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The California Lichen Society seeks to promote the appreciation, conservation, and study of lichens. The interests of the Society include the entire western part of the continent, although the focus is on California. Dues categories are (in $US per year): Student and fixed income (eBulletin only) - $10, Regular - $20 ($25 for foreign members, or $20 foreign student memberships), Family - $25, Sponsor and Libraries - $35, Donor - $50, Benefactor - $100, and Life Members - $500 (one time) payable to the California Lichen Society, PO Box 472, Fairfax, California 94978. Members receive the Bulletin (print and online access), the right to vote in society elections, and notices of meetings, field trips, lectures and workshops.

This number of the Bulletin of the California Lichen Society (ISSN 1093-9148) was edited by John Villella (johnvillella@yahoo.com) and was produced by Erin P. Martin (shastalichens@gmail.com). The Bulletin welcomes manuscripts on technical topics in lichenology relating to western North America and on conservation of lichens, as well as news of lichenologists and their activities. The best way to submit manuscripts is by e-mail attachments in the format of a major word processor (DOC or RTF preferred). Use italics for scientific names. Please submit figures in electronic formats with a resolution of 300 pixels per inch (600 minimum for line drawings). Email submissions are limited to 10MB per email, but large files may be split across several emails or other arrangements can be made. Contact the Interim Editor, Tom Carlberg, at tcarlberg7@yahoo.com, for details of submitting illustrations or other large files. A review process is followed. Nomenclature follows Esslinger's cumulative checklist online at http://www.ndsu.edu/pubweb/~esslinge/chcklst/chcklst7.htm. The editors may substitute abbreviations of authors names, as appropriate from The International Plant Names Index - http://www.ipni.org/index.html. Style follows this issue. Electronic reprints in PDF format will be emailed to the lead author at no cost.

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Front Cover: *Ramalina menziesii*. See article by Shrestha and St. Clair pg. 5. Photo by Kerry Heise.

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The Effects of Gaseous Ozone and Nitric Acid Deposition on Two Crustose Lichen Species from Joshua Tree National Park

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My name is Elizabeth C. Hessom, and I recently completed my M.S. in Environmental Sciences at the University of California, Riverside. Towards the end of 2011, I received a student grant from CALS to support my thesis research looking at the effects of two common atmospheric pollutants on two crustose lichen species from Joshua Tree National Park. Here I present the summarized findings from this research.

When I started graduate school in 2010, I had a piqued interest in lichens; however I had little direct research experience with them, let alone with the crustose growth form. Preliminary studies helped increase my comfort level in working with crustose lichens, and I became more and more intrigued about lichens in general. At the time I was also working for the USDA Forest Service Pacific Southwest Research Station in Riverside, CA, under the supervision of Dr. Pamela Padgett. The Forest Service had used epiphytic lichens as passive bioindicators of atmospheric conditions, and was interested in expanding this use to crustose lichens. This interest shaped my research project which looked at the effects of two common atmospheric pollutants on two common crustose species within southern California, specifically Joshua Tree National Park. I wanted to see if they could be used as passive bioindicators.

In order to gain insight on what crustose lichen species were present within the park, and which ones would be ideal for collecting, I contacted Kerry Knusden, from the UC Riverside Herbarium for his input. Kerry had been working in the park at the time doing an assessment of the lichen species present, and provided me with helpful information. We took our first field trip to the park in May 2011 to assess which lichens I should collect in areas where low atmospheric deposition was occurring. This helped ensure that the lichen samples I was working with would be fairly pristine before I exposed them to their lab fumigation trials of different atmospheric pollutants. After that first trip, Kerry and I decided that I should collect two fairly prevalent species for my study, *Lobothallia praeradiosa* (Nyl.) Hafellner, and *Acarospora socialis* H. Magn.. Both of these species also happened to have unknown sensitivities to ozone (O_3) and the nitrogen compound nitric acid (HNO_3), which are prevalent atmospheric pollutants within the Los Angeles Basin. Westerly winds often cause these pollutants to deposit within Joshua Tree National Park, so we decided that these species would be tested for their sensitivities to O_3 and HNO_3 (Allen et al. 2006; Allen et al. 2009), to see if they could be used as passive indicators for the pollutants.

Kerry and I proceeded to return to Joshua Tree National Park multiple times within the next year to set-up passive samplers (to detect current atmospheric pollutant concentrations in the field), and to collect the lichen samples themselves. Since the lichens were crustose in nature, this made them more difficult to collect than epiphytic growth forms, because they need to remain attached to their rock substrate. This resulted in hot days in Joshua Tree National Park, chipping away at rocks to get lichen samples (Fig. 1). Once collected, the samples were brought back to UC Riverside and prepped for fumigations in the CSTRs (continuously stirred tank reactors) (Fig. 2) with O_3 and HNO_3 separately.

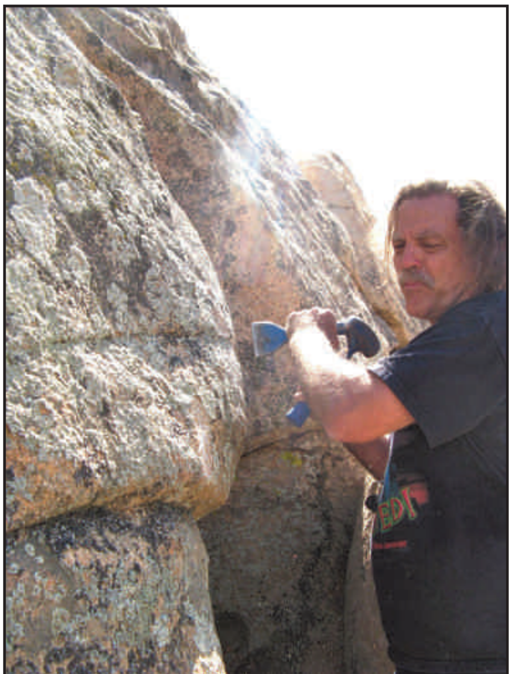

Figure 1. Kerry Knusden obtaining crustose lichen samples. Photo by Elizabeth Hessom.

Figure 2. CSTR with lichens present at bottom of chamber. Photo by Elizabeth Hessom.

The two lichen species underwent an O_3 fumigation, and a HNO_3 fumigation, both of which were 90 days long. Throughout the fumigations, physiological measures were taken on day 0, 30, 60, and 90 to assess the health of the lichen species in response to the pollutants. These measures included recording: 1) chlorophyll fluorescence to determine if damage occurred to photosystem II (PSII) or the algal component of the lichen, and

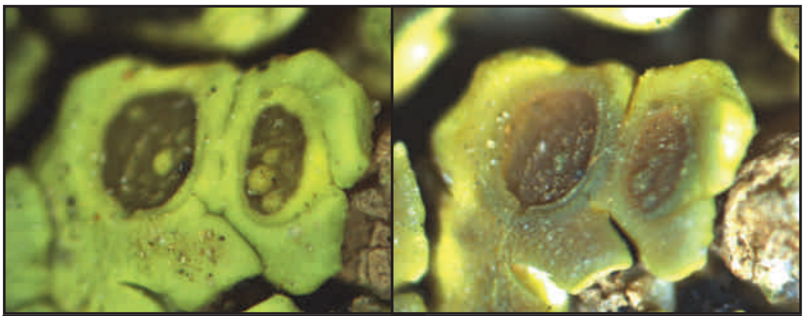

Figure 3. Imaging at 6.3x showing *Acarospora socialis* before O_3 on the left, and after on the right. Photo by Elizabeth Hessom.

2) measuring ion loss to determine if thallus damage had occurred. In addition, microscopic imaging was performed during each sampling period to register if thallus damage or color change had occurred. A novel protocol was also developed to measure the dark respiration occurring from the lichens during each sampling period to see if the fungal component of the lichens was damaged, and changing the output of CO_2 being released. Previous protocols used in the literature involved more destructive methods, which removed the lichen from its substrate (Larson & Kershaw 1975). However, in order to avoid this destructive step with the crustose lichen, a protocol was developed by placing the lichen/rock substrate sample into a darkened mason jar, which was then hooked up to a Licor-7000 infrared gas analyzer (LI-COR Environmental, NE, USA) to measure the total released CO_2 during dark respiration from the lichen sample. With the results from these measures, we were able to determine the sensitivity of *Lobothallia praeradiosa* (Nyl.) Hafellner, and *Acarospora socialis* H. Magn. to O_3 and HNO_3.

Results indicated that both species had similar sensitivities to O_3 and HNO_3. Both species registered physical damage during the O_3 fumigation (as captured by the imaging protocol, Fig.3), increased cation loss, as well as a decrease in dark respiration. Neither species showed major physical damage to HNO_3, but both manifested a decrease in chlorophyll fluorescence, suggesting damage to the photosynthetic systems of the algae symbiont. These results suggest that both species reacted negatively to the presence of O_3, and therefore could be used as passive bioindicators for O_3 in a field setting. The species however did not have a strong negative reaction to HNO_3 fumigation, indicating that it may not be feasible to use these species as bioindicators of HNO_3 pollution.

Findings from this research also suggested that the fungal component is more sensitive to the present atmospheric pollutants than the algal component. This may be due to the fact that the fungal component makes up the majority of the lichen structure, thus more of it is exposed to atmospheric deposition, whereas the algal component is more protected within the fungal structure (Purvis 2000).

Overall, this study expanded the background knowledge of these two unstudied crustose species, their susceptibilities to two different pollutants, and their potential use as passive bioindicators for atmospheric pollution. This study also helped expand the current research on crustose lichen species, and illustrated that atmospheric deposition fumigation studies can be done on crustose lichens, despite the difficulties they present in needing to remain attached to their substrate. I hope that this research generates interest to work with crustose lichens, and use them as bioindicators in the future.

Acknowledgments

I would like to thank CALS for their support throughout this research project, and for helping make it possible. I would also like to thank my thesis committee, particularly Dr. Pamela Padgett, and Dr. David Parker. Lastly, I would like to thank Kerry Knusden for all of his help, guidance, and enduring hot days out in Joshua Tree National Park with me.

Literature Cited

Allen E. B., A. Bytnerowicz, M. E. Fenn, R. A. Minnich & M. F. Allen. 2006. Impacts of anthropogenic N deposition on weed invasion, biodiversity and the fire cycle at Joshua Tree National Park. Unpublished report. PMIS Number 72123: 1-35.

Allen E. B., L. E. Rao, R. J. Steers, A. Bytnreowicz & M. E. Fenn. 2009. Impacts of atmospheric nitrogen deposition on vegetation and soils at Joshua Tree National Park. In R.H. Webb, L.F. Fenstermaker, J.S. Heaton, D.L. Hughson, E.V. McDonald, & D.M. Miller (Eds.), The Mojave Desert: Ecosystem Processes and Sustainability (78-100). Las Vegas: University of Nevada Press.

Larson, D. W. & K. A. Kershaw. 1975. Measurement of CO_2 exchange in lichens – new method. Canadian Journal of Botany-Revue Canadienne De Botanique 53: 1535-1541.

One of the field sites for this study near Pine City, CA. Photo by Elizabeth Hessom.

Typical Joshua Tree lichen mosaic. *Acarospora socialis* is dominant, mixed with *Candelariella citrina* and *Xanthoparmelia mexicana*, growing on monzogranite. There are several other smaller crustose lichens mixed among them including the endolithic *Lecidea laboriosa*, which are not visible. Photo by Jana Kocourková

Anti-microbial Activity of Extracts from Two Lichens- *Ramalina menziesii* and *Usnea lapponica*

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Resistance of various pathogenic bacteria against current antibiotic therapies has become a serious medical issue. Therefore, the search for new antibiotics is essential to the effective management of rapidly evolving drug resistant pathogenic bacterial strains. In this study the in vitro anti-microbial activity of crude chemical extracts from two North American lichens Ramalina menziesii *and* Usnea lapponica *was investigated. Extracts from these two lichens were screened against four pathogenic bacteria and minimum inhibitory concentrations (MIC) were calculated. The broth dilution method was used to quantitatively determine MIC values. Extracts from both species inhibited growth of all tested bacteria except* Escherichia coli. *Usnic acid was identified as the major active compound in both species using thin layer chromatography. Acetone extracts were found to be more effective than methanol extracts. Acetone extracts of both lichens were found to be particularly active against* Staphylococcus aureus *and* Pseudomonas aeruginosa *with a MIC value of 15.6 µg/ml reported for both species. However, the acetone extract from* U. lapponica *(MIC = 15.6 µg/ml) was more active against Methicillin-resistant* S. aureus *than the extract from* R. menziesii *(MIC = 250 µg/ml). In conclusion, chemical extracts from both lichens examined in this study merit further investigation.*

Introduction

Bacterial infections represent one the most serious problems facing modern medicine and the development of new drug therapies to effectively counteract bacterial pathogens has become one of the top research priorities among medical researchers. The development of antibiotics in the 1940s provided a powerful tool for addressing bacterial infections; however, because of the widespread misuse of antibiotics, several bacterial strains have evolved resistance to almost all of the currently used antibiotics, a condition that poses a significant threat to the health and welfare of humans as well as a significant challenge to researchers. Hence, there is an urgent need for a new class of antibiotics with a new mode of action so that the potential lifetime of anti-microbial drug therapies can be increased.

Natural products have made a significant contribution to modern drug discovery efforts. Drug therapies useful against a variety of microbial pathogens

Ramalina menziesii at Crane Creek Regional Park in Sonoma County. Photo by Clint Kellner.

have already been identified and developed from several natural sources, including: vascular plants, fungi, prokaryotes, marine organisms, etc., yet there still remains a vast potential reservoir of untapped possibilities; among them lichen secondary metabolites.

The antibiotic potential of lichen secondary compounds was first investigated by Burkholder et al. (1944). Since then numerous studies have further examined the potential use of a variety of lichen compounds as antibiotics. However, of the 18,500 known lichen species (Boustie & Grube 2005) with more than 1,000 identified secondary compounds (Molnar & Farkas 2010), only a few have been tested against bacteria and identified as potential antibiotics. North America is home to a diverse assemblage of lichen species. Although taxonomic, ecological, and phylogenetic studies of North American lichens have increased, studies focusing on the biological and/or pharmaceutical roles of lichens and their secondary metabolites have generally been limited. In order to more thoroughly explore the potential antibiotic roles of North American lichens, we have screened more than 35 species, including *Ramalina menziesii* and *Usnea lapponica* collected from two different sites in California. Here we report on the antibiotic potential of crude extracts from these two lichens against four different pathogenic bacteria – *Escherichia coli, Pseudomonas aureginosa, Staphylococcus aureus*, and Methicillin-resistant *S. aureus* (MRSA).

Materials and Methods

Collection of Lichen Samples

The two California lichens, *R. menziesii* and *U. lapponica* used in this study were collected respectively from Hastings Natural History Reserve, Carmel Valley, California (36° 22' 45.47" N latitude, 121° 33' 58.47" W longitude) and about 15 km south of Willits, near "Seabiscuit's Barn" in Mendocino County, California (39° 19' 12.7776" N latitude, 123° 18' 36.777" W longitude). Voucher specimens of both species have been deposited in the Herbarium of Nonvascular Cryptogams at the M.L. Bean Life Science Museum, Brigham Young University (BRYC).

Extraction of Lichen Secondary Chemicals

Four grams of lichen material from

each species were ground in liquid nitrogen and then extracted separately in 40 ml each of acetone and methanol. The extracts were dried under a stream of nitrogen gas and the residue was then dissolved in DMSO. The stock solution (8 mg/ml) was stored at -20^{0}C.

Identification of the Lichen Compounds

Major lichen compounds present in both species were identified using standard TLC techniques (Orange et al. 2001).

Microbial Cultures

Strains of *Staphylococcus aureus* (ATCC 6538P), *Escherchia coli* (ATCC 11229), and *Pseudomonas aureginosa* (ATCC 27853) were provided by Dr. Rex G. Cates, Department of Biology, Brigham Young University while the Methicillin-resistant *Staphylococcus aureus* (*S. aureus* COL) was provided by Dr. Bryan Wilkinson, University of Illinois. All bacterial cultures were prepared by transferring a single colony of each strain into 10 ml of Muller Hinton Broth (Sigma Aldrich, St. Louis, MO) and incubated at 37^{0}C for 24 hours.

To determine the biological activity of the lichen extracts, minimum inhibitory concentration (MIC) values for both lichens were calculated against all four bacterial strains using the micro-well dilution assay method. Serial dilutions of each lichen extract were prepared using Muller Hinton Broth with concentrations ranging from 500 - 3.9 µg/ml in a 24 well plate. Into each well 4 µl of an overnight culture of one of the 4 bacterial strains were added. From the 24 well plate, 100 µl of each concentration were then transferred to a 96- well plate in triplicate. Gentamycin was used as a positive control and DMSO of equivalent concentration was added as the vehicle control. After 24h incubation 60 µl of p-iodonitrotetrazolium violet (INT; Sigma Aldrich, St. Louis, MO) were added to each well. Living bacteria will reduce the INT dye and change the color from colorless to pink. The concentration at which there is no reduction of INT represents the specific MIC value for that particular concentration of lichen extract (Mann and Markham, 1998).

Results

Identification of lichen secondary compounds

TLC analysis showed that both *U. lapponica* and *R. menziesii* contain usnic acid as their major secondary compound.

Minimum Inhibitory Concentration

The acetone and methanol extractions of *U. lapponica* and *R. menziesii* were screened against the four different bacterial strains and all extracts were found to be active against three of the four bacteria – *S. aureus, P. aureginosa*, and

Table 1. Minimum Inhibitory Concentration (MIC) values (µg/ml) for lichen extracts against the four bacterial strains.

	E. coli		***P. aureginosa***		***S. aureus***		**MRSA**	
	A	**M**	**A**	**M**	**A**	**M**	**A**	**M**
R. menziesii	>500	>500	15.6	62.5	15.6	125	250	500
U. lapponica	>500	>500	15.6	15.6	15.6	31.25	15.6	62.5

Methicillin-resistant *S. aureus* in the tested concentrations (Table 1). The acetone extraction of both lichens was found to be more active than the methanol extract. The MIC values for Gentamycin against *E. coli, S. aureus*, and *P. aureginosa* were <3.5 µg/ml and for Methicillin-resistant *S. aureus* it was <10 µg/ml. The vehicle control (DMSO) did not show any activity against the four bacterial strains.

Discussion

Although the search for novel antibiotic compounds from various natural sources has been in process for many years it is currently gaining momentum as the frequency and extent of antibiotic resistance has increased. Among the various natural sources of potential antibiotic drug therapies, lichens show particular promise because they produce an impressive suite of low molecular weight secondary compounds. In this study the anti-microbial activity of crude chemical extracts from two lichen species (*U. lapponica* and *R. menziesii*) were tested against four pathogenic bacteria and quantitatively assessed by determining MIC values. To our knowledge, this is the first study reporting on the antibiotic properties of these two North American lichen species. Our results show that crude extracts, at various concentrations, from both lichens were effective against *P. aureginosa, S. aureus* and Methicillin-resistant *S. aureus* but not against *E. coli*. Our results are consistent with other published studies examining the antibiotic properties of lichens (Gulluce et al. 2006; Karagöz et al. 2009; Paudel et al. 2008; Turk et al. 2003).

Although both the acetone and methanol extractions showed activity against all the bacterial strains except *E. coli*, the acetone extraction showed even greater activity when compared with the methanol extraction. Several studies (Ranković et al. 2007; Turk et al. 2003; Yilmaz et al. 2005) have reported similar differences between these two extraction solvents. Hence it can be concluded that the solvent used in the extraction process either directly affects the inhibitory strength of the lichen compounds or fails to effectively extract particularly active compounds.

Both of the lichen species examined in our study contained usnic acid as a major chemical constituent. Usnic acid has been documented as an effective antibiotic compound against a variety of pathogenic bacteria (Cocchietto et al. 2002; Ingólfsdóttir 2002). However, there was a clear difference in the MIC values between the two extraction solvents for three of the four bacteria, particularly in the case of the Methicillin-resistant *S. aureus*. This phenomenon may be due to the fact there is some measure of quantitative variation in the content of the secondary compounds between the two solvents (Nybakken & Gauslaa 2007); or there may be a synergistic effect between the various compounds in one or both of the crude extracts. Several studies have reported that some lichen compounds either as crude extracts or as purified compounds are not active against *E. coli* and *P. aeruginosa* (Ingólfsdóttir 2002; Lauterwein et al. 1995; Yilmaz et al. 2005). Results from our study were similar for *E. coli,* but extracts from both lichens demonstrated impressive activity against *P. aeruginosa* (Table 1). Likewise, Ingólfsdóttir et al. (1985) showed that both crude extracts and purified compounds from some lichens were active against *P. aeruginosa*. We think that variation in the results among these different studies may be related to the chemical combinations characteristic of different lichen species, the solvent used for extraction, and/or the resistance capacities for specific bacterial strains.

Our results show promise for using crude chemical extracts of North American lichens as potential new sources for discovering anti-microbial secondary metabolites. Crude extracts from lichens tested in conjunction with this project showed good inhibitory activity against *P. aeruginosa, S. aureus*, and Methicillin-resistant *S. aureus*. In conclusion, chemical extracts obtained from these two lichens merit further research consideration.

Acknowledgements

We would like to express our sincere appreciation to the California Lichen Society Education Grants Program for providing funding for this project. Thanks also go to Monica Proulx, Brigham Young University and Mark R. Stromberg, Natural Reserve System, University of California for collecting lichen samples and Jocelyn Raphael, Brigham Young University for her help in the lab. We also thank Clint Kellner and Stephen Sharnoff for providing the photos used in this article.

Literature Cited

Boustie, J. & M. Grube. 2005. Lichens - a promising source of bioactive secondary metabolites. Plant Genetic Resources 3: 273-287.

Burkholder, P. R., A. W. Evans, I. McVeigh & H. K. Thornton. 1944. Antibiotic activity of lichens. Proc Natl Acad Sci USA 30: 250-255.

Cocchietto M., N. Skert, P. L. Nimis & G. Sava. 2002. A review on usnic acid, an interesting natural compound. Naturwissenschaften. 89:137-46.

Gulluce, M., A. Aslan, M. Sokmen, F. Sahin, A. Adiguzel, G. Agar & A. Sokmen. 2006. Screening the antioxidant and antimicrobial properties of the lichens *Parmelia saxatilis*, *Platismatia glauca, Ramalina pollinaria, Ramalina polymorpha* and *Umbilicaria nylanderiana*. Phytomedicine 13: 515-521.

Ingólfsdóttir, K. 2002. Usnic acid. Phytochemistry 61: 729-736.

Ingólfsdóttir, K., S. F. Bloomfield & P. J. Hylands. 1985. In vitro evaluation of the antimicrobial activity of lichen metabolites as potential preservatives. Antimicrobial Agents and Chemotherapy 28: 289-292.

Karagöz, A., N. Dogruöz, Z. Zeybek & A. Aslan. 2009. Antibacterial activity of some lichen extracts. Journal of Medicinal Plants Research 3: 1034-1039.

Lauterwein, M., M. Oethinger, K. Belsner, T. Peters & R. Marre. 1995. In vitro activities of the lichen secondary metabolites vulpinic acid, (+)-usnic acid, and (-)-usnic acid against aerobic and anaerobic microorganisms. Antimicrobial Agents and Chemotherapy 39: 2541-2543.

Mann, C. M. & J. L. Markham. 1998. A new method for determining the minimum inhibitory concentration of essential oils. J Appl Microbiol 84: 538-44.

Molnar, K. & E. Farkas. 2010. Current results on biological activities of lichen secondary metabolites: a review. Z Naturforsch C, 65: 157-173.

Nybakken, L. & Y. Gauslaa. 2007. Difference in secondary compounds and chlorophylls between fibrils and main stems in the lichen *Usnea longissima* suggests different functional roles.

Lichenologist 39: 491-494.
Orange, A., P. W. James & F. J. White. 2001. Microchemical Methods for the identification of lichens. British Lichen Society. London, pp. 101.
Paudel, B., H. D. Bhattarai, J. S. Lee, S. G. Hong, H. W. Shin & J. H. Yim. 2008. Antibacterial potential of Antarctic lichens against human pathogenic Gram-positive bacteria. Phytother Res 22: 1269-1271.
Ranković, B., M. Mišić & S. Sukdolak. 2007. Evaluation of antimicrobial activity of the lichens *Lasallia pustulata, Parmelia sulcata, Umbilicaria crustulosa*, and *Umbilicaria cylindrica*. Microbiology 76:, 723-727.
Turk, A. O., M. Yilmaz, M. Kivanc & H. Turk. 2003. The antimicrobial activity of extracts of the lichen *Cetraria aculeata* and its protolichesterinic acid constituent. Z Naturforsch C 58: 850-854.
Yilmaz, M., T. Tay, M. Kivanc, H. Turk & A. O. Turk. 2005. The antimicrobial activity of extracts of the lichen *Hypogymnia tubulosa* and its 3-hydroxyphysodic acid constituent. Z Naturforsch C 60: 35-38.

Usnea lapponica. Photo by Stephen Sharnoff.

The Lichens of Joshua Tree National Park

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There are no lichens on Joshua trees.

The biggest Joshua trees can be over 200 years old and 70 feet tall. They have beautiful clusters of creamy white blossoms pollinated by nocturnal moths. I have spent over 100 days in Joshua Tree National Park studying lichens since 2005. I never get tired of seeing Joshua trees at the end of the day, in the last sunlight, the pink time. Their fruit was a favorite food of ground sloths that once roamed Pleistocene Mojave savannas. Sloth patties spread the seeds.

Joshua Tree National Park is the 15th largest national park in the United States. It is bigger than Yosemite National Park. And like Yosemite most of its area is designated wilderness. It is a couple hours from L.A. and the Pacific. The park contains the southwestern corner of the Mojave Desert and a very dry chunk of the Sonoran Desert called in California the Colorado Desert. It has basins and ranges. It is on the very edge of the North American Plate. If you have never been there, you should see the Joshua trees and the giant piles of monzogranite boulders and slabs, the beautiful naked geology, the wildflowers in spring.

And the lichens.

Lichens are conspicuous in Joshua Tree National Park - bright yellow, citrine, oranges, blacks, usnic acid greens, browns, whites from dense pruina - their colors splashed across pale monzogranite outcrops and dark banded gneiss, photographed by countless visitors. But the lichens are not everywhere. Lichens are absent from most of the park, from south slopes and ridgelines, from miles of the desert floor, even sometimes where you would expect them. They are in the washes and on the north side of large outcrops, in ancient canyons and on top the highest peaks. They are most diverse and plentiful in pinyon pine-juniper woodland.

No one had ever studied the lichens of Joshua Tree National Park. In 2004, botanist Tasha La Doux saw a picture of me in a CNPS newsletter, sprawled out on the desert, looking at a soil crust with my hands-lens. New at Joshua Tree National Park, with a doctorate from Rancho Santa Ana Botanic Garden, Tasha had begun an

Joshua Tree National Park. Photo by Jana Kocourková.

inventory of the plants of the national park, which they are completing in 2013. She invited me to take a look at the lichens. We surveyed the alkaline Keys Ranch in the Wonderland of Rocks and on top of Eureka Peak in the Little San Bernardino Mountains and did some random collecting around the park (Knudsen & La Doux 2005 & 2006). I eventually identified about 60 lichens. I was not entirely convinced there were many more species in the park, but Tasha proposed an inventory and we eventually got the money. I started collecting in December 2010. Jana Kocourková got an international grant to work with me, studying lichenicolous fungi, helping to describe new lichen species, and even to do a photography exhibit on the Mojave Desert in Prague. We worked together in the field in 2011 and 2012. I collected and curated 1954 specimens from 238 sites and identified over 145 taxa, with 6 probably new to science. We are describing new species of *Dimelaena, Heteroplacidium, Lecidea*, and *Sarcogyne*. There were 50 more species than I expected and more than I hoped. The government has published online *The Lichens of Joshua Tree National Park: an Annotated Checklist* by Kerry Knudsen, Josh Hoines, and Mitz Harding (2013) available for free download at the CALS web site. The annotated checklist discusses every species we collected in the park with lots of pictures and maps.

At the beginning of the 21st century, most of the lichens occur on rock in Joshua Tree. The granites and monzogranites are the predominant rock type in Joshua Tree. Over 2 billion year old gneiss is also common, the same rock

Rocky terrain at Joshua Tree National Park. Photo by Jana Kocourková.

that is at the bottom of the Grand Canyon, here thrust to the surface along the edge of the North American Plate by the subduction of the Pacific Plate. Joshua Tree was once on the coast of North America 100s of millions of years ago. Now it is land-locked, far from the Pacific, cut off from the oceanic fogs and the low marine layers by the coastal ranges. (In 100s of millions of years, Joshua Tree will be coast again, sloping down to beaches strewn with seaweed. Then Los Angeles will be on a giant island off the coast of northern California, as the Pacific Plate sails for Alaska and oblivion). Some lichens appear to prefer the monzogranite and never occur on gneiss. No species appears to occur only on gneiss. But because it is a hard durable rock, gneiss outcrops can have diverse and colorful lichen communities.

There are two basalt summits, Malapai Hill and a hill without a name in the Lost Horse Mountains. We found no lichens restricted to basalt. There are no major limestone deposits in the park. All the limestone eroded away long ago. There is marble deep in the Eagle Mountains, but I have not hiked there yet. We only found

Psora tuckermanii. Photo by Jana Kocourková.

one large area of exposed caliche rich in lichens. *Caloplaca nashii* and *Candelariella aurella*, which can grow on concrete, were abundant on seasonal drainages on monzogranite outcrops, where quickly evaporating rainwater leaves calcium crystals.

If you are interested in geology, you should buy Joshua Tree National Park Geology by D.D. Trent and R.W. Hazlett (2002). It's a modern classic published by the Joshua Tree National Park Association. It is a beautiful book for 10 bucks in the visitor centers and twice as much on Amazon.

Soil crusts are common in Joshua Tree, though most of the desert is desiccated mineral soil that blows away from between your fingers. The most common crusts are almost invisible, formed of filamentous cyanobacteria and one-celled algae, archaea, and fungi that are just sterile strings. This soil does not blow away in the wind. It is friable. Lichens appear to be successional, growing on these well-formed crusts after they have stabilized the sandy soil. Some lichens may stabilize pioneering soil crusts stimulating a richer succession of algae, archaea, and cyanobacteria. This fall of 2013, Dr. Nicole Pietrasiak and I will give a 2 day seminar with lectures, field trips, and lab, on the soil crusts of Joshua Tree National Park. Nicole got both her masters and her doctorate studying landscape, soil crusts, and algae in the Mojave Desert. She loves lichens in soil crusts. She is cutting edge.

The most common lichens in Joshua Tree are *Acarospora socialis, A. strigata, Caloplaca nashii, C. squamosa, Candelariella aurella, Circinaria arida, Clavascidium lacinulatum, Collema coccophorum, Heteroplacidium compactum, Lobothallia praeradiosa, Physcia dimidiata, Psora tuckermanii, Sarcogyne plicata, S. privigna, Xanthoparmelia mexicana*, and *Xanthoria elegans*. Another 50 species are relatively less common to frequent. That leaves about 73 species that are rare or infrequent in the Mojave Desert and maybe 6 in the Sonoran Desert. Those are rough numbers. Our results, presented in the annotated checklist, are preliminary.

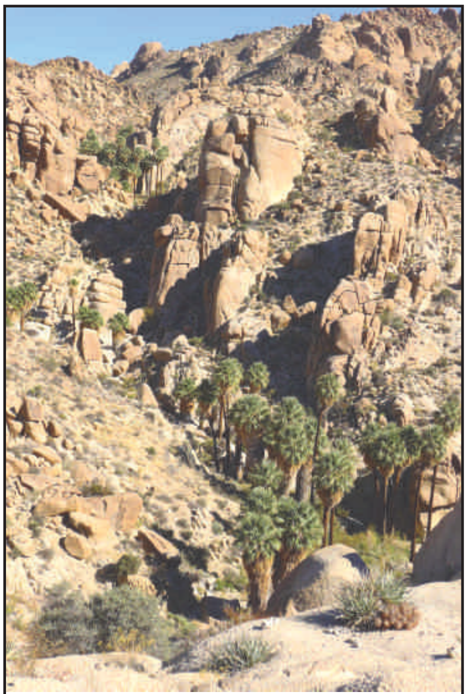
Almost all the lichens in Joshua Tree are crustose. There are no fruticose lichens. The macrolichens are all foliose. Only the *Xanthoparmelia* get big. Foliose lichens like *Phaeophyscia hirsuta* and *P. sciastra* are so reduced they are easily overlooked. There is not much on the trees and only in the higher elevations of the park. It is just too dry. *Physcia dimidiata, Caloplaca durietzii*, and *Buellia punctata* are infrequently found growing on the permanently shaded bases of ancient junipers. Other species are rarer, like two *Cyphelium* and *Lecanora laxa*. *Xanthomendoza fallax* still occurs on junipers, but like the *Physconia* and *Physcia*, often looks stunted from the low humidity and tattered from lacerating wind storms. But it is thriving on granite in the bottom of shady little canyons, out of the wind and sun.

We are going deeper and deeper into the wildness areas in Joshua Tree. One by one we are bagging the highest peaks. We expect to discover more species for the park and we will probably discover some more taxa new to science. I plan to eventually write keys for the park for monitoring and inventory use when I am satisfied that we have captured most of the diversity. We hope the Joshua Tree National Park Association will ultimately publish a lichen field guide for the park to accompany the keys for public education.

Joshua Tree National Park contains two deserts, the Mojave Desert (high desert) and the Sonoran Desert (low desert). They can be cold and hot. There can be snow. It can be hot enough in summer to kill tourists lost and without water in four or five hours. There's a large arcing transition zone between the two deserts where the overall elevation drops below 3000 feet, which is predominately Sonoran.

The Mojave Desert is where the Joshua trees occur, thousands and thousands. There are also oaks, pinyon pines and junipers, manzanita and gigantic Nolina. Quail Mountain at 5,813 feet is the highest peak. Lichens are more plentiful and diverse as elevation increases. This part of the park generally gets the highest rainfall, especially from Keys View to Black Rock, often 4 inches in a year. Of the 145 lichens

Xanthoparmelia mexicana. Photo by Jana Kocourková.



Lost Palm Canyon in the Eagle Mountains. Photo by Jana Kocourková.

Acarospora socialis. Photo by Jana Kocourková.

we reported for the park, 143 occur in the Mojave Desert in the northwest portion of the park, but only about 70 species also occur in the Sonoran Desert and its transition zone in the park (Knudsen et al. 2013).

The northwest area of Joshua Tree National Park, where the greatest diversity and density of lichens occur, has high levels of nitrate deposition (Allen et al. 2009). Overall the crustose lichens appear tolerant to current conditions. Elizabeth Hessom found that two common crustose species can be affected by high levels of exposure to nitric acid and ozone (Hessom 2012). One of them, *Acarospora socialis*, can get a brown discoloration from episodic ozone exposure (Hessom 2013). The brown areas we examined so far on Joshua Tree populations were infections by an undescribed anamorphic fungus. The immediate danger from nitrate deposition to lichens is fire. The nitrate deposition fertilizes the invasive grasses like red brome. When they die in summer, their biomass does not blow away and between the rocks and Joshua trees they become dry, yellowish carpets of fuel. The fires in the desert are caused by lightning. Before invasive grasses started piling on the fuel load, lightning fires would be small and burn out quickly because of the wide spacing of the desert shrubs and trees. Now the dead invasive grasses fuel extensive fires that can wipe out thousands of Joshua trees, and blowtorch lichens off the rocks. The lichens may never come back in to areas that have burned. The best example of this devastation is along the dirt road to Covington Flats where once some of the biggest Joshua Trees in the park spread their branches beneath the stars. Even if the lichens come back, it will probably take hundreds of years. Lichens grow slow in the desert. We do not know how slow! During droughts they probably do not grow at all. Nor do we have any idea how old lichens are in the desert. A lichen the size of a quarter could be 50 years old. Maybe a lot older. There are some specimens of *Aspicilia cuprea* in the


Lower Covington Flats. Photo by Jana Kocourková.

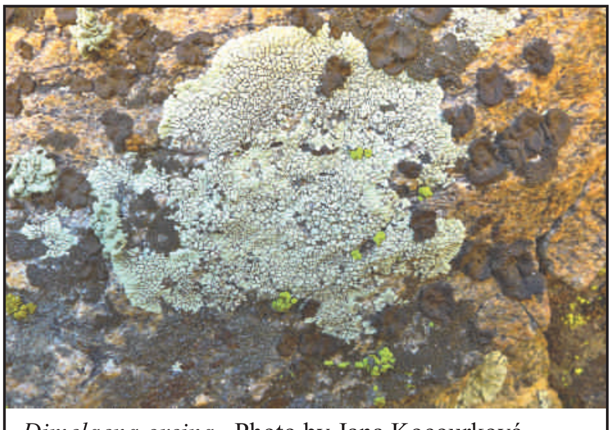
Wonderland of Rocks as wide across as dinner plates. How old are they?

In the Sonoran Desert in Joshua Tree National Park the elevations drop to as low as 500 feet. The Joshua trees disappear and creosote bush is everywhere. There are gray smoke trees in the big washes like Fried Liver Wash. There is ocotillo with red flowers and thickets of jumping cholla with lethal spines. New mountain ranges rise above the low desert: the Pinto range, the Coxcombs (they have a jagged profile like a rooster's red comb), the Eagle Mountains, the Cottonwood Mountains. There is the great Pinto Basin, once a Pleistocene lake, Pinto Lake. On its shores the first Californians lived. Their village thrived for 1000s of years. They hunted mega fauna on the savanna. They fished and swam. There were regular winter and summer rains. Over 10,000 years ago, the Holocene began and the glaciers receded and the summer rains began to disappear. The lake dried up, the top soil of savanna was eroded away, the mega fauna became extinct, and the village was abandoned.

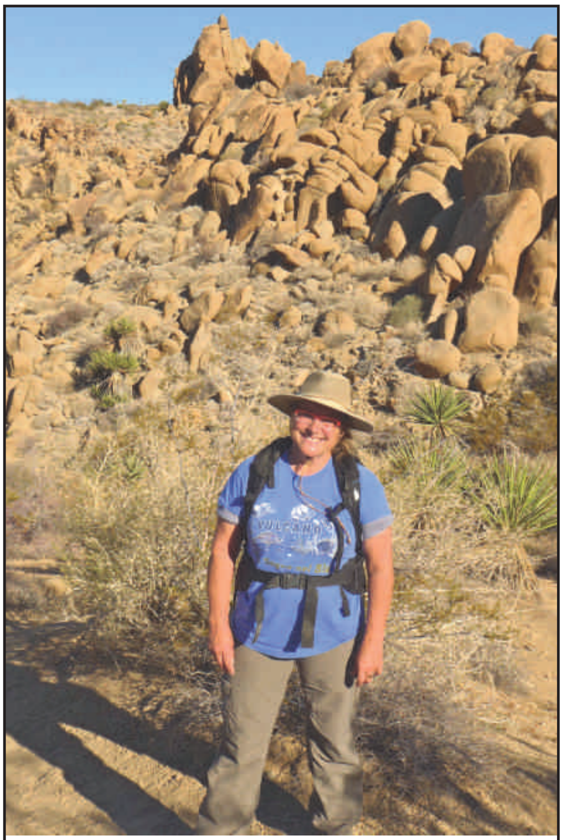
The annual rainfall in the Sonoran Desert in Joshua Tree is usually 2 inches, often from rare monsoons, sometimes dropped in an hour with violent flash flooding. The main highway across the park was wiped out in 2011. In Arizona, the Sonoran Desert often gets 15 inches of rain a year and it has a regular monsoon season. In Joshua Tree, there is not the rich and diverse flora of small cyanolichens and large effigurate *Lecanora* species found in Arizona (Schultz 2009).

At the beginning of the 21st century, current global warming models predict that the southwest will become more arid (for a readable overview see de Buys 2012). Joshua Tree is already getting drier and warmer. Pinyon pines are dying. Birds are moving higher up slopes to nest. Some lichens like *Acarospora peliscypha* are rare and never found fertile, probably due to environmental stress.

The reason Joshua Tree has over 145 species is climate change. During the 2.5 million years of the Pleistocene, Joshua Tree was wetter and the diversity of lichens was obviously much higher. Lichens like *Dimelaena oreina* and *Lecanora sierrae* that now normally occur in southern California and eastern Sierra Nevada Mountains above 6000 feet were probably common as well as hardy coastal range species like *Buellia badia, Lecidea*

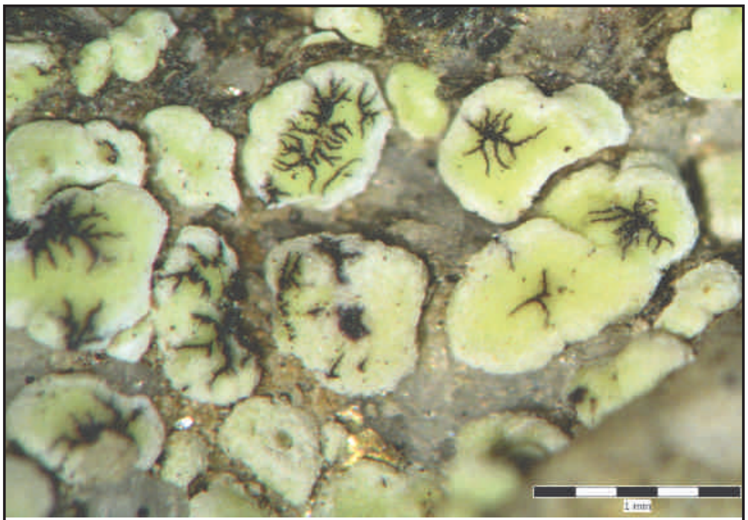

Dimelaena oreina. Photo by Jana Kocourková.

mannii and *Miriquidica scotopholis*. Also, many species that are now common in Arizona were probably once common in Joshua Tree, like *Lecanora argopholis, Lepraria vouauxii*, and *Caloplaca pellodella*, which are rare now. During the Pleistocene there were fertile and well-developed soils that would have supported more abundant and diverse soil crusts. Species like *Endocarpon pusillum* and *Placidium squamulosum* would have probably been common as well as maybe 20 species that now occur in coastal southern California soil crusts (Hernandez & Knudsen 2012). An example of possible Pleistocene diversity in the soil crusts of Joshua Tree is the new species *Sarcogyne mitziae* K. Knudsen, McCune & Kocourk. (Knudsen et al. in review). It is named for NPS botanist Mitz Harding. She found one population in a soil crust in the Little San Bernardino Mountains. We have never found it anywhere else in southern California. But Bruce McCune collected it in Idaho and Jane Ponzetti made a small collection in Washington. It must have once been common and its distribution probably more extensive throughout western North America.



Jana Kocourková on the hunt for lichenicolous fungi in Joshua Tree National Park. Photo by Kerry Knudsen.

Approximately 73 lichen species and infraspecific taxa occur only in the Mojave Desert in the northwest region of the park. Approximately 60 of those species are known from 5 or less collections, many from 1 to 3 collections. If Joshua Tree becomes drier and warmer, many of these rarer species are threatened. These lichens will not disappear immediately. But an inventory a hundred years from now in 2113 will probably find fewer species at lower densities in more restricted microhabitats. We are currently living through a human-made and global extinction event in which an unknown percentage of the world's current c. 8.7 million species, maybe as much as 40 or 50 percent, will disappear, many never to be known to science. Fortunately, most of the lichen species that could be extirpated from Joshua Tree have centers of distribution with denser populations elsewhere, either in the coastal and montane areas of California, or in other states in the Basin and Range Province or the Sonoran region. What the lichen flora would be in a drier and warmer future in the Mojave Desert is already revealed in the Sonoran Desert in Joshua Tree: less diversity, at less density. A future lichen



The lichenicolous fung*us Lichenostigma subradians* on *Acarospora socialis*. Photo by Jana Kocourková.

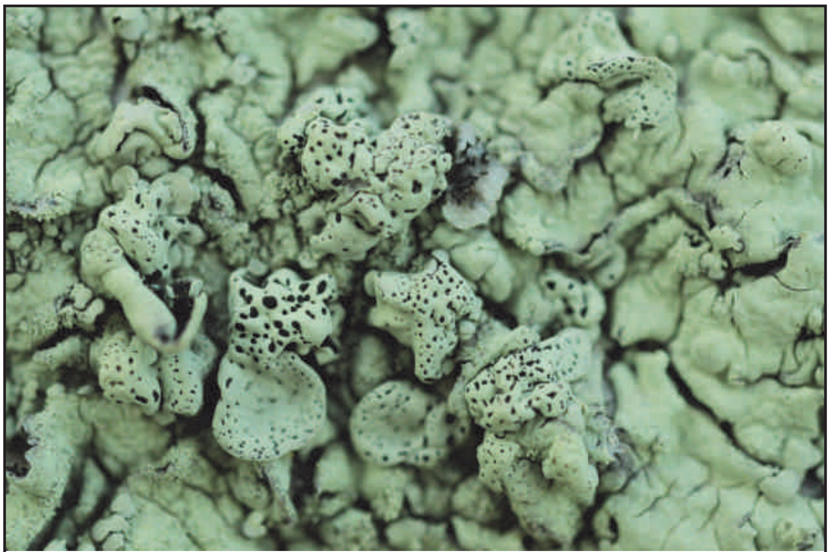
flora of 70 species?

Though not discussed in our annotated checklist, Jana Kocourková and I are studying two non-lichenized fungal groups at Joshua Tree National Park: lichenicolous fungi and saxicolous micro-fungi.

We have identified about 25 lichenicolous fungi so far and discovered two new lichenicolous lichens we are describing from Joshua Tree. Jana collected as many as 50 taxa. She discovered more than 10 species new to science, including species of *Polycoccum* and *Toninia*. *Lichenostigma* taxa are dominant and diverse. The ratio of lichenicolous fungi species to lichen species is the highest she has ever seen. This is probably due to the large areas of undisturbed habitat. She will be publishing on Joshua Tree for many years to come.

The saxicolous non-lichenized microfungi we are studying are *Lichenothelia*, black fungi that grow on rocks, either saprobic or lichenicolous, maybe weakly associated with algae. These are black thin populations, often on boulders under 200 year old junipers. They look like mineral deposits if you are just hiking by. Specimens from Joshua Tree have been sequenced and a phylogeny generated (Muggia et al. 2012). We are revising *Lichenothelia* species, beginning with *L. calcarea* Hessen, until recently only known from the type collected in Inyo County by Cherie Bratt (SBBG! isotype), but common in Joshua Tree.

During our 1st co-operative agreement for an inventory, I helped prepare the lichen pages for the park website which are still in development, including new text and a checklist linked to pictures. We just completed our 4th annual climate change summit for local high school biology students. CALS has supported the summit with an educational grant to buy hands-lens that the students use to monitor permanent lichen plots every year. I worked with two grad students as well. They both utilized lichens. Elizabeth Hessom (UCR) studied air pollution and



The lichenicolous fungi *Nesolechia oxyspora*. Photo by Jana Kocourková.

CALS supported her with a student grant (Hesssom 2012 & 2013). Jana's student Marketa Michalová studied the secondary metabolites of the lichens of Joshua Tree. She mastered thin-layer chromatography with Martin Kukwa in Poland. She is also a trained singer and she can rock. Little woman. Big voice. Because of Marketa, our lichen inventory made a small contribution to the continuing musical history of Joshua Tree.

The connection between rock music and Joshua Tree goes back to the 60s. Graham Parsons was an influential rock musician who played with The Byrds and the Flying Burrito Brothers. He often spent weekends in Joshua Tree. People like Keith Richards of the Rolling Stones used to come out to Joshua Tree and party with Parsons in the desert. Parsons expressed the wish to be cremated when he died and his ashes spread over Cap Rock. In 1973 he died of a drug overdose in room 8 of the Joshua Tree Inn at age 26. Morphine and alcohol. Despite his wishes, Parsons' family requested his body be shipped back to Louisiana for burial. While his body was waiting for the flight at Los Angeles International Airport, it disappeared. Parsons was cremated on Cap Rock and his ashes scattered in the wind.

The rock group America, who did a cool desert song, had an album cover photographed in Joshua Tree as did the original Eagles. U2 stood next to an old Joshua tree for the cover of their album Joshua Tree. That tree is now dead. The Gram Fest or the Cosmic American Music Festival was held annually in honor of Parsons in Joshua Tree from 1996 to 2006. There is a strong local music and art scene.

In December 2011, Marketa Michalová flew in to LAX to study with me for a week. She is a native of Prague. It's a big city with a cool and diverse music scene. Marketa sings in a couple of rock bands. She has long dreads she whips around when she is rocking. For a few days we went to Joshua Tree for her to see where the lichens grew that she was studying in the lab. She had never seen the desert before. And Joshua Tree is panoramic! The empty space between the sky and desert floor stretches away forever. Marketa was blown away.

On our last day, we went to Indian Cove. This is the north edge of the monzogranite maze of the Wonderland of Rocks. Mojave Man is supposed to live in the Wonderland of Rocks. He is a cross between a homeless person and big foot. Kind of pathetic actually. He is the one who steals beer out of ice boxes in the Indian Cove campground. He is probably not dangerous. Well, I have heard no tales of mayhem anyway. Some say his parents abandoned him in the desert. I heard he had a doctorate in English literature, grew his hair like a San Francisco bear, all Walt Whitman, and flipped out on an acid trip at Willow Hole. And he just stayed out in the Wonderland of Rocks, cooking rattlers and rabbits over an open fire for food, sharing water holes with big horn sheep, hiding in a cave during the hot days. As Marketa and I hiked across the open desert, we joked about Mojave Man like characters in the sunny beginning of a cheap horror movie.

Marketa and I entered the maze of the Wonderland of Rocks. I started collecting lichens on a shaded outcrop. Marketa began poking around. So she would not get lost, I told her I would stay where I was collecting until she came back. Marketa climbed up a steep skinny side wash and dropped in to the next canyon, taking notes and pictures for her thesis. I eventually finished collecting, sat down against a boulder, and waited for her. No use calling out for her. The desert eats your words. I stared at my boots. I needed to buy new boots. I thought about what kind of boots I should buy, about Jana, the end of capitalism, when I was going to revise *Acarospora socialis*, was I going to stop on the way back home for a traditional Indio-style date shake at Hadley's. Marketa was taking a long time. Finally I stood up, paced around, and shouted her name. Nothing. Best to stay in one place. I sat down again and leaned back against the boulder. Soon, I was nodding. I can fall asleep anywhere. In my dream the cement dinosaurs in Cabazon were alive like in *Pee Wee Herman's Big Adventure* and they were joyfully attacking a line of cars backed up from the Morongo tribe's glitzy casino. I couldn't get off the freeway to get a date shake at Hadley's. Suddenly I woke up! Where was Marketa? I instantly thought of Mojave Man, then that horror movie, the first version, *Hills Have Eyes*…..I smiled at myself. My imagination was running away from reality again. Marketa was just wandering around somewhere. I better find her. I got on the Boy Scout Trail and there she was, walking back from the car. She was all relief and smiles. She started laughing. Then talking fast, telling me everything. She had been afraid. She had gotten lost, lost in the desert. Totally lost.

As we drove to Palm Springs on the way back to my house, we started riffing about how that would make a great song, Lost in the Desert. It definitely should have a haunting guitar break. And indubitably the desert should mean more than the desert, it would mean all of life, and we are lost, lost in the desert.

We were just riffing.

The first time Jana and I heard "Lost in the Desert" was in Prague, in a club like a garage with good beer from the microbrewery and smoke in the air with a

skunky odor. Marketa and her band Hoodermanix had really written the song "Lost in the Desert". You can download it for free at:
http://bandzone.cz/hoodermaniax or troll for some Hoodermanix performances on U-Tube. Marketa dedicated it to me that night in English and they rocked. The guitar break, filling the long dark hall, was pure Mojave.

Acknowledgments

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Literature Cited

Allen E. B., L.E. Rao, R. J. Steers, A. Bytnreowicz & M. E. Fenn. 2009. Impacts ofatmospheric nitrogen deposition on vegetation and soils at Joshua Tree National Park, pp. 78—100 *In* R.H. Webb, L.F. Fenstermaker, J.S. Heaton, D.L. Hughson, E.V.McDonald & D.M. Miller (*Eds.*) The Mojave Desert: Ecosystem Processes andSustainability. Las Vegas: University of Nevada Press.

de Buys, W. 2011. A Great Aridness: Climate Change and the Future of the American Southwest. U.S.A.: Oxford University Press, 384 pp.

Hernandez, R.R. & K. Knudsen. 2012. Late-successional biological soil crusts in a biodiversity hotspot: an example of congruency in species richness. Biodiversity and Conservation 21 (4): 1015–1031.

Hessom, E. 2012. The Effects of Gaseous Ozone and Nitric Acid Deposition on two Crustose Lichen Species from Joshua Tree National Park. Master's thesis. UCR.

Hessom, E. 2013. The Effects of Gaseous Ozone and Nitric Acid Deposition on two Crustose Lichen Species From Joshua Tree National Park. Bulletin of the California Lichen Society 20(1): 1-4.

Knudsen, K., J. Hoines & M. Harding. 2013. The lichen flora of Joshua Tree National Park: an annotated checklist. Natural Resource Technical Report NPS/JOTR/NRTR—2013/ (number not assigned at press time). National Park Service, Colorado: Fort Collins. Download for free at CALS website.

Knudsen, K., J. Kocourková & B. McCune. In review. *Sarcogyne mitziae* (Acarosporaceae), a new species from biotic soil crusts in western North America. The Bryologist.

Knudsen, K. & T. La Doux. 2005. Lichen flora of the Southwestern Mojave Desert: Key's Ranch, Joshua Tree National Park, San Bernardino County, California, USA. Evansia 22(3): 103-109.

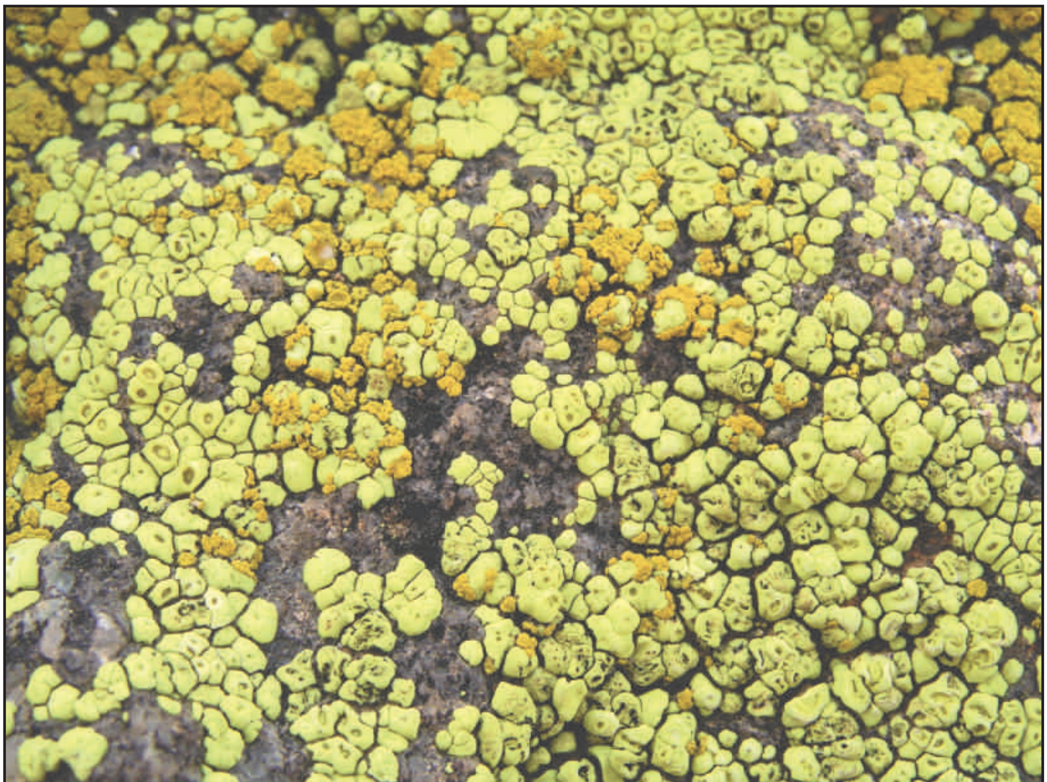
Knudsen, K. & T. La Doux. 2006. Lichen flora of the southwestern Mojave Desert: Eureka Peak, Joshua Tree National Park, Riverside and San Bernardino County, California. Evansia 23(2): 24-27.

Michalová, M. 2012. Chemistry of lichens of southwest Mojave Desert. 101 pp., Ms [Dipl. Pr.; depon. In: Faculty of Environmental Sciences, Czech University of Life Sciences, Praha]. Duplicate copy in library of New York Botanical Garden.

Muggia, L., C. Gueidan, K. Knudsen, G. Perlmutter & M. Grube. 2012. The Lichen Connections of Black Fungi. Mycopathologia. Online publication. DOI 10.1007/s11046-012-9598-8

Schultz, M. 2009. Chasing small cyanolichens. Bulletin of the California Lichen Society 16(2): 34-37.

In the distance, the Wonderland of Rocks glows white in the late afternoon sun. Photo by Jana Kocourková.



Candelariella citrina (orange) and *Acarospora socialis* (yellow) grow on a monzogranite boulder in Joshua Tree. Photo by Jana Kocourková.

Thirty Years of Lichen Decline in the Southern Sierra Nevada

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Changes in some lichen populations have been recorded over the past 30 years at Central Camp, Madera County, CA in the southern Sierra Nevada.

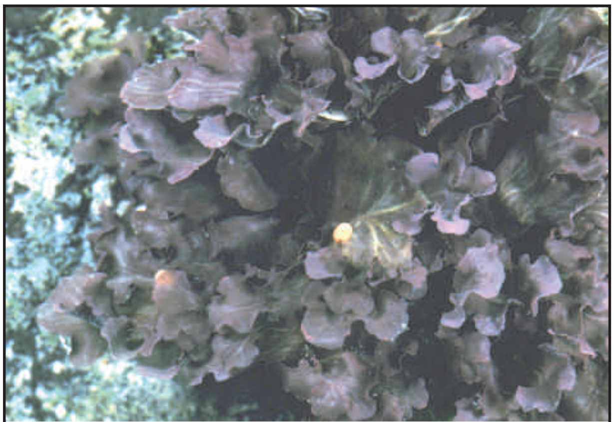
I had a cabin in Central Camp, Madera County for many years, and often lichenized there. Central Camp is a small mountain community of old cabins left from the Sugar Pine Lumber Company that went bankrupt in the 1920's. It is located within a square mile of private land in the Sequoia National Forest in Madera County at 1630m (5450 ft) elevation; 37º 21' N, 119º 28' W. It is in an ecotone of mixed conifers, shrubs, and riparian and meadow vegetation.

Peltigera gowardii (Synonym: *Hydrothyria venosa*)

It was at Central Camp in early summer, 1977 that I found *Peltigera gowardii*, which at that time was called *Hydrothyria venosa*. This is one of the few lichens that grow in running fresh water, particularly in cold mountain streams. It was growing abundantly in a side creek of the North Fork of Sand Creek. This population almost covered the side creek bed 3-4 feet wide for about 50 feet. Some years later the side creek population was only 2-3 feet wide for nearly 38 feet. The side creek had a smooth, solid granite base while the North Fork of Sand Creek was almost entirely large and small boulders. *Peltigera gowardii*, in Sand Creek proper, was restricted to the downstream roots of Indian Rhubarb (*Darmera peltata*) growing in the middle of the stream. Both have thunderous runoff in normal snow-pack years. Most *P. gowardii* are found attached to cobblestones in slowly flowing mountain creeks.

I sent sample collections of the *Peltigera* to Mason Hale at the Smithsonian Institution in Washington, D.C., and to William Weber, at the University of Colorado, Boulder in 1977. Several years later later, samples of *P. gowardii* populations, including the one at Central Camp, were taken by William C. Davis, who published his Ph. D. dissertation on the ecophysiology of *Hydrothyria* (Davis 1999). I took several lichenologists to see this *P. gowardii* colony; Cherie Bratt in September 1985, and Bruce Ryan in June & July 1994. Both made collections that are deposited in various herbaria (ASU, MIN, MSU, SBBG, WIS).

Over time, the original population of *P. gowardii* gradually decreased in size, and



Peltigera gowardii. Photo by Stephen Sharnoff.

was replaced by a water-tolerant moss. In the fall of 2006, *P. gowardii* thalli could only be found close to the bank of the side creek. The population was almost gone. In the drought years of 2007, I was able to check portions of Sand Creek to see if thalli had persisted growing on the lee side of roots of Indian Rhubarb. The roots were either bare or covered with the same water-tolerant moss that had replaced *P. gowardii* in the side creek. The huge colony of *P. gowardii* apparently had died out.

Alectoria sarmentosa

In 1974 there was a small cluster of White Fir, perhaps an acre in size at the end of a meadow near Central Camp. These firs were heavily draped with *Alectoria sarmentosa*. The group of firs was bounded by an old railroad grade (now a dirt road) that is one of the entrance roads to Central Camp. A small artificial lake nearby provided some moisture to the site, with an evening updraft up a canyon.

Late in the 1970s large clumps of the *Alectoria*, enough to fill grocery sacks for college chemistry classes, were dropping from the trees. At the same time, some of the large clumps of *Alectoria* on the trees were showing signs of sunburn. Slowly over the years, the firs have had less and less *Alectoria* on the limbs, and less windfall on the ground. By 2000, few thalli of the lichen could be seen in the trees. The decline of the lichen may have resulted from several drought years and from engine exhaust from increased vehicle traffic on the road adjacent to the firs.

At the same time that *Alectoria* was disappearing from the firs, small thalli of the *Alectoria* were appearing infrequently on the ground about one quarter mile to the east, where my cabin was located. No *Alectoria* could be sighted in the trees of the forested area around the cabin.

Alectoria sarmentosa. Photo by Richard Droker.

Bryoria fremontii

Bryoria fremontii is quite abundant on Red Fir (*Abies magnifica*) in this area at about 2,130 m elevation (7,000 ft). Small thalli of *B. fremontii* became evident on lower limbs of the White firs, about the time that *Alectoria* disappeared.

Tuckermannopsis platyphylla

In the late 1970's I collected large amounts of windfall thalli of *Tuckermannopsis platyphylla*, requested by Isabelle Tavares (U. C. Berkeley) for distribution. The amount of windfall

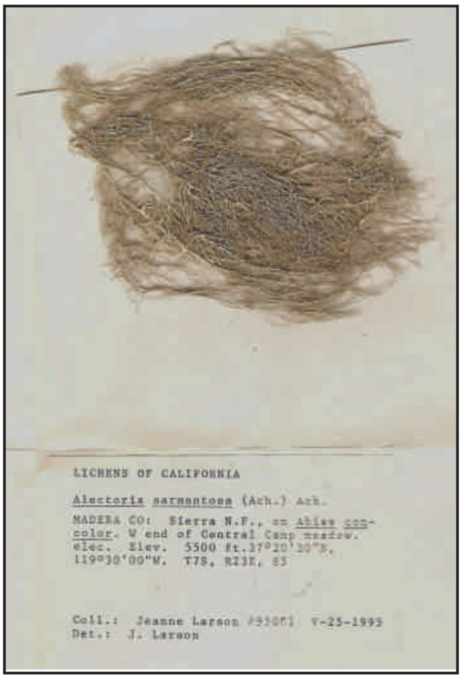
Tuckermannopsis diminished greatly by about the mid-1980's. By Spring 2007 no *T. platyphylla* could be found on the ground. However, small thalli had colonized in places on my cedar porch railings, along with *Letharia* and an occasional thallus of *Bryoria fremontii*.

In 2008, an occasional windfall branch of White Fir showed new colonies of *Tuckermannopsis platyphylla*, but they were much smaller than those collected in 1977.

***Letharia* spp.**

The Incense Cedar tree (*Calocedrus decurrens*) limbs in this area are amply clothed with *Letharia* lichen. In 2004-2007, there was less windfall of *Letharia*. In spring of 2007, after a very short winter rain and low snowfall, very few thalli of *Letharia* were on the ground. In Spring 2009, after a heavy snow season there were still fewer windfall *Letharia*. The trunks of the large Incense Cedars still have abundant colonies.

Nodobryoria abbreviata.
Photo by Stephen Sharnoff.



Nodobryoria abbreviata

I sent material of *Nodobryoria abbreviata* from Central Camp to I. W. "Ernie" Brodo at the Canadian Museum in Ottawa, Canada. Brodo found that the material from Central Camp had pycnidia that he had not seen on other material of the species. Brodo also had requested more material collected by Dan Hamon of *N. abbreviata* from rock cracks at 2,900 m (9,500 ft.) elevation at Mono Hot Springs, Fresno County. I have not been able to get to that site to look for the *Nodobryoria*, but perhaps a reader will be interested enough to seek it out.

Acknowledgements

I would like to thank Stephen Sharnoff and Richard Droker for providing photos used in this article.

Literature Cited

Davis, W. C. 1999. Ecophysiology of *Hydrothyria venosa*, an aquatic lichen. Ph. D. dissertation, Arizona State University, Tempe.

Bruce Ryan's Collections in Madera County, California

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Jeanne Larson lives in Fresno, Fresno County, in the southern San Joaquin valley, and has been interested in lichens for a lifetime. Some of her experiences have included collecting with Bill Weber on the Santa Rosa Plateau, near Temecula, SW Riverside County (1983), and taking lichenologists collecting in Madera County, which includes the southern end of the Sierra Nevada range as well as adjacent farming country. Part of Yosemite National Park, as well as parts of Inyo and Sierra National Forests are in Madera County. Jeanne had a cabin in this area, and made one of the earliest finds of *Hydrothyria venosa* (now *Peltigera gowardii*), a lichen that grows in cold mountain streams. Bruce Ryan, a grad student at Arizona State University at the time, collected extensively in Madera County, and sent Jeanne a list of his lichen collections from Madera County in the summer of 1994. She recently sent me his list, which was never published. Lichen reports are infrequent from this area at the southern terminus of the Sierra Nevada, so it is worthwhile to publish this list for Madera County. Species names have been updated. Ryan's collection numbers have been checked in the ASU database (with 400 collections from Madera County) and that at Santa Barbara Botanic Garden (with 126 such collections). Ryan donated a small set of local collections to the San Joaquin Experimental Forest Headquarters.

Bruce Ryan on a Northwest Lichen Guild field trip to Mt. Baker, WA in 1992. Photo by Stephen Sharnoff.

A total of 172 species are reported for Madera County. Two new reports for the California lichen catalog (Tucker & Ryan 2006) were found: *Caloplaca lactea* (A. Massal.) Zahlbr. and *Peltigera retifoveata* Vitik. The locations for collections are reported in the species entry, if not duplicated in the list of Ryan's collection sites below. Several Madera Co. collections by other collectors are included in the present list, for species that were not reported by Ryan.

Collection Sites

Ryan collected at over 20 different locations in Madera County in 1994. These are numbered below; locations of collections of each species are indicated by these numbers in the species list. Ryan's collection numbers are not included, but may be derived at the ASU (CNALH) website. Most of the Ryan collections are in the ASU herbarium; duplicates are at WIS, MIN, SBBG, MSU, and Sierra NF Headquarters. Mosses were collected as well, but these were not identified on Ryan’s list.

1. Forest at edge of Roush Meadow, E of Sierra NF Rd 7S76, Sierra N. F., 6,200 ft. elev., 37°16’ N, 119°26’30” W, 29 June 1994.

2. Edge of China Meadow, Sierra N. F., T8S, R23E, S14; 6,000 ft. elev., 37°14’ N, 119°25’W, 29 June 1994.

3. Shinn Grove, S of Sierra NF Rd TS07-J (E of Rd 7S07), Sierra N. F., 37°14’ 45”N, 119°25’30”W, T8S, R23E, S11, 5,600 ft. elev., 29 June 1994.

4. Brown’s Creek, near intersection with Rd 8S09, and toward SW. Sierra N. F., 6200-6400 ft. elev. 37°19’N, 119°27’W; T9S R22E S18. 27 June 1994.

5. Grounds of North Fork Minarets Ranger Station, Sierra N. F., 2,600 ft. elev.; 37°14’ N, 119°30’W; T8S R23E S13; 30 June 1994.

6. San Joaquin Experimental Forest, at end of Arena Rd 28 mi (45 km) N of Fresno, 37°05’ 30” N, 119°45’W; T9S R20E S36; 1 July 1994 (including Larson, W. Weber collections).

7. Peckinpah Meadow, E of Rd 8S26, Sierra N. F., 5,600 ft., 37°16’ N, 119°27’30”W; T8S, R23 S4?; 7 July 1994.

8. Along Minarets Rd., ca. 2 mi SW of Clearwater Creek, Sierra N. F., 4,100 ft., 37°12’ N, 119°22’30”W; T8S R24E S20; 10 July 1994.

9. NW of Rock Creek Campground, off Minarets Rd., Sierra N. F., 4,400 ft., 37°16’ 30”N, 119°22’W; T8S R24E S28; 10 July 1994 (also along Rock Creek).

10. Powerhouse Rd., S of bridge at E end of Kerckhoff Lake, Sierra N. F., 100 ft., 37° 09’ N, 119° 30’W; 12 July 1994.

11. Near intersection of Sierra NF Rd 7S68 and Rd 8S09, Sierra N. F., 6,200 ft., 37°17’ N, 119°27’30”W; T7S, R23E S33; 16 July 1994.

12. Owl Creek, S of Sierra NF Rd 8S70, Sierra N. F., 5,800 ft., 37°16’30” N, 119°26’30”W; T7S, R23E S35; 16 July 1994.

13. Gertrude Creek, E of Sierra NF Rd 7S07, Sierra N. F., 5,500 ft., 37°14’ N, 119°26’ W; T8S, R23E S11; 16 July 1994.

14. Benedict Meadow, Sierra N. F., 5,500 ft., 37° 15’ N, 119°26’ W; T8S, R23E S11; 16 July 1994.

15. Sierra NF Rd 7S02, ca. 1 mi E of Sierra NF Rd 8S09, Sierra N. F., 6,720 ft., 37°20’ N, 119°25’ W; T7S, R23E S11; 21 July 1994.

16. Rainbow Lake, Minarets Wilderness, Sierra N. F., 9,120 ft., 37°35’ N, 119°22’ W; 10 Aug. 1994. Collected by Liz McCullough.

17. Hwy 41 S of Oakhurst, 15-26 km S of Coarsegold, ca. 40 km N of Fresno, 240 m. (787 ft.), 36.0666667 – 119.7666667, 1 Aug. 1985.

18. E side of Hwy 49, 15 km S of Coulterville, ca. 1.6 km N of Merced River, 37.61667 - 120.13333, 1 Oct. 1989.

19. Hwy 41, 31 km NW of Coarsegold, 70 km S of Coulterville), 37.38333-118.61667, 1 Oct. 1989.

20. 4716: Along Rte. 41, Foothills of Sierra Nevada, 16 Sept. 1985.

21. 4717: Along Rte. 41, E of San Joaquin River crossing, 16 Sept. 1985.

22. 4718-4720: Near Larson’s cabin, Central Camp, Sierra N.F. (Minarets

District),16 Sept. 1985.

23. 4721-4725, 4730-35: Sand Creek, near Central Camp, Sierra N.F., 16 Sept. 1985.

24. 4727- 9, 4781 etc.: Sierra N.F., 16 and 17 Sept. 1985.25. 1.8 mi S of intersection with Rd., North of Central Camp Minarets District, Sierra NF, 16 Sept. 1985.

26. Along Railroad grade entrance to Central Camp, Sierra N.F., 16 Sept. 1985.

27. Rd to Bass Lake, SE of Rte. 41 near Wishon, Sierra N.F., 18 Sept. 1985.

Species List

Acarospora schleicheri (Ach.) A. Massal. - 6, 17
Ahtiana sphaerosporella (Müll.Arg.) Goward - 14, 15
Alectoria sarmentosa (Ach.) Ach. - (J. Larson coll., Central Camp)
Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold (=*Circinaria caesiocinerea*) - 8, 9
Aspicilia confusa Owe-Larss. & A. Nordin - 17
Aspicilia cuprea Owe-Larss. & A. Nordin (*W. Weber*, as *A. epiglypta*) - 6, 17
Aspicilia nashii Owe-Larss. & A. Nordin (*W. Weber 82037*) - 6
Biatora globulosa (Flörke) Fr. (C. Printzen s.n.) - 12
Bryoria fremontii (Tuck.) Brodo & D. Hawksw. - 13, 22
Buellia chloroleuca Körb. - 12
Buellia dakotensis (H. Magn.) Bungartz - 19
Buellia penichra (Tuck.) Hasse (collected as *Diplotomma alboatrum*) - 4, 9
Buellia punctata (Hoffm.) A. Massal. (Syn.: *Amandinea punctata*) - 19*
Buelliella inops (Triebel & Rambold) Hafellner - 28, 6 (*W. Weber Exs. 693*)
Calicium viride Pers. - 4
Caloplaca cerina (Ehrh. ex Hedw.) Th. Fr. - 4
Caloplaca crenulatella (Nyl.) Oliv. - 5, 16 (det. C. Wetmore)
Caloplaca ignea Arup - 17, 19
Caloplaca lactea (A. Massal.) Zahlbr. (*B. Ryan 32212*; new report for CA) - 5
Caloplaca saxicola (Hoffm.) Nordin - 6, 17
Candelaria pacifica Westberg (called *C. concolor* in field) - 5, 6, 17, 19
Candelariella rosulans (Müll. Arg.) Zahlbr. - 10, 11, 17, 18
Candelariella vitellina (Hoffm.) Müll. Arg. - 5, 6, 8, 16
Chaenotheca subroscida (Eitner) Zahlbr. - 4, 9
Cladonia chlorophaea (Flörke ex Sommerf.) Sprengel - 3, 5, 10, 11, 17, 18, 24
Cladonia fimbriata (L.) Fr. 5, 7, 9, 23, 24
Cladonia macilenta Hoffm. - 22 (*C. Bratt 4760*, Central Camp)
Cladonia ochrochlora Flörke 22 (*C. Bratt 4767*, Central Camp)
Cladonia rei Schaerer - 10, 11
Cladonia subradiata (Vain.) Sandst. - 9, 10, 11
Dermatocarpon americanum Vain. - 8, 23, 25, 26
Dermatocarpon reticulatum H. Magn. - 4
Dimelaena californica (H. Magn.) Sheard - 17
Dimelaena oreina (Ach.) Norman - 8, 17, 18,19
Diploschistes muscorum (Scop.) R. Sant. - 10, 11, 18
Diploschistes scruposus (Schreb.) Norman - 5, 8, 24
Evernia prunastri (L.) Ach. – 3, 5, 13, 14

Flavoparmelia flaventior (Stirt.) Hale - 5
Fuscopannaria californica (Tuck.) P. M. Jørg. - 9, 10 (= *Vahliella californica*)
Fuscopannaria cyanolepra (Tuck.) P. M. Jørg. - 25 (*C. Bratt 4764*, nr. Central Camp)
Fuscopannaria praetermissa (Nyl.) P. M. Jørg. - 9
Hydrothyria venosa J. L. Russell (= *Peltigera gowardii*) - 4, 12
Hypocenomyce anthracophila (Nyl.) P. James & Gotth. Schneid. - 14, 15
Hypocenomyce scalaris (Ach. ex Lilj.) M. Choisy - 12 14
Hypogymnia imshaugii Krog - 2, 3, 4, 13, 15, 22, 23, 25
Hypogymnia metaphysodes (Asah.) Räsänen - 1
Lecanora albella (Pers.) Ach. (including syn., *L. pallida*) - 4
Lecanora circumborealis Brodo & Vitik. - 2, 9, 14
Lecanora dispersa (Pers.) Sommerf. - 4
Lecanora hybocarpa (Tuck.) Brodo - 9, 19
Lecanora intricata (Schrad.) Ach. - 10, 11
Lecanora laxa (C. Printzen s.n., S of Chiquito Ridge, crossing of Rd 7S02 over Rock Creek, Sierra NF, 13 Sept 1997)
Lecanora mellea W. A. Weber - 8, 9, 17, 18, 24
Lecanora muralis (Schreb.) Rabenh. - 8, 17
Lecanora muralis* subsp. *dubyi (Müll. Arg.) Poelt - 6
Lecanora orizibana Vain. - 7
Lecanora pacifica Tuck. - 1, 4, 19
Lecanora polytropa (Hoffm.) Rabenh. - 10, 11, 16
Lecanora pseudistera Nyl. - 4
Lecanora pseudomellea B. D. Ryan - 17
Lecanora saligna (Schrad.) Zahlbr. - 6 (*W. Weber CO-L-82041*)
Lecanora sierrae B. D. Ryan & T. H. Nash - 16
Lecanora varia (Hoffm.) Ach. - 9, 14
Lecidea atrobrunnea (Ramond ex Lam. & DC.) Schaerer - 23 (*C. Bratt 4721*, Sand Creek)
Lecidea auriculata Th. Fr. - 6
Lecidea fuscoatra Nyl. - 8
Lecidea laboriosa Müll. Arg. (*C. Bratt 4717*, E of San Joaquin River crossing)
Lecidea tessellata Flörke - 17
Lecidella asema (Nyl.) Knoph & Hertel - 23 (*C. Bratt 4753b*, Sand Creek)
Lecidella euphorea (Flörke) Hertel - 1, 4, 8, 9
Lepraria caesioalba (B. de Lesd.) J. R. Laundon - 23 (*C. Bratt 4723*, Sand Creek)
Lepraria* cf. *neglecta (Nyl.) Erichsen - 7, 8
Lepraria xerophila Tønsberg - 24 (coll. as "*Siphula* sp."; *C. Bratt 4737*, Sierra NF)
Leptochidium albociliatum (Desm.) M. Choisy - 24 (*C. Bratt 4778*, Sierra NF)
Leptogium burnetiae* var. *hirsutum (Sierk) P.-M. Jørg. (as *L. hirsutum*) - 8, 9
Leptogium lichenoides (L.) Zahlbr. - 8, 9, 23, 24
Leptogium palmatum (Huds.) Mont. (as *L. corniculatum*) - 5, 10, 11
Letharia columbiana (Nutt.) J. W. Thomson - 2
Letharia vulpina (L.) Hue - 1, 3, 15, 16, 24
Melanohalea elegantula (Zahlbr.) O. Blanco, etc. (as *Melanelia elegantula*) - 1, 9, 23
Melanohalea exasperatula (Nyl.) O. Blanco, etc. (as *Melanelia exasperatula*) - 3, 5
Melanelixia glabra (Schaerer) O. Blanco, etc. (as *Melanelia glabra*) - 5, 6, 8, 17, 19

Melanelixia glabroides (Essl.) O. Blanco, etc. (as *Melanelia glabroides*) - 8
Melanohalea subolivacea (Nyl.) O. Blanco, etc. (as *Melanelia subolivacea*) - 4, 17
Miriquidica scotopholis (Tuck.) B. D. Ryan & Timdal (Syn.: *Psorula scotopholis*; *W. Weber 690*) - 6
Nodobryoria abbreviata (Müll. Arg.) Common & Brodo - 3, 13
Normandina pulchella (Borrer) Nyl. - 24 (*C. Bratt 4794*, Sierra NF)
Ochrolechia androgyna (Hoffm.) Arnold - 9, 12
Parmelia sulcata Taylor - 1, 24
Parmelina coleae Arguello, del Prado, Cubas, & Crespo (collected as *P. quercina*) - 5, 19
Peltigera collina Ach.) Schrad. - 4
Peltigera gowardii Lendemer & H. O'Brien (Syn.: *Hydrothyria venosa*) - 4, 12, 22
Peltigera praetextata (Flörke ex Sommerf.) Zopf - 4, 5, 9, 10
Peltigera retifoveata Vitik. - 5 (*B. Ryan 32038-b*; New report for CA)
Peltigera rufescens (Weiss) Humb. - 9
Peltigera didactyla (With.) J. R. Laundon (as *P. spuria*) - 22 (*C. Bratt 4758*, nr Central Camp)
Peltula euploca (Ach.) Poelt - 28, 6 (*J. Larson 970*)
Peltula zahlbruckneri (Hasse) Wetmore (*J. Larson 610*, Greenameyer's Hill, 3 mi S of Mormon Bar, Mariposa Co.)
Pertusaria amara (Ach.) Nyl. - 27 (*C. Bratt 4771*, 3.8 mi N of Bass Lake, Sierra NF)
Phaeophyscia ciliata (Hoffm.) Moberg - 23 (*C. Bratt 4759*, Sand Creek)
Phaeophyscia decolor (Kashiw.) Essl. - 9, 23
Phaeophyscia orbicularis (Neck.) Moberg - 5, 19
Physcia adscendens (Fr.) H. Olivier - 5
Physcia aipolia (Ehrh. ex Humb.) Fürnr. (! Moberg) - 5, 17
Physcia biziana (A. Massal.) Zahlbr. (! Moberg) - 5, 6. 8, 9, 17, 19, 23
Physcia mexicana B. de Lesd. - 19
Physcia phaea Moberg - 19
Physcia stellaris (L.) Nyl. - 19
Physcia tenella (Scop.) DC. (! Moberg) - 4
Physcia tribacia (Ach.) Nyl. - 15
Physconia americana Essl. - 6 (*W. Weber 82040*), 23
Physconia detersa (Nyl.) Poelt - 23 (*C. Bratt 4759*, Sand Creek; not in CA)
Physconia* cf. *distorta (With.) J. R. Laundon (?; not in CA) - 6
Physconia enteroxantha (Nyl.) Poelt - 5, 6, 8, 9, 17, 19, 23
Physconia fallax Essl. - 5
Physconia leucoleiptes (Tuck.) Essl. - 1
Physconia muscigena (Ach.) Poelt - 24 (*C. Bratt 4776*, Sierra NF)
Physconia perisidiosa (Erichsen) Moberg - 5, 8
Placidiopsis cinerascens (Nyl.) Poelt - 22 (*C. Bratt 4770*, nr Central Camp)
Placidium lacinulatum (Ach.) Breuss (= *Clavascidium lacinulatum*) - 27 (*C. Bratt L-13123*, Rd to Bass Lake, SE of Rte 41 nr Wishon, Sierra NF)
Psora californica Timdal - 18
Psora globifera (Ach.) A. Massal. - 18
Psora nipponica (Zahlbr.) Gotth. Schneid. - 24, 27
Psorula rufonigra (Tuck.) Gotth. Schneider - 8
Punctelia jeckeri (Roum.) Kalb (as *P. subrudecta*) - 5
Ramalina farinacea (L.) Ach. - 3, 14

Ramalina subleptocarpha Rundel & Bowler (*Darrow 210*, Oakhurst, 23 June 1933)
Rhizocarpon badioatrum (Flörke ex Sprengel) Th. Fr. - 10, 11
Rhizocarpon bolanderi (Tuck.) Herre - 10, 11, 17, 18, 19, 24
Rhizocarpon geographicum (L.) DC. - 10, 11, 24
Rhizocarpon lecanorinum (Körb.) Anders - 10, 11
Rhizocarpon macrosporum Räsänen - 11
Rhizocarpon riparium Räsänen - 11
Rhizoplaca glaucophana (Nyl. ex Hasse) W. A. Weber 6 (*J. Larson 606*; *J. Larson 79-024*, Yosemite Lakes subdivision, 3 mi W of Hwy 41 (nr Indian Casino) on Rd 416; *J. Larson 80-01*, near Raymond Granite quarry. distributed as *#640*, Lichenes Exsiccatae, University of Colorado.
Rhizoplaca marginalis (Hasse) W. A. Weber (*J. Larson 82-01*, campground above Eastman Lake, E of Chowchilla)
Rinodina archaea (Ach.) Arnold - 12
Rinodina californiensis Sheard - 9
Rinodina capensis Hampe - 4, 5, 9, 19
Rinodina exigua (Ach.) S. Gray - 9
Rinodina laevigata (Ach.) Malme - 9
Rinodina milvina (Wahlenb.) Th. Fr. - 9
Rinodina mniaraea (Ach.) Körb.- 8
Rinodina olivaceobrunnea C. W. Dodge & G. E. Baker - 23 (*C. Bratt 4739*, Sand Creek)
Rinodina santaemonicae H. Magn. - 5, 9
Rinodina septentrionalis Malme (*B. Ryan 32163a*, det. by J. Sheard; not reported by Sheard for CA in 2010 monograph) - 9
Sarcogyne similis H. Magn. - 5
Staurothele drummondii (Tuck.) Tuck. - 17
Staurothele fissa (Taylor) Zwackh - 23 (*C. Bratt 4754b*, Sand Creek)
Thelomma ocellatum (Körb.) Tibell - 14
Trapeliopsis glaucopholis (Nyl. ex Hasse) Printzen & McCune (called *T. wallrothii* in field; syn.: *Trapeliopsis californica*) - 5, 6, 18, 24
Trapeliopsis wallrothii (Flörke ex Sprengel) Hertel & Gotth. Schneid. - 6 = misidentifications of either *T. glaucopholis* or *T. steppica*)
Tuckermannopsis orbata (Nyl.) M. J. Lai - 4, 12
Tuckermannopsis platyphylla (Tuck.) Hale - 3, 4, 12, 22
Umbilicaria cinereorufescens (Schaer.) Frey - 8
Umbilicaria phaea Tuck. - 5, 6, 8, 17, 18, 22, 24
Umbilicaria virginis Schaerer - 23 (*C. Bratt 4735b*, Sand Creek)
Usnea filipendula Stirt. - 13
Usnea* cf. *lapponica Vain. - 3
Vahliella californica (Tuck.) P. M. Jørg. (Syn.: *Fuscopannaria californica*) - 9, 10
Vulpicida canadensis (Räsänen) J.-E. Mattsson & M. J. Lai - 5
Xanthomendoza fallax (Hepp) Søchting, Kärnefelt & S. Y. Kondr. (collected as *Xanthoria fallax*) - 6, 17
Xanthoparmelia amableana (Gyeln.) Hale - 24 (*C. Bratt 4784*, Sierra NF)
Xanthoparmelia coloradoensis (Gyeln.) Hale - 5, 18
Xanthoparmelia cumberlandia (Gyeln.) Hale - 18
Xanthoparmelia hypomelaena (Hale) Hale - 17, 18
Xanthoparmelia inserta (Kurok. & Filson) Elix & J. Johnst. (as *X. tasmanica* in field) - 5
Xanthoparmelia mexicana (Gyeln.) Hale - 24 (*C. Bratt 4786*, Sierra NF)
Xanthoparmelia novomexicana (Gyeln.)

Hale - 5, 6, 18
Xanthoparmelia plittii (Gyeln.) Hale - 6, 24
Xanthoparmelia subramigera (Gyeln.) Hale - 6, 17, 18
Xanthoparmelia tuckeriana Elix & T. H. Nash - 6 (*B. Ryan 32088*)
Xanthoparmelia tucsonensis T. H. Nash) Egan - 6
Xanthoparmelia *verruculifera* (Nyl.) A. Crespo, Elix, D. Hawksw., & Lumbsch (as *Neofuscelia verruculifera*) - 18, 24
Xanthoria polycarpa (Hoffm.) Rieber (Syn.: *X. ramulosa*) - 1, 4, 5, 14, 17, 19
Xanthoria* cf. *ramulosa (Tuck.) Herre = *X. polycarpa* - 5, 7
Xylographa hians Tuck. - 3, 14
Xylographa parallela (Ach.: Fr.) Behlen & Desberger - 3
Xylographa vitiligo (Ach.) J. R. Laundon 3

Comments

The relatively high elevations in the southern Sierra Nevada yielded especially common or abundant species of *Aspicilia, Lecanora, Lecidea, Rhizocarpon, Rhizoplaca*, and *Staurothele*.

Two species are reported as new to CA: *Caloplaca lactea* and *Peltigera retifoveata*. A possible third is *Rinodina septentrionalis*, although it was not included in the 2010 monograph for North America by J. Sheard. Sheard had identified two California specimens including one from Madera County. Under *Lecanora*, *L. muralis* ssp. *dubyi* had one previous report [as s. l.], and *L. orizabana* and *L. intricata* each had two previous reports. Twelve species of *Xanthoparmelia* included several that have been rarely reported for CA: four species, each with one previous report: *X. hypomelaena, X. inserta, X. tuckeriana*, and *X. tucsonensis*; and *X. amableana* with only two previous reports. Among ten species of *Rinodina*, four have only two previous reports (*R. archaea, R. californiensis, R. milvina*, and *R. olivaceobrunnea*); two had only three previous reports (*R. laevigata* and *R. mniaraea* [all before 1984 for the latter]. *Chaenotheca subroscida* had three previous reports. Madera County is a rich natural area with many rarely collected lichens to be found.

Lichen material from Madera County was included in two sets of Exsiccati. Bruce Ryan collected enough of the unusual aquatic lichen, *Hydrothyria venosa* (= *Peltigera hydrothria*), for an Exsiccat set (*Nash Exs. #164; B. Ryan 32035*) issued by T. Nash at Arizona State University, Tempe. William Weber included *Peltula zahlbruckneri* (*#610*, collected by J. Larson) and *Rhizoplaca glaucophana* (#606) in Lichenes Exsiccatae, Fascicle 16 (*#601-640*), distributed by the University of Colorado, Boulder. In another fascicle, Weber included *Buelliella inops* as *Exs. #693.*

Literature Cited

Tucker, S. C. & B. D. Ryan. 2006. Revised catalog of lichens, lichenicolous and allied fungi in California. Constancea 84 (Univ. of Cal., Berkeley) Online. ~280 pp. (Being revised, April, 2013) http://ucjeps.berkeley.edu/constancea/84/

Weber, W. A. 1984. Lichenes Exsiccatae, Fascicle 16 (no. 601-640), distributed by the University of Colorado, Boulder.

The Lichens of Southwest Oregon's Illinois River Watershed

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A preliminary list of the lichens of southwest Oregon's Illinois River watershed is presented. Data are drawn from a variety of sources such as unpublished technical reports, personal herbarium records and educational workshops. Four hundred and six lichens in 133 genera are reported including one species, Melaspilea interjecta *that is new for North America.*

Introduction

The Illinois River watershed located in southwestern Oregon and northwest California (Figure 1) is a natural wonderland known for its botanical richness and high number of serpentine endemic plant species. Ecoregions collide here with influences of the Coast Ranges, Cascade, Klamath and Siskiyou Mountains all contributing to the vascular flora represented (Whittaker 1961). The Illinois River watershed has a land area of 983 square miles and is a major tributary to the Rogue River comprising about 20% of the Rogue River watershed. The highest peak in the watershed is Greyback Peak at 7,055 ft. elevation and the lowest point is 279 ft. elevation at the confluence of the Illinois and Rogue rivers. About 81% of the Illinois basin is Forest Service or Bureau of Land Management land.

The purpose of this paper is to present a preliminary checklist of lichens that occur in the Illinois River watershed to complement the natural history education activities conducted by the Siskiyou Field Institute and Southern Oregon University. Major habitats found here include coniferous forest, mixed conifer/hardwood forest, chaparral, oak woodland, oak savannah, and serpentine-influenced xeric communities. Tree diversity is high with most of the land broadly covered in a Mixed–Evergreen forest type with *Pseudotsuga menziesii* and *Lithocarpus densiflorus* dominating. Conifer species commonly encountered include *Calocedrus decurrens, Pinus lambertiana, P. ponderosa, Taxus brevifolia* and *P. jefferyii* on serpentine sites. The most common hardwoods are *Arbutus menziesii, Chrysolepis chrysophylla, Quercus chrysolepis, Quercus garryana* and *Quercus kelloggii* with *Alnus rubra, Acer macrophyllum* and *Fraxinus latifolia* in wetter streamside areas. Forests in the western portion of the watershed contain the above trees as well as *Tsuga heterophylla* and *Chamaecyparis lawsoniana* (Franklin & Dryness 1973).

Over 550 plant species are known from the Deer Creek Center property alone (Morse 2008) and the Rough and Ready Botanical Area is regarded as one of the richest sites for rare plants in Oregon (Borgias & Ullian 1994). Geologic complexity also contributes to overall

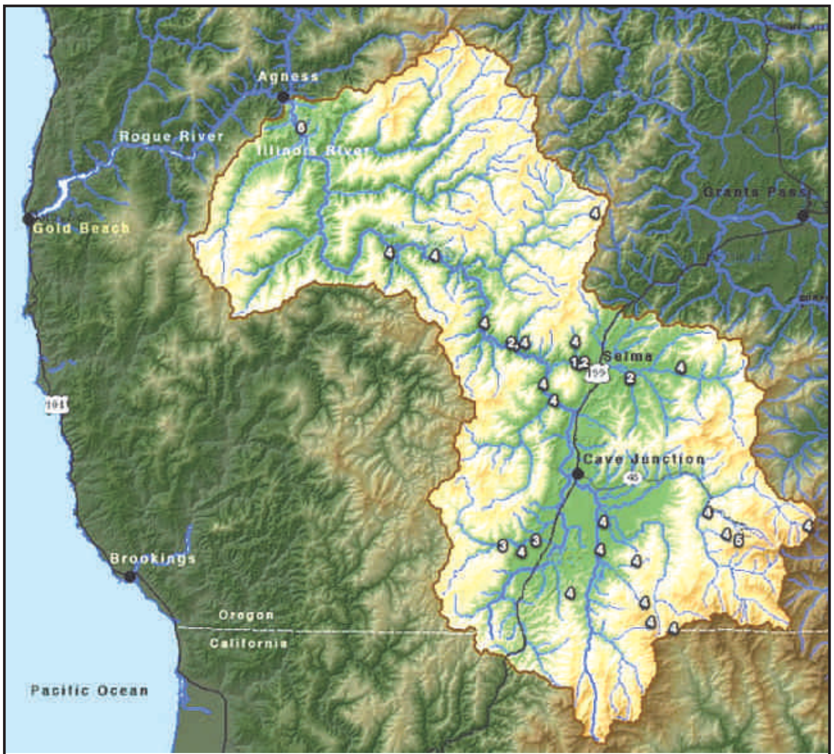

Figure 1. The Illinois River Watershed with collection locations. The numbers correspond to the column in which the record appears in Table 1. Image used with permission of Rogue Riverkeeper.

habitat heterogeneity with ultramafic rocks such as peridotite and serpentinite, quaternary sediments, landslide deposit covers, shales and sandstones, metasedimentary rock as well as marble (in the area of Oregon Caves) all found in the area (Morse 2008). This region remained ice-free during the last glacial maximum and has had long ecological continuity. All of these factors make the Illinois River watershed an especially interesting area to explore lichen diversity.

Materials and Methods

The list of lichens presented here (Table 1) is a compilation of records from a variety of previously unpublished sources detailed below. The first is the Northwest Lichenologist Westside Macrolichen Certification in 2009. The second is a rock crust lichens class given by Bruce McCune at the Siskiyou Field Institute in 2012. The third is a list generated in 1998 by the OSU Lichen and Bryophyte Working Group for the Rough and Ready Creek Botanical Area. The fourth is the results from a query of Bruce McCune's database of collections made within the watershed. The fifth is a list produced by Alexander Mikulin and Jim Riley of the Oregon Caves National Monument and the final source is survey records from public land surveys done by Pacific Crest Consulting LLC in the watershed. Only records that are fully identified to species with a high level of confidence are included. Lichen names follow Esslinger (2012).

For the Northwest Lichenologists Certification Exam eleven participants each surveyed one of two 0.38 hectare plots (radius = 34.7 m) at the Deer Creek Center for as many epiphytic macrolichen species as possible, subject to a 2-hour time limitation. Samples were collected for all species detected by each participant and determined using standard laboratory techniques. Experts then confirmed the identifications and the collections then went back to the participants for their personal collections, with a very few collections being deposited at OSC. A list of all lichens encountered on both plots was generated; these records are in column 1. A few additional records made by Kristi Mergenthaler and John Villella from the Deer Creek Center are included with these results.

For the Rock Crust Lichen Workshop twelve participants visited three sites and collected saxicolous crustose lichens for about an hour at each location. One of the sites was on the Deer Creek Center property and two were at other valley locations. The collections were identified using standard laboratory techniques at the Deer Creek Center and a list of the identified lichens was generated. An attempt was made by the group to collect and identify as much species diversity as possible but due to the limited collection and workshop time it is assumed that many lichens remain unreported from the sites visited. These records are included in column 2.

The OSU Lichen and Bryophyte Working Group made a two-day visit to areas in the Rough and Ready Creek watershed in 1998. They produced an unpublished list of lichens that are included as column 3. This list was submitted as testimony to the U.S. Forest Service in response to proposed mining operations at Rough and Ready Creek. The list contributes many of the calicioid records here, thanks to participation by Eric B. Peterson and Jouko Rikkinen.

Bruce McCune's specimen database was queried for Josephine County records and those that were within the Illinois River watershed are in column 4. This database includes mostly McCune collections, located in OSC and McCune's research herbarium, along with selected confirmed records by other collectors and located in other herbaria. Many of these were also reported in Rikkinen (2003, sites G1a and G1b).

Alexander Mikulin and Jim Riley collected in Oregon Caves National Monument and produced a list of lichens for the area that was then provided to the managers there. These data are included in column 5. Because of the calcareous rocks present, many of the calciphiles reported here are from this site.

Pacific Crest Consulting LLC conducted pre-disturbance lichen and bryophyte surveys on public lands in various locations including the lower watershed. The lichen records that are results of these surveys are included in column 6.

The Consortium of North American Lichen Herbaria online database (http://lichenportal.org/portal/records) includes additional records for the area. We did not, however, confirm these, so they were omitted from our list.

Results

A preliminary list of the lichens of the

Illinois River watershed is presented in Table 1. We report 406 lichen taxa in 133 genera, including one species that is new to North America; 87% of taxa reported are chlorolichens 12% are species with cyanobionts, and 1% are non-lichenized. Twenty-nine species were found in 5-6 sources, 104 in 3-4 sources, and 274 species were found in 2 or fewer sources. Some noteworthy species are discussed below.

Melaspilea interjecta (*Loring 8959*) was found during the Rock Crust Lichen Workshop at a location along Illinois River Road (441457E / 4682020N NAD83, 460m elevation). The site is steep, exposed, generally south-facing slope with large outcrops composed of greenstone, a low-grade non-calcareous metamorphic rock exhibiting a green coloration, from which the *Melaspilea* collection was made. This is the first record of the species for North America. It was previously thought to be endemic to Great Britain, where it is considered rare (Purvis et al. 1992).

Melaspilea is a cosmopolitan genus that is best developed in the tropics. Species usually occur on bark, more rarely on rock or other lichens. The thallus is crustose and usually immersed. Apothecia range from somewhat round to lirelliform, with black discs. The thallus of *M. interjecta* is immersed and apparent only as a slightly pale greenish-grey discoloration of the rock substrate. The photobiont is trebouxioid. Apothecia are black, lirelliform and often branched (Figure 2). Spores are reminiscent in shape to a bowling pin or shoe sole (Figure 3). They are colorless, one-septate, very fragile at the septum, and turn brown when old.

Figure 2. Lirelliform apothecia of *Melaspilea interjecta*. Photo by Scot Loring.

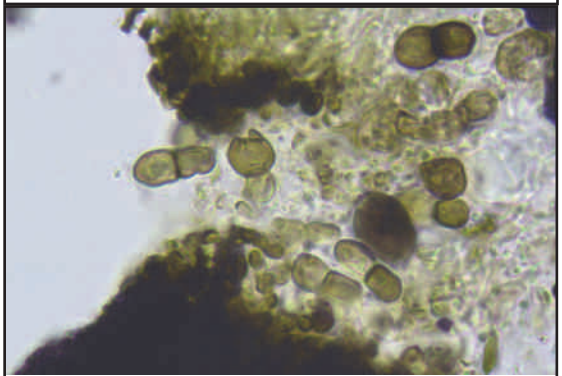

Figure 3. Older spores of *Melaspilea interjecta* exhibiting brown color. Photo by Martin Hutten.

M. interjecta is not easily confused with other crustose lichens reported from Pacific Northwest North America. Relatively few have lirellae and of those that do, most are found on bark or wood, such as the genus *Graphis*, commonly found on trunks of hardwoods such as *Alnus*. Of the saxicolous species, *Lithographa tesserata* has simple spores, un-branched lirellae, and is arctic-alpine in distribution; species of *Opegrapha* have spores that are at least three-septate and *Trentepohlia* is the photobiont.

Schaeraria dolodes was collected at

Rough and Ready Creek (*McCune 24043*). This western North American endemic lichen is thought to be widespread but under collected in the northwest where it can be found as an epiphyte in Mediterranean habitats. It is more common in Northern Rocky Mountains (Schmull & Spribille 2005).

Toninia ruginosa* subsp. *pacifica was collected by Alexander Mikulin in 2000 on the top of Mt. Ruchi, Lake Mountain Trail, in Oregon Caves National Monument (*Mikulin 3-AOR*). More common in California, this is a rare species in Oregon, where it is otherwise known from only a single location on the immediate coast.

Discussion

The species represented on this list are a unique assemblage of lichens due to factors of geographic location, habitat, ecological continuity and geology. Other similar papers listing lichens from nearby locations of southwest Oregon and northwest California show the Klamath-Siskiyou ecoregion to have a wide variety of lichen species at various locations (Miller et al. 2011, Villella 2010, Wright 1998). The large area of the Illinois River watershed contributes to the high species diversity reported here when compared with other lists published from the area. Wright (1998) reported 104 lichens from two locations in the Siskiyou Mountains to the east of the Illinois Valley, Miller et al. (2011) report 136 lichens from two southern Oregon coastal location and Villella (2010) reports 57 species from a more arid location in the Cascade-Siskiyou area of eastern Siskiyou County California. Apparently, lichen beta diversity (sensu. Whittiker 1960) in this region is high, mirroring the same pattern as vascular plants within the Klamath-Siskiyou region.

Future work focusing on the lichens of this unique area will undoubtedly turn up many more species. In particular, some species groups and substrates are still under-represented, such as lignicolous, epiphytic, and saxicolous crustose species, lichenicolous fungi, and the genera *Acarospora, Usnea*, and *Verrucaria*. The northern and western portions of the watershed have few collection locations; it is here that more coastal influence lichens could be found to increase the species list even further.

Acknowledgements

Thanks to John Roth of the Oregon Caves National Monument for providing the list of lichens reported by Mikulin and Riley. Thanks to James Lendemer for identifying many of the *Lepraria* specimens. Thanks to the participants in the various groups that contributed to this publication including: Shelly Benson, Richard Brock, Richard Callagan, Tom Carlberg, Jason Clark, Rick Demmer, Charity Glade, Amanda Hardman, Martin Hutten, Krisit Mergenthaler, Alexander Mikulin, Jesse Miller, Peter Nelson, Eric Peterson, Jim Riley, Daphne Stone, Steve Sheehy, and Gretchen Vos.

Literature Cited

Borgias, D. & B. Ullian. 1994. Oregon Plants, Oregon Places: Rough and Ready Creek. Kalmiopsis 4:1-6.

Esslinger, T. L. 2012. A cumulative checklist for the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. North

Dakota State University: http://www.ndsu.edu/pubweb/~esslinge/chcklst/chcklst7.htm (First Posted 1 December 1997, Most Recent Version (#18) 13 December 2012), Fargo, North Dakota.

Franklin, J. F. & C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. Gen. Tech. Rep. PNW-GTR-008. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 427 p.

McCune, B. 1994. Lichen species groups in the Columbia Basin; ecosystem functions and indicator values. Report to Eastside Ecosystem Management Project. Oregon State University, Corvallis. 51 pp.

Miller, J., B. McCune, D. Kofranek, J. Villella, R. Demmer, K. Mergenthaler & A. C. Barber. 2011. Lichens from South Slough and Horsfall Dunes on the southern Oregon coast. Evansia 28:92-99.

Morse K. 2008. Vascular Plant Inventory of Deer Creek Center Property in Selma, Oregon. MS Thesis, Southern Oregon University. 125 pages.

Purvis, O.W., B.J. Coppins, D. L. Hawksworth, P. W. James & D. M. Moore (eds.). 1992. The Lichen Flora of Great Britain and Ireland. London: Natural History Museum Publication, 710 pp.

Rikkinen, J. 2003. Calicioid lichens and fungi in the forests and woodlands of western Oregon. - Acta Botanica Fennica 175: 1-41.

Schmull, M. & T. Spribille. 2005. *Schaereria dolodes* (Nyl. ex Hasse) Schmull & T. Sprib.: a second corticolous species in the genus. Lichenologist 37: 527-533.

Villella, J. 2010. The lichens of the Horseshoe Ranch Wildlife Area. Bulletin of the California Lichen Society 17(1-2): 9-12.

Whittaker, R. H. 1960. Vegetation of the Siskiyou Mountains, Oregon and California. Ecological Monographs, 30, 279–338.

Whittaker, R.H. 1961. Vegetation history of the Pacific Coast States and the "central" significance of the Klamath Region. Madrono 16(1): 5-32.

Wright, D. 1998. Collections from the 1998 Northwest Lichen Guild - CALS field trip to the Pilot Rock area, Siskiyou Mountains, Jackson County, Oregon, May 23, 1998. Bulletin of the California Lichen Society 5(2): 28-37.

Lichenologists visit a serpentine site at the Siskiyou Field Institute's Deer Creek Center.

Table 1. Preliminary List of Lichens of the Illinois River Watershed. 1 = NWL certification plots, 2 = SFI rock crust workshop, 3 = OSU lichen group, Rough and Ready Creek, 4 = McCune database records, 5 = Mikulin and Riley, Oregon Caves, NM 6 = Loring et al., Pacific Crest Consulting.

Lichen Species	1	2	3	4	5	6
Acarospora cervina (Ach.) A. Massal.					x	
Acarospora glaucocarpa (Ach.) Körb					x	
Acarospora fuscata (Schrader) Arnold		x		x	x	
Agonimia tristicula (Nyl.) Zahlbr.					x	
Ahtiana pallidula (Tuck. ex Riddle) Goward & Thell	x		x	x		x
Ahtiana sphaerosporella (Müll. Arg.) Goward					x	x
Alectoria imshaugii Brodo & D. Hawksw.	x			x	x	x
Alectoria lata (Taylor) Lindsay						x
Alectoria sarmentosa (Ach.) Ach.	x		x	x	x	x
Alectoria vancouverensis (Gyelnik) Gyelnik ex Brodo & D. Hawksw.	x		x	x		x
Arctomia delicatula Th. Fr.				x		
Arthrorhaphis citrinella (Ach.) Poelt		x				
Aspicilia americana B. de Lesd.		x		x		
Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold					x	
Aspicilia cinerea (Linneaus) Körb.					x	
Aspicilia cyanescens Owe-Larss. & A. Nordin		x		x		
Aspicilia knudsenii Owe-Larss. & A. Nordin		x		x		
Aspicilia sipeana (H. Magn.) Owe-Larss. & A. Nordin		x		x		
Aspicilia supertegens Arnold					x	
Bacidia salmonea S. Ekman				x		
Baeomyces carneus (Retz.) Flörke					x	x
Baeomyces rufus (Hudson) Rebent.						x
Bellemerea alpina (Sommerf.) Clauzade & Cl. Roux				x		
Bellemerea cinereorufescens (Ach.) Clauzade & Cl. Roux				x	x	
Biatora vernalis (L.) Fr.					x	
Bryoria capillaris (Ach.) Brodo & D. Hawksw.	x		x	x	x	x
Bryoria fremontii (Tuck.) Brodo & D. Hawksw.	x		x	x	x	x
Bryoria friabilis Brodo & D. Hawksw.			x			x
Bryoria fuscescens (Gyelnik) Brodo & D. Hawksw.	x		x	x	x	x
Bryoria glabra (Mot.) Brodo & D. Hawksw.	x					x
Bryoria pseudofuscescens (Gyelnik) Brodo & D. Hawksw.			x			x
Buellia abstracta (Nyl.) H. Olivier		x		x		
Buellia badia (Fr.) A. Massal.					x	
Buellia chloroleuca Körb.				x		
Buellia dispersa A. Massal.				x		
Buellia muriformis A. Nordin & Tønsberg				x		x
Caeruleum heppii (Nägeli ex Körber) K. Knudsen & L. Arcadia					x	
Calicium abietinum Pers.			x			x
Calicium adaequatum Nyl.			x		x	x
Calicium glaucellum Ach.			x		x	x
Calicium parvum Tibell			x			x

Table 1 (cont.). Preliminary List of Lichens of the Illinois River Watershed. 1 = NWL certification plots, 2 = SFI rock crust workshop, 3 = OSU lichen group, Rough and Ready Creek, 4 = McCune database records, 5 = Mikulin and Riley, Oregon Caves, NM 6 = Loring et al., Pacific Crest Consulting.

Lichen Species	1	2	3	4	5	6
Calicium viride Pers.			x	x	x	x
Caloplaca atrosanguinea (G. Merr.) I. M. Lamb		x				
Caloplaca citrina (Hoffm.) Th. Fr.			x		x	x
Caloplaca demissa (Körber) Arup & Grube		x				
Caloplaca diphyodes (Nyl.) Jatta		x	x	x		
Caloplaca ferruginea (Hudson) Th. Fr.				x		
Caloplaca fraudans (Th. Fr.) H. Olivier					x	
Caloplaca invadens Lynge				x		
Caloplaca lactea (A. Massal.) Zahlbr.					x	
Caloplaca oregona H. Magn.				x		x
Caloplaca saxicola (Hoffm.) Nordin						x
Caloplaca subsoluta (Nyl.) Zahlbr.		x		x		
Calvitimela armeniaca (DC.) Hafellner				x		
Candelaria pacifica Westberg	x	x	x			x
Candelariella aurella (Hoffm.) Zahlbr.		x		x		x
Candelariella citrina B. de Lesd.		x		x		x
Candelariella vitellina (Hoffm.) Müll. Arg.		x	x	x		x
Carbonea vitellinaria (Nyl.) Hertel					x	
Cavernularia hultenii Degel.						x
Chaenotheca brunneola (Ach.) Müll. Arg.			x	x		x
Chaenotheca chlorella (Ach.) Müll. Arg.						x
Chaenotheca chrysocephala (Ach.) Th. Fr.			x	x		x
Chaenotheca ferruginea (Turner ex Sm.) Mig.			x			x
Chaenotheca furfuracea (L.) Tibell					x	x
Chaenotheca gracillima (Vainio) Tibell						x
Chaenotheca phaeocephala (Turner) Th. Fr.			x			x
Chaenotheca subroscida (Eitner) Zahlbr.						x
Chaenotheca trichialis (Ach.) Th. Fr.			x			x
Chaenotheca xyloxena Nádv.						x
Chaenothecopsis debilis (Turner & Borrer ex Sm.) Tibell			x			x
Chaenothecopsis haematopus Tibell			x			x
Chaenothecopsis nana Tibell			x			x
Chaenothecopsis pusilla (Ach.) A.F.W. Schmidt			x			x
Chaenothecopsis savonica (Räsänen) Tibell			x			x
Circinaria calcarea (L.) A. Nordin, S. Savić & Tibell						x
Cladonia scabriuscula (Delise) Leight.					x	
Cladonia carneola (Fr.) Fr.	x		x		x	x
Cladonia cervicornis (Ach.) Flotow			x	x		
Cladonia chlorophaea (Flörke ex Sommerf.) Sprengel	x			x	x	x
Cladonia coniocraea (Flörke) Spreng.					x	x
Cladonia cornuta (L.) Hoffm.						x

Table 1 (cont.). Preliminary List of Lichens of the Illinois River Watershed. 1 = NWL certification plots, 2 = SFI rock crust workshop, 3 = OSU lichen group, Rough and Ready Creek, 4 = McCune database records, 5 = Mikulin and Riley, Oregon Caves, NM 6 = Loring et al., Pacific Crest Consulting.

Lichen Species	1	2	3	4	5	6
Cladonia ecmocyna Leighton						x
Cladonia fimbriata (L.) Fr.	x	x	x	x	x	x
Cladonia furcata (Hudson) Schrader	x		x	x	x	x
Cladonia ochrochlora Flörke	x			x	x	x
Cladonia phyllophora Hoffm.			x	x		x
Cladonia portentosa subsp. ***pacifica*** (Ahti) Ahti			x	x		x
Cladonia pyxidata (L.) Hoffm.	x		x	x	x	x
Cladonia squamosa var. ***subsquamosa*** (Nyl. ex Leighton) Vainio			x		x	x
Cladonia subulata (L.) Weber ex F.H. Wigg.					x	
Cladonia transcendens (Vainio) Vainio	x		x		x	x
Cladonia trassii Ahti					x	
Cladonia umbricola Tønsberg & Ahti						x
Cladonia verruculosa (Vainio) Ahti		x	x			x
Collema furfuraceum (Arnold) Du Rietz	x			x		x
Collema nigrescens (Hudson) DC.	x				x	x
Collema tenax (Sw.) Ach.					x	
Collema undulatum var. ***granulosum*** Degel.						x
Cornicularia normoerica (Gunn.) Du Rietz				x		x
Cyphelium inquinans (Sm.) Trevisan			x		x	x
Cyphelium pinicola Tibell			x			
Dendriscocaulon intricatulum (Nyl.) Henssen	x			x	x	x
Dermatocarpon bachmannii Anders				x		x
Dermatocarpon leptophyllodes (Nyl.) Zahlbr.		x		x		
Dermatocarpon meiophyllizum Vainio				x		x
Dermatocarpon miniatum (L.) Mann					x	x
Dermatocarpon reticulatum H. Magn.					x	x
Dermatocarpon rivulorum (Arnold) Dalla Torre & Sarnth.						x
Diploschistes muscorum (Scop.) R. Sant. subsp. muscorum		x				x
Diploschistes scruposus (Schreber) Norman		x			x	
Diplotomma alboatrum (Hoffman.) Flotow					x	
Endocarpon pusillum Hedwig						x
Esslingeriana idahoensis (Essl.) Hale & M. J. Lai	x		x	x	x	x
Evernia prunastri (L.) Ach.	x	x	x	x	x	x
Fuscopannaria aurita P. M. Jørg.		x		x		
Fuscopannaria coralloidea P. M. Jørg.		x		x		
Fuscopannaria crustacea P.M. Jørg.					x	
Fuscopannaria cyanolepra (Tuck.) P. M. Jørg.		x		x		x
Fuscopannaria leucostictoides (Ohlsson) P. M. Jørg.			x	x		x
Fuscopannaria mediterranea (Tav.) P. M. Jørg.				x	x	
Fuscopannaria pacifica P. M. Jørg.			x	x	x	x
Fuscopannaria praetermissa (Nyl.) P.M. Jörg.					x	x

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Lichen Species	1	2	3	4	5	6
Fuscopannaria pulveracea (P. M. Jørg. & Henssen) P. M. Jørg.	x			x		x
Fuscopannaria thiersii P. M. Jørg.		x		x		
Graphis scripta (L.) Ach.						x
Hypocenomyce anthracophila (Nyl.) P. James & Gotth. Schneider				x		
Hypocenomyce castaneocinerea (Räsänen) Timdal			x		x	
Hypocenomyce scalaris (Ach. ex Lilj.) M. Choisy					x	
Hypogymnia apinnata Goward & McCune			x	x		x
Hypogymnia enteromorpha (Ach.) Nyl.	x		x	x	x	x
Hypogymnia imshaugii Krog	x		x	x		x
Hypogymnia inactiva (Krog) Ohlsson	x		x			x
Hypogymnia occidentalis L. Pike	x			x	x	x
Hypogymnia physodes (L.) Nyl.	x		x	x		x
Hypogymnia tubulosa (Schaerer) Hav.	x		x	x		x
Hypogymnia wilfiana Goward, T. Sprib. & Ahti	x		x	x	x	
Hypotrachyna sinuosa (Sm.) Hale	x			x		x
Icmadophila ericetorum (L.) Zahlbr.						x
Imshaugia aleurites (Ach.) S. F. Meyer	x		x	x	x	x
Ionaspis lacustris (With.) Lutzoni				x		
Japewia subaurifera Muhr & Tønsberg			x			x
Japewia tornoënsis (Nyl.) Tønsberg			x	x		
Kaernefeltia merrillii (Du Rietz) Thell & Goward	x		x	x		x
Lecanora argopholis (Ach.) Ach.					x	
Lecanora bicincta Ramond				x		
Lecanora cadubriae (A. Massal.) Hedl.				x		
Lecanora cenisia Ach.				x	x	
Lecanora confusa Almb.		x		x		x
Lecanora dispersa (Pers.) Sommerf.	x				x	
Lecanora muralis (Schreber) Rabenh.	x			x		
Lecanora nigromarginata H. Magn.				x		
Lecanora pacifica Tuck.		x		x		x
Lecanora polytropa (Hoffm.) Rabenh.				x	x	
Lecanora pringlei (Tuck.)				x		x
Lecanora rupicola (L.) Zahlbr.				x	x	
Lecanora schizochromatica Pérez-Ortega, T. Sprib. & Printzen				x		
Lecanora semitensis (Tuck.) Zahlbr.		x	x	x		
Lecanora sierrae B. D. Ryan & T. H. Nash				x		
Lecidea ahlesii (Hepp.) Nyl.					x	
Lecidea atrobrunnea (Lam. & DC.)				x		
Lecidea auriculata Th. Fr.				x		
Lecidea fuscoatra (L.) Ach.		x		x	x	x
Lecidea holopolia (Tuck.) Zahlbr.				x		

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Lichen Species	1	2	3	4	5	6
Lecidea leucothallina Arnold					x	
Lecidea melaphanoides Nyl.				x		
Lecidea plana (J. Lahm) Nyl.			x	x		
Lecidea syncarpa Zahlbr.				x		
Lecidea tessellata Flörke		x		x		x
Lecidella carpathica Körber		x			x	
Lecidella elaeochroma (Ach.) M. Choisy		x		x		
Lecidella stigmatea (Ach.) Hertel & Leuckert		x				
Lempholemma chalazanum (Ach.) B. de Lesd.					x	
Lempholemma cladodes (Tuck.) Zahlbr.				x		
Lepraria alpina (B. de Lesd.) Tretiach & Baruffo				x		
Lepraria borealis Lohtander & Tønsberg				x	x	
Lepraria caesioalba (B. de Lesd.) J. R. Laundon				x		
Lepraria diffusa var. ***chrysodetoides*** (J. R. Laundon) Kukwa				x	x	
Lepraria eburnea J. R. Laundon				x		
Lepraria elobata Tønsberg				x		
Leprocaulon subalbicans (I. M. Lamb) I. M. Lamb & Ward					x	
Leptochidium albociliatum (Desm.) M. Choisy		x	x	x	x	x
Leptogium cellulosum P. M. Jørg. & Tønsberg	x					x
Leptogium gelatinosum (With.) J. R. Laundon				x	x	x
Leptogium lichenoides (L.) Zahlbr.	x	x		x	x	x
Leptogium palmatum (Hudson) Mont.			x		x	x
Leptogium plicatile (Ach.) Leighton						x
Leptogium polycarpum P. M. Jørg. & Goward	x				x	x
Leptogium pseudofurfuraceum P. M. Jørg. & Wallace						x
Leptogium rivale Tuck.						x
Leptogium saturninum (Dickson) Nyl.	x					x
Leptogium siskiyouensis Daphne Stone & Andrea Ruchty				x		x
Leptogium subaridum P.M. Jørg. & Goward					x	
Leptogium teretiusculum (Wallr.) Arnold						x
Letharia columbiana (Nutt.) Thoms.					x	x
Letharia gracilis Kroken ex McCune & Altermann						x
Letharia vulpina (L.) Hue	x		x	x	x	x
Lichenomphalia umbellifera (L. : Fr.) Redhead, Lutzoni, Moncalvo & Vilgalys			x	x		x
Lobaria hallii (Tuck.) Zahlbr.	x			x	x	x
Lobaria oregana (Tuck.) Müll. Arg.						x
Lobaria pulmonaria (L.) Hoffm.	x		x	x	x	x
Lobaria scrobiculata (Scop.) DC.	x		x	x		x
Lopadium disciforme (Flotow) Kullhem			x			x
Loxosporopsis corallifera Brodo, Henssen & Imshaug						x
Massalongia carnosa Korber					x	x

Table 1 (cont.). Preliminary List of Lichens of the Illinois River Watershed. 1 = NWL certification plots, 2 = SFI rock crust workshop, 3 = OSU lichen group, Rough and Ready Creek, 4 = McCune database records, 5 = Mikulin and Riley, Oregon Caves, NM 6 = Loring et al., Pacific Crest Consulting.

Lichen Species	1	2	3	4	5	6
Megaspora verrucosa (Ach.) Hafellner & V. Wirth		x	x	x		
Melanelia tominii (Oxner) Essl.						x
Melanelixia fuliginosa (Fr. ex Duby) O. Blanco et al.	x	x			x	x
Melanelixia subaurifera (Nyl.) O. Blanco et al.	x				x	x
Melanohalea elegantula (Zahlbr.) O. Blanco et al.	x					x
Melanohalea exasperatula (Nyl.) O. Blanco et al.	x		x		x	x
Melanohalea infumata (Nyl.) O. Blanco et al.					x	
Melanohalea multispora (A. Schneider) O. Blanco et al.	x		x		x	x
Melanohalea subelegantula O. Blanco et al.						x
Melanohalea subolivacea (Nyl.) O. Blanco et al.					x	x
Melaspilea interjecta (Leight.) A.L. Sm.		x				
Menegazzia subsimilis (H. Magn.) R. Sant.						x
Micarea denigrata (Fr.) Hedl.				x		
Microcalicium disseminatum (Ach.) Vainio			x			x
Miriquidica scotopholis (Tuck.) B. D. Ryan & Timdal		x		x		
Multiclavula mucida (Fr.) R. Petersen						x
Mycobilimbia berengeriana (A. Massal.) Hafellner & V. Wirth				x		
Mycobilimbia carneoalbida (Müll. Arg.) S. Ekman & Printzen		x		x		
Mycocalicium subtile (Pers.) Szatala			x			x
Nephroma helveticum Ach.	x		x	x	x	x
Nephroma laevigatum Ach.	x			x		x
Nephroma parile (Ach.) Ach.	x				x	x
Nephroma resupinatum (L.) Ach.	x		x		x	x
Nodobryoria abbreviata (Müll. Arg.) Common & Brodo				x	x	x
Nodobryoria oregana (Tuck.) Common & Brodo			x	x	x	x
Normandina pulchella (Borrer) Nyl.			x		x	x
Ochrolechia arborea (Kreyer) Almb.				x		
Ochrolechia farinacea Howard				x		
Ochrolechia juvenalis Brodo				x		
Ochrolechia mexicana Vainio				x		
Ochrolechia oregonensis H. Magn.			x	x	x	x
Ochrolechia subathallina H. Magn.			x	x		
Ochrolechia subpallescens Verseghy		x		x		x
Ochrolechia upsaliensis (L.) A. Massal.		x				x
Opegrapha herbarum Mont.						x
Ophioparma rubricosa (Müll. Arg.) S. Ekman			x	x		
Parmelia hygrophila Goward & Ahti	x	x		x	x	x
Parmelia pseudosulcata Gyelnik						x
Parmelia saxatilis (L.) Ach.		x	x	x	x	x
Parmelia sulcata Taylor	x		x	x		x
Parmelina coleae Argüello & A. Crespo						x

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Lichen Species	1	2	3	4	5	6
Parmeliopsis ambigua (Wulfen) Nyl.				x	x	x
Parmeliopsis hyperopta (Ach.) Arnold			x	x	x	x
Parmotrema arnoldii (Du Rietz) Hale						x
Peltigera britannica (Gyelnik) Holt.-Hartw. & Tønsberg			x		x	x
Peltigera canina (L.) Willd.			x		x	x
Peltigera collina (Ach.) Schrader	x		x		x	x
Peltigera degenii Gyelnik						x
Peltigera gowardii Lendemer & H. O'Brien					x	
Peltigera leucophlebia (Nyl.) Gyelnik			x	x	x	x
Peltigera malacea (Ach.) Funck					x	x
Peltigera membranacea (Ach.) Nyl.		x			x	x
Peltigera neopolydactyla (Gyelnik) Gyelnik						x
Peltigera pacifica Vitik.				x	x	x
Peltigera ponojensis Gyelnik				x	x	x
Peltigera praetextata (Flörke ex Sommerf.) Zopf				x	x	x
Peltigera rufescens (Weiss) Humb.					x	x
Peltigera venosa (L.) Hoffm.						x
Pertusaria amara (Ach.) Nyl.						x
Pertusaria chiodectonoides Bagl. ex A. Massal.		x		x		
Pertusaria subambigens Dibben						x
Phaeophyscia decolor (Kashiwadani) Essl.					x	x
Phaeophyscia endococcinodes (Poelt) Essl.					x	
Phlyctis argena (Sprengel) Flotow						x
Phlyctis speirea G. Merr.				x		
Physcia adscendens (Fr.) H. Olivier	x					x
Physcia aipolia (Ehrh. ex Humb.) Fürnr.	x	x	x	x	x	x
Physcia biziana (A. Massal.) Zahlbr.				x		x
Physcia caesia (Hoffm.) Fürnr.		x		x		
Physcia dubia (Hoffm.) Lettau				x		
Physcia phaea (Tuck.) J. W. Thomson					x	
Physcia tenella (Scop.) DC.	x	x		x		x
Physconia americana Essl.	x	x		x	x	x
Physconia enteroxantha (Nyl.) Poelt	x					x
Physconia perisidiosa (Erichsen) Moberg	x	x			x	x
Pilophorus acicularis (Ach.) Th. Fr.					x	x
Pilophorus clavatus Th. Fr.						x
Placidiopsis cinerascens (Nyl.) Breuss		x		x		
Placopsis gelida (L.) Lindsay			x			
Placopsis lambii Hertel & V. Wirth				x		x
Placynthiella icmalea (Ach.) Coppins & P.James					x	x
Placynthiella oligotropha (J. R. Laundon) Coppins & P. James				x		

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Placynthium nigrum (Hudson) Gray				x	x	x
Platismatia glauca (L.) W. L. Culb.. & C. F. Culb.	x		x	x	x	x
Platismatia herrei (Imshaug) W. L. Culb.. & C. F. Culb.	x		x	x	x	x
Platismatia stenophylla (Tuck.) W. L. Culb.. & C. F. Culb.	x		x			x
Platismatia wheeleri Goward, Altermann & Björk						x
Pleopsidium flavum (Bellardi) Körber		x				
Polychidium muscicola (Sw.) Gray			x	x	x	x
Protopannaria pezizoides (Weber) P. M. Jørg. & S. Ekman				x		x
Protoparmelia badia (Hoffm.) Hafellner					x	
Protoparmelia ochrococca (Nyl.) P. M. Jørg., Rambold & Hertel			x	x		
Pseudephebe pubescens (L.) M. Choisy				x		x
Pseudocyphellaria anomala Brodo & Ahti	x	x	x	x	x	x
Pseudocyphellaria anthraspis (Ach.) H. Magn.	x	x	x	x	x	x
Pseudocyphellaria crocata (L.) Vainio						x
Psora globifera (Ach.) A. Massal.				x		
Psora nipponica (Zahlbr.) Gotth. Schneider			x		x	x
Psora tuckermanii R.A. Anderson ex Timdal					x	x
Pyrenopsis furfurea (Nyl.) Th. Fr.		x		x		
Ramalina dilacerata (Hoffm.) Hoffm.	x			x		x
Ramalina farinacea (L.) Ach.	x	x	x	x		x
Ramalina menziesii Taylor						x
Ramalina subleptocarpha Rundel & Bowler	x					
Ramalina thrausta (Ach.) Nyl.						x
Ramboldia cinnabarina (Sommerf.) Kalb, Lumbsch & Elix			x	x	x	
Rhizocarpon bolanderi (Tuck.) Herre		x		x		
Rhizocarpon cf. ***hochstetteri*** (Körber) Vainio		x		x	x	
Rhizocarpon cinereonigrum Vain.					x	
Rhizocarpon copelandii (Körber) Th. Fr.				x		
Rhizocarpon distinctum Th. Fr.				x		
Rhizocarpon ferax H. Magn.				x		
Rhizocarpon geographicum (L.) DC.				x		x
Rhizocarpon grande (Flörke ex Flotow) Arnold		x		x		
Rhizocarpon lecanorinum Anders		x		x		
Rhizocarpon polycarpum (Hepp) Th. Fr.		x		x		x
Rhizocarpon reductum Th. Fr.		x		x		
Rhizocarpon riparium Räsänen		x		x		
Rhizocarpon viridiatrum (Wulfen) Körber			x	x		
Rhizoplaca chrysoleuca (Sm.) Zopf						x
Rhizoplaca melanophthalma (DC) Leuckert				x	x	x
Rimularia insularis (Nyl.) Rambold & Hertel				x		
Rimularia limborina Nyl.			x	x		

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Lichen Species	1	2	3	4	5	6
Rinodina badiexcipula Sheard				x		
Rinodina confragosa (Ach.) Körb.					x	
Rinodina disjuncta Sheard & Tønsberg				x		
Rinodina hallii Tuck.		x		x		
Rinodina laevigata (Ach.) Malme		x				
Rinodina marysvillensis H. Magn.				x		
Rinodina milvina (Wahlenb.) Th. Fr.		x		x		
Rinodina parasitica H. Mayrhofer & Poelt				x	x	
Sarcogyne privigna (Lecidea p. Ach.) A. Massal.					x	
Schaereria dolodes (Nyl. ex Hasse) Schmull & T. Sprib.			x	x		x
Sphaerophorus tuckermanii Rosanen					x	x
Sphaerophorus venerabilis Wedin, Högnabba & Goward	x			x		x
Spilonema revertens Nyl.		x		x		
Staurothele areolata (Ach.) Lettau				x		
Staurothele drummondii (Tuck.) Tuck.					x	
Staurothele fissa (Taylor) Zwackh		x				
Stereocaulon condensatum Hoffm.						x
Stereocaulon intermedium (Savicz) H. Magn.				x		
Stereocaulon sterile (Savicz) I. M. Lamb ex Krog		x	x	x		x
Sticta fuliginosa (Hoffm.) Ach.	x	x	x		x	x
Sulcaria badia Brodo & D. Hawksw.						x
Tephromela atra (Hudson) Hafellner		x	x	x		
Toninia ruginosa subsp. ***pacifica*** Timdal				x		
Trapelia coarctata (Sm.) M. Choisy					x	
Trapeliopsis glaucopholis (Nyl. ex Hasse) Printzen & McCune		x		x		
Trapeliopsis granulosa (Hoffm.) Lumbsch			x		x	
Tremolecia atrata (Ach.) Hertel				x		
Tuckermannopsis orbata (Nyl.) M. J. Lai			x	x	x	x
Tuckermannopsis platyphylla (Tuck.) Hale	x		x	x	x	x
Tuckermannopsis chlorophylla (Willd.) Vainio	x		x	x	x	x
Umbilicaria americana Poelt & T. H. Nash						x
Umbilicaria angulata Tuck.						x
Umbilicaria arctica (Ach.) Nyl.				x		x
Umbilicaria cylindrica (L.) Delise ex Duby					x	x
Umbilicaria deusta (L.) Baumg.					x	x
Umbilicaria hyperborea (Ach.) Hoffm.				x		x
Umbilicaria krascheninnikovii (Savicz) Zahlbr.				x		x
Umbilicaria phaea Tuck.		x		x		x
Umbilicaria polyphylla (L.) Baumg.				x		x
Umbilicaria polyrrhiza (L.) Fr.				x		x
Umbilicaria proboscidea (L.) Schrader				x		

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Lichen Species	1	2	3	4	5	6
Umbilicaria torrefacta (Lightf.) Schrader				x		x
Umbilicaria vellea (L.) Hoffm.				x		x
Umbilicaria virginis Schaerer				x		x
Usnea cavernosa Tuck.	x		x	x	x	x
Usnea cornuta Körber subsp. ***cornuta***			x			x
Usnea filipendula Stirton	x		x	x	x	x
Usnea flavocardia Räsänen	x			x		x
Usnea glabrata (Ach.) Vainio	x		x	x		x
Usnea hirta (L.) F. H. Wigg.	x			x		x
Usnea lapponica Vainio	x		x			x
Usnea pacificana P. Halonen						x
Usnea scabrata Nyl.				x		
Usnea subfloridana Stirton				x		x
Vahliella californica (Tuck.) P. M. Jørg.				x		
Vahliella leucophaea (Vahl) P. M. Jørg.					x	
Verrucaria hydrela Ach.					x	
Verrucaria margacea (Wahlenb.) Wahlenb.					x	
Verrucaria muralis Ach.		x		x		
Verrucaria nigrescens Pers.						
Vestergrenopsis sonomensis (Tuck.) T. Sprib. & Muggia					x	x
Vulpicidia canadensis (Räsänen) J.-E. Mattsson & M. J. Lai	x		x	x		x
Xanthomendoza fallax (Hepp ex Arnold) Søchting, Kärnefelt & S. Kondr.						x
Xanthomendoza fulva (Hoffm.) Søchting, Kärnefelt & S. Kondr.		x				
Xanthomendoza hasseana (Räsänen) Søchting, Kärnefelt & S. Kondr.	x					x
Xanthomendoza mendozae (Räsänen) S. Kondr. & Kärnefelt					x	x
Xanthomendoza oregana (Gyelnik) Søchting, Kärnefelt & S. Kondr.						x
Xanthoparmelia angustiphylla (Gyelnik) Hale				x		
Xanthoparmelia coloradoënsis (Gyelnik) Hale						x
Xanthoparmelia cumberlandia (Gyelnik) Hale		x		x		x
Xanthoparmelia loxodes (Nyl.) O. Blanco et al.				x		x
Xanthoparmelia mougeotii (Schaerer) Hale		x	x	x		x
Xanthoparmelia plittii (Gyelnk) Hale						x
Xanthoparmelia subhosseana (Essl.) O. Blanco et al.					x	
Xanthoparmelia verruculifera (Nyl.) Crespo et al.		x		x		x
Xanthoria candelaria (L.) Th. Fr.	x				x	x
Xanthoria elegans (Link) Th. Fr.					x	x
Xanthoria polycarpa (Hoffm.) Th. Fr. ex Rieber	x		x		x	x
Xylographa parallela (Ach. : Fr.) Behlen & Desberger			x			

CALS Research/Educational Grants Program

CALS offers small grants to support research or education pertaining to lichens in California. No geographical constraints are placed on grantees or their associated institutions. The Research/Educational Grants committee administers the grants program, with grants awarded to an individual only once during the duration of a project.

Grant Applicants should submit a proposal containing the following information:

1. Title of the project, applicant's name, address, phone number, email address, and date submitted.
2. Estimated time frame for project
3. Description of the project: outline the objectives, hypotheses where appropriate, and methods of data collection and analysis. Highlight aspects of the work that you believe are particularly important and creative. Discuss how the project will advance knowledge of California lichens.
4. Description of the final product: We ask you to submit an article to the CALS Bulletin, based on dissertation, thesis, or other work.
5. Budget: summarize intended use of funds. If you received or expect to receive grants or other material support, show how these fit into the overall budget.

The following list gives examples of the kinds of things for which grant funds may be used if appropriate to the objectives of the project: expendable supplies, transportation, equipment rental or purchase of inexpensive equipment, laboratory services, salaries, living expenses, and supplies. CALS does not approve grants for outright purchase of high-end items such as computers, software, machinery, or for clothing.

6. Academic status: state whether you are a graduate student or an undergraduate student. CALS grants are available to non-students conducting research in areas related to California lichens. CALS grants are available to individuals only and will not be issued to institutions.
7. Support: one letter of support from a sponsor, such as an academic supervisor, major professor, or colleague should accompany your application. The letter can be emailed to the chairperson of the education committee, enclosed with the application, or mailed separately to the CALS Grants Committee Chair.
8. Your signature, as the person performing the project and the one responsible for dispersing the funds.

The proposal should be brief and concise.The research/education grants committee brings its recommendations for funding to the CALS Board of Directors, and will notify applicants as soon as possible of approval or denial. Members of the education committee review grant proposals once or twice a year based on: completeness, technical quality, consistency with CALS goals, intended use of funds, and likelihood of completion. Grant proposals received by October 1, 2013, will be considered for the current grant cycle. CALS typically offers 2 grants in the amounts of $500 and $750 each year.

Obligations of Recipients

1. Acknowledge the California Lichen Society in any reports, publications, or other products resulting from the work supported by CALS.
2. Submit a short article to the CALS Bulletin.
3. Submit any relevant rare lichen data to California Natural Diversity Data Base using CNDDB's field survey forms.
4. Periodically update the research/education committee of progress on the project.

How to submit an application: Please email submissions or questions to the committee chairperson by Oct. 1, 2013. The Interim Committee Chairperson is Shelly Benson. Her email is president@californialichens.org.

News and Notes

CALS' First President Recognized

Janet Doell, a founding member of the California Lichen Society, celebrated her 90th birthday this March. Family and friends – including some fellow lichen enthusiasts – gathered to mark the occasion with food, drink, song, and many tales of a life being lived to the fullest.

Janet is moving to Alaska, but we couldn't let her go without giving her a token of our appreciation. CALS President, Shelly Benson, took the opportunity to present Janet with a framed specimen of lace lichen (*Ramalina menziesii*; See photo).

In recognition of all that Janet means to CALS, the following text was included in the framed piece:

The California Lichen Society is proud to honor Janet Doell, the guiding light around whom the founding members gathered in 1994 to promote the appreciation, preservation, and study of California lichens.

From the very beginning, Janet has shown incredible dedication to the society. With wisdom and foresight, she established CALS as a non-profit organization. She acted as the first president and then proceeded to contribute as member-at-large and as chair of the poster and mini guide committee. She also authored numerous articles in the Bulletin of the California Lichen Society.

Janet has been a mentor, a teacher, and an inspiration to so many of us. May we all live up to her legacy as we strive to do our part to help the society continue and flourish.

Shelly Benson, our current CALS president, presents Janet Doell with a gift recognizing her life-long dedication to CALS. Photo by Sarah Minnick.

"I find myself inspecting little granules, as it were, on the bark of trees – little shields or apothecia springing from a thallus – such is the mood of my mind, and I call it studying lichens."
~Henry David Thoreau

Thank you, Janet, for all your thoughtful planning, hard work, and enthusiasm.

By Sarah Minnick

Hit Me with Your Best Shot!

CALS is putting out the call to all members and friends for your best lichen photos that we will arrange into a 2014 calendar! Please submit small format photographs to Christine Walker at

"Lichen Shoe" at Monterey Dunes State Park, 6/24/12. Photo by Debbie Brusco.

christine@californialichens.org by July 1. When all entries are collected, we'll sort the photos by their visual impact and our ability to caption them in detail. If you have identified the lichen, please let us know, but don't hesitate to send photos of undetermined lichens, we'll do our best to place them as long as you let us know where the photo was taken. *A committee including internationally renowned nature and lichen photographer Stephen Sharnoff will make the final decision.* When the winners have been chosen, we'll come back to them for a high resolution image which will be placed with a credit to the photographer in a calendar that we hope will grace the shelves of many gift and book stores and raise awareness about the incredible, diverse world of lichens.

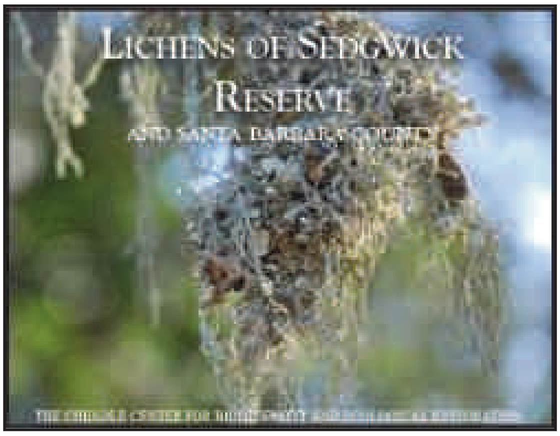
By Christine Walker

New Lichen Book For California Available

In spring of 2012, Shirley Tucker taught a lichen class for students and staff of the Cheadle Center for Biodiversity and Ecological Restoration (CCBER) on the campus of the University of California, Santa Barbara. Students collected lichens on field trips to Sedgwick Reserve in the Santa Ynez valley, and identified their collections using a variety of references, although none was adequate, especially for an introduction to lichens. The lichen flora was written up for the CALS Bulletin in 2012 (CALS Bulletin 19(2): 94-97).

In response to this need, Dr. Tucker, together with the staff of the Cheadle Center, produced an introductory book on lichens of the Sedgwick Reserve. The contents also are appropriate for the Santa Barbara area and the Santa Ynez mountain range. Excellent color photographs of 56 common lichens at Sedgwick are provided, most by Christopher Broughton, university staff photographer. Also included are descriptions of the species, and a list of the approximately 140 species found on the Reserve. All have been vouchered in collections at CCBER and at the Santa Barbara Botanic Garden herbarium.The book is aimed toward assisting students and docents as well as visitors to the Sedgwick Reserve. Oak savanna predominates at the Sedgwick Reserve, and these oaks are laden with masses of lichens such as *Ramalina menziesii*, the California Lace Lichen.

The "Lichens of Sedgwick Reserve & Santa Barbara County" is available for purchase at the Cheadle Center for Biodiversity and Ecological Restoration (CCBER) located on the UC Santa Barbara campus. Price: $18.25 each (tax included) plus $7 for postage and handling. Only cash and checks accepted. Please make out checks to the "U.C. Regents." Books will be sent after payment has been received. Send payments to: Dr. Jennifer Thorsch -



Director, Cheadle Center for Biodiversity and Ecological Restoration (CCBER), University of California, Santa Barbara, Santa Barbara, CA 93106-9610.

By Shirley Tucker

Marin Municipal Water District Lichen Walk with Identification Session at College of Marin

On March 20th, Shelly Benson led a lichen walk hosted by Marin Municipal Water District at Lake Lagunitas in Fairfax, CA. Many of the participants were associated with the Water District, either staff or volunteers. The group walked along the trail that encircles the lake. It had been raining that day and all the lichens were hydrated and looking their finest. The trail hosts a good diversity of lichens, including cyanolichens (*Pseudocyphellaria anthrapsis, Sticta fuliginosa, Peltigera membranacea, Peltigera ponojensis, Leptogium palmatum*, and *Collema nigrescens*). Participants collected interesting-looking lichens for closer examination in the lab at College of Marin. The College recently completed construction on their new science-math-nursing building; CALS appreciates the relationship we hold with the Department of Biology and we are thankful for the use of this beautiful new space.

Participants spent several hours in the lab looking at the anatomy of lichens under the microscope and keying out a few specimens (*Cladonia squamosa* var. *subsquamosa, P. membranacea*, and *S. fuliginosa*). They gained experience in determining whether a lichen contains a green alga or cyanobacteria by examining the photobiont layer. Additionally, they compared cyphellae and pseudocyphellae; and looked at soredia, isidia, veins, and rhizines.

By Shelly Benson

Lichen Dye Workshop Generates Purple Dye and General Interest in Lichens

In January 2013, the Sonoma County Mycological Society (SOMA) held their 16th annual three-day gathering of mushroom enthusiasts, SOMA Wild Mushroom Camp. The weekend is a big soiree of fun, food, and fungi, with activities, lectures, and workshops focused on learning about wild mushrooms. Many of the fungiphiles who attend have become excited about lichens, knowing that there

Examples of wool dyed with lichens. Photo by Sarah Minnick.

The "Dyeing with Lichens" display at SOMA Camp. Photo by Sarah Minnick.

Examples of wool dyed with lichens. Photo by Sarah Minnick.

is a fungal component at work in these complex organisms.

Last year, CALS board members Kathy Faircloth and Shelly Benson, represented CALS – and lichens – at SOMA Camp. Their lecture on lichen basics sparked much interest, and CALS Mini Guides sold like hot cakes. On the heels of that success, the camp's fiber arts and mushroom dyeing coordinators were interested in hosting a lichen-dyeing workshop in 2013.

As it turned out, there were many students and masters of mushroom dyeing eager to learn about lichens and lichen dyeing at the 2013 SOMA Camp. To begin the workshop, Shelly shared the basics of lichens with a new group of enthusiasts. Her presentation paid particular attention to the traits we would use to identify dye lichens. Students tried the C test on a piece of *Flavopunctelia flaventior* and were delighted in the C+ red color change they saw. Afterward, they all headed into a dark closet to ooh and aah over the UV+ *Parmotrema arnoldii*. Following the lecture and lab tests, we prepared the dye pots and put the lichens on to simmer. The color palette included three colors: yellow, orange, and purple. Wolf lichens (*Letharia* spp.) are known for their bright yellow thali, and they give a similar-color dye when boiled. *Usnea* species, despite their yellow-green cortex, can create an orange color when boiled. The purple came from a mix of two species, *Evernia prunastri* and *Flavopunctelia flaventior.*

Purple is one of the most amazing colors to achieve, since it is so far from the colors most people imagine coming from lichens – or plants or fungi, for that matter. Not only is it hard to imagine, it is hard to achieve in the natural dyeing world. Throughout history lichens have been a natural source for purple dye, sometimes to the detriment of lichen species that are overharvested to the point of extirpation (i.e. *Ochrolechia tartarea* in Scotland and northern England).

The process requires a bit of chemistry involving the proper lichens, ammonia, and oxygen. Combine these in a jar and add time to get…PURPLE! The length of time varies but is commonly more than three months. However, we found an exception to this rule in *F. flaventior*, which seemed to develop into a strong dye after only six weeks.

While testing various lichen species for their dye properties, Shelly and I discovered that *F. flaventior* far outperformed some other purple-producing lichens that we had read about in the literature. We were delighted to find such a shockingly-strong color hidden in such a common lichen, one that had not been mentioned in any of the articles or texts we had read. Though our original intent was to work with a dye completely made from *Evernia prunastri*, we thought it would only improve the dye pot to add the small amount of *F. flaventior* dye liquor we had on hand.

The results were great. The purple turned out to be bright lavender, a color not often seen in the natural dyeing world. While the mushroom dyers had seen mushrooms produce almost any color under the sun, they admitted that purples such as this were almost unheard of.

At the end of the day, the students went back to their cabins with yarns of various colors and a greater understanding and appreciation of lichens. While they were excited about lichen dyeing possibilities, they were also aware of the grave importance of sustainable collection practices. Lichens were acknowledged in places they were never noticed before, and a feeling of respect for lichens was born.

For information about sustainable lichen collection practices and additional lichen dyeing resources, visit the Blogs tab at: www.californialichens.org.

By Sarah Minnick

CALS Annual Meeting and Festivities

On January 26, 2013, lichen enthusiasts gathered for a full day of community driven activities. The day began with a lichen walk at Olompali State Historic Park in Marin County. The park has a rich history given that it is one of the oldest inhabited areas in California dating back to 500 AD. Participants included: Shelly Benson, Debbi Brusco, Tom Carlberg, Janet Doell , Distance Everheart, Kathy Faircloth, Alf Fengler, Bill Hill, Clint Kellner, Hanna Mesraty, Sarah Minnick, Ted Robertson, Deanna Schiel, Kathryn Strachota, Ken-ichi Ueda, Vishnu, Christine Walker, and Brian Kie Weissbuch.

As lichen walks go, the participants did not travel far before finding the eye-candy hard to ignore. A few memorable lichen-rich sites along the walk included the wall of an old barn, a rock outcrop, an old wooden bridge over a small creek, and a variety of oak species. Lichen rich discussions engaged participants to mingle and connect over lunch in the park's interactive Cost Miwok village installation.

Many participants joined in identifying lichens, such as *Chrysothrix candelaris, Flavopunctelia flaventior, Mycoblastus caesius, Ramalina menziesii, Teloschistes chrysophthalmus, Thelomma occidentale*, and *Xanthoria tenax*. For a more documented listing, please see the CALS iNaturalist project: http://www.inaturalist.org/projects/olompali-state-historic-park

Following the lichen walk at Olompali was a community driven potluck with a cake celebrating CALS 19th birthday. A special thanks was emphasized towards Janet Doell for her many years of dedicated service with CALS, her efforts have encouraged many.

The night wound down with

presentations from Martin Hutten and Christine Walker who shared some of their research on lichens. Martin's presentation included a glimpse into the lichen populations and their community relationships at Yosemite National Park. As a CALS grant recipient, Christine shared her preliminary findings of the inventory of the Valentine Easter Sierra Reserve.

By Hanna Mesraty

Update from May 1, 2103, College of Marin (COM) Lichen Workshop

We had a terrific workshop yesterday. Although few in number, Bill Hill, Clint Kellner, Patti Patterson, we were quite productive in examining lichens Bill and Clint brought. Bill collected some nice specimens from a trip he took to Mendocino County, from a rest stop on hwy 101, 3 miles north of the junction to Covello.

We examined several lichens, and identified *Usnea cavernosa, Usnea diplotypus, Hypogymnia occidentalis,* and *Hypogymnia physodes* among others. According to Brodo, "Lichens of North America", page 717, knowledge of the range of *U. diplotypus* is too incomplete for mapping, although it is thought to be widespread. The *U. cavernosa* we examined appeared to have soredia, however both Brodo and McCune state soredia lacking. Therefore the structures we saw were likely apothecia with prunia. Perhaps we can post our photos and get some input. It was a joy to exercise our lichen vocabulary reviewing words such as foveolate (*U. cavernosa*) fibrillose, papilla, etc. while looking at good examples of those structures.

We were pleased to have extra specimens on hand to make our lichen cards to pass out at the next event. Our lichen cards (specimens glued to good card stock) were a hit at the CAL day, and we would like to start making them in advance of our next event. It is a joy to get together and examine our specimens, and share information, and discuss ways to inspire interest in lichens, and of course the workshops are open, so please join us at future COM workshops.

By Patti Patterson

CALS Supports Young Scientists at the Sonoma County Science Fair

The Sonoma County Office of Education invited CALS to participate in the County science fair by helping judge student projects. On February 23, 2013, CALS president, Shelly Benson, and CALS community outreach coordinator, Hanna Mesraty, convened at Sonoma State University with other volunteers and community organizations who support science. They donned their judge's credentials and set to work evaluating grades 6-12 science projects. Students were awarded ribbons based on the overall score for their project. Exceptional student projects were nominated to receive cash awards.

CALS was proud to present a $100 award to Christian Placencia Mata, junior at Technology High in Rohnert Park. Christian's project, "Testing the Accuracy of Food Calories by Using a Calorimeter and Calorimetry" also awarded him a blue ribbon of recognition. His efforts and enthusiasm were obvious given his self-made calorimeter which was used in his experiments. His project reflected his

A CAL day participant views lichens under a stereoscope at the California Lichen Society Display. Photo by Hanna Mesraty.

ability to think scientifically, maintain documented data and results, communicate his findings, and follow-up on his research. CALS is happy to support young people learning and enjoying the scientific process. Our presence at this event introduced many students, teachers, and parents to the study of lichens, and hopefully inspired some to learn more.

By Hanna Mesraty

CAL Day at UC Berkeley 2013

CALS set up alongside the California Native Plant Society and the SF Mycological Society, at the UC Jepson Herbaria for CAL Day on Saturday, April 20. CAL day is a campus wide open-house which offers 300 events for prospective students and the surrounding community. Various departments and local societies

Nancy Hillyard volunteered at the CAL day lichen display and shared her passion for lichens with many of the participants. Photo by Hanna Mesraty.

come prepared to engage with the crowds while building awareness for their causes.

CALS offered an information booth with interesting lichen print-outs, CALS mini-guides, and sample lichen cards to welcome the crowd. There was also a microscope table set up for children of all ages to get a closer look at the world of lichens. Many curious participants enjoyed browsing the "lichen library" and asked many questions. The direct engagement stimulated conversations about lichens and their role within various environmental systems. The lichen cards were especially valuable as they facilitated engagement with the community, gave the participants a direct connection point for interaction, and they were able to take them home.

Special thanks to the UC Jepson Herbaria for hosting CALS, any and all who have contributed to the lichen card project over time, as well as to CALS members' Distance Everheart, Bill Hill, Nancy Hillyard, Hanna Mesraty, Patti Patterson, Christine Walker, and Irene

Winston who shared their time and efforts for CAL Day.

By Hanna Mesraty

The California Lichen Society Partners with the California Native Plant Society to Promote Rare Lichen Conservation

Thanks to the generosity of many California Lichen Society members and a grant from the Mead Foundation, we met our goal of $5,000 needed to put rare lichens into the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants (Inventory). We are very excited to see this project come to fruition.

The CALS Conservation Committee strives to increase awareness of lichen conservation in California. It has developed a rigorous one-year sponsorship process for assigning rarity rankings to lichens. These methods result in strongly-justified decisions for lichen conservation. Nine California lichens have already received a rarity ranking and there are over 100 additional candidates in need of review.

CNPS strongly supports CALS in our effort to increase the visibility and recognition of rare California lichens. That is why we have partnered on a project which will add rare lichens to the CNPS Inventory. The Inventory is an online database (http://www.rareplants.cnps.org) created to promote rare plant conservation. It is the go-to database if you are looking for information about rare plant species, whether you are a naturalist, conservationist, government agency, or a contractor working on environmental permitting. The Inventory will give invaluable exposure to lichens and provide a platform for education and awareness about lichen conservation.

In order to add lichens to the Inventory, the existing database and website need to be modified to accommodate new, lichen-specific data fields and data categories. The one-time cost of $5,000 was needed to make these modifications and input the lichen data. Ongoing maintenance and updates to the database are estimated at $1,700 annually. Our partner, CNPS, has committed to an in-kind contribution to cover all annual maintenance and update costs for the long-term. Once the project is complete, information about California's rare lichens will be easily accessible to amateur naturalists, professional biologists, and interested citizens using the Inventory. We'll let you know when you can search the Inventory for your favorite rare lichen!

By Eric Peterson and Shelly Benson

CALS Education Grants

Applications are now begin accepted for this year's CALS Education Grants cycle. Students or other CALS members who seek monetary support for research on California lichens are welcome to apply. Please spread the word about these grants to anyone you think would be interested. CALS has produced a flyer that members can distribute. If you would like one of these flyers please contact Shelly Benson at president@californialichens.org. The deadline to submit proposals is Oct. 1, 2013.

Also, the CALS Educational Grants committee is looking for members who would like to participate in the grant review process. This commitment involves evaluating and ranking the proposals once a year based on a rubric developed by the committee. If you would like to participate in this process please contact Shelly at the email above.

CALS on Social Media

CALS is now available on social media sites, check us out!
https://www.inaturalist.org/users/cals
https://twitter.com/CALichenS
https://www.facebook.com/californialiche ns

CALS is also curating a community lichen discussion called "Ask a Lichenologist" on iNaturalist. With emphasis on community as a resource, this project was designed to encourage discussions about lichens for any skill level. Curious? Join the discussion. https://www.inaturalist.org/projects/ask-a-lichenologist. If interested in getting involved in the project, contact Hanna@californialichens .org.

By Hanna Mesraty

Full Color Versions of the Bulletin are Now Available Online

Want to see the Bulletin in full color? All members now have access to the eBulletin online, which we are producing in full color. Members can also view copies of all older Bulletin issues on our website. To access the Bulletin online follow the instructions below:

1) Go to the CALS website: http://californialichens.org.
2) Under the Bulletin tab, select "Bulletin of the California Lichen Society (members)".
3) Click the link "log in".
4) A login window should appear where you can enter your username and password.
5) To obtain a password, click on the link *Lost your password?* at the bottom of the login window.
6) Enter your email address. You must use the same email address we have on file.
7) Check that email account for a password reset message, then follow the instructions.

Please direct any questions to webmaster@californialichens.org.
To update your email address, please let us know by sending an email to both webmaster@californialichens.org and secretary@californialichens.org.

I would like to thank everyone who submitted photos, news and notes, and information about upcoming events for this issue. Your submissions help make the Bulletin both informative and beautiful to look through. Thank you!

By Erin P. Martin

Best of the Board: CALS Board Meeting Highlights

Annual Meeting: Jan. 26, 2013

• Discussed fundraising to support listing of rare lichens in CNPS Online *Inventory of Rare and Endangered Plants*
• New 'Community Outreach' and 'Activities and Events' coordinator positions were filled. Thanks, Hanna Mesraty and Christine Walker, for getting excited about CALS and bringing new ideas to the table.
• Website reorganization was scheduled. CaliforniaLichens.org is the place to go to pay your membership online, show your support with a donation, or access back

issues of the eBulletin in full-color. Come see what's new.

• CALS is plotting to take over Facebook and Twitter…or just be part of the world of social networking. Check us out!

• New emails for CALS positions @californialichens.org. Drop us a line sometime.

• CALS is considering administering grants that are awarded by other organizations. This discussion to be continued…

Board Meeting #1: March 7, 2013

• We, the Board, think we should meet more often. Maybe once a month, or so. There are so many fun things to work on, and we'd like to keep things moving along. Go team!

• We discussed some new ways to maintain good e-communication. Let's keep our email inboxes organized with easy to read, informative subject lines. None of this Re:Fw:Re:re:fwd: business.

The complete meeting minutes are available to members on our website: www.CaliforniaLichens.org.

Irene Winston's granddaughter, Naomi, "helping" at the lichen exhibit at the Jepson Herbarium, April 20th, 2013. Photo by Irene Winston.

High school biology students study lichens in permanent panels at Black Rock in Joshua Tree National Park. This photo was taken during the 4th Annual Student Summit on Global Warming. The students have not lost any of the hand-lens donated by CALS to this program. Photo by Kerry Knudsen.

Bill Hill volunteering at the CAL Day display. Photo by Hanna Mesraty.

Upcoming Events

Tilden Park Botanic Garden Workshop
Second Saturday Each month.

Lichen workshops occur at the Regional Parks Botanic Garden, Tilden Regional Park, Berkeley, the second Saturday of each month, from 1:30pm or 2pm to 4:30pm. Bill Hill and Irene Winston started the workshops during the winter months of 2010. We do lichen walks in the Garden, a California native plants garden, and classifications and keying of lichens from the Garden's fallen wind-blown twigs. The Garden's 10 acres offer a plethora of each type of lichen although the gelatinous ones are not obviously present. Participants also bring in lichen samples for keying. For a quick basic overview of lichens in the Garden, please see the November 2010 e-newsletter at http://us1.campaign-archive.com/?u=01091d83e4aa193c78a88 8704&id=a346a1307d. For any information or suggestions, please contact Bill Hill, aropoika@gmail.com or at 415-686-6146.

Ongoing Lichen Workshops, College of Marin (COM), Science Center
1st and 3rd Wednesday of each month, 5:30 to 9:00 PM

We encourage you to attend these enjoyable workshops at the College of Marin. Meet in the new Science Math Nursing building room 112. Dr. Paul DiSilva has graciously allowed us to use the classroom and scopes. Please RSVP to Bill Hill, who organizes the logistics (contact Bill at aropoika@gmail.com or at 415-686-6146). We bring our own lichens and work with each other to identify them. There are usually snacks. Parking at the college is $3.

Explore the Lichens of the Valentine Eastern Sierra Reserve Mammoth Lakes, CA with Christine Walker
June 22, 2013 10 am – 3 pm

The Valentine Eastern Sierra Reserve is a sanctuary protected from development by the Valentine family's gift to the UC Natural Reserve System in 1973. Settled below the Mammoth Lakes Basin at approximately 8000 feet in elevation, the 156 acre property threads through a number of plant communities that are representative of the greater region. The great sagebrush meadow and Jeffrey pine forest are bisected by Mammoth creek and waterfall and dotted, in the springtime, with a breathtaking display of alpine wildflowers. A handful of log cabins dating from the 1920's house researchers and students who investigate this special property's unique geology, flora, and fauna. With the permission and guidance of Valentine's Director Dan Dawson, and the support of a California Lichen Society Education Grant, I undertook a lichen inventory of the reserve in the summer of 2012. I am returning to continue work on that inventory this summer and invite members of the California Lichen Society to join me on a rare tour of the property. Space is limited, please contact me at christine@californialichens.org to reserve yours. There is no charge to attend and I will provide information about camping accommodations in the area to those who enroll.

Overview of a small section of Tolowa Dunes State Park. In the foreground are sand dunes covered with invasive European beach grass; in the background is a part of the shore pine/spruce forest, beyond which is Lake Earl and Lake Tolowa. Photo by Tom Carlberg.

Tolowa Dunes Lichen Walk
Sunday, July 14, 2013, 1-4 pm

Questionably plants, definitely native, unquestionably important, and usually small, lichens are an overlooked but important link in most ecosystems. Tolerant and intolerant of locales that are arid and inundated, polluted and pristine, responses to environmental stresses vary widely by species. There are estimates of slightly less than 5000 species in 646 genera in North America; 1600 species are reported for California. Yet few people are able to place names on even the most common lichens, which means that an essential component of most natural resource inventories is lacking. Opportunities to learn about identifying lichens are infrequent, although the basic characters used in identification can easily be learned in a day.

Join lichenologist Tom Carlberg in Crescent City on 14 July 2013, at the Lake Earl Wildlife Area Information Center for a brief slide presentation and a longer walk through the dune forest in the vicinity of Lake Earl, a coastal lake immediately north of Crescent City, California. Meet a little before 1:00pm at the Center, bring water and wear sturdy shoes. Your experience will be greatly enhanced if you bring a hand lens! A map to get to the Center is at www.tolowacoasttrails.org/pdfs/Tolowa_Map_2010LR.pdf.

Bryoria pseudocapillaris on contorted shore pine (*Pinus contorta* var. *contorta*) at Tolowa Dunes State Park. Photo by Tom Carlberg.

For more information, contact Tom Carlberg at tcarlberg7@yahoo.com.

American Bryoloigcal and Lichenological Society (ABLS) Annual Meeting
July 27 - July 31, 2013

The ABLS annual conference will be at the Riverside Hilton, New Orleans, Louisiana. Registration for the conference, workshops, field trips, and ticketed events can be found at: https://www.etouches.com/ereg/index.php ?eventid=56723& (the BOTANY 2013 website). The Society has a field trip planned for Sunday, July 28th to the Barataria Preserve, Jean Lafitte National Historical Park.

The Barataria Preserve south of New Orleans is the park's wildest site with

23,000 acres of swamp, marsh, trails, and waterways, a living laboratory of Louisiana's endangered wetlands. South Louisiana's long growing season and abundant rain means it's a great place to be a plant.

The Barataria Preserve contains three major plant systems: hardwood forest, swamp, and marsh, and is a good place to see over 400 species of plants. This is encompassed in an elevation change of a little over half a foot - not much to humans but making all the difference to the park's flora. Lichens and bryophytes are abundant mostly on tree trunks and canopy branches.

Our field trip will be led by Park Naturalist Aleutia Scott, and Jim Bennett and Roger Rosentreter of ABLS. Please bring comfortable hiking shoes, and bug spray (mosquitoes!). Water will be provided. Restrooms are available at the Visitor's Center. Note that collecting will NOT be permitted, although we will look at lots of lichens and bryophytes. This is a great opportunity to see habitats and plant communities that will be unfamiliar to those coming from more northern regions. Do come and explore with fellow ABLS enthusiasts! If time and the weather permit it, we will make a short stop at Jefferson Davis Parkway to view the lichen lines on the live oaks.

Soil Crusts of Joshua Tree National Park
Oct. 19-20, 2013

Lichenologist Kerry Knudsen and soil crust biologist Dr. Nicole Pietrasiak will present a class on the biological soil crusts at Joshua Tree National Park. Oct. 19-20, 2013, presented by the Desert Institute of the Joshua Tree National Park Association. There will be lectures, lab, and field work. Nicole is an expert in desert soil crust biology and the algae and cyanobacteria of desert crusts. She recently discovered a new genus of cyanobacteria that occurs in Chile and California as well as amazing undescribed algal diversity in Joshua Tree crusts. Kerry will discuss lichens role in soil crusts, show how to identify common soil crust lichens, and introduce the new terricolous species *Sarcogyne mitziae*. Nicole and Kerry have been working in Joshua Tree since 2004. Further information will be posted on the CALS Listserve as well as available at www.joshuatree.org

For more information, contact Kerry Knudsen at knudsen@ucr.edu.

Soil crust community at Joshua Tree National Park. Photo by Jana Kocourková.

PRESIDENT'S MESSAGE

Hello CALS community! I am honored to serve as the new president of the Society. I would like to take this opportunity to thank the past board members for all of their work through the years. Former President, Bill Hill, will focus his efforts onvthe CALS Council, a group of active members who work closely with the Board of Directors for visioning the future direction of the Society. We are looking for more members to join the council, so let me know if you are interested. We would like to express our gratitude to Erin Martin for the many years of active service she contributed to CALS in her roles as President, Secretary, Production Editor, and Education Grants Committee Chair; we wish her the best of luck with her active academic career in Florida. We're happy to have Tom Carlberg, former Member-at-Large, as our new Vice president, and we welcome Sarah Minnick as the new Secretary. Kathy Faircloth continues her exemplary work as our faithful Treasurer. We are also excited to announce that two formerly vacant committee positions have been filled. We welcome Hanna Mesraty as the Community Outreach Coordinator and Christine Walker as Activities and Events Coordinator. Finally, we thank John Villella for his work as Editor for the past two years; John has decided to leave that role in favor of focusing his attention on the Conservation Committee.

I am very excited about the many ideas and activities CALS is working on now. We are planning more field trips now that Christine has joined our team as Activities and Events Coordinator. If you're interested in leading a walk or have a suggestion for a trip location, get in touch with Christine (see inside front cover for contact information). We have also been making many changes to grow our membership and increase the activity within our community. We have re-organized our website (californialichens.org) so you can easily find what's new with CALS, what events are planned, and what people are learning on field trips and at workshops through our blogs. You can even pay your membership or make donations online from our website via PayPal. CALS is expanding its reach by connecting with those lichen enthusiasts who are active in the social media world. You can now follow CALS is on Facebook and Twitter. We are also excited about developing our presence on iNaturalist. We are working with the creators of iNaturalist to launch a project called "Ask a Lichenologist." Keep an eye out for this community-driven discussion where we work to identify California lichens using photos uploaded by observers across the state. It's sure to be informative, fun, and a great way to connect with others working to put a name on their lichen specimens. You can find links to CALS social media sites on our website.

Lastly, I'd like to thank you, for being a CALS member. Your support drives this society. I'm looking forward to creating more opportunities for you to appreciate and learn about lichens, and share those experiences with the broader CALS community.

Shelly Benson
President@californialichens.org

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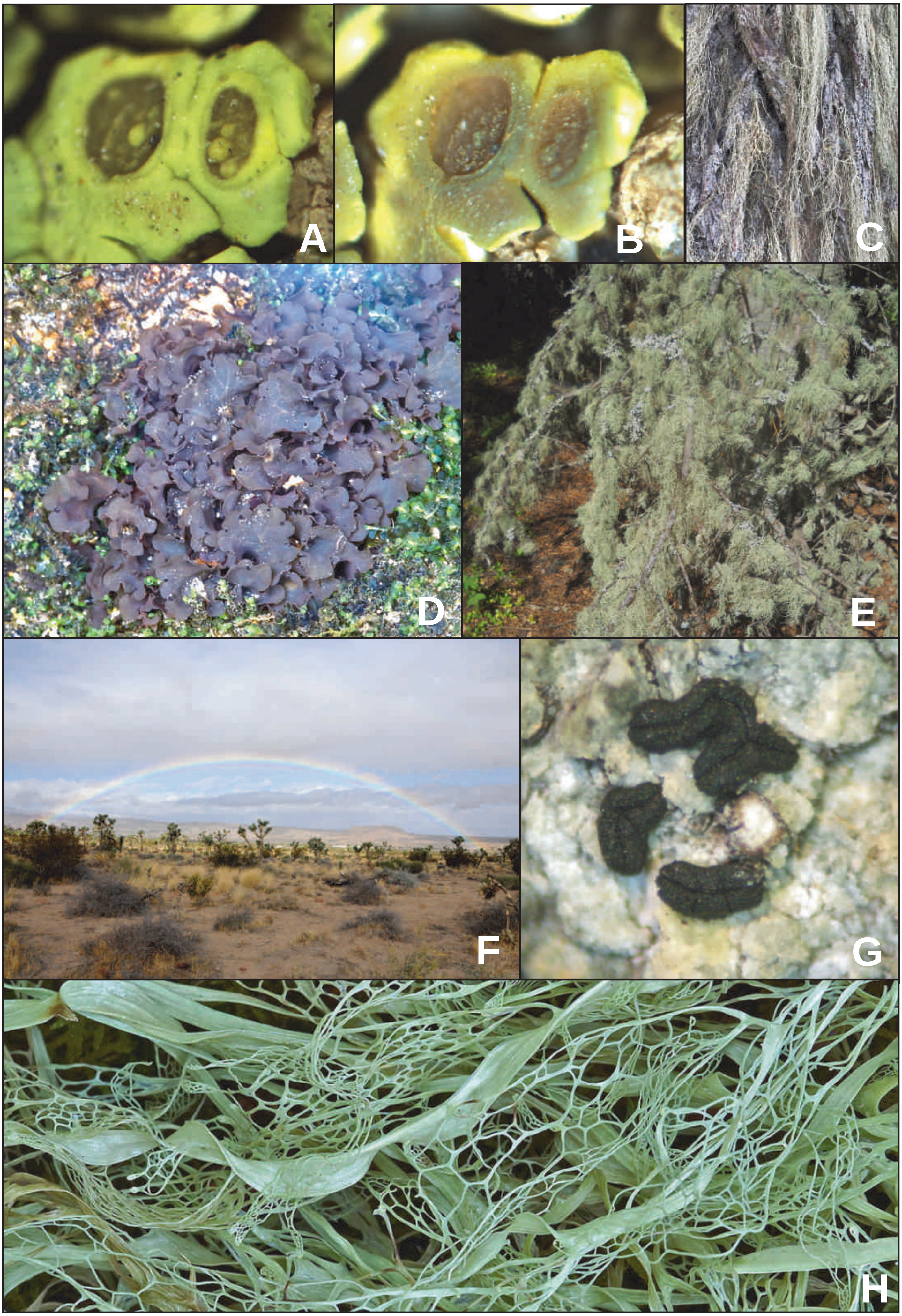
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