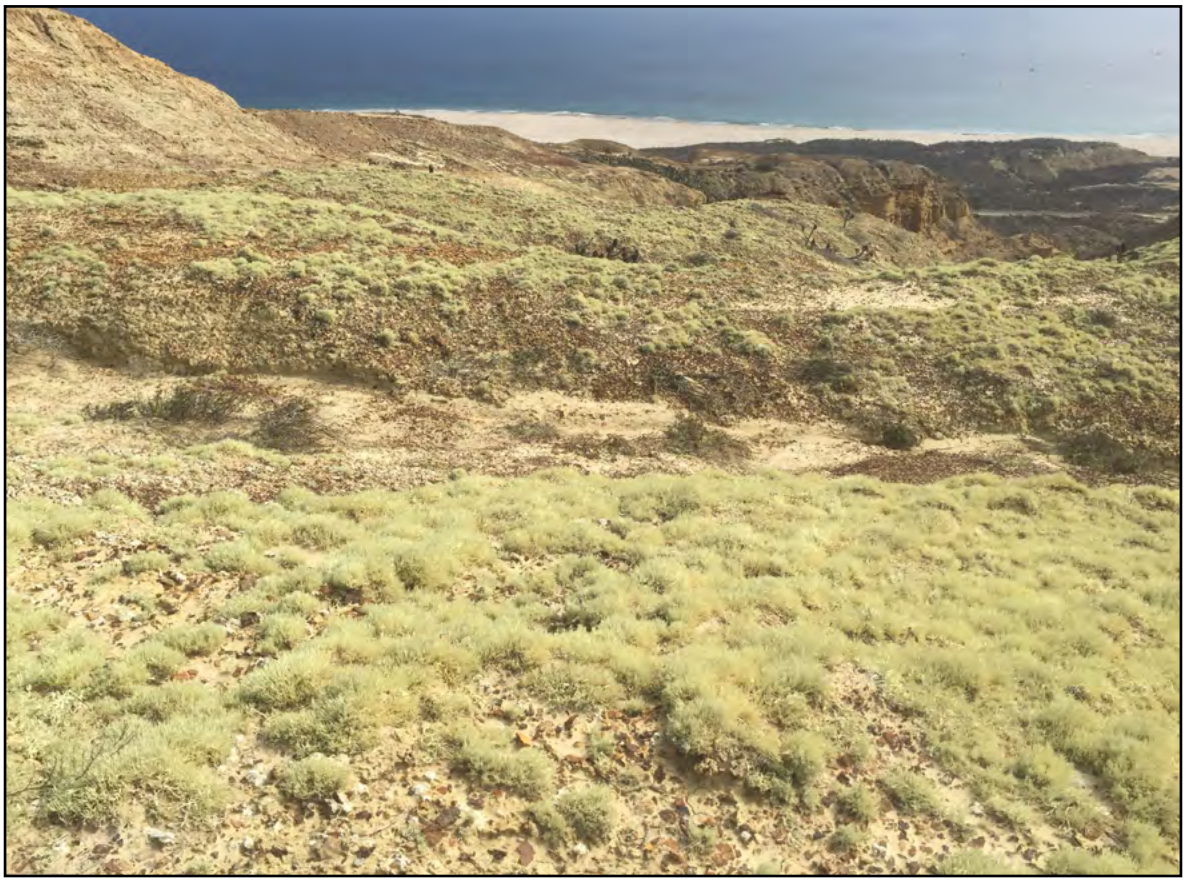
Bulletin of the California Lichen Society



Volume 22 No. 2 Winter 2015

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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 (600ppi 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 editor, John Villella at Editor@californialichens.org, 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 - 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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Cover Photo: Fields of *Niebla ramosissima* with the Pacific Ocean in the background, San Nicolas Island. Photo by Tim Wheeler.

Niebla ramosissima: an endemic of San Nicolas Island

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Niebla ramosissima. San Nicolas Island.

Abstract

Niebla ramosissima Spjut is considered a terricolous species endemic to San Nicolas Island. It is recognized as a species reproducing by fragmentation on calcareous gypsum-veined soil and is not a synonym of *Niebla homalea*. It is distinguished by its lack of a holdfast or rhizines, its thin blades that do not widen, and the fact that it rarely produces apothecia or pycnidia.

Keywords

Clonal species, biotic soil crusts, Channel Islands, diversity, taxonomy.

Niebla ramosissima Spjut, *Niebla* and *Vermilacinia* (Ramalinaceae) from California and Baja California: 126 (1996). Holotype: U.S.A. CALIFORNIA. San Nicolas Island. S side, along Theodolite Road, soil on south-facing slope, 700 feet, 12 Feb. 1993, *C. Bratt 8124* (SBBG!)

For description see Spjut 1996.

Discussion

There are eight islands off southern California, the Channel Islands, the Galapagos of California. Along their rugged coasts on salt-sprayed cliffs and inland in secluded grottos and on large basalt boulders, *Niebla* dominates, encrusting substrates like a congregation of meditative green hedgehogs. There are 11 species on the Channel Islands (Bowler & Marsh 2004). Visitors to the islands, hiking on Santa Cruz or Catalina, will most likely only see *Niebla ceruchis* and *N. cephalota* on the bushes and *N. homalea* on rock. *Niebla ceruchis* and *N. cephalota* are most common on shrubby *Baccharis* and generally always look the same and are easily identified by sight. The pictures of these two species in Sharnoff's California lichen book (2014) are typical.

Niebla homalea can look very different from one island to the next, as well as in different microhabitats, from windy ridges to protected canyon bottoms. No one

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Niebla homalea on rock.

picture captures the phenotypic variety of the common *N. homalea,* its polymorphic exuberance. A classic book of lichenology by Richard W. Spjut is *Niebla and Vermilacinia (Ramalinaceae) from California and Baja California* (1996). Like a kaleidoscope, in dozens of pictures, Spjut unintentionally did capture the perplexing forms of *Niebla homalea*.

And Spjut was perplexed by the variability of *Niebla homalea*! The key he wrote is impossible to use despite photographs and drawings of all the species (Spjut 1996). Spjut split *Niebla homalea* into 32 different species according to the revision of *Niebla* in Vol. 2 of the *Lichen Flora of the Greater Sonoran Desert Region* (Bowler & Marsh 2004). Using the Sonoran key *Niebla homalea* is easily identified. The forms are local or often environmental modifications. Once one has seen a lot of *N. homalea* only the most extreme forms will make a lichenologist pause in the field and flip open a hand-lens. But both the taxonomic revisions of Spjut and Bowler and Marsh have only been based on morphological and chemotaxonomic analysis. What is needed is a robust phylogenetic study of *Niebla* and a new revision of the taxonomy. We have no doubt that even comparing genes, most of Spjut's names will remain synonyms of *N. homalea.* Spjut probably holds the record in lichenology for naming the same species the most amount of times. Thirty-one times according to Bowler & Marsh (2004). We disagree. We think Spjut was right at least once.

In 2015, we flew out to San Nicolas Island on a Navy plane and the 58 miles from Point Magu took less than 20 minutes. The first lichens on this island were collected by the botanical adventurer Blanche Trask and sent to H.E. Hasse. The modern investigation of San Nicolas Island for lichens began with Charis Bratt and William Weber in 1992. Bratt returned several times and her collections are preserved at Santa Barbara Botanical Garden (SBBG) and are the most valuable scientific and historical record of lichens on the island at the end of the 20th century. She was joined by T.H. Nash II (Arizona State University) and Shirley Tucker (SBBG) who also made important collections in 1995. We have surveyed the island in 2014 and 2015, for a total of 10 days, checking past records and collecting specimens for the Channel Islands flora project. We collected over 30 new records for the island including the rare species *Naetrocymbe herrei* and *Adelolecia sonorae* (UCR Herbarium 2015).

In hiking San Nicolas Island we were impressed by the large crusts of *Niebla* growing on calcareous

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Gypsum plate habitat.

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Niebla ramosissima in Theodolite Road area.

soil rich in gypsum deposits. Based on a collection by Bratt from the Theodolite Road area on the south side of the island, Spjut described this taxon as *Niebla ramosissima.* But Bowler and Marsh (2004) considered *N. ramosissima* a synonym of *Niebla homalea.* On San Nicolas Island, *N. homalea* grows on rock and has a holdfast and blades that thicken as they age as well as abundant apothecia and pycnidia. Fragments falling on soil do not grow that we have observed. But *N. ramosissima* has uniform branching capillary branches that do not thicken as they age and rarely have apothecia or pycnidia (Spjut 1996). We personally saw no apothecia. Additionally, the species has no holdfast or rhizohyphae. The populations cover stark, desolate meters of gypsum and sandstone-derived soil.

Niebla ramosissima is an asexual, clonal species spreading by fragmentation. The branches are easily broken off by wind, erosion, or the rotting of the base of the lichen. Fascicles of branches easily split off in your hand. The branches lie on the infertile soil like scattered bones but are soon covered up by fine calcareous alluvium after it rains. These thinly buried branches are the beginning of new individuals. They

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Niebla ramosissima fragmentation in a small gully.

can become quite large. Up to six inches tall and even wider.

In the million years that San Nicolas Island has been rising above the Pacific, one lineage evolved that was adapted to replicating by fragmentation on the ceaselessly eroding and desolate calcareous and gypsum-veined marine terraces. Thus we consider *Niebla ramosissima* a good species, endemic to San Nicolas Island, and not a synonym of *Niebla homalea*. Spjut apparently only described *N. homalea* 30 different times.

Acknowledgements

We thank Shirley Tucker (SBBG) for funding the Channel Islands lichen flora project. We thank William Hoyer and the U.S. Navy for making our visits to San Nicolas Island possible. We thank Matt Guilliam, herbarium curator and botanist, for hosting our visits to Santa Barbara Botanical Garden. The work of Kerry Knudsen was financially supported by the grant ''Environmental aspects of sustainable development of society''42900/1312/3166 from the Faculty of Environmental Sciences, Czech University of Life Sciences Prague.

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Niebla ramosissima on San Nicolas Island. In the background, Kerry Knudsen studies the finer points of *Niebla* species.

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Tim Wheeler (left) and Kerry Knudsen (right) in front of a sea of *Niebla ramosissima* on San Nicolas Island.

Lake Tahoe's lichen trimline

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As treated by Timoney and Marsh (2005), lichen trimlines are characteristic of aquatic systems where lichen-covered rocks border fluctuating water bodies (Figure 1). Trimlines are one example of zonation in lichen distribution, formed in response to physical and ecological factors. According to the authors, these factors may include species tolerance to immersion/desiccation, siltation, water and substrate chemistry, water and ice scouring, current velocity, substrate stability, wave splash, shade, competition with bryophytes and vascular plants, and colonization rates after disturbance.

Saxicolous lichen trimlines are relatively level and distinct transition zones found on bedrock lined lake shores. They occur as a result of disturbance to the rock lichen community, typically due to high water events. These trimlines might remain visually distinct for several decades in the absence of disturbance (Marsh & Timoney 2005), and likely represent the highest water level in the immediate historic past (Wetzel 2001).

Lake Tahoe is a large freshwater lake in the Sierra Nevada of California and the largest alpine lake

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Figure 1. Whale Beach, east shore of Lake Tahoe, showing a distinct line between heavy coating of lichens above and unlichenized rock below, September 15, 2015.

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Figure 2. Lake Tahoe photographic shoreline survey, 1916, showing large boulders at Emerald Bay with lake elevation at 6231.6 feet.

in North America (USGS 2015). Intermittently, along the 72 miles of lakeshore, can be found large granitic boulders and bedrock substrate. A simplified geological map of locations along Lake Tahoe's shoreline where granite can be found is published on-line (Schweickert et al. 2011).

Some of the boulders bear a distinct demarcation from lichenized surface to unlichenized surface (Figure 2). These trimlines appear to be the result of a combination of past lichen growth and then subsequent loss of lichen thalli at and below water level during high lake levels. Currently, it appears that Lake Tahoe's trimline sits at about 10 feet above lake level (Figure 3). In addition, this trimline has not been found to occur on the south-facing surfaces (Figure 4).

Scientists recently warned that the drought in California, now in its fourth year, will mean that by late summer the lake, which depends primarily on snowmelt, will likely drop to its lowest level in recorded history, about three feet below its natural rim (Sulek 2015). "In the Mediterranean climate of California, with 80% of the precipitation occurring during the winter months, Sierra Nevada snowpack plays a critical role in replenishing the state's water reservoirs…." (Belmecheri et al. 2015). On April 1 of this year, when the California snowpack generally has reached its greatest depths, the Sierra snowpack was measured at 5 percent of normal. Such low amounts of snow are beyond unusual – they are unprecedented in the past 500 years. The snowpack has not been so low since about the Middle Ages (Reese 2015). Conversely, the highest recorded historic lake level was in 1907 when the lake rose above 6231.19 (Adams & Minor 2001).

There are more than 3,000 named lakes, reservoirs, and dry lakes in the state of California (Wikipedia 2015), yet few of them have the necessary characters for lichen lines. Lake Tahoe has those necessary characters, such as large granitic boulders or bedrock at various locations along the shoreline (granititic

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Figure 3. Whale Rock, showing approximate height of the trimline above the level of the lake in September, 2015.

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Figure 4. South face of Whale Rock (left side of rock), showing lack of trimline.

boulders are located primarily along the east shore of the lake - see Schweickert et al. 2011) fluctuating lake level (see Figure 5 for monthly elevations of the lake 1900-Present), and the presence of conditions conducive to lichen colonization on rock surfaces – undisturbed surfaces, time, and clean air (Goerig & Chatfield 2004).

Lake Tahoe's average surface elevation is 6,225 feet above sea level, making it the highest elevation lake of its size in the United States. Its exact elevation, controlled by a dam at Tahoe City, depends on the balance between how much water flows in from the mountains and how much water is evaporated from the surface or is let out into the Truckee River (USGS 2015).

Lake Tahoe's natural rim sits at an elevation of 6223 feet above sea level. The Lake Tahoe Dam in Tahoe City, originally built as a timber crib dam in 1870, was reconstructed as part of the Newlands Project between 1909 and 1913 by the Reclamation Service (precursor to Bureau of Reclamation) and the Truckee River General Electric Company (predecessor to Sierra Pacific Power). The dam adds 6.1 feet of capacity to the Lake, and that additional capacity is administered as a federal reservoir for irrigation storage and municipal water use in Nevada (USDI Bureau of Reclamation 2015; "Sea to Sierra," 2014).

Lake elevation normally fluctuates between 6223 feet (the lake's natural rim) and 6229.1 feet (the upper legal limit of dam storage) (McCutcheon 2015). Adams and Minor (2001) report that the highest recorded historical elevation of the lake was in 1907, when the now legally mandated maximum elevation of 6,229.1 feet was exceeded by 2.09 feet.

Sixty-three tributaries drain into the lake, but only one, the Truckee River, flows out. The level of the lake changes daily in response to input from the tributaries and from rain or snow falling directly onto the lake, evaporation, and water release at the Lake Tahoe Dam. Due to a single rainstorm in February 2015, the lake level rose almost 5 inches (Jacobs 2015).

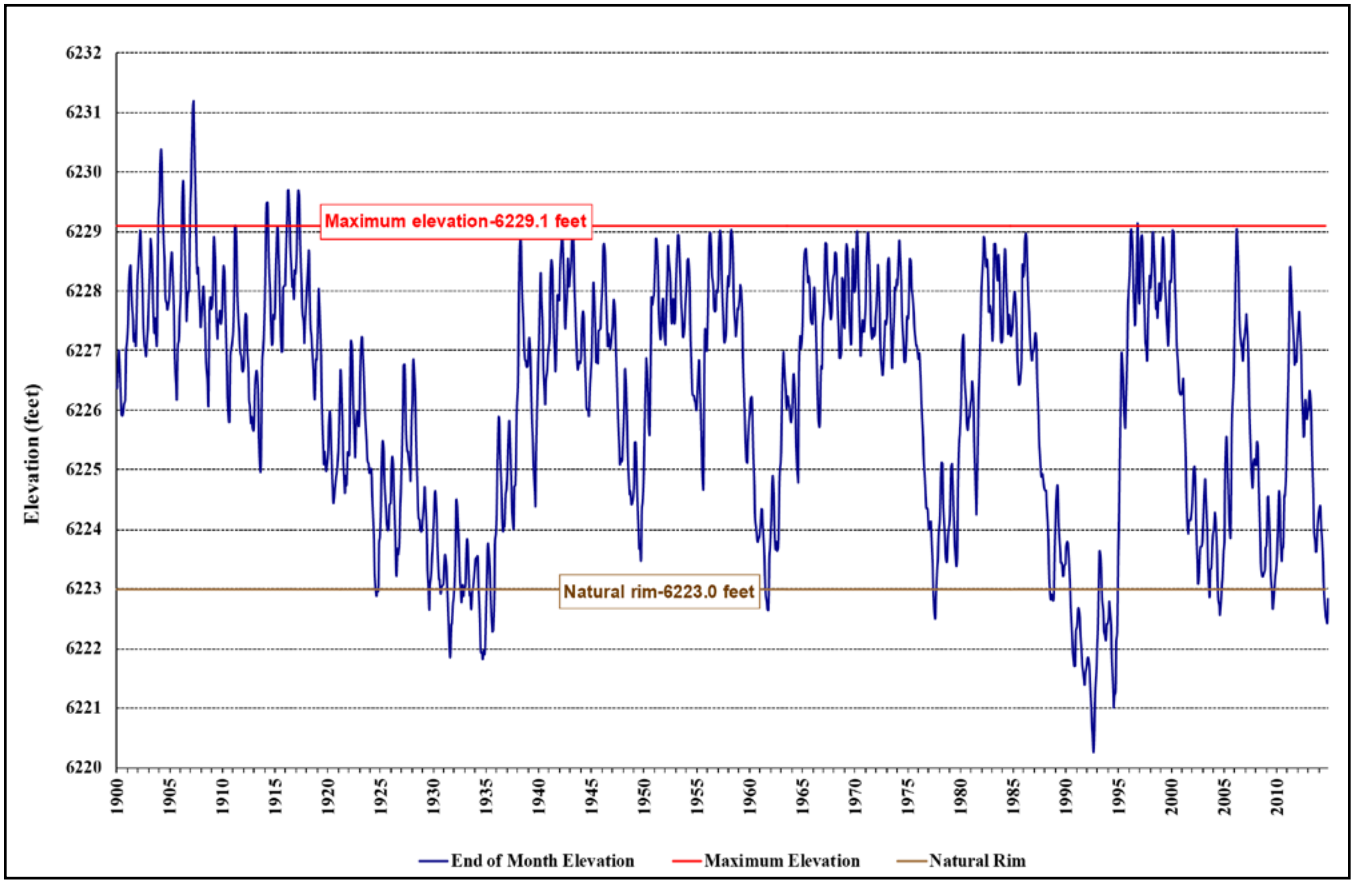
Although various texts - such as *Limnology: Lake and River Ecosystems* by Robert G. Wetzel (2001) that mentions the "Flechten linie" of Naumann (1931) - discuss this distinct community demarcation in

general terms, investigations and literature on lichen trimlines is scant.

Gilbert and Giavarini (2000) studied the lichens of lake margins in England, Scotland, and Wales, and recognized four overlapping bands: submerged, lower splash, upper splash, and terrestrial. They found the zonation patterns related to length of submergence and water chemistry. Familiar to lichenologists in California, Mason Hale, co-author of *Lichens of California* (1988), published an article on the topic of trimlines: "The Lichen Line and High Water Levels in a Freshwater Stream in Florida" in 1984 (*Bryologist* 87 (3): 261–265). A study conducted on water-origin saxicolous lichen trimlines on acidic metacrystalline bedrock outcrops in the Peace-Athabasca Delta, northern Alberta, Canada (Timoney & Marsh 2005), found a total of twenty-seven species of saxicolous lichens in the vicinity of the trimlines (Table 1). In that research, species richness above the trimline (26 species) was almost twice that found below the trimline (14 species).

While working for the US Forest Service, Lake Tahoe Basin Management Unit, my interest in the trimline was piqued when I was often asked about what constitutes the dark dividing line found on some of the boulders around the Lake (Figure 6-9). As that line has become more apparent with the current drought and the dropping of lake level, I have taken more of an interest in it. I recently collected a small sample of lichens near the trimline on boulders at Whale Beach. Better sampling of the trimline itself, and at more locations around the lake, could improve upon the knowledge of this fascinating topic.

I sent the collected samples to Kerry Knudsen, Lichen Curator, The Herbarium, Department of Botany & Plant Sciences, University of California Riverside (UCR). His determination was that they were non-



TRUCKEE MEADOWS WATER AUTHORITY

Figure 5. Lake Tahoe's historical monthly elevations, 1900 to present.

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Figure 6. Lichen trimline, Zephyr Cove, east shore.

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Figure 7. Looking toward the Zephyr Cove trimline, across a wide expanse of exposed beachsand.

aquatic lichens that also form a black-looking mosaic in southern California, although he wasn't currently aware of trimlines around lakes in southern California. The main lichen that had apothecia was *Dimelaena thrysanota*. It was mixed with *Miriquidica scotopholis* (sterile) and *Xanthoparmelia verruculifera*. There were some white sterile thalli - possibly *Rhizoplaca glaucophana* - mixed with small amounts of *Acarospora thamnina* and *Umbilcaria phaea*. According to Kerry, this is a common arid California black crust community.

Table. 1 Comparison of lichen species found above the trimline around a lake in Alberta, Canada (Timoney and Marsh, 2005, p. 78), and specimens collected at Whale Beach, Lake Tahoe, CA. Note: With more collecting, it is presumed that additional species will be found to occur above and below the Lake Tahoe trimline.

Alberta, Canada	**Lake Tahoe**
Aspicilia caesiocinerea	*Acarospora thamnina*
Cladina stellaris	*Dimelaena thrysanota*
Dermatocarpon reticulatum	*Miriquidica scotopholis*
Dimelaena oreina	*Rhizoplaca glaucophana*
Lasallia pensylvanica	*Umbilicaria phaea*
Leproloma vouauxii	*Xanthoparmelia verrucuifera*
Melanelia disjuncta	
Melanelia sorediata	
Melanelia stygia	
Parmelia saxatilis	
Parmelia sulcata	
Phaeophyscia sciastra	
Phaeophyscia hispidula	
Physcia caesia	
Physcia dubia	
Physcia phaea	
Physconia muscigena	
Placidium squamulosum	
Ramalina intermedia	
Rhizocarpon disporum	
Rhizoplaca chrysoleuca	
Staurothele fissa	
Umbilicaria deusta	
Umbilicaria muehlenbergii	
Xanthoparmelia somloënsis	
Xanthoria elegans	

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Figure 8. Caloplaca species colonizing exposed rock below the black trimline at Zephyr Cove.

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Figure 9. Closeup of possible double trimline at Zephyr Cove.

Acknowledgements

I would like to thank Kerry Knudsen for identifying the lichens collected at Whale Beach, and for accessioning them into UCR and New York Botanical Garden (NYBG) herbaria. I would also like to thank Gay Havens for introducing me to Whale Beach, and Liv Seemann for the use of her kayak and waterproof camera in my quest to get trimline photos near Logan Shoals.

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A fertile *Leprocaulon* from California

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Abstract
We describe and illustrate the apothecia and spores of *Leprocaulon adhaerens,* a species that is rarely fertile. The apothecia have a blackish brown to brown or reddish brown disk, sometimes lightly pruinose, with a distinct, raised, lecideine margin. As they age they become strongly convex with the margin turned under. The thalline exciple is lacking or reduced to bits of thallus clinging to the outside of the proper exciple. The ascus wall is I+ blue, with a thickened I+ blue dome. Spores are 1-septate and 10–13 x 3.5–5 µm.

Introduction

The recently described *Leprocaulon adhaerens* (K. Knudsen, Elix & Lendemer) Lendemer & Hodkinson (Knudsen et al. 2007) was found richly fertile in San Benito County, California. The purpose of this note is to supplement the meager information on apothecia in *Leprocaulon* (in the sense of Lendemer & Hodkinson 2013) by describing and illustrating the apothecia and spores for this record. Although Lendemer and Hodkinson (2013) mentioned that fertile individuals of *L. adhaerens* and *L. santamonicae* (K. Knudsen & Elix) Lendemer & Hodkinson have been found, we found no prior description of the apothecia and spores in the literature.

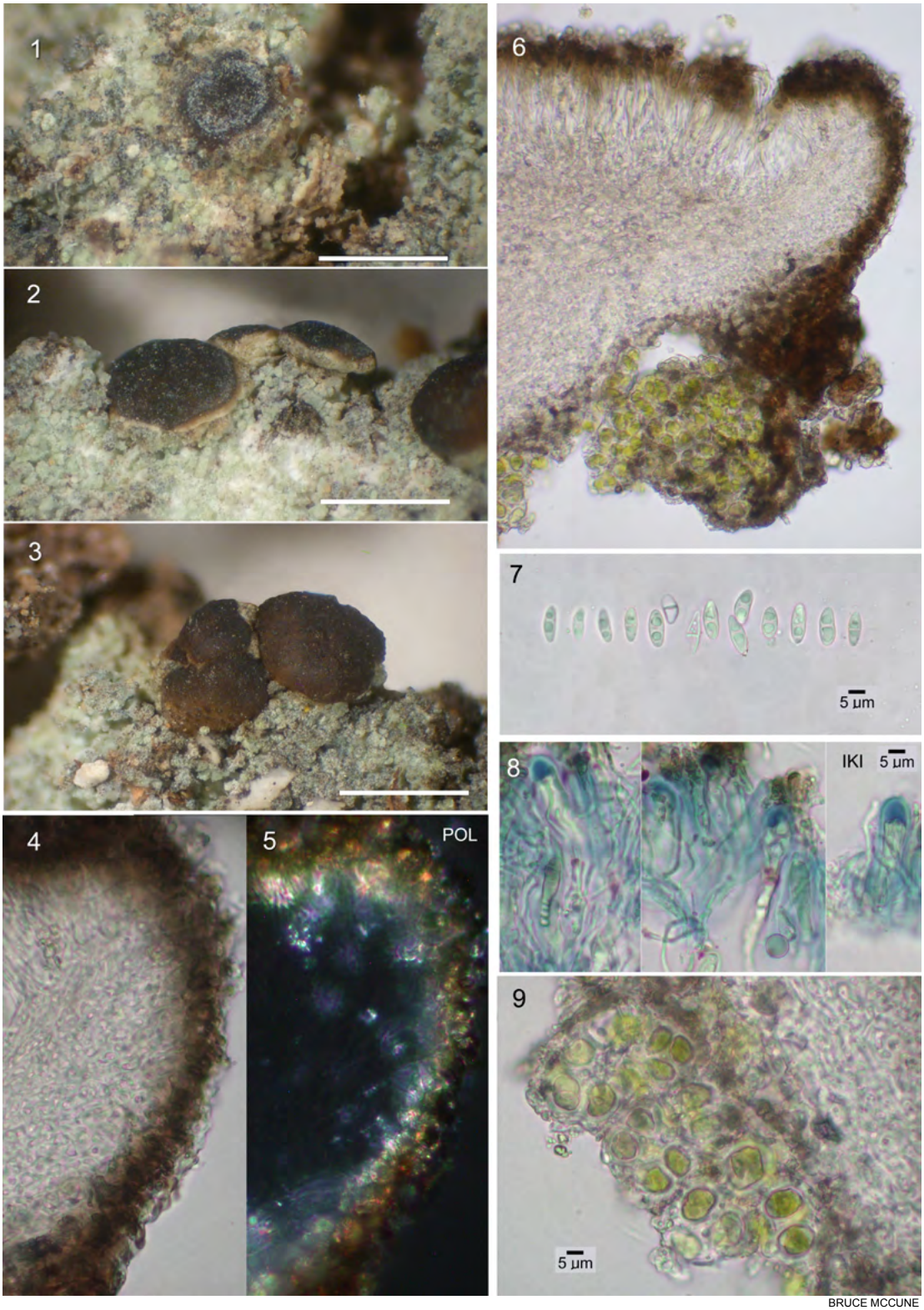
Leprocaulon adhaerens was originally described as a *Lepraria*, and indeed it is leprose, as in the traditional concept of *Lepraria.* This species, along with *L. santamonicae*, are unusual among leprose species in western North America in being bluish tinged and the presence of pannarin or argopsin. In fact, their appearance suggests *Fuscopannaria cyanolepra* or *F. leprosa*, but both of those are P– and contain cyanobacteria, while *L. adhaerens* and *L. santamonicae* are P+ orange-red and contain green algae.

Leprocaulon santamonicae and *L. adhaerens* are very similar in appearance to each other but can be distinguished by some observers in the field by subtle differences in morphology and color (Knudsen et al. 2007). We have found these distinctions to be difficult to apply, so the safest approach is thin-layer chromatography (TLC): *L. santamonicae* contains argopsin while *L. adhaerens* contains pannarin and zeorin as major substances. Both species occur on the West Coast with *L. adhaerens* ranging farther north to southern Oregon and *L. santamonicae* not found north of California. The exact ranges of these recently recognized species are still not well documented.

Description of Apothecia of *Leprocaulon adhaerens* (Figures 1-9)

The abbreviation POL refers to birefringence in polarized light; iodine (I) reactions refer to IKI, that is, elemental iodine dissolved in 0.5% potassium iodide. Although the specimen on which we based this description is small, it has numerous apothecia with a wide range of sizes and ages. The specimen was confirmed to contain pannarin and zeorin by TLC using solvent systems A and C and methods of Culberson (1972). Pannarin and argopsin are close to each other in Rf value, and are closely related substances. Pannarin runs near atranorin in A and C, but on our plates argopsin comes out slightly higher (ca. 2 mm) than pannarin in A, moreso in C.

Apothecia with a disk that is blackish brown to brown or reddish brown, sometimes lightly pruinose (Figures 1 and 2), roundish, to 1.2 mm diam, initially flat and dark brown black with a distinct, raised, lecideine margin, becoming strongly convex and the margin turned under (Figure 3); thalline exciple lacking or reduced to bits of thallus clinging to the outside of the proper exciple (Figure 6); proper exciple dark brown black at the upper edge, pale below, in section



Figures 1-9. *Leprocaulon adhaerens*, Rosentreter 7257. 1. – Juvenile apothecium. 2. – Mature apothecium. 3. – Old apothecium showing strongly convex disk and turned under margin. 4. – Proper exciple in water. 5. – Proper exciple in polarized light (POL). 6. – Apothecial section in water. 7. – Ascospores in water. 8. – Asci in IKI. 9. – Photobiont cells at base of exciple in water. Scale bar 1 mm unless otherwise indicated.

(light microscope) with a dark brown edge, brownish granular and POL+ on the surface (Figures 4 and 5), hyaline within, with narrow radiating hyphae, I–; epihymenium with diffuse brown pigment and pale yellow-brown granules, POL+; hymenium hyaline, 57–62 µm tall, I+ blue; hypothecium hyaline, thick, inspersed with oil drops, I+ blue; paraphyses free in water, about 1 µm in diameter, simple or branched near the tips; ascus wall I+ blue, with a thickened I+ blue dome (Figure 8); ascospores hyaline, ellipsoid, the ends sometimes pointed, 1-septate, 10.3–12.9 × 3.4–5.0 µm (median 11.4 × 4.4 µm; Figure 7), 8/ascus. Pycnidia not seen.

Lendemer and Hodkinson (2013) stated that in the Leprocaulaceae, "Fertile taxa have *Halecania*-type asci, lecanorine apothecia and hyaline ascospores that resemble those of *Lecania*." The apothecial structure that we observed for *L. adhaerens* agrees with this, including the *Halecania*-type ascus (Figure 8), except that the apothecia are not clearly lecanorine. That is, the proper exciple is distinct but the thalline exciple is lacking or reduced to bits of thallus attached to its exterior (Figures 3 and 8). Perhaps it is to be expected, however, that a leprose growth form might not allow the construction of a coherent thalline exciple.

Lendemer and Hodkinson (2013) placed *Leprocaulon* and *Halecania* in the family Leprocaulaceae, which is sister to a clade containing the Physciaceae and Caliciaceae. None of those families, however, include *Lecania* in the strict sense. Despite the similarity to *Lecania* in spores, therefore, all of the available evidence supports the placement of *L. adhaerens* in the Leprocaulaceae.

Locality Data

USA: California: San Benito County, San Benito Range, Pinnacles National Monument, *Quercus* woodland and chaparral, outcrops near Chalone Creek, on soil over HCl- rock, 36° 30'N 121° 10'W, 315 m, 29 June 1991, *Rosentreter 7257* (SRP), with B. McCune and C. Bratt.

Acknowledgements

We thank Elisa Alphandary for thin-layer chromatography and James Lendemer for his helpful review.

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Tardigrades inhabit lichen and moss in Smith Rock State Park, Oregon

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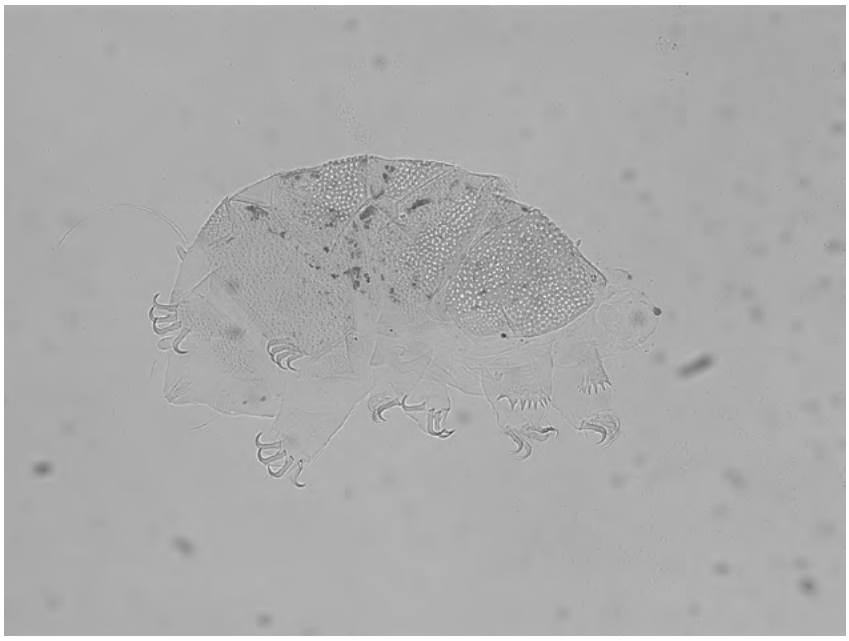

ALEXANDER YOUNG

Heterotardigrade *Echiniscus*

Abstract

One moss and twelve lichen samples collected from exposed rock cliffs at Smith Rock State Park in central Oregon contained 117 tardigrade specimens representing three orders, five families, and five genera, providing the first documentation of the phylum Tardigrada at this location. While tardigrades are widely known for their capacity to survive in extreme environments, little is known about species level habitat preferences. Previous research suggests that microclimatic differences in humidity may influence habitat suitability and determine species distribution. We examined tardigrade community composition in saxicolous moss and lichen at Smith Rock State Park in two small areas separated vertically by 122 meters. We examined if sample diversity was related to the species of moss or lichen (habitat), elevation, or weight of a sample. Tardigrades were preserved on microscope slides, and identified to Genus or species level. Wide variation was observed between seemingly identical habitats, with no apparent effect of elevation, habitat, or sample weight. The tardigrade species *Echiniscus trisetosus* had the highest abundance, and the lichen species *Umbilicaria phaea* and *Rhizoplaca melanophthalma* supported a majority of tardigrade individuals.

Introduction

Rock outcrops support the establishment and growth of saxicolous lichen and moss communities and provide physical refuge for a whole world of meiofaunal organisms including nematodes, rotifers, colembola, and tardigrades. The phylum Tardigrada, or water bears, is composed of small invertebrate animals ranging from 0.2 to 0.9 mm in length. They are complex organisms that have five body segments, four pairs of legs ending in claws, complex mouth and pharynx systems, and no respiratory or circulatory systems (Kinchin 1997). These animals have been found worldwide in aquatic, marine, and terrestrial habitats. They are notable for their ability to tolerate extreme environments (Miller 1997,

Glime 2013). Terrestrial tardigrades (limno-terrestrial tardigrades) are commonly found in patches of lichen and moss and require a threshold of humidity as they are only active when surrounded by a film of water. Tardigrades are known for their ability to withstand a drying environment. When osmotically stressed, a tardigrade will decrease its surface area, and lose up to 98% of its water content, entering an anhydrobiotic state known as a "tun" (Wright 1989). Water bears in a tun state can tolerate an extreme range of environmental conditions for prolonged periods of time (Kinchin 1994). Different species of tardigrade show variation in the ability to enter the tun state, often limited by the rate of desiccation experienced in the environment (Wright 1991), thus species' response to seasonal humidity patterns create complex community dynamics (Schuster 2007).

Some tardigrade species are known to have broad geographic ranges (Glime 2013), however, little attention has been given to the study of small scale species distribution. Meyer (2006) reports high spatial variability in tardigrade community composition among seemingly identical habitats. Miller and Heatwole (1994) show significant evidence for non-random clustering of species within a patch of moss, with more than half of the specimens occurring within the top 1.76 cm. Wright (1991) documents different tardigrade species specifically found in regularly desiccated, high stress habitats (xerophillic) as compared to species with limited tolerance to desiccation requiring consistently higher humidity (hygrophyllic) (Wright 1989).

Over the last 75 years, 25 species of tardigrades have been reported by four papers from the state of Oregon (Meyer 2013). This project aimed at beginning to document the tardigrade diversity in Smith Rock State Park, Oregon by collecting saxicolous lichen and moss species from two elevations on the same rock cliff. The project tested a hypothesis of uniformity, i.e. there should be no differences in tardigrade populations between habitats (moss & lichen species), elevation, or sample weight. This is the first report of the phylum Tardigrada from the walls of Smith Rock State Park.

Methods

Field Collection

The exposed cliffs of Smith Rock State Park are located on the leeward side of the Cascade Range in a desert setting in central Oregon. The region receives an average of 21.6 cm of rain per year, with temperatures exceeding 37º C in summer and below -18º C in the winter (Watts 1992). The rock is primarily composed of tuff, a volcanic rock with silica rich magma intrusions. The sheer cliffs rise above 120 meters allowing for variation in humidity along a vertical gradient.

Patches of moss and lichen were collected from the base of the northwestern face of the Smith Rock Group formation and from 122 meters above, at the summit of the technical climbing route "Wherever I May Roam" (Watts 1992). A dull metal spatula was used to collect 5 by 5 cm patches of morphologically distinct lichen or moss. No rock was damaged. The resulting debris was collected in paper bags and dried at room temperature.

Oregon Parks Recreational Department Permit

Although no species of tardigrade is listed under either the State or Federal Endangered Species Acts, the cryptogamic communities they inhabit are sometimes considered rare or sensitive. It is therefore necessary that all rules, regulations, and guidelines regarding destructive sampling be followed. This project was conducted under Oregon Parks Recreational Department Permit No: 035-14

Processing Habitat for Tardigrades

Small habitat samples of unique lichen and moss morphologies were examined for traces of tardigrade communities including tardigrade eggs, cuticle bound eggs (exuvia), the remnants of adult and juvenile tardigrades (cuticles), and living tardigrades (Miller 1997). Prior to hydration, a dried sub sample of habitat (moss or lichen) was weighed using a Sartorius BP210 S scale. The sample was hydrated with 25 mL of commercial spring water for 24 hours. A broad mouthed pipette was used to vacuum the sediment from the bottom of the hydrating vessel and placed into a 2.5 x 5.0 x 0.5 cm trough. The

area of the trough was visually searched at 20x with a dissecting microscope. Specimens were selected and moved with the aid of an Irwin loop (Schram 2012). Specimens were deposited into a drop of PVA (polyvinyl alcohol) media (Salmon 1951) on a glass slide and covered with a glass cover slip.

Tardigrade Identification

Images were captured with a Zeiss AxioImager D2 compound microscope using DIC (Differential Interference Contrast) microscopy. Tardigrade identification was determined with the keys in Ramazzotti and Maucci (1983), Pilato and Binda (2010), and Michalczyk and Kaczmarek (2012). Nomenclature follows Guidetti and Bertolani (2005), Degma and Guidetti (2007), and Degma *et al.* (2009-2015).

Lichen Identification

Lichens were imaged in the field with an Olympus Tough tg-3 camera (Figure 1), and identified with *Lichens of North America* (Brodo *et al.* 2001). Dr. Bruce McCune, University of Oregon, kindly confirmed the identifications.

Statistical Tests

Analysis of Variance (ANOVA) in R (ver. 3.1.3) was used to analyze for the uniformity of tardigrade diversity for sample location, habitat, and weight (R Development Core Team 2008). The diversity of a sample was quantified using the Shannon index (Cain 2011). A *p*-value less than 0.05 would represent a significant difference between two variables.

Results

Twelve patches of lichen and one patch of acrocarpous rock moss were collected. Samples contained five species of lichen (Table 1, Figure 1). One hundred seven tardigrades were recovered from seven of the lichen samples and 10 specimens were found in the moss sample (Table 1). Tardigrade abundance varied dramatically between samples: five samples did not contain tardigrades, whereas one sample contained 61 specimens (Table 1). All tardigrades were identified to genus and three were identified to species including *Echiniscus trisetosus* Cuenot, 1932, *Isohypsibius marcellinoi* Binda & Pilato, 1971, and *Ramazzottius oberhauseri* Doyere, 1840 (Figure 2). *Isohypsibius marcellinoi* is a new record for the state of Oregon having been recorded only from California, Tennessee and Greenland (Meyer 2013) and *Echiniscus trisetosus* was the most abundant species of tardigrade (Figure 2).

The mass of the samples ranged from 0.15 to 1.86 grams. A slight increase in tardigrade abundance was observed for samples above 1.5 grams (Figure 3) while the most abundant sample contained 61

Table 1. A summary of sample information including the abundance of each genus.

Lichen species	Weight (g)	Location	Total	*Echiniscus*	*Isohypsibius*	*Macrobiotus*	*Milnesium*	*Ramazzottius*
Candelleria	0.83	Top	0	0	0	0	0	0
Candelleria	0.15	Top	5	5	0	0	0	0
Moss	1.86	Top	10	0	7	0	3	0
Physcia dimidiata	1.07	Bottom	1	0	1	0	0	0
Physcia dimidiata	1.74	Top	0	0	0	0	0	0
Pleopsidium flavum	1.44	Top	2	0	0	2	0	0
Rhizoplaca melanophthalma	1.54	Bottom	4	0	1	0	1	2
Rhizoplaca melanophthalma	0.86	Top	61	47	0	0	12	2
Umbilicaria phaea	1.54	Bottom	0	0	0	0	0	0
Umbilicaria phaea	1.00	Top	0	0	0	0	0	0
Umbilicaria phaea	1.58	Top	0	0	0	0	0	0
Umbilicaria phaea	1.6	Top	1	0	0	0	0	1
Umbilicaria phaea	1.67	Top	33	32	0	0	1	0

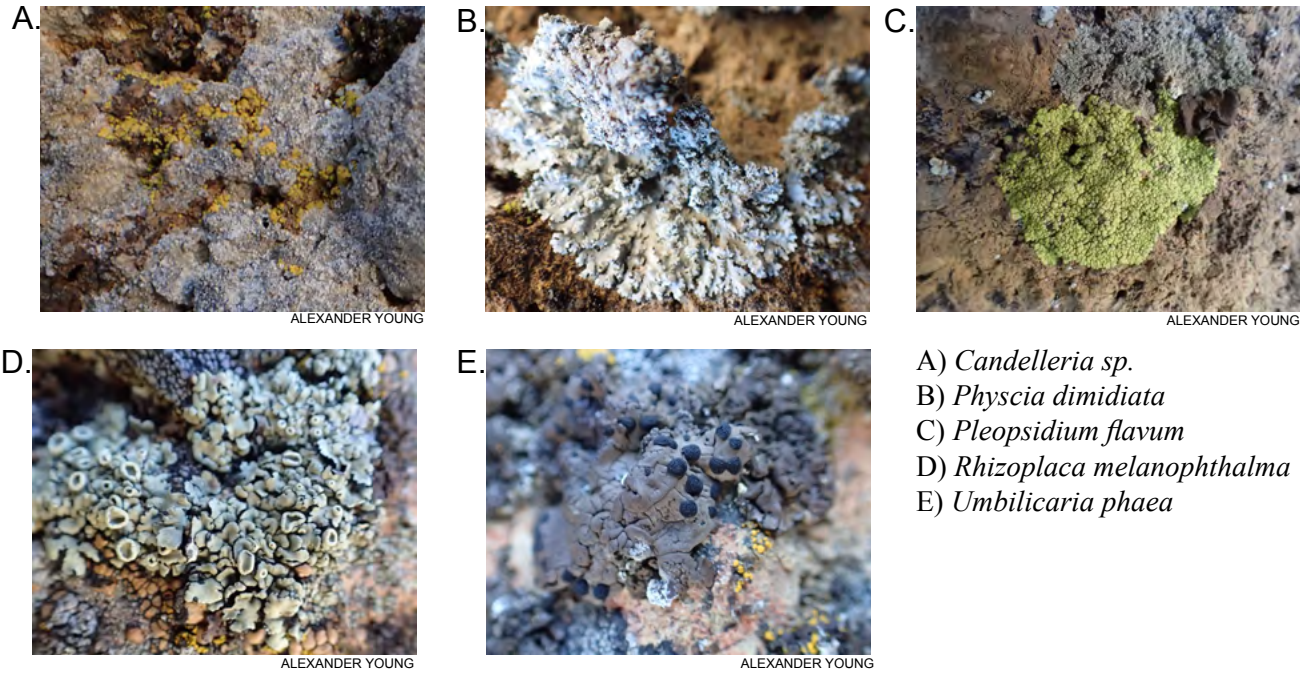

Figure 1. Images of lichen collected at Smith Rock State Park, Oregon.

tardigrades and only weighed 0.86 grams.

The diversity of each sample was calculated as the Shannon index. No evidence was found that diversity was related to cryptogam species (moss or lichen), location of collection (top or bottom), or the mass of the sample.

Discussion

This report has added the phylum Tardigrada with five genera and three species to the Smith Rock State park diversity records, and the species *Isohypsibius marcellinoi* is new to the biodiversity of Oregon. This is not a complete view of composition of the tardigrade community in Smith Rock State Park or Oregon but is a snapshot in time of a small collection area. This report does not account for spatial or seasonal variation. It provides evidence of the presence of tardigrades in the park, an observation of some of the resident tardigrade species, and demonstrates the variation between patches of moss and lichen species.

Our data shows great differences in tardigrade population density and diversity (Table 1) thus the hypothesis of uniformity is rejected. Yet, the analysis of variance did not identify that differences in habitats (moss & lichen), location, or sample weight were sufficient to explain the differences. To explain the wide variation in tardigrade communities across the small collection site it is necessary to propose that random not uniform dispersal events into habitats with variable suitability result in the establishment of micro-populations (Glime 2013) that resemble islands.

Additionally, Miller and Heatwole (1994) showed that moisture may be the most important factor influencing community dynamics. If the distribution

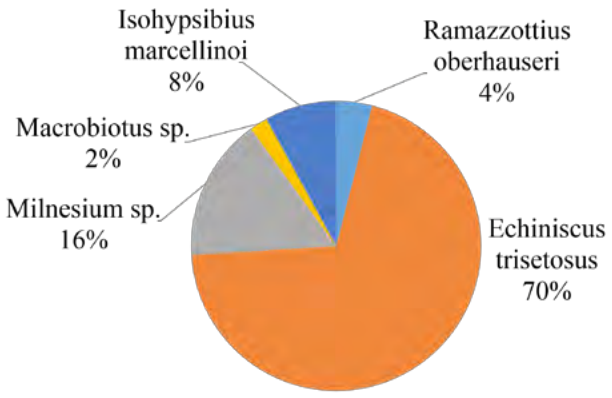

Figure 2. Proportional representation of Smith Rock State Park tardigrade genera.

of moss and lichen is also influenced by moisture, it is plausible that the variation in tardigrade communities is also a reflection of the suitability of the substrate that is the lichen or moss habitat. The ability of terrestrial tardigrades to exist in an anhydrobiotic state for a prolonged time does not supersede the need for a suitable environment.

Our experience suggests that future investigations into tardigrade communities must include a more rigorous investigative design and sampling technique to insure definitive analysis that will identify the contribution of each variable. Additionally, we recommend that field collections be greater than 1.5 grams. We conclude that the small size of the collection was not sufficient to identify the characteristics responsible for the disparity of tardigrade diversity and density.

Acknowledgements

We thank the Oregon Parks Recreational Department for permission to collect and transport lichen and moss samples from Smith Rock State Park. Lewis & Clark College provided research space in addition to other resources for this project. Dr. William Miller, Baker University and Dr. Bruce McCune, University of Oregon provided their expertise in tardigrades and lichens, respectively. Jake Oram assisted with the technical climbing efforts.

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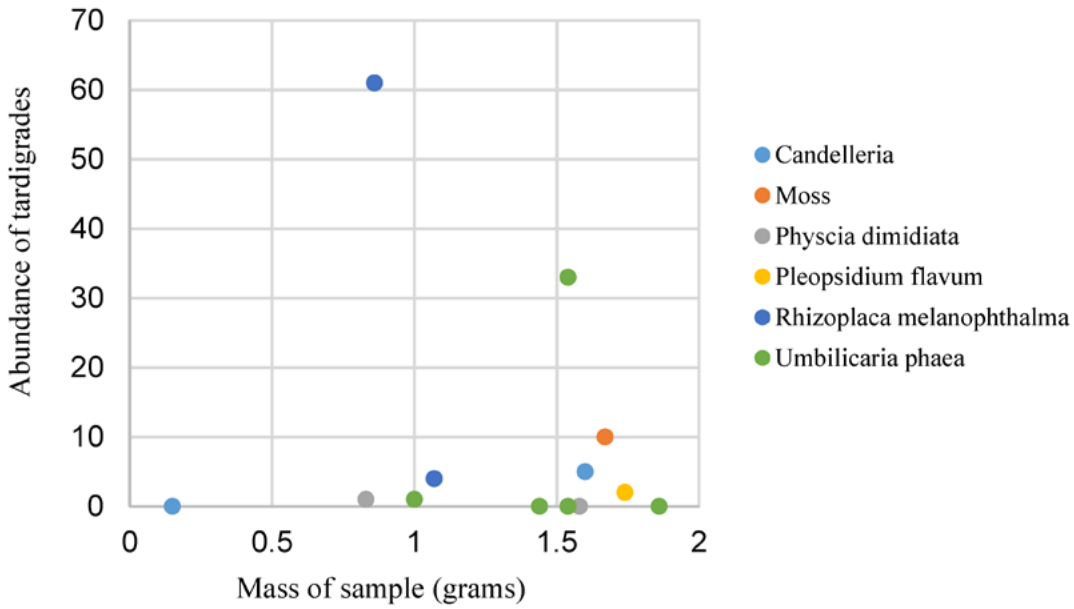

Figure 3. Sample mass versus the abundance of tardigrades in each sample.

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News and Notes

Lichens and turtles, oh my!

CALS members Shelly Benson and JJ Johnson staffed the lichen information booth at a special event on September 12, 2015 at Mountain Lake in the Presidio of San Francisco—Super Science Saturday & Turtle Release. The Presidio Trust recently completed a major restoration of Mountain Lake. They are now reestablishing a population of Western pond turtles (California's only native freshwater aquatic turtle) into the cleaned-up ecosystem. The Presidio Trust involved the community all along the way of the restoration effort—from work days to weekend science talks (Science Saturdays) at the lake. The focus on Mountain Lake was not just the aquatic ecosystem but also the terrestrial ecosystem. In July of 2013, Jason Lisenby, Presidio Trust restoration manager, invited Shelly to talk about the lichens of Mountain Lake at a Science Saturday event.

The lichen information booth gave CALS the opportunity to tell many San Franciscans about the California state lichen. We made several new displays, one of theme highlighting our state lichen: lace lichen, *Ramalina menziesii*. An activity enjoyed by both young and old was making a lace lichen rubbing. This event made science fun and interesting for kids and adults!

By Shelly Benson

SHELLY BENSON

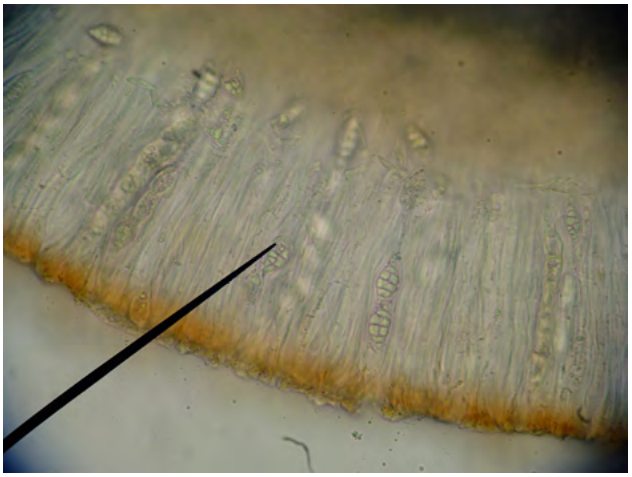
JJ Johnson staffing the CALS booth.

SHELLY BENSON

Two young San Franciscans learned about the California state lichen by making a lace lichen rubbing.

A micro-morphological view inside lichens

CALS and the San Francisco Microscopical Society held a joint workshop looking at the hidden world of symbiosis that exists inside of lichens. Miko Nadel and Bill Hill led this evening workshop at San Francisco State on September 11, 2015. Microscopes and some samples were provided. Participants practiced making thin sections and learned the intricacies of the light microscope for optimum viewing of specimens.



MIKO NADEL

Fungal spores in apothecium.

Need a copy of *Lichens of North America*?

CALS still has some copies of *Lichens of North America* by Brodo, Sharnoff, and Sharnoff. This lichen guide has easy to follow keys and amazing photographs. We'd like to see these books put to good use. All you need to do is send us a message and tell us how this book would help you. The CALS Board of Directors will review the submissions and select recipients for the books based on need. Preference will be given to education, interpretation, or research based projects or activities.

Send your submission to:
President@californialichens.org.

Nils Nelson's book request was granted this fall. Here's what he has to say: "So far the book has helped me tremendously studying for the NW Lichenologist exam, the photos and genus descriptions are especially helpful. This book is an essential ingredient of a comprehensive library one needs as a professional in this field. I look forward to every chance I get to open up this giant beautiful tome. Thanks CALS!"

UNKNOWN

Nils Nelson, recipient of *Lichens of North America*.

A field trip to Lava Beds

In late May, 2015, Steve Sheehy, Eric Peterson, Tom Carlberg, Kathy Faircloth and John Villella attended the Lava Beds National Monument CALS field trip. Many different habitats were visited including areas rich in rock crusts, soils crusts, and epiphytes. Participants also spent some time exploring the unique habitats of cave openings.

We are working to finish up the identification of specimens and we plan to bring Ted Esslinger, professor emeritus at North Dakota State University and expert in the family *Physciaceae*, out there during the workshop in Klamath Falls in April 2016. After that we will be finishing up the report, to be published in a future issue of the CALS bulletin.

Congratulations are due to Steve Sheehy who was awarded the volunteer of the year award from Lava Beds for his efforts to organize this event as well as his on-going effort to document the lichen biodiversity of this National Monument. Way to go Steve!

By John Villella

CALS grant recipients for 2015

CALS grant recipients this year are Miko Nadel and Lish Dawn. We are happy to congratulate them, as we think their work is helping contribute to the appreciation, conservation, and study of lichens.

If you are interested in learning more about the CALS grant program, check out our webpage! http://californialichens.org/resources/cals-educational-grants-program/

Miko Nadel

Project: A monograph of *Usnea* from São Tomé and Príncipe
Favorite lichen: *Usnea* Baileyi Group

Miko has been a member of CALS since 2010, and has been curious about lichen since his first job after college in 2002. Under the direction of Linda Geiser and Doug Glavich, he worked on an aquatic lichen study for the US Forest Service. Since then his life has guided him to graduate school at San Francisco State University, where he will be finishing his Masters this December under the guidance of Dr. Dennis Desiardin.

"Hopefully after I graduate I can continue to work in the evolutionary biology field. If I can work with lichens, great!"

Miko's current work focuses on better understanding of the *Usnea* genus. *Usnea*'s morphology is character-poor, so having secondary data is helpful to identifying it at the species level. The CALS grant helped him learn new techniques so that he may share genetic information about *Usnea* with others.

"The collection I am working on are from tropical Africa, a little far from California. I am hoping that my work will help give more understanding to the *Usnea* genus as a whole by adding molecular data to GenBank."

With the CALS grant Miko was able to learn side by side with other lichen professionals, such as with Bruce McCune and his lab at Oregon State University, and have access to their equipment needed for research.

"The grant supported me to learn and conduct thin layer chromatography (TLC), which is invaluable when working on lichen systematics. I had never had the opportunity before, until the CALS grant, when I was able to work with the McCune lab and perform TLC on all my specimens. For me personally, it was great to educate myself and connect with other lichen researchers. I now have chemistry knowledge and data to share which will hopefully help identify new species."

UNKNOWN

Miko Nadel, 2015 CALS grant recipient.

When asked about his decision to study lichenology, a field that not many students pursue, Miko's response was supportive of others who may be interested in entering the field of lichenology.

"Education is not always about the job you get when you finish. I hope people follow their hearts when looking at what to study and learn. Lichens are understudied and underfunded, but if they interest someone I hope they can dive in, especially if a CALS grant could help them get there!"

If you are interested in learning more about Miko's research, check out his poster from the *Botany 2015* conference in Edmonton, Alberta, Canada from this summer. http://www.researchgate.net/publication/280568727_A_review_of_the_lichen_genus_Usnea_from_So_Tom_and_Prncipe_using_morphology_molecular_data_and_chemotaxonomy

Lish Dawn

Project: An artistic approach to lichen awareness
Favorite lichen: *Ramalina menziesii* — lace lichen

Lish joined CALS two years ago after a walk co-led by artist Laurie Palmer and CALS president Shelly Benson. The walk focused on art and biology by highlighting the beauty of lichen in the Marin Headlands.

Lish says of her work, "Lichens are incredible organisms, tied into small and larger systems. Awareness of these systems and being present with our surroundings is very important to me, mankind, and my artistic work. My relationship with lichen tunes into those thoughts and values."

Lish is the first artist recipient of the CALS grant program. This is an exciting step for CALS as we are excited to reach new audiences and help lichen research in California evolve. There are a lot of ways that a lichen enthusiast could get involved with CALS, including applying for the CALS grant.

"It is neat to see there are so many ways to support lichen awareness, appreciation, and research, and not all are about looking through a microscope. I am appreciative that CALS values research in lichens

LISH DAWN

Sculpture, *Investigation below the surface:* Xanthoria parietina*/Sunburst Lichen,* by 2015 CALS grant recipient, Lish Dawn.

through the arts. If anyone out there has an idea for research in the arts or sciences related to lichen, do not hesitate to apply!"

The CALS grant has helped Lish focus on her current body of work in printmaking and sculptural arts. She has been exploring the delicate relationships lichens have as indicators within their habitats.

"Lichens are awe inspiring organisms, indicators of air quality and the health of their ecosystems. With the grant I am able to create work that talks about these concepts visually for a larger audience."

Sculpture and printmaking are expensive art forms, a large portion of her grant covers the cost for her to get the supplies needed to carryout her artistic work and plan the exhibit.

"I had a vision for what I wanted to do, and had already started working on that body of work. Making art is expensive, largely due to the cost of printmaking materials and supplies for making molds for sculptures and casting with resin."

Alongside her artistic efforts, Lish is focusing on the gallery experience for her show in the Bay Area this spring. She hopes to find the best way to share and display her art so that it helps bring lichen awareness to a larger audience.

"I am thinking about how to present the work, how to create a space with no shoes, no congestion, perhaps a board walk circle where people could walk on the soils of the grounds where the lichens were collected. Maybe there will also be artist books for people to sit with in that reflective space."

CALS members and lichen enthusiasts, keep an eye out for more information on Lish's spring show. Announcements will be shared on CALS Facebook page and yahoo email group. For more of Lish's work, check out her website — lishdawn.com.

"I will be showing the work in the Bay Area and expect a fair amount of people to come! I can anticipate, and am excited about the amazement around these organisms' existence."

By Hanna Mesraty

UNKNOWN

Lish Dawn, 2015 CALS grant recipient.

Upcoming Events

Calendar of Events

See event descriptions for details on calendar items.

January 9: *Lichen Discovery Walk at Almaden Quicksilver County Park*, San Jose

January 28: *Workshop: Introduction to Lichen Identification*, Santa Barbara

January 29: *Field trip to Scorpion Ranch on Santa Cruz Island*, Channel Islands

January 30: *CALS Annual meeting at Sedgwick Reserve - field trip, dinner, and speaker*, Santa Ynez

January 31: *Tour of the Santa Barbara Botanic Garden and Herbarium*, Santa Barbara

February 13: *Field trip: Lichen Love in San Francisco*, San Francisco

February 13: *Lichen Discovery Walk at Santa Teresa County Park*, San Jose

March 6: *Introductory Workshop: Year of the lichen*, Berkeley

March 12: *Lichen Discovery Walk at Uvas Canyon County Park*, Morgan Hill

March 12-13: *Biological Soil Crusts of Joshua Tree National Park*, Twentynine Palms

March 19: *Workshop: Introduction to Lichen Identification at Pepperwood Preserve*, Santa Rosa

April 1-3: *Foliose Physciaceae*, Klamath Falls, OR

June 7-9: *Biological Soil Crusts: Ecology and Management*, Lander, WY

2nd Saturday of every month (usually): *Tilden Regional Parks Botanic Garden Lichen Identification Workshop*, Berkeley

1st and 3rd Fridays of every month (usually): *College of Marin (COM) Lichen Identification Workshop*, Kentfield

Lichen Discovery Walks in Santa Clara County Parks

CALS member Cait Hutnik is a docent with the Santa Clara County Parks. She will be leading three different lichen walks this winter and early spring. For more information about the walks, call (408) 918-7770.

Leader: Cait Hutnik
Date: Saturday, January 9, 9:00 AM – Noon
Location: Almaden Quicksilver County Park, Santa Clara County
Fee: free
Description: This easy 1.5 mile out-and-back nature walk is the first in a series that will explore habitats where lichen communities thrive. During this docent guided interpretive walk, learn to identify some of the most common forest lichen and discover ways these fascinating organisms benefit both wildlife and the environment. Meet at the Wood Road Trail parking lot, Almaden Quicksilver County Park, junction of Mt Umunhum and Hicks Road, San Jose.

Leader: Cait Hutnik
Date: Saturday, February 13, 9:00 AM – 1:30 PM
Location: Santa Teresa County Park, Santa Clara County
Fee: free
Description: Enjoy a moderate 2.8 mile loop hike with a park docent to discover numerous brightly colored lichen verities that thrive in serpentine grasslands and learn ways these organisms benefit both wildlife and the environment. Meet at the Stile Ranch Trail parking lot on San Vicente Road, west of the Fortini Road junction.

Leader: Cait Hutnik
Date: Saturday, March 12, 9:00 AM – Noon
Location: Uvas Canyon County Park
Fee: $6 parking fee
Description: Take an easy 1.5 mile nature walk along trails from the lower to upper waterfalls with a park docent to discover the incredible beauty and diversity of lichen that thrive in the park's riparian forests. Learn ways these organisms benefit both wildlife and the environment. Meet at the day use parking lot, 4200 Uvas Rd, Morgan Hill, CA

CALS Annual Meeting: January 28-31, 2016

We have cause to celebrate at the upcoming annual meeting—lace lichen (*Ramalina menziesii*) becomes the official California state lichen on January 1, 2016! Come help us celebrate this victory and enjoy a weekend of events with other lichen enthusiasts. The meeting will be held on January 30th at Sedgwick Reserve in Santa Barbara County—this will include a field trip, pot-luck dinner, and evening speaker. We've planned some extra events before and after the annual meeting, so come out and lichenize with us!

Annual Meeting Event Schedule

THURSDAY, JANUARY 28TH: Introduction to Lichen Identification Workshop

Time: 9:00 AM to 3:00 PM
Location: Santa Barbara Botanic Garden (SBBG)
Fee: $30 CALS members and SBBG members, $45 non-members.
Registration: Register through SBBG (www.sbbg.org/classes-events/classes/lichen-identification-workshop)
Description: Shelly Benson, CALS president, will lead this introductory workshop. Get a refresher on those lichen terms and structures so you'll be up-to-speed for the lichen events planned for the rest of the weekend. For a full class description and to register, visit the SBBG website (www.sbbg.org).

FRIDAY, JANUARY 29TH: Field trip to Scorpion Ranch on Santa Cruz Island

Time: 8:15 AM to 4:30 PM
Location: Island Packers at Ventura Harbor
Fee: $59 adults, $54 seniors.
Registration: Reserve your boat transportation through Island Packers (www.islandpackers.com), and please also RSVP to secretary@californialichens.org so we have a general idea of group size.
Description: Spend the day exploring the lichens of Santa Cruz Island. The Scorpion Ranch area is reported to have nice displays of *Niebla* species. Local lichenologist Kerry Knudsen has made a species list of the area that we'll post on the CALS website. Bring all the essentials for a full day at the coast, and don't forget your hand lens! NOTE: In the event that weather cancels the boat crossing, we'll have an alternate field trip on the mainland out of the Ventura area.

SATURDAY, JANUARY 30TH: The Big Day at Sedgwick Reserve—field trip, dinner, and speaker

Sedgwick Reserve, located in the Santa Ynez Valley, is part of the UC Natural Reserve System. Public access to the reserve is limited, so CALS members will have a unique opportunity to explore this beautiful property. The reserve hosts a rich lichen flora that thrives in a diversity of habitats including coastal sage scrub, chaparral, oak woodlands, gray pine forest, and riparian areas. Be sure to check out the field guide *Lichens of Sedgwick Reserve and Santa Barbara County* by Shirley Tucker. Also, a lichen checklist for the reserve is available in the Bulletin of the California Lichen Society: 2012, volume 19(2): 94-97.

Saturday's events at Sedgwick Reserve are free; however, RSVP is required. **Please RSVP to secretary@californialichens.org by January 23th if you plan to attend.** (You only get the secret password to get in the gate once you RSVP.) Primitive accommodations (tent cabins) are available the night of the 30th ($5). Tent cabin space is limited, so indicate when you RSVP if you'd like to rough it at the reserve after the big day.

Field Trip
Time: 10:00 AM to 4:00 PM
Location: Seps of the Tipton Meeting House
Description: We'll have introductions from 10-10:30, then head out to explore the lichens of Sedgwick. Bring a lunch, hand lens, and your lichen book. We have permission to collect specimens and we'll have some resources for working on lichen identification back at the Tipton Meeting House.

Socializing and Pot-Luck Dinner
Time: 4:00 PM to 7:00 PM
Location: Tipton Meeting House
Description: We'll gather at the Tipton Meeting House after the field trip to socialize and look at the lichens we collected. There will be a pot-luck dinner from 6:00-7:00.

Evening Speaker
Time: 7:00 PM to 8:00 PM
Location: Tipton Meeting House
Description: Guest speaker and topic TBA

SUNDAY, JANUARY 31ST: Tour of the Santa Barbara Botanic Garden and Herbarium

Time: 10:00 AM to 1:00 PM
Location: Santa Barbara Botanic Garden
Fee: $10 adults, $8 seniors, $6-8 kids
Registration: Entry into SBBG can be purchased at the door. Please RSVP to secretary@californialichens.org.
Description: Join us for a walk through the garden to admire the vascular plants while secretly keeping an eye out for the lichenized fungal flora that resides among them. Local lichenologist Shirley Tucker will give us a tour of the garden's herbarium.

BRIAN HAWKINS

The Channel Islands viewed from Inspiration Point, Anacapa Island.

Field trip: Lichen Love in San Francisco!

Leader: Shelly Benson
Date: February 13, Saturday, 10:00 AM to 1:00 PM
Location: Pershing Square, Presidio of San Francisco
Fee: free
Description: This is a joint field trip with the Yerba Buena Chapter of the California Native Plant Society. This Valentine's weekend we're going to the big city. Grab your sweetheart and come for a romantic stroll in the Presidio of San Francisco and contemplate the symbiotic relationship that is a lichen. Lichens grow everywhere, even in the big city. We'll observe some interesting patterns in lichen, including where lichens grow or don't grow.

Meet in Pershing Square, on Arguello Blvd at the south end of the Main Post. The PresidiGo shuttle lines stop at the Transit Center (215 Lincoln Blvd) at the Main Post, and the Muni 43 bus stops nearby on Presidio Blvd. If there's significant rain, we'll try again on February 20. Contact: Gail Wechsler, wechslerifolia@gmail.com.

Workshop: Introduction to Lichen Identification

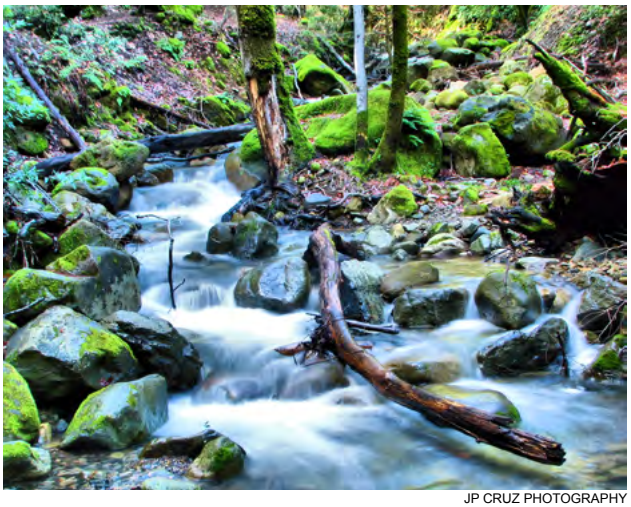
Instructor: Shelly Benson
Date: January 28, 9:00 AM to 3:00 PM
Location: Santa Barbara Botanic Garden (SBBG)
Fee: $30 CALS members and SBBG members, $45 non-members
Registration: Register through SBBG (www.sbbg.org/classes-events/classes/lichen-identification-workshop)
Description: Interested in lichens? Do you want to know what they are, where they grow, how they reproduce, and how to identify them? This is the workshop for you! Shelly Benson, Sonoma Co lichenologist, will lead this exploration into the lichen world. In this introductory class you will learn the basics of lichen biology and ecology. We will focus on recognizing the various lichen structures that are used in identification. We will use dichotomous keys, chemical spot tests, and dissecting microscopes to identify lichens to the genus-level. The workshop structure includes a classroom lecture, a short field trip, and lab time to identify lichens. Bring a hand lens, bring a lunch, and if you have any unidentified lichens—bring them too!

Workshop: Year of the lichen

Instructor: Shelly Benson
Date: Sunday, March 6, 10:00 AM to 3:00 PM
Location: Tilden Regional Parks Botanic Garden visitor center, Berkeley CA
Fee: $55 members/ $60 non members
Registration: Register through the Friends of Regional Parks Botanic Garden (http://www.nativeplants.org/events-and-classes/classes-field-trips-workshops/)
Description: 2016 is the year of the lichen, at least in California. On January 1st, the Golden State will officially declare lace lichen as the California state lichen. In celebration of our newest state symbol, come learn about lichens with local lichenologist Shelly Benson. This introductory class will cover the basics: what lichens are, how they reproduce, why they are important, and point out the structures that are used for identification purposes. The workshop includes a classroom lecture, hands-on demonstrations exhibiting lichen structures, and a walk through the garden to observe lichens in their natural habitats.

Workshop: Biological Soil Crusts of Joshua Tree National Park

Instructors: Nicole Pietrasiak (New Mexico State University) and Kerry Knudsen (UC Riverside) **Date:** March 12-13
Location: Desert Institute at Joshua Tree National Park
Fee: $135 JTNPA/PINE member, $145 non member; credit fee $160 JTNPA/PINE member, $170 non member
Registration: Register through the Desert Institute at http://www.joshuatree.org/desert-institute/field-classes/biological-soil-crusts-2/
Description: The desert floor may look like dirt and sand but it is full of living small and microscopic organisms vital to the park's ecosystem. Many of these organisms live in biological highly active soil crusts that cover the first inch of the desert soil surface. This field class will introduce crypto-biotic soil crusts with an emphasis on soil algae and lichens. Participants will study the secret life of these microscopic organisms as they demystify this thin layer of soil. Nicole and Kerry will discuss the components of crusts such as cyanobacteria (one of the oldest known life forms on earth), green algae, diatoms, bacteria, fungi, and lichens. The instructors will also discuss why these organisms are important to biodiversity and ecological function in arid lands. During the lab session, participants will see the biodiversity of the park's crusts up close through two different types of microscopes. On the second day, the class will go into the field to identify and assess the condition of several types of algal and lichen soil crust communities found in JTNP. For a look at the lichens of Joshua Tree National Park download the illustrated checklist at http://www.nps.gov/jotr/learn/nature/upload/lichen_report.pdf



JP CRUZ PHOTOGRAPHY

Uvas Canyon County Park, Morgan Hill, CA. See event listing for details about a lichen discovery walk to this park.

Workshop: Introduction to Lichen Identification

Instructor: Shelly Benson
Date: March 19, 9:00 AM to 3:00 PM
Location: Pepperwood Preserve, Santa Rosa CA
Fee: $30
Registration: Register through Pepperwood Preserve (app.pepperwoodpreserve.org)
Description: Interested in lichens? Do you want to know what they are, where they grow, how they reproduce, and how to identify them? This is the workshop for you! Shelly Benson, Sonoma Co lichenologist, will lead this exploration into the lichen world. In this introductory class you will learn the basics of lichen biology and ecology. We will focus on recognizing the various lichen structures that are used in identification. We will use dichotomous keys, chemical spot tests, and dissecting microscopes to identify lichens to the genus-level. The workshop structure includes a classroom lecture, a short field trip, and lab time to identify lichens. Bring a hand lens, bring a lunch, and if you have any unidentified lichens—bring them too!

Workshop: Foliose Physciaceae

Instructor: Theodore Esslinger
Date: April 1-3
Location: Oregon Institute of Technology, Klamath Falls, Oregon
Fee: $200
Registration: Space is limited; if you are interested in attending please contact John Villella, johnvillella@yahoo.com.
Description: We are delighted to welcome Dr. Theodore Esslinger from North Dakota to provide us with insight into a diverse and important group of lichens, Physciaceae. The workshop will focus on identification of temperate and northern species in the most frequently encountered foliose genera of the Physciaceae, especially Phaeophyscia, Physcia, Physciella, and Physconia, as well as rarer genera such as Anaptychia and Heterodermia. The first day participants will make observations of Physciaceae in nearby Lava Beds National Monument and then spend the next two days working with materials in the lab, with most lecturing being informal and occurring while working on the collections. Among other activities, we will practice the appropriate use of reagent spot tests on the thallus and methods for making hand sections to study the various tissue types of the physcioid thallus. In addition to material we are able to collect on our field trips students are strongly encouraged to bring specimens with them, especially any problem materials they would like help with.

Workshop: Biological Soil Crusts - ecology and management

Instructor: Roger Rosentreter
Date: June 7-9
Location: The Peaks Conference Center at the Inn at Lander, Lander, Wyoming
Fee: Free to BLM employees, $500 tuition for non-BLM participants
Registration: Contact Lori Young, lyoung@blm.gov
Description: This course describes the types of soil crusts and their importance in maintaining rangeland and soil health. Participants will learn about the importance of soil crusts, how to identify soil crusts, and the effects of management actions on soil crusts. The objective of the course is to educate land management personnel and public land users about biological soil crusts and why biological soil crusts are an integral part of the ecosystem. As a result of attending this class and field exercises, the trainee will be able to:

(1) Identify the major components of biological soil crusts
(2) Distinguish biological soil crusts from physical or chemical soil crusts
(3) Determine what soil types and plant communities have high potential for biological soil crusts
(4) Identify the ecological and hydrological roles filled by biological soil crusts
(5) Assess impacts of different types and intensities of activities on biological soil crusts;
(6) Develop management alternatives and guidelines that maintain ecological functions of biological soil crusts; and
(7) Integrate biological soil crusts assessment into routine monitoring procedures.

The course consists of both classroom and field sessions. Approximately two half days will be spent conducting field exercises. The remaining time will consist of classroom sessions.

Recurring Workshops

College of Marin (COM)
Lichen Identification Workshop
835 College Avenue
Kentfield, CA
ScienceMathNursing Bldg., Room SMN 112
1st and 3rd Fridays, 6:00 PM - 9:00 PM
We bring our own lichens and work with each other to identify them. Occasionally, there are snacks to share. We encourage you to attend these enjoyable workshops where we learn about and practice using various identification keys and microscopes. Parking at the college is $3 but there is free parking just behind the (new) SMN building on Laurel Ave, off Sir Francis Drake Blvd. Please RSVP to Bill Hill who organizes the logistics: aropoika@gmail.com or 415-686-6146.

Tilden Regional Parks Botanic Garden
Lichen Identification Workshop
Junction of Wildcat Canyon Rd. and S. Park Dr.
Berkeley, CA
2nd Saturday of the month, 1:30 PM - 4:30 PM
We often check some lichens in the garden and then do some keying and discuss lichen topics of interest. If you would like to have a particular topic covered, please let us know. Please RSVP to Irene Winston if you are planning to attend: irene@californialichens.org or 510-548-6734

CALS Grant Program

The California Lichen Society offers small grants to support projects pertaining to the lichens of California. No geographical constraints are placed on grantees or their associated institutions. The CALS Grants Committee administers the program. A grant is awarded only once to a project during its duration.

Applicants should submit a proposal containing the following information:

- Title of the project, applicant's name, address, phone number, email address, and the date submitted.
- Estimated time frame for project.
- Description of the project: outline the purposes, 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.
- Description of the final product. We ask you to submit an article to the CALS Bulletin, based on dissertation, thesis, or other work.
- 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, and living expenses. CALS does not approve grants for outright purchase of high-end items such as computers, software, machinery, or for clothing.
- Academic status. State whether you are a graduate student or an undergraduate student. CALS grants are also available to non-students conducting research on California lichens. CALS grants are available to individuals only and will not be issued to institutions.
- Academic 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 enclosed with the application or mailed separately to the CALS Grants Committee Chair.
- Your signature, as the person performing the project and the one responsible for dispersing the funds.

The proposal should be brief and concise. The CALS 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.

Review: Members of the Grant Committee review proposals once a year. Proposals are evaluated for completeness, technical quality, consistency with CALS goals, intended use of funds, and likelihood of completion. Grant proposals received by October 1 each year will be considered for that year's grant cycle.

Grant Amounts: CALS typically offers two grants of $750 and $1,000 each year. Usually, two grants are awarded to separate individuals; however ,during some years both grants are awarded to one person. Award amounts depend largely on member contributions; therefore, the size of the grants may vary from year to 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 *Bulletin fo the California Lichen Society,* 3) submit any relevant rare lichen data to California Natural Diversity Data Base using CNDDB's field survey forms.

How to submit an application: Please email applications or questions to the CALS Grants Committee Chair at *Grants@californialichens.org* by **October 1 of the current calendar year.** The current chair is Tom Carlberg.

President's Message

I am really looking forward to the New Year because in my mind 2016 is the year of the lichen—lace lichen to be specific. I am so proud of the work that CALS has done to become the first state to declare a lichen as a state symbol. Since the California state lichen law takes effect on January 1st, 2016, I propose that we dedicate the whole year to announcing this news near and far. Receiving the recognition of a state symbol is a HUGE boost for lichen awareness. The opportunity to work lichens into any casual conversation has just increased substantially! Now it is up to all of us to spread the word and educate our fellow Californians (or our fellow countrymen as the case may be for our out-of-state and international members). Tell your neighbors and colleagues, family and friends, tell everyone! While staffing the lichen information table at the Mountain Lake turtle release event, I told a 3rd grade student about our state lichen and encouraged her to tell her teacher and classmates. She walked away with a lace lichen rubbing that she made and assured me she would help get the word out.

CALS president, Shelly Benson, with the California state lichen, *Ramalina menziesii*.

In 2016 I also want to engage our members throughout the state. That's why we are holding our annual meeting in southern California. It has been a while since the last CALS activity in that area. I look forward to meeting new and old members alike. I hope to forge stronger connections with members across the state in the coming year to motivate greater participation within the society—lead a walk, submit a photo or an article for the bulletin, get involved in the CALS board or a committee. The great thing about volunteer organizations like CALS is that they unite people with a common passion. CALS is made of people who love lichen and what the society has to offer is the direct result of volunteer efforts. So, get involved and share your lichen energy with the CALS community in 2016!

Shelly Benson
President@californialichens.org

California Lichen Society

PO Box 472, Fairfax, California 94978

The California Lichen Society (CALS) 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.

Members receive the *Bulletin of the California Lichen Society* (print and/or online access), voter rights in society elections, access to the CALS community, and notices of meetings, field trips, lectures, and workshops.

Membership Dues (in $US per year)
Student and fixed income (online eBulletin only) - $10
Regular - $20 ($25 for foreign members)
Family - $25
Sponsor and Libraries - $35
Donor - $50
Benefactor - $100
Life Members - $500 (one time)

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Membership dues can be made payable to:
California Lichen Society, PO Box 472, Fairfax, California 94978

To join or renew online, please visit www.californialichens.org/membership

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Niebla species endemic to coastal California and/or coastal Mexico, from Sonoma County to Baja California Sur[1]

Niebla combeoides JASON HOLLINGER

Niebla ceruchoides (with *Dudleya* sp. growing from center of lichen) JASON HOLLINGER

Niebla laevigata JASON HOLLINGER

Niebla isidiascens JASON HOLLINGER

Niebla robusta STEPHEN SHARNOFF

Niebla procera JASON HOLLINGER

Niebla polymorpha (right) with *Niebla homalea* (left; not endemic to the stated region) JASON HOLLINGER

1. Knudsen, K. and J. Kocourková. 2012. The Annotated Checklist of Lichens, Lichenicolous and Allied Fungi of Channel Islands National Park. Opuscula Philolichenum, 11: 145-302.