopsis ambigua	fo	Bark	9
Peltigera canina	fo	Moss	13
P. didactyla	fo	Soil, Moss	18
P. ponojensis	fo	Moss, Litter	23
P. praetextata	fo	Litter	5
P. rufescens	fo	Moss, Soil, Litter	36
Phaeophyscia constipata	fo	Rock +	9
P. hirsuta	fo	Bark	5
*P. nigricans**	fo	Bark, rock	
P. orbicularis	fo	Rock -, Moss on Rock	14
P. sciastra	fo	Rock +-	27
Phaeorrhiza nimbosa	sq	Soil	5
*P. sareptana**	sq	Soil, rock +	
Physcia adscendens	fo	Bark, Wood	59
P. biziana	fo	Rock -, Bark	14
P. caesia	fo	Rock +-, Bark	82
P. dimidiata	fo	Rock -, Wood, Bark	41
P. dubia	fo	Rock -, Wood, Bark	45
P. phaea	fo	Rock -	18
P. stellaris	fo	Bark, Wood	18
Physciella chloantha	fo	Rock +	5
Physconia enteroxantha	fo	Rock -, Wood	9
P. isidiigera	fo	Bark, Wood, Moss	18
P. muscigena	fo	Moss, Soil, Litter	27
*Placidium lacinulatum**	sq	Soil	
P. squamulosum	sq	Soil	14
Placynthiella uliginosa	cr	Bark, Wood	5
*Placynthium nigrum**	cr	Rock +	
Platismatia glauca	fo	Bark, Rock -, Wood	23
Pleopsidium chlorophanum	cr	Rock -	14
Polysporina urceolata	cr	Rock +	5
Protoparmelia badia	cr	Rock -	5
Psora cerebriformis	sq	Soil	5
P. decipiens	sq	Soil	9
P. tuckermanii	sq	Rock crevices, Soil	46
Punctelia perreticulata	fo	Rock, Bark	9
Pyrrhospora elabens	cr	Wood	5
Rhizocarpon disporum	cr	Rock -, Bark	23
R. geographicum	cr	Rock -	5
*Rhizoplaca chrysoleuca**	fo	Rock -, Wood, Bone	55
R. melanophthalma	fo	Rock -, Wood, Bone	73
*R. peltata**	fo	Rock -	
R. subdiscrepans	fo	Rock -	5
Rimularia insularis	cr	Lichen on rock	5
Rinodina bischoffii	cr	Rock +	14
Sarcogyne regularis	cr	Rock +	5
Sporastatia testudinea	cr	Rock +-	9
Staurothele areolata	cr	Rock +	5
S. drumondii	cr	Rock +	18
*Synalissa symphorea**	fr	Rock +	
Thelidium sp.*	cr	Rock +-	5
Thyrea confusa	fo	Rock +	5
Toninia sedifolia	sq	Soil	14
Trapeliopsis flexuosa	cr	Wood	9
*T. granulosa**	cr	Soil	
Tuckermannopsis chlorophylla	fo	Bark	27
Umbilicaria hyperborea	fo	Rock -	36
U. kraschenninikovii	fo	Rock -	5
U. phaea	fo	Rock -	18
U. torrefacta	fo	Rock -	32
U. virginis	fo	Rock -	9
Usnea hirta	fr	Bark, Wood	18
U. lapponica	fr	Bark	9
U. substerilis	fr	Bark	36
*Verrucaria compacta**	cr	Rock +	
V. nigrescens	cr	Rock +	9
V. sphaerospora	sq	Rock -	9
Xanthomendoza fallax	fo	Bark	9
X. fulva	fo	Rock -, Bark, Wood	41
Xanthoparmelia camtschadalis	fo	Soil	9
X. coloradoensis	fo	Rock -, Soil	9
X. mexicana	fo	Rock -, Wood, Bone	55
X. plittii	fo	Rock +-	32
X. subdecipiens	fo	Rock -	23
Xanthoparmelia wyomingica	fo	Soil	9
Xanthoria elegans	fo	Rock +-	68
X. polycarpa	fo	Bark	18
X. sorediata	fo	Wood, Bark	9