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Contents

This issue of the *Bulletin of the California Lichen Society* (ISSN 1093-9148) was edited by Jes Coyle and Justin Shaffer (editor@californialichens.org) and was produced by Sarah Minnick (production@californialichens.org).

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Cover image: Nine species in nine inches. Justin Shaffer captures a colorful lichen community at the Landels-Hill Big Creek Reserve in Big Sur. Submit cover photos for consideration to editor@californialichens.org.

Showcasing *Palicella schizochromatica* in California: a widespread and underappreciated species

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Introduction

Palicella schizochromatica (Pérez-Ortega, T. Sprib. & Printzen) Rodr. Flakus & Printzen has been collected in western North American by many lichenologists over the years. One of the first reports of the species in the literature is in Fink (1935) who misidentified it as *Lecidea carnulenta*. Since then it has fooled several other authors, masquerading as *Lecanora symmicta and Ramboldia elabens*, among others. Some authors have recognized that it was a problematic taxon and referred to it by herbarium names, i.e. *Lecanora* sp. 1, *Lecanora* sp. A and *Lecanora "meliocarpella"*. (See Pérez-Ortega *et al.* (2010) for a full list). It wasn't until 2010 that Pérez-Ortega *et al.* formally described it in *Lecanora* (*L. schizochromatica* Pérez-Ortega, T. Sprib. & Printzen). Most recently, it was transferred to a newly erected genus, *Palicella*, by Rodriguez Flakus & Printzen (2014).

This checkered past in part reflects the astonishing outward variability of this interesting species. Its thallus is crustose and varies in development from verrucose-areolate to nearly immersed. The color of the apothecia is particularly variable, from pale yellowish to bluish gray to greenish black to reddish brown to jet black, often varying within the same thallus and even the same apothecium, resulting in a piebald pattern. The key to recognizing the species in the field is the apothecial margins, which are characteristically darker and shinier than the disks.

Microscopically, however, *P. schizochromatica* is quite consistent: the epihymenium has coarse golden-brown granules on top (clearing in K); a blue-green pigment is present in the upper exciple and/or epihymenium (Cinereorufa-green following Meyer & Printzen (2000), K+ green and N+ red); the exciple has strongly gelatinized, slender, branched, radiating hyphae with abruptly capitate, pigmented tips; the paraphyses are slender and unpigmented, with scarcely expanded tips; the asci are *Lecanora*-type with 8 narrowly ellipsoid, simple, hyaline spores with a distinct wall. Algae are restricted to the base of the proper exciple or sometimes completely absent from the apothecium.

The thallus and apothecia contain atranorin and usnic acid as major substances, typically giving K+Y and KC+Y reactions, especially when the thallus is well-developed, however spot tests are sometimes weak and can be missed.

Palicella schizochromatica is endemic to western North America where it is widely reported from coniferous forests in mountain regions of the Pacific Northwest in Oregon, Washington, Idaho, northwestern Montana, Alaska, and British Columbia. It is an epiphytic species occurring particularly on bark and wood of conifers. Reports from California are sparse, but it appears to be widespread west of the Sierra Nevada and Cascade Mountains, extending southward along the coast at least as far as Santa Barbara County. It is apparently absent from arid regions including the Central Valley, Mojave Desert

and the Great Basin[1] (Figure 1). Its affinity for more mesic regions may explain the apparent absence from much of Southern California.

In the discussion following its description, Pérez-Ortega *et al.* (2010) expressed reservations regarding two specimens cited from California, drawing attention to the inspersed hymenium of one specimen (Trinity Co., *Spribille 18405*, GZU) and swollen paraphyses in the other (Del Norte Co., *Muggia s.n.*, TSB-38880). Three years later, Hutten *et al.* (2013) reported it to be "common on bark and wood" in Yosemite National Park, with no comments on aberrant or anomalous material. The present authors have encountered this species several times from a number of areas in California. Here we critically compare 7 collections from California to authentic reference material from the inland Pacific Northwest (see specimens examined).

1 The specimen from the Santa Rosa Range in Nevada on CNALH (*Hollinger 7664c*) is highly aberrant, and likely represents an undescribed species.

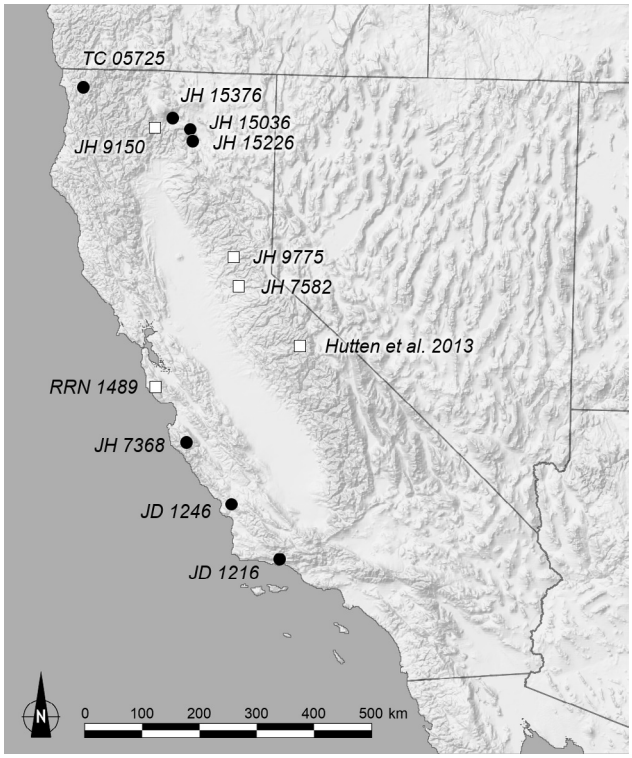

Figure 1. Distribution of *Palicella schizochromatica* in California. Black circles are specimens examined for this study. White squares are other specimens and literature reports.

Methods

Morphology of specimens was studied with hand-cut sections mounted in water and 10% KOH using standard microscopy techniques. Asci were first mounted in water, then a drop of 10% KOH was added, then rinsed with a drop of water, then finally stained with ca. 10% Lugol's solution. Spores were mounted in water and measured by eye with the aid of a reticle or were measured from calibrated photographs; only mature spores free of the ascus were considered. Spores without a distinct wall were considered immature and ignored. Twenty spores per specimen were measured where possible.

Results and Discussion

Our California specimens show typical patterns of variation in the color and shape of apothecia and the development of the thallus (Figure 2). The structure of the proper exciple (Figure 3a) is identical to that of northern material, as are the slender, unexpanded paraphyses (Figure 3c), epihymenial granules and Cinereorufa-green pigment in the upper exciple (Figure 3b). We found no sign of swollen paraphyses in our material. All but one of our California specimens have a clear hymenium. The spores in our California material measure (9.0)9.5-[11.4±1.1]-13.0(13.5) × (3.0)3.2-[3.9±0.4]-4.5(5.2) µm (N=83 from 6 specimens, excluding *TC 05725* for reasons discussed below; numbers are the range of 90% of spores, with extremes in parentheses, and means and standard deviations in square brackets). This is on the long side but overall consistent with the range of averages, 9.7–11.1 × 3.5–4.1 µm, reported by Pérez-Ortega *et al.* (2010).

One specimen (*TC 05725*) is unusual in a few respects. It has smaller spores than the rest (avg. 9.1 µm long), streaks of fine granules inspersing the hymenium from above, and what looks at first glance to be soredia growing on top of the thallus areoles. These "soredia" are minute, yellow-green, chain-like proliferations of globose cells (Figure 4). We are not certain the "soredia" even belong to the lichen, but we've never seen anything quite like it before, and are uncertain how to classify it. This aberrant specimen was collected from a much wetter locality than any of the other collections we've seen (inside or outside California). Average annual precipitation

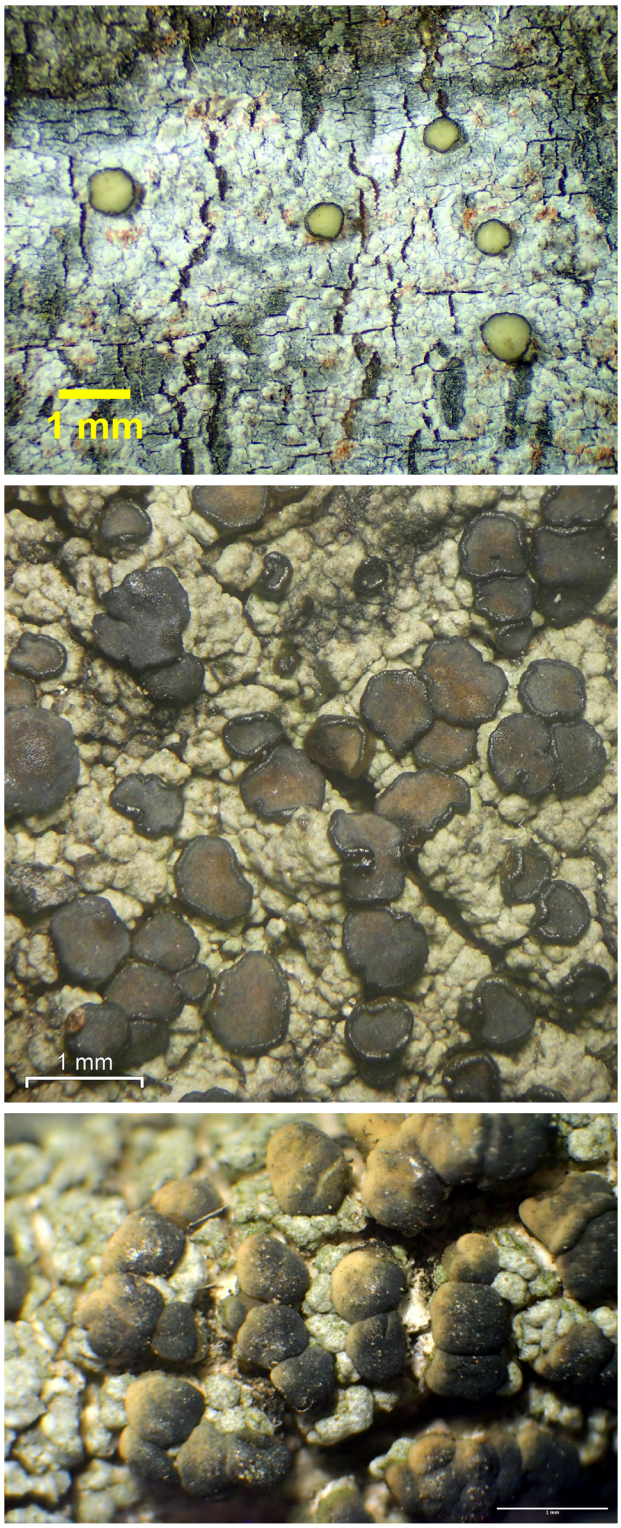

Figure 2. Habit and variability of *Palicella schizochromatica*. From the top, *TC 05725*, *JH 15226*, *JD 1216*.

Figure 3. a, b – Variation in pigmentation of exciple and epihymenium, mounted in water. c – Paraphyses, mounted in KOH. (a, c – *JH 15226*, b – *TC 05725*; scale bars 10 µm)

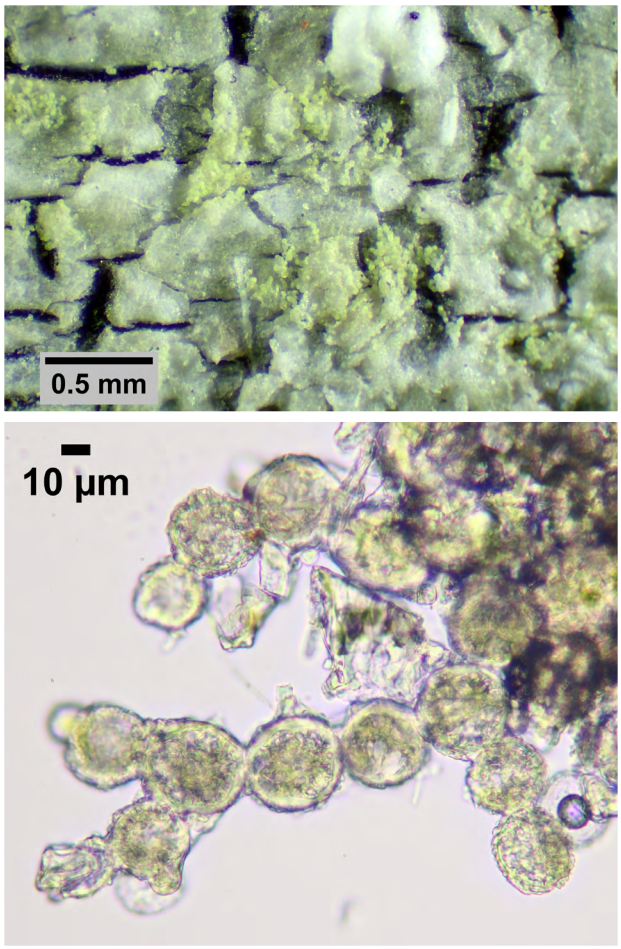

Figure 4. Left: chains of globose cells atop thallus areoles. Right: microscopic image of chains. Both from TC 05725.

exceeds 300 cm at this location; the localities of the other specimens we examined for this study receive 43–144 cm annually (PRISM 2012).

One of our specimens (*JH 15036*) is infected with *Lichenodiplis lecanorae* (Vouaux) Dyko & D. Hawksw., a common lichenicolous fungus found on a variety of host species in *Lecanora* sensu lato. *L. lecanorae* produces tiny black pycnidia within the host's hymenium that contain very pale (often appearing hyaline), simple, broadly ellipsoid, truncate conidia 4–4.5 × 2–2.5(3) µm (Diederich 2004). We have also seen the superficially similar *Lichenoconium erodens* (Jaap) D. Hawksw. growing on a specimen of *P. schizochromatica* in eastern Washington (Spokane Co., Turnbull N.W.R, on *Pinus ponderosa* branch in pine savanna near wetland, *N. Noell 1005*, EWU). *L. erodens* is a smaller species whose conidia are typically darker, smaller, globose and nontruncate.

Outside of California, *Palicella schizochromatica* appears to be most common on conifer bark and wood. McCune (2017) also reports it on *Alnus* and *Artemisia*. It is no different in our California specimens, which were mostly collected on conifers, except for *JD 1216* which was growing on *Arctostaphylos glauca*, and *TC 05725* on *Alnus rubra* bark. We also have an unconfirmed record of a specimen growing on oak bark (*JH 9150*).

The relative dearth of specimens reported for California is notable, possibly as a result of the same morphological confusion which kept the species from being formally described until 2010. In California, *Palicella schizochromatica*, especially pale-fruited forms, is most likely to be confused with *Cliostomum griffithii* (Sm.) Coppins, a coastal crustose lichen on bark and wood that can have similarly colored piebald apothecia. However, *C. griffithii* apothecial rims are generally concolorous or paler than the disk and not as shiny as *P. schizochromatica's*. In the lab, *C. griffithii* is readily distinguished by its two-celled spores. The range and ecology of the two species overlap, but *C. griffithii* is more or less restricted to the coast and it tends to prefer deciduous trees (Ekman 2004).

Conclusion

Although limited to a review of only a handful of collections, we found *Palicella schizochromatica* in California to be consistent in morphology, anatomy and ecology with published literature and specimens from the Pacific Northwest outside of California, with the exception of one aberrant specimen with unusually small spores. In California, *P. schizochromatica* is broadly associated with mesic forests in mountainous areas, but its range is still imperfectly known owing to the relatively few specimens reported. The species should be sought in coniferous forests throughout the state, and particularly in coastal Northern and Southern California where records are sparse.

Specimens examined

CANADA. BRITISH COLUMBIA. Thompson-Nicola Reg.: Coldwater Creek, exit 256 of Coquihalla Hwy., on *Pseudotsuga* branches in dry *Pinus–Pseudotsuga* forest, *JH 17905*. U.S.A. CALIFORNIA. Del Norte Co.: Six Rivers N.F., headwaters of unnamed tributary of Jones Creek, near terminus of FS Road 16N02L, east of Ship Mountain, on *Alnus rubra* trunk bark in riparian old-growth *Pseudotsuga menziesii / Chamaecyparus lawsonii / Abies concolor* forest, *TC 05725*; Monterey Co.: Los Padres N.F., White Oaks Campground, on pine trunk in high oak forest, *JH 7368* (sub *Lecidea rubrocastanea*); San Luis Obispo Co.: Cuesta Ridge Botanical Area, on *Cupressus sargentii*, *JD 1246*; Santa Barbara Co.: transverse range above Santa Barbara, East Camino Cielo, on dead *Arctostaphylos glauca*, *JD 1216*; Shasta Co.: Harlow Place, ca. 750 m WSW of jct. of Hwy. 89 with Harlow Flat Rd., on *Pseudotsuga* branch in mixed forest with oak, ponderosa pine and incense cedar, *JH 15036* (sub *Vulpicida canadensis*); Burney, just E of Hwy. 89 ca. 4 km NNW of jct. with Hwy. 299, on *Pinus ponderosa* branch in ponderosa-oak savanna, *JH 15226*; Siskiyou Co.: Mount Shasta, just S of jct. of Pilgrim Creek Rd. and Widow Springs Dr., on *Pinus ponderosa* branch at edge of pine plantation with scattered *Abies concolor*, *JH 15376.* IDAHO. Idaho Co.: Slate Creek Lookout, on conifer branch in montane forest on top of ridge, *JH 17835*. WASHINGTON. Spokane Co.: Turnbull N.W.R., on *Pinus ponderosa* twig in pine savanna, *JH 7061*. (JH = Jason Hollinger; JD = Jason Dart; TC = Tom Carlberg. All collections reside in the herbaria of the respective authors.)

Additional specimens not examined for this study. U.S.A. CALIFORNIA. Eldorado Co.: Pollock Pines, on *Pseudotsuga*, *JH 7582* (UBC); Placer Co.: Emigrant Pass, on *Abies concolor*, *JH 9775* (UBC); Santa Cruz Co.: Big Basin Redwoods, on *Sequoia sempervirens*, *Reese Naesborg 1489* (UC, det. T. Spribille 2017); Shasta Co.: Castle Crags, on oak, *JH 9150* (EVE).

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Notes on three new species described from California

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Abstract: Three new species recently described from California are briefly discussed: *Acarospora bernardinensis, A. erratica*, and *Ramalina sarahae*.

***Acarospora bernardinensis* K. Knudsen, J.N. Adams, Kocourk. & Y. Wang**

This is a calciphyte in the *Sarcogyne canadensis-wheeleri* clade, which is sister to the European *Acarospora glaucocarpa* group (Knudsen et al. 2020). This is the only member of this clade so far reported from California. The species is currently considered endemic to the San Bernardino Mountains where it is common in the Mojave Desert interface on dolomite or occasionally on granite where the two substrates are mixed. It was the basis for the California report of *Acarospora glaucocarpa* in the Sonoran lichen flora (Knudsen 2007). It has verruciform areoles or elevated apothecia that can be epruinose or densely pruinose, the margin eventually formed by the expanded parathecium, a character common in this clade and in the European *Acarospora glaucocarpa* group. Also common in these clades is the dark blue (amyloid) hymenial gel in Lugol's (IKI). Euamyloid hymenial gel is always deep blue even if Lugol's is old (Knudsen & Kocourková 2019). A majority of Acarosporaceae have hemiamyloid hymenial gel. For pictures of this calciphyte see the paper in *The Bryologist* available through many university libraries if you are not a subscriber, or it can be requested from the authors (Knudsen et al. 2020).

***Acarospora erratica* K. Knudsen & Kocourk. (Figure 1)**

This is a calciphyte that is usually found on small pebbles in Idaho, Montana, and Utah. It is currently only known in California from the White Mountains in Inyo National Forest on dolomite rubble in the Bristlecone pine forests (Knudsen & Kocourková 2018). It is usually verruciform with a single apothecium, 0.3–0.4 mm tall, and 0.3–0.5 mm wide. It is distinguished by its broad ellipsoid to globose ascospores and usually stout paraphyses (2–3 µm thick at midlevel). It has hemiamyloid hymenial gel in Lugol's (red or blue-to-red in thin sections squashed). For protocol see Knudsen & Kocourková (2018). The stain of hymenial gel in Acarosporaceae is a species-level character but if Lugol's is old or too concentrated hemiamyloid gel can appear blue and not fade (Knudsen & Kocourková 2018). The use of hymenial gel for identification was not used in recent treatments of Acarosporaceae because Magnusson's records of hymenial gel are often not reproducible (Magnusson 1929). There was no protocol for reproducible results and reaction of hymenial gel to Lugol's was not utilized as a diagnostic character in recent treatments (Clauzade et al. 1981; Fletcher et al. 2009; Knudsen 2007; Westberg et al. 2011). The margin around apothecia is formed from the thallus and parathecium is narrow and unexpanded. Occasional specimens are pruinose.

Some previous specimens from White Mountains were identified as *Acarospora obnubila* H. Magn. (Knudsen 2007). *Acarospora elevata* H. Magn. and *A.*

Figure 1. *Acarospora erratica* (holotype, Knudsen & Kocourková 2018). Scale = 1.0 mm.

obnubila have euamyloid hymenial gel (the revision of these taxa is in preparation). The article describing the species with more pictures is available for free download at the sites of Opuscula Philolichenum, Recent Literature on Lichens, and ResearchGate (Knudsen & Kocourková 2018).

***Ramalina sarahae* K. Knudsen, Lendemer & Kocourk.**

This is a species possibly endemic to the Channel Islands. It is currently known from specimens from San Miguel Island, its type locality, and from San Nicolas Island. It usually grows on *Leptosyne gigantea.* Its distribution on other islands, the central coast of California, or in Baja Mexico needs further study. It could be confused with *R. lacera* (With.) J.R. Laundon that also has a cortex without chondroid strands (Gumboski et al. 2014; Kashiwadani & Nash 2004). *Ramalina sarahae* differs in having only linear pseudocyphellae and no soralia. *Ramalina sarahae* has a caespitose growth form with thinner branches 1.5–3.0 mm wide vs. the branches of *R. lacera* that are strap-like and up to 15 mm. For pictures see the paper in The Bryologist, available through many university libraries if you are not a subscriber, or it can be requested from the authors (Knudsen et al. 2018).

Acknowledgements

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California lichenology and the City Nature Challenge

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Abstract

The City Nature Challenge (CNC) is an annual event in which urban areas around the world compete to document biodiversity in their cities. This paper analyzes (1) how the 2019 and 2020 CNC events affected the observation of lichens in California on iNaturalist and (2) whether CNC participants were more likely to observe lichens after the event. Rates of lichen observation on iNaturalist were highly elevated in California during the CNC and this was primarily driven by an increased overall number of observers. Lichen observation rates differed by an order of magnitude between the six participating California cities, but were remarkably consistent across years within the same city. Despite the large increase in lichen observation, there was no evidence that participation in the CNC increased the likelihood that a person would observe lichens in the future. This reveals a tremendous opportunity for organizations like the California Lichen Society to promote lichenological interest through collaborations with CNC-associated events.

Introduction

Each year at the end of April, amateur and veteran naturalists turn their smart-phone cameras toward their backyards and local parks in a competition that pits city against city in a 4-day race to garner the most participants, observations and species. Dubbed the "City Nature Challenge", the now global event began in 2016 as a friendly competition between Los Angeles and San Francisco to celebrate the first ever Citizen Science Day. Teams at the California Academy of Sciences in San Francisco and the Natural History Museum of Los Angeles County wanted to encourage their residents to get outside and explore the biodiversity that was hiding in plain sight around their homes. And what a success it has been- from an initial 2 cities and 1,018 participants in 2016, this year, 41,165 people joined from 244 cities on 6 continents.

The primary tool that participants use to collect observations during the City Nature Challenge (CNC) is iNaturalist, a social-networking website and smart-phone app that enables users to create a collection of photographs of species they have observed and then work collaboratively to identify them. iNaturalist currently has over 34.7 million observations from a community of 928,000 users and each year the CNC encourages more to join and contribute.

As a scientist who studies the ecology of lichens, I often wonder how many other people are looking at lichens in a non-professional setting. Do efforts like the City Nature Challenge increase the visibility of these typically overlooked organisms by encouraging people to look more carefully and closely at the world around them? Does the CNC increase lichenological observations? I decided to investigate these questions by analyzing observations and observers of lichens in California before, during and after the 2019 and 2020 City Nature Challenges. One fantastic feature of iNaturalist is that it generates biodiversity data by the people and for the people. All observations are accessible online (https://www.inaturalist.org/observations) and can be used by regular citizens and research scientists alike to answer any questions they dream up about biodiversity and those who discover it. Thus, after pondering these questions late one night it was (relatively) straightforward to go online and find and answer the next morning.

Methods

I accessed all observations of taxa belonging to lichen-containing fungal genera that were observed during the City Nature Challenges of 2019 and 2020 in every California city that participated: San Francisco Bay Area, Los Angeles County, San Diego and Sacramento participated in 2019 and 2020, whereas Orange County, Mendocino County and the Inland Empire participated only in 2020. I summarized the number of unique lichen observers and observations

in each participating city during the 2019 and 2020 CNC events. I also calculated the number of unique taxa observed in each city and for each observer to determine which cities and which iNaturalist users found the most lichens during the 2019 and 2020 CNC events.

Next I wanted to evaluate whether the City Nature Challenge (CNC) increases the overall rate of lichen observation in California. To do this, I compared the number of observations of lichens and number of lichen taxa observed in time periods of length to the CNC (4 days) that occurred over the weekends two weeks before and two weeks after the CNC events within the entire state of California. A detectable spike during the event compared to before and after the event would indicate that the CNC significantly increases lichenological observations in California.

Inclusive time periods used were, for 2019: April 12 - 15 (before), April 26 - 29 (during), May 10 - 13 (after); and for 2020: April 10 - 13 (before), April 24 - 27 (during) and May 8 - 11 (after).

Lastly, I wanted to evaluate whether the CNC influences the extent to which people pay attention to lichens. Because the CNC can cause people to join iNaturalist, I first determined when they joined; I refer to those who joined iNaturalist more than one year before the 2019 CNC as "veteran users", those who joined within one week of the event as "new users" and those who joined between one year and one week as "novice users". For veteran users, I counted the number of lichen observations they made during a 50 week period before and after the event (with a 1-week buffer on either side of the event to control for any residual CNC excitement). This eliminated any observations made during 2018 or 2020 CNC events as well. For new users who joined iNaturalist shortly before or during the 2019 CNC, I calculated the fraction who continued to observe lichens over the next 50 weeks. For novice users, I compared the number of lichen observations they made since joining up until the event to the number of lichen observations made during a time period of equal length immediately following the event.

iNaturalist does not include searchable information on whether a fungal taxon is lichen-forming. I used a cumulative checklist of lichen-forming and lichenicolous fungi for the United States and Canada (Esslinger 2019) to define lichen genera for the search. This means that observations identified only to family are not included in this analysis. However, as genus is the taxonomic level typically used for tentative field identifications, this seemed an appropriate way to filter intentional lichen observations from those obtained casually or accidentally. Note that this can inflate the number of taxa counted, since, for example, *Flavoparmelia* and *Flavoparmelia caperata* count as two taxa.

All analyses were performed in R v.3.6.0 (a free software and programming language for statistical analysis) and iNaturalist data was accessed using the iNaturalist API (https://api.inaturalist.org/v1/). Code and data used in this analysis are available at http://github.com/jescoyle/CNC-Lichens.

Results

How much lichen observation happens in California cities during the CNC?

Table 1 summarizes the number of unique lichen observers, observations and taxa from each participating region during the 2019 and 2020 CNC events and compares these statistics to the totals across all taxa. Four regions participated in both events: San Francisco Bay Area, Los Angeles County, San Diego County, and Sacramento. Although the number of observations and participants decreased notably in 2020 (lichen observations declined 13 - 67%, lichen observers declined 15 - 57%), the fraction of participants who observed at least one lichen decreased only slightly (at most 3%) and the fraction of all observations that were lichens was remarkably consistent across years. This implies that lichen observation during the CNC is directly related to the overall number of participants; more people result in proportionally more lichen observations. Decreased participation in 2020 was most likely a result of COVID-19 restrictions on events; many parks were closed and there were no CNC-associated bioblitz events scheduled this year, which would typically increase levels of participation and observation (A. Young, personal communication, May 22, 2020).

Table 1. Comparison of lichen observation in participating California regions during the City Nature Challenge 2019 and 2020 events. The table lists the number of observations recorded on iNaturalist (Observations), the number of iNaturalist users recording observations (Observers) and the number of distinct taxa recorded. These numbers were tallied separately across observations of all taxa (All) and observations of taxa belonging to North American lichen-forming fungal genera (Lichens).

		Observations		Observers		Taxa	
City		**Lichens**	**All**	**Lichens**	**All**	**Lichens**	**All**
San Francisco Bay Area	2019	554	38028	151	1947	119	3183
	2020	443	31450	129	2496	112	2975
Los Angeles County	2019	47	34125	26	1555	28	3249
	2020	28	19134	14	1568	17	2494
San Diego County	2019	278	38241	61	1188	93	3019
	2020	93	17213	26	920	38	2409
Sacramento	2019	38	9798	25	536	12	1279
	2020	33	8703	17	742	28	1654
Inland Empire	2020	81	10899	18	485	38	1835
Orange County	2020	8	3921	4	281	8	1078
Mendocino County	2020	15	1407	6	106	12	624

In contrast, lichen observation rates differed by an order of magnitude among regions. San Francisco Bay Area consistently had the highest rate of lichen observations, with lichens comprising 1.5% of all observations and 5 - 8% of participants observing at least one lichen. Mendocino County had similar rates (1.1% of observations, 5.7% of participants) followed by San Diego, the Inland Empire and Sacramento (0.4 - 0.7% of observations, 2 - 5% of participants). Los Angeles and Orange counties had low rates of lichen observation relative to the other regions (< 0.2% of observations, < 2% of participants). Why are participants in these counties 10 times less likely to record lichens? Is the behavior of participants in Los Angeles and Orange County fundamentally different from that of participants in San Francisco and Mendocino? Probably not. The lower rate of lichen observation most likely reflects poor air quality (Figure 1) and other environmental differences that decrease lichen abundance and diversity.

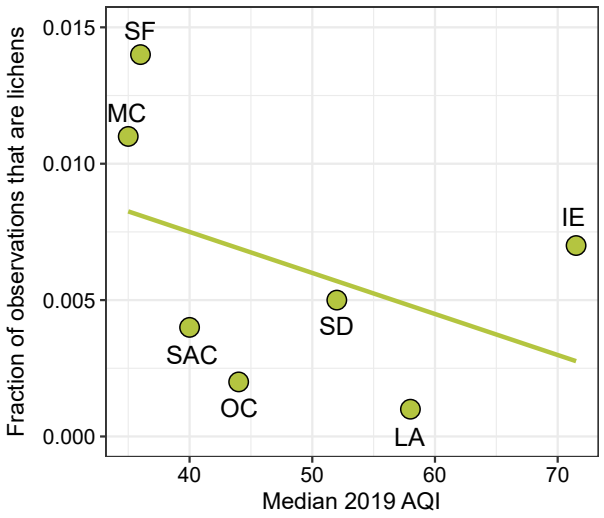
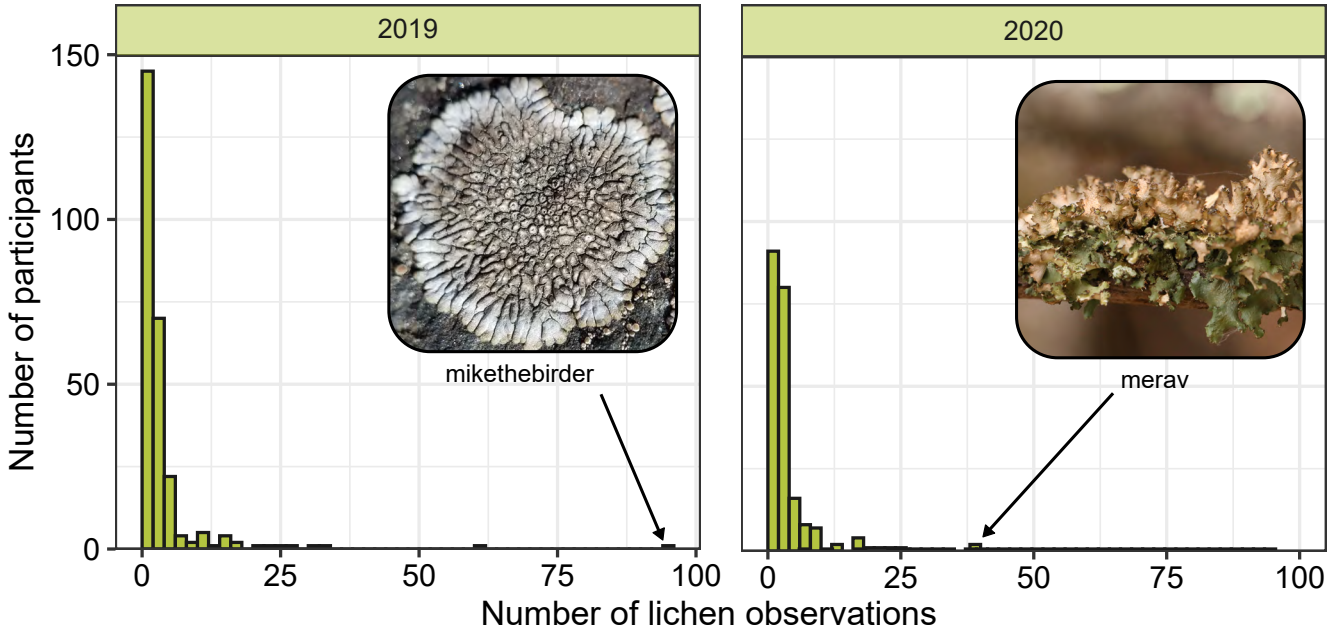


Figure 1. Correlation between air quality and the fraction of 2020 City Nature Challenge observations that were lichens. Each point represents a participating California city in 2020: San Francisco (SF), Mendocino County (MC), Sacramento (SAC), San Diego (SD), Los Angeles (LA) and the Inland Empire (IE). The median air quality index value for each county in 2019 was obtained from Air Data, US EPA (2019), with the AQI for the Inland Empire being the average of the AQI in San Bernardino and Riverside counties. Air quality scores below 50 indicate good quality air and scores above 50 indicate moderate air quality. Line shows a linear regression with a modest negative correlation (r = - 0.42).

Rates of lichen observation differed substantially among participants (Figure 2). 477 iNaturalist users made at least one observation of a lichen in one of the participating California cities during the 2019 and 2020 CNC events, with 57 participating in both

Figure 2. Frequency of lichen observation among City Nature Challenge participants who observed at least one lichen. The number of total lichen-observing participants was 263 in 2019 and 214 in 2020. Example observations from the CNC are shown for the two participants who observed the most lichens in 2019 (mikethebirder: *Dimelaena radiata*) and in 2020 (merav: *Tuckermannopsis orbata*). Photos are credited with iNaturalist user names.



years. Across both years, approximately half of the participants observed only one lichen and 72% observed 2 or fewer lichens. Only 6.7% percent of participants observed 10 or more lichens.

Does the City Nature Challenge increase lichen observation in California?

The 2019 City Nature Challenge clearly increased the overall rate at which people observe lichens on iNaturalist in California (Figure 3). The number of lichen observations was five times higher during the 2019 CNC than during comparable time periods two weeks before and after the event. This increase in observations included an approximately three-fold increase in the number of taxa observed and number of people observing lichens. For perspective, in 2019 in all of California, iNaturalist users made a total of 1,640,750 observations, less than 1% of which were of lichens. Of those 14,606 lichen observations, 6.5% were made during the four days of the CNC. So, the daily rate of lichen observations was six times higher during the CNC than it was on average during the rest of the year.

While overall lichen observation clearly increases during the CNC, it is less clear how useful these observations are for documenting lichen biodiversity. Due to the experience-level of most participants, lichen observations during the CNC are more likely to belong to common, abundant and easily identified taxa. The top five most observed taxa were (in order): *Flavoparmelia caperata*, *Xanthoria parietina*, *Evernia prunastri*, *Usnea* sp., and *Ramalina menziesii*. A comparison of lichen taxa identified in San Francisco during the 2019 CNC with a 2012 checklist of 138 lichen species from the Presidio of San Francisco (Benson *et al.* 2012) showed an overlap of only 31 species out of a total of 88 CNC species (this estimate accounts for nomenclature changes). Three possibilities could account for this; (1) CNC observations are misidentified, (2) CNC participants are finding species in the San Francisco Bay Area that don't occur in Presidio habitats, or (3) CNC participants are finding species that were overlooked in previous expert inventories. While the first almost certainly occurs, the second and third explanations provide some justification for the CNC to motivate lichen inventories in other parts of the SF Bay Area or to revisit areas previously thought to be well-documented.

Does the City Nature Challenge change the likelihood that participants will observe lichens in the future?

Participants in the 2019 City Nature Challenge who observed lichens were a mixture of "veterans" who had joined iNaturalist more than a year before the event (58%), "novices" who joined at least a week before (18%) and new users who joined iNaturalist shortly before or during the event (23%). A small fraction (4%) of veteran and novice users only used iNaturalist during the CNC, whereas the majority (55%) of new users did not continue to use iNaturalist after the CNC.

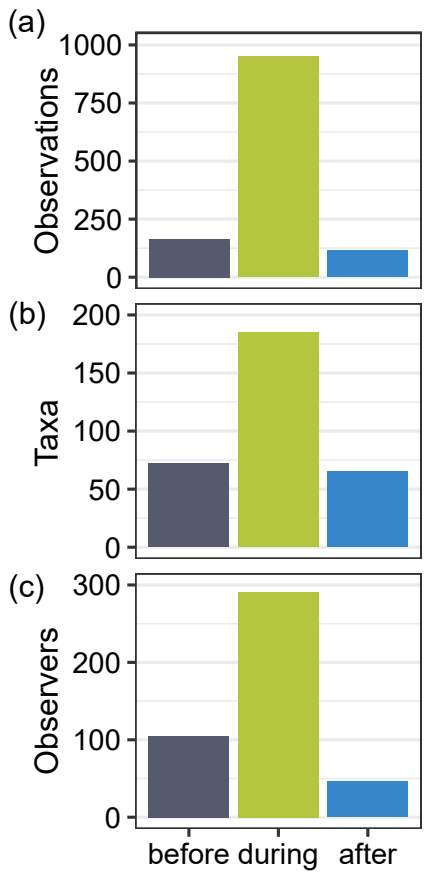


Figure 3. Effect of the 2019 City Nature Challenge on iNaturalist lichen observations in California. Panels show (a) the number of lichen observations recorded, (b) the number of unique lichen taxa and (c) the number of iNaturalist users who observed a lichen during four-day weekend-spanning periods shortly before, during and after the 2019 CNC event across all of California.

There was no evidence that the City Nature Challenge in 2019 increased the likelihood of California participants observing lichens in the future. Among the 172 veteran and novice iNaturalist users who used iNaturalist both before and after the CNC, there was no consistent change in the rate at which lichens were observed or the fraction of the observations that were of lichens (Figure 4). Of the 28 new iNaturalist users, who continued to use iNaturalist during the following year, only 6 (9%) made observations of lichens.

Conclusions

The City Nature Challenge substantially increases the rate of lichen observation in California on the iNaturalist platform. It does this not by motivating new interest in lichens, but simply by getting more people to spend more time outside examining the world around them. It falls to natural history organizations, such as the California Lichen Society, to translate people's enthusiasm during the CNC into longer-term learning about nature. By partnering with local bioblitzes and other events organized in conjunction with the CNC, CALS members have a tremendous opportunity to share our knowledge and introduce new enthusiasts to the diverse and wonderful world of lichens.

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Many thanks to Allison Young and Lila Higgins who organize the City Nature Challenge each year, to the thousands of participants who share their observations on iNaturalist and to the iNaturalist team who make these data available to researchers and the public.

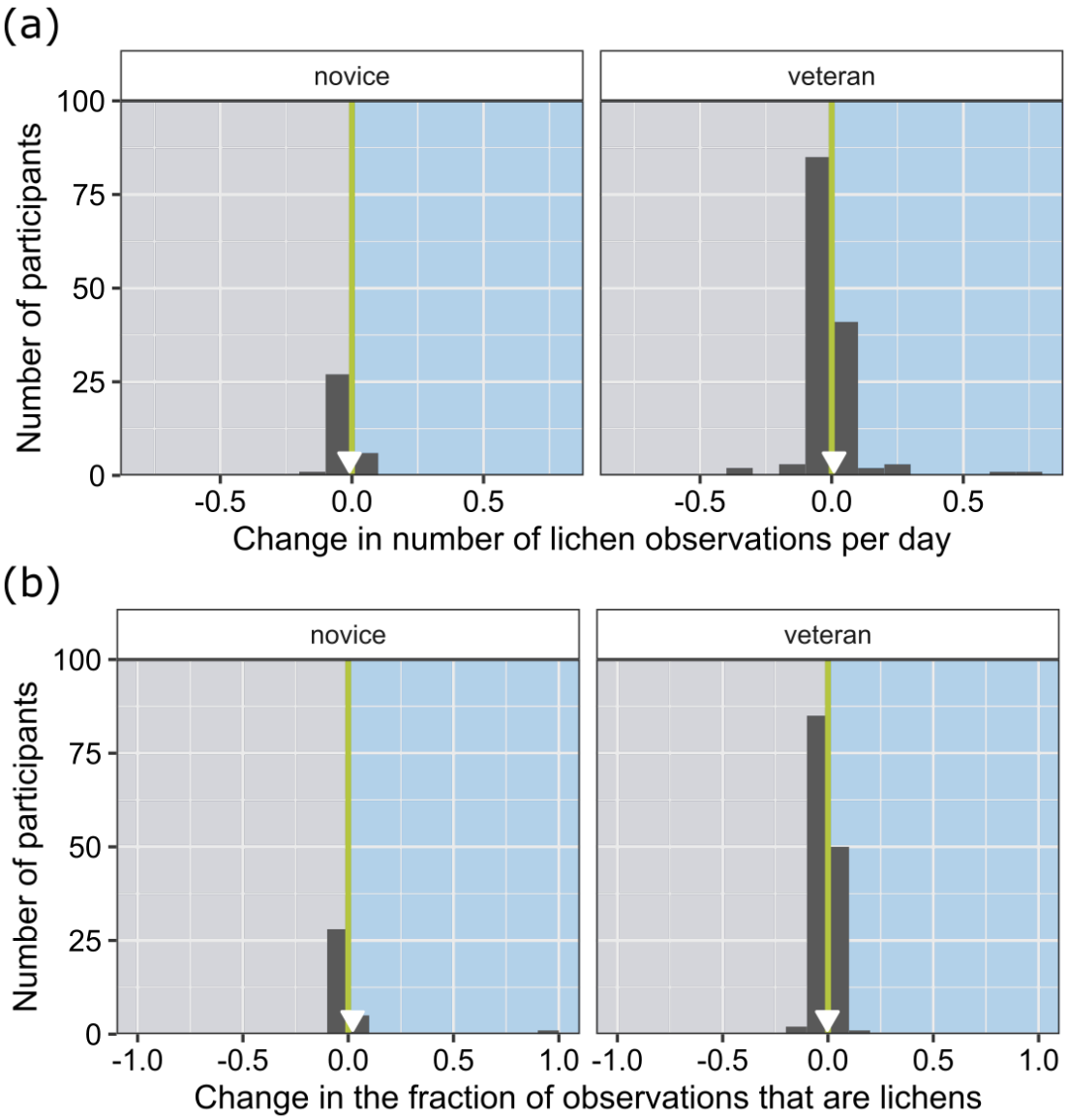

Figure 4. Comparison of lichen observation rates among veteran and novice iNaturalist users before and after the 2019 City Nature Challenge. The difference in the (a) number of lichens observed per day and (b) fraction of iNaturalist observations that were of lichens was calculated for each user between comparable time periods before and after the 2019 CNC event. A positive change indicates that the rate of lichen observation was higher after the CNC (participants are in the blue section of the histogram), whereas a negative change indicates that rates were higher before the CNC (grey section). No change is marked with a green vertical line. White triangles mark the median rate across all users (veterans: N = 138; novices: N = 34). Paired two-sided t-tests showed no consistent change in the number of lichens observed per day (veterans: t = 1.02, P = 0.31; novices: t = 1.60, P = 0.12) or in the fraction of observations that were lichens (veterans: t = 1.03, P = 0.31; novices: t = 0.7, P = 0.48).

New and interesting records of lichens from California

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Abstract: One lichen species is reported as new to the state of California. Two species are presented as unknown, and eight additional species are unusual or interesting for other reasons.

Editor's note: The New and Interesting *section was an irregular feature compiled primarily by Judith and Ronald Robertson in many prior CALS Bulletins. Its intent was and is to provide a forum for the presentation of brief news about interesting lichen species encounters in California and surrounding areas, including puzzling ones. Judging by the contributions we hope this feature will appear regularly in future issues. This issue's* N&I *was organized and compiled by Tom Carlberg. If you are interested in contributing to the* N&I *in future issues, please send submissions directly to the editors: Jes Coyle and Justin Shaffer at editors@californialichens.org. We look forward to your interesting finds!*

Acolium sp. On wood of an old downed *Quercus* within an open *Quercus* savanna of Quail Ridge Reserve, Napa County. *EBP#4985* (part 1 at CAS; parts 2-4 hb. Peterson to be dispersed).

This robust specimen defies clear identification. The name *Acolium* was recently resurrected to represent a few members of what had been *Cyphelium* (most, including the type for *Cyphelium*, have been transferred to *Calicium*). Anatomically it seems most like the parasitic *Acolium sessile* (Pers.) Arnold, which is known from Europe and the eastern coast of North America. However, this specimen is clearly not parasitic and differs in the spore ornamentation. Another potential might be *A. karelicum*, except my specimen lacks much of a superficial thallus and the spore walls are not nearly as thick and cracked as in typical *A. karelicum*.

The thallus is mainly immersed in the substrate (Figure 1), visible only as pale grayish patches among the wood fibers of the substrate. Ascomata are less than 0.7 mm across and lack pruina on either the excipulum or the spore mass. Spores are ca. 10-13 µm in length, with an ornamentation of irregular cracks in the spore wall. This is the only specimen I have of this taxon and to sort it out, I would welcome further specimens you might come across! *Reported by Eric B. Peterson*.

Aspicilia filiformis Rosentreter – San Luis Obispo County: Los Padres National Forest, La Panza Range, on rocky red clay soil in a biological crust community, *JD 1517*. *Aspicilia filiformis* is an uncommon terricolous lichen with a fruticose growth habit that forms small tufts of creeping horizontal branches with filiform, forked, black tips (Figure 2). It differs from the similarly fruticose and terricolous *Aspicilia californica* Rosentreter primarily by having forked branch tips and a K- reaction, whereas *A. californica* has simple branch tips and is K+R, indicating the presence of norstictic acid. In California it has been reported in San Benito County (Tucker et al. 2006; Rajakaruna et al. 2012), and specimen records (Consortium of North American Lichen Herbaria (CNALH) 2020) show a handful of other collections in the state, in Tulare, Kern and San Luis Obispo Counties. *Reported by Jason Dart*.

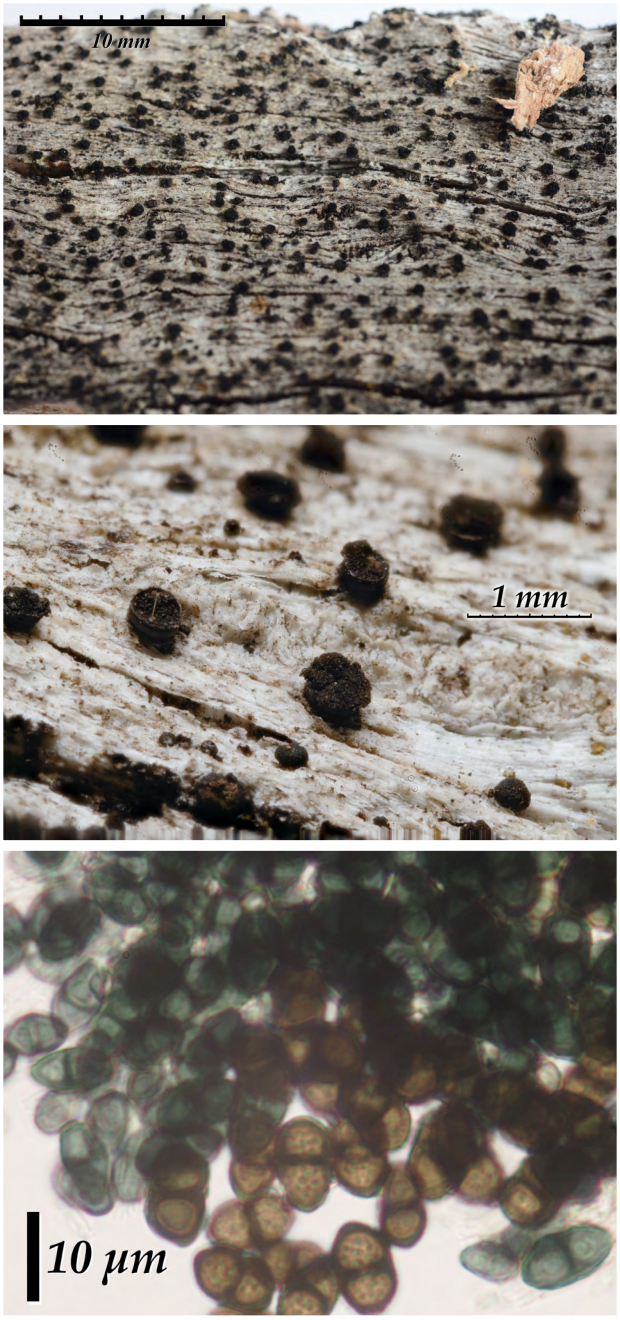

Figure 1: *Acolium* sp. From top to bottom: colony ca. life size, scale bar = 10 mm; closer look at ascomata and thallus, scale bar = 1 mm.; ascospores, scale bar = 10 µm.

Figure 2. *Aspicilia filiformis.* From top to bottom: habit; detail of black forked branch tips.

Calicium montanum Tibell. New to California! On wood of a very large decorticate snag (presumably *Quercus lobata*) on a northerly slope at the bottom of a small valley at Quail Ridge Reserve, Napa County. *EBP#4967* (part 1 at CAS; parts 2-14 hb. Peterson to be dispersed).

A luxuriant growth of this species was found on an old snag resulting in a specimen clearly worth the effort of navigating a poison oak thicket to get to it! Although this species has not been previously reported in the state, it identified quite cleanly to *C. montanum* and photographs were provided to Dr. Leif Tibell who was agreeable with the identification. *C. montanum* was previously reported for North America based on a single specimen from Arizona (Kolb and Spribille 2001; Tibell and Ryan 2004a), so this may be only the second specimen for North America.

Thallus episubstratic, grayish and roughly verrucose (Figure 3). Ascomata are short-stalked (nearly sessile) and have a thick white pruina on the excipulum. Spores 8-12 µm in length, single septate, with a rough verrucose ornamentation and occasional cracks.

Although quite a robust colony was found, the infrequency of equivalent habitats in California cannot be understated. This was an extremely large snag which would likely be removed from most managed lands; it was an unusually dense and humid microsite within a severely fire-prone vegetation type; and it was in a climate zone that has been largely occupied by humans. *Reported by Eric B. Peterson*.

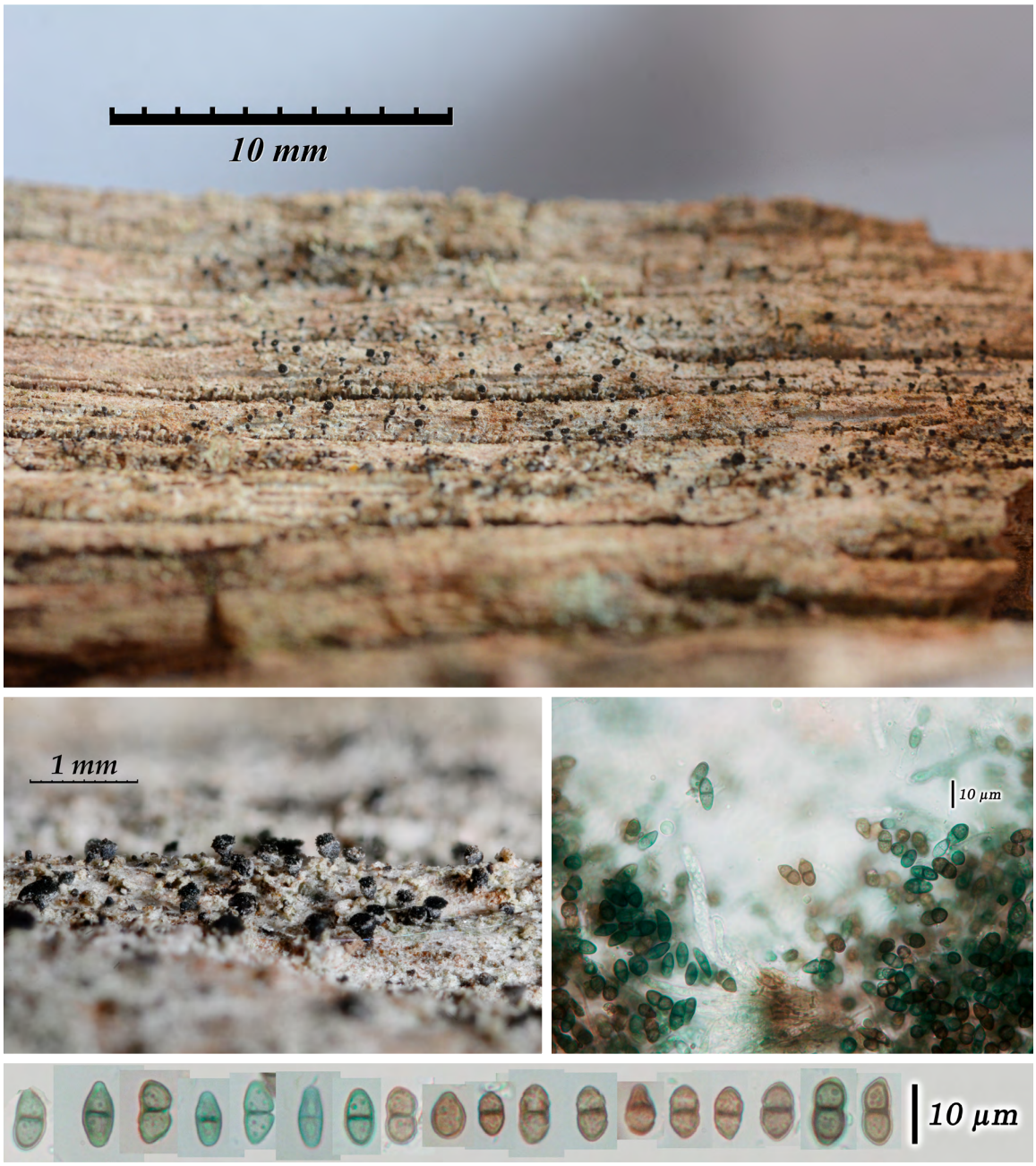

Figure 3: *Calicium montanum*. Top: colony ca. life size, scale bar = 10 mm. Middle, left to right: closer look at ascomata and thallus, scale bar = 1 mm.; ascospores, scale bar = 10 µm. Bottom: ascospores digitally aligned to show range in form and size, scale bar = 10 µm.

Calicium sp. On wood fencing (likely cedar) in *Quercus douglasii* woodlands of Quail Ridge Reserve, Napa County. *EBP#4976* (CAS), *EBP#4977* (hb. Peterson). This as yet undetermined taxon was found at two different locations on the reserve. Both specimens were extremely minute, even for those who look for minute lichens! They appeared like a faint speckling on weathered wood. The specimens key closest to *Calicium trachylioides* (previously *Cyphelium trachylioides*) based on the spore size and lack of bright yellow rhizocarpic acid. However, Tibell (1999) provided a photo of that species as it occurs in northern Europe, which looks extraordinarily robust compared to these Quail Ridge specimens. These also lack the brown pigments of *C. trachylioides*.

C. trachylioides was reported for North America (and California) based on a single collection by Tibell (1978). That specimen likely remains the sole basis of the inclusion in the Sonoran Flora, as the distribution specifies an elevation in California of 1370 m (Tibell and Ryan 2004b), although there are now reports of the species in Washington and British Columbia. I have collected what I suspect is *C. trachylioides* in Washoe County, Nevada, although I did not include it in the checklist for the state (Ryan and Peterson 2007) because it seemed like a dubious identification. That specimen is poorly developed and the thallus, while brown, does not have verrucae constricted at the base like Tibell (1978, 1999) describes. Rather, the thallus looks almost like the verrucae typical in *Thelomma*. The Quail Ridge specimens diverge even more and I can barely imagine that they belong to the same taxon as the Nevada specimen.

While working on these specimens, I came across photos and diagrams of the conidial lichenicolous genus *Sclerococcum*, which has some remarkable convergences with sessile *Calicium*: the conidiospores are dark and often septate, bearing a remarkable resemblance to *Calicium*, plus the conidiomata form spore masses much like the mazaedial ascomata of a sessile *Calicium*. Diederich (2015) provides a key to all known lichenicolous *Sclerococcum* that includes only one species (*S. tephromelarum*) with conidiospores in a size range that matches the Quail Ridge specimens, but the conidiomata would be smaller. Other species have conidiomata in the

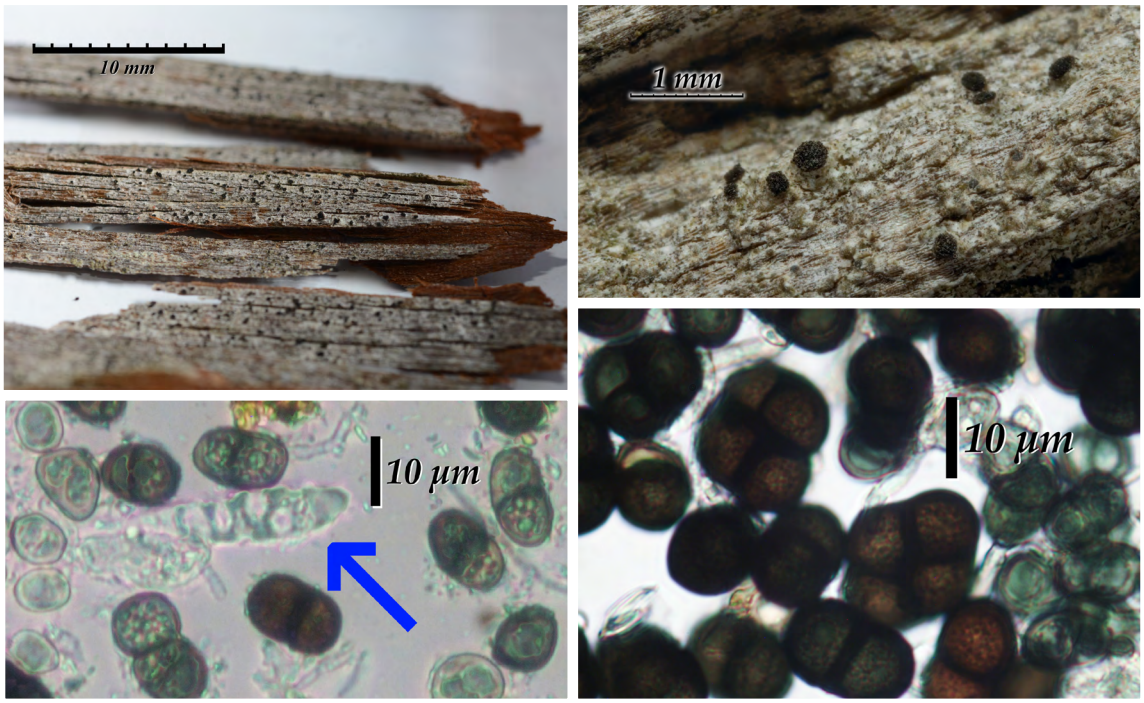

Figure 4: *Calicium* sp. Clockwise from upper left: colony ca. life size, scale bar = 10 mm.; closer look at ascomata and thallus, scale bar = 1 mm.; ascospores, scale bar = 10 µm.; ascus (blue arrow), scale bar = 10 µm.

appropriate size range, but have smaller spores. It took some time, but I was eventually able to find what appear to be asci (see Figure 4 - arrow), thus I am fairly certain these specimens are indeed *Calicium*. It also appears that the ascospores are released from the asci exceptionally early and careful sectioning shows a gradient in spore maturation much like would be expected for conidiomata.

Ascomata are less than 0.3 mm in diameter and immersed within a very thin grayish thallus that matches the color of the weathered wood it grows on (Figure 4). The excipulum is poorly developed. Spores are ca. 16-22 um in length and ornamented with a very fine network of cracks. Like most species of *Calicium*, the spores are mostly single-septate although a few were observed with additional septae forming sub-muriform spores (see figure). More specimens are needed to sort out this miniscule taxon! *Reported by Eric B. Peterson*.

Psora pruinosa Timdal – San Luis Obispo County: Los Padres National Forest, La Panza Range, on rocky red clay soil in a biological crust community, *JD 806*. *Psora pruinosa* is known primarily from Southern California and Baja, where Timdal (2002) reported it as rare. In the 18 years since, only 5 specimens have been recorded in the CNALH (2020). These modern collections are from Catalina Island (*Wetmore 73277, Knudsen 15239.1*), Riverside County (*Bratt 6074, 8838*) and an outlier locality in Mono County reported in Robertson (2003). Two historic specimens were collected in 1932 by H. E. Parks from Camp Kearny Mesa near Miramar, north of San Diego (CNALH 2020), but have not been re-collected since. In a biological soil crust community in the La Panza Range we found the white clumps of *Psora pruinosa* standing out among yellow *Acarospora schleicheri* and dark mounds of *Clavascidium lacinulatum* and *Psora pacifica*. Aside from its dense white pruina, *Psora pruinosa* is differentiated from other species in the genus by the presence of pannarin, which produces orange needle-like crystals when in contact with the reagent *para*-phenylenediamine (P) (Figure 5). This collection will be deposited in the R.F. Hoover Herbarium (OBI) at California Polytechnic State University, San Luis Obispo. *Reported by Jason Dart*.

Figure 5. *Psora pruinosa*. From top to bottom: habit; Pannarin crystals in P at 400x.

Texosporium sancti-jacobi (Tuck.) Nádv. – San Luis Obispo County: Los Padres National Forest, La Panza Range, on rocky red clay soil in a biological crust community, *JD 1159*; Santa Barbara County, Burton Mesa area of Lompoc, on dead wood lying in sand in opening of maritime chaparral, *JD 793.2*. A lichen with a very distinctive look and habit, *Texosporium sancti-jacobi* is also considered rare in California (Bratt 2002, McCune & Rosentreter 1992). It is included on the list of Special Vascular Plants, Bryophytes, and Lichens published by the California Department of Fish and Wildlife (January 2020). It is a terricolous lichen occurring in biological soil crust communities where it grows on old rabbit pellets, mosses, detritus, soil, and rarely old wood. *Texosporium sancti-jacobi* has an immediately recognizable green spore mass with a bright yellow collar (Figure 6) and should be on the "must see" list of anyone who loves lichens. *Reported by Jason Dart*.

Figure 6. *Texosporium sancti-jacobi*. From top to bottom: habit on wood in Santa Barbara County; San Luis Obispo County on soil.

Strangospora moriformis (Ach.) Stein – San Luis Obispo County: Salinas Valley at Atascadero, on old fence boards, *JD 725* (OBI); La Panza Range, on dead branch of *Pinus sabiniana*, *JD 1525*. This is an obscure crustose lichen that occurs on wood and bark, where tiny black convex apothecia form with little or no visible thallus, making it difficult to see. It often occurs with other tiny species including *Buellia* and *Lecanora*. When mounted in water, the apothecial section shows a distinctive and beautiful blue epihymenium and saccate asci with hundreds of tiny globose spores (Figure 7). *Strangospora moriformis* has a broad North American distribution, with scattered records on east and west coasts as well as the Midwest and Canada. In California it occurs south of the Bay Area, primarily between Los Angeles and San Diego. These two specimens are the first reported for San Luis Obispo County (CNALH 2020). Although specimen records and published reports of the species are uncommon, the species is likely overlooked by collectors and may be much more common. *Reported by Jason Dart*.

"***Aspicilia desertorum***" group – Monterey County: Cholame Hills near Parkfield, boulder field in semi-arid annual grassland, on siliceous rock, *JD 561* (Det. J. Hollinger 2018). This unique collection represents a sorediate form of a widely distributed and common species complex referred to here as "*Aspicilia desertorum*" group. Taxonomy of this group is still a work in progress, and numerous taxa are expected throughout the North American range. Although a number of fertile lichen species occasionally have sorediate forms, this characteristic apparently has not previously been reported in the literature for this group. In our specimen, soredia were abundantly

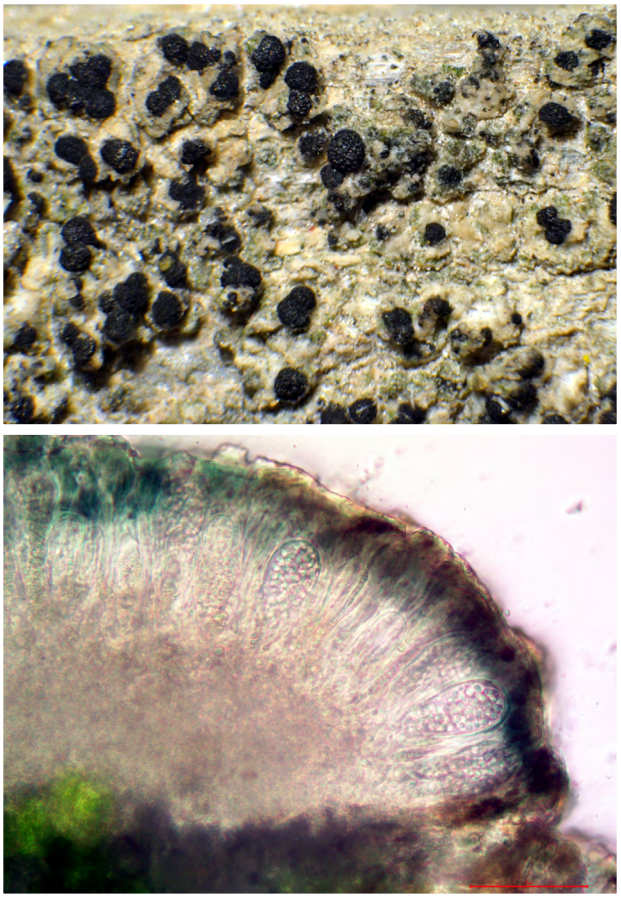

Figure 7. *Strangospora moriformis*. From top to bottom: habit; apothecial section in water at 400x.

produced on the thallus. Apothecia were rare, with a thin white rim and pruinose disks (Figure 8). The asci contained two large spores each. Spot tests were negative. This group occurs commonly in drier regions of Southern California, extending north to near the Bay Area. *Reported by Jason Dart*.

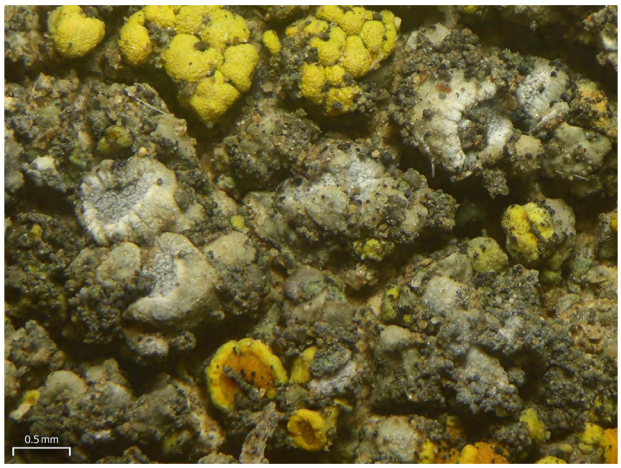

Figure 8. *"Aspicilia desertorum"* group, showing apothecia and soredia. Photo by JH.

Candelariella antennaria Räsänen – San Luis Obispo County: Paso Robles, on old wood fence boards in rural ranchlands, *JD 1188* (OBI). First reported in California by Westberg (2007) in Ventura County, later discussed by Tucker (2009) in a CALS Bulletin for New Reports and Comments on California Lichens, *Candelariella antennaria* continues to be rarely documented in the state. Tucker (2010) collected it at the Santa Barbara Botanic Gardens, and

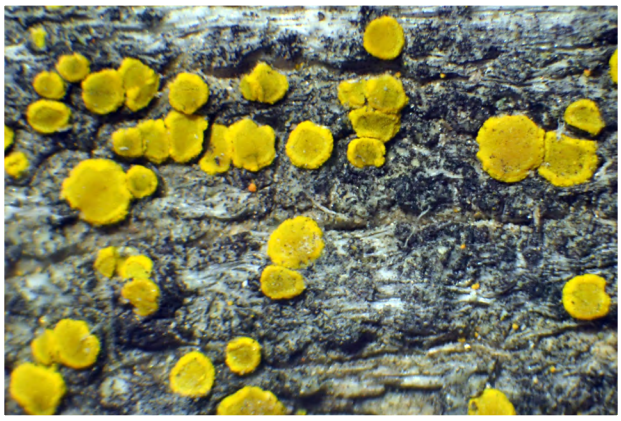

Figure 9. *Candelariella antennaria*. Habit.

specimen records show occurrences in Mono, Lassen, and Mendocino Counties (CNALH 2020). This small but handsome species is characterized by a thin grey thallus on wood or bark, lecanorine apothecia with 8-spored asci, and spores narrowly ellipsoid to oblong (Figure 9). In the field it could easily be confused with other common *Candelariella* species, which may suggest that it is overlooked by collectors in California. *Reported by Jason Dart*.

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News and Notes

Three West Coast endemic *Ramalina* are closely related

A few years ago, Shelly Benson kindly sent me fresh specimens of *Ramalina leptocarpha* and *R. subleptocarpha* from Petaluma, California, for DNA extraction. At the time, I was gathering more data for what had started—way back in 1995—as Chapter 3 of my dissertation (LaGreca 1997): a preliminary molecular phylogeny for the genus *Ramalina*. My taxon sampling is biased towards North America, and I was very keen to include all common North American *Ramalina* species Previous to this, DNA sequences of *R. subleptocarpha* were unavailable—the ones I obtained from Shelly's specimens are the first.

Lichenologists have had great trouble reconstructing a molecular phylogeny for *Ramalina* because, for the genetic loci sequenced so far, the internal branches are short and lack support. This is probably due to an early adaptive radiation event—i.e., the rapid evolution of many species from a single common ancestor. I haven't had much luck untangling this; Shelly's specimens, however, provided me with more detail in the basal portions of my phylogeny (Figure 1). Although most internal branches of my phylogeny remain unresolved, what **is** clear is that large, strap-shaped *Ramalina* species that lack medullary secondary products evolved first, and smaller species that produce secondary products evolved later (i.e., they are "derived"). Among the former group (Clades K, L, M and N in Figure 1), three west coast endemics—*R. leptocarpha*, *R. menziesii* (California's State Lichen!), and *R. subleptocarpha*—share a common ancestor (Clade L). In addition, two of them, *R. leptocarpha* and *R. subleptocarpha*, appear to be very closely related.

Ramalina leptocarpha and *R. subleptocarpha* are a classic lichen "species pair", the former being exclusively sexual and the latter reproducing only by soredia. Species pairs have been a popular subject for molecular phylogenetic studies of lichens, with many workers concluding they are merely populations of the same species; more extensive sampling will be needed to adequately address whether this is the case here. Gathering more data and resolving the relationships of this species pair would certainly make an excellent research project for a budding lichenology student.

[Results presented here are from my upcoming publication, currently "in press" in The Lichenologist: LaGreca, S., Lumbsch, H.T., Kukwa, M., Wei, X., Han, J.E., Moon, K.H., Kashiwadani, H., Aptroot, A. & S.D. Leavitt. 2020. A molecular phylogenetic evaluation of the *Ramalina siliquosa* complex, with notes on species circumscription and relationships within *Ramalina*.]

—Scott LaGreca, Duke University, Durham NC

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LaGreca, S.A. 1997. The systematics and evolution of the lichen genus *Ramalina* with an emphasis on the *R. americana* chemotype complex. Ph.D. thesis, Duke University.

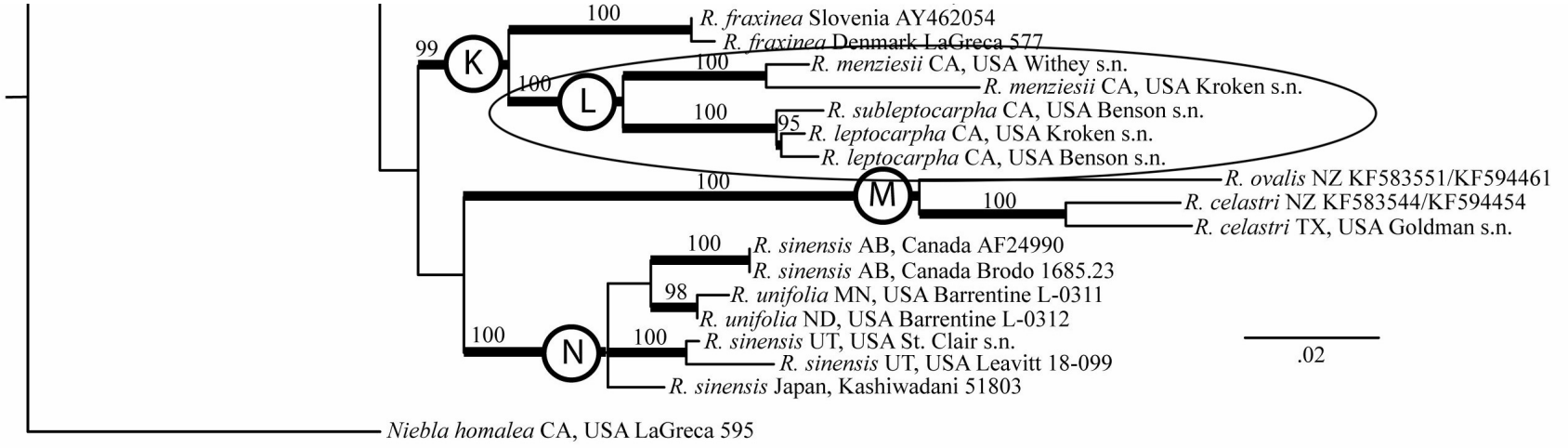

Figure 1. Phylogenetic relationships within the genus *Ramalina* based on a maximum-likelihood analysis of concatenated ITS, IGS, RPB1 and RPB2 sequences. Bootstrap values ≥75% are given above the internodes; these branches are depicted with thickened lines. Clades marked with letters are discussed in the text. A molecular clock has not been calibrated to the tree; scale at bottom gives the nucleotide substitution rate.

Ramalina subleptocarpha *Ramalina leptocarpha* *Ramalina menziesii*

JJ JOHNSON, CC BY-NC (FROM INATURALIST.ORG).

The three monophyletic west coast endemic *Ramalina* in-situ.

Charismatic Microflora at Zzyzx

In late February 2020, about 30 people made a journey to the remote Desert Studies Center (DSC), operated by a consortium of universities in the California State University system and located in the Mojave National Preserve, near Zzyzx, California. Some had a short 3-hour trip; others needed to drive for days, or use an airport. The draw was a Jepson Herbarium-sponsored workshop on biological soil crusts (BSCs), an intimate association of cyanobacteria, algae, microfungi, lichens and bryophytes that live within or on top of the uppermost few millimeters of soils. In the absence of plant cover, BSCs bind soil particles, increasing resistance to wind and water erosion; in the presence of heavy plant cover, they are outcompeted. Soil crusts fix carbon and increase availability of phosphorus. Most BSCs include cyanobacteria that are able to fix nitrogen, providing nutrients in otherwise nutrient-poor soils.

The DSC is a remarkable place, situated on the western shore of Soda Dry Lake. The entry drive is patchily lined with remarkable old-growth palm trees. The springs in the area have been a water stop for humans long before the arrival of Europeans, and have a long history since then. The buildings that now support education and research began as the Zzyzx Mineral Springs resort, established in 1944. The facility was built for desert conditions, and the older buildings including the residences are stone and cinderblock with concrete floors, and shaded exterior walkways that channel cooling breezes. The Zzyzx Pond is a refreshing place to rest your eyes.

But I digress. The first day of the workshop was designed as an introduction to lichens and mosses of BSCs, taxonomic groups with which many in the workshop had only a passing familiarity. After a lichen powerpoint by Tom Carlberg and a moss presentation by Mandy Slate, we headed out to some limestone hills behind the administration buildings. I was very excited, as limestone is not common in my area. However I had not realized what a dry place the Mojave is, and I found the lichen species diversity on soil to be low, and the total abundance likewise. Individuals of the genera common in the area (*Collema, Enchylium, Heppia*) were much smaller than I was used to. I was already learning...

USED WITH PERMISSION

TOM CARLBERG

Top: The Desert Studies Center (DSC) in the Mojave National Preserve, near Zzyzx, California.
Bottom: the Zzyzx Pond.

The second and third days were occupied with presentations on reproductive biology, population genetics, the microbiome, and evolution (courtesy of Kirsten Fischer); poikilohydry and desiccation tolerance with the knowledgeable Brent Mishler; and Matt Bowker's presentations on cyanobacteria, ecosystem function, and restoration of biocrusts using material from the greenhouse-scale "bryotron" developed in the Bowker lab.

Field trips were interspersed throughout. We learned (and saw) that filamentous sheathed cyanobacteria are the first colonizers of new soils; that rugosity of the soil surface (flat, rugose, pinnacled and rolling) is a function of moisture and temperature; that BSC organisms survive in habitats that are completely dry at times; that some crusts are *physical* crusts, not biocrusts, and result from rain and disturbance; and I

was shocked to learn that the dryland habitats favored by BSCs cover approximately 40% of the earth's surface. They also typically have very low resistance to disturbance.

You can imagine how intensive this workshop was, and the amount of information presented was challenging. But I would do it all again, if the opportunity arises. If you are interested, here are a couple online publications for your perusal:

Rosentreter, R., M. Bowker, and J. Belnap. 2007. A Field Guide to Biological Soil Crusts of Western U.S. Drylands. U.S. Government Printing Office, Denver, Colorado. https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/s3fs-public/atoms/files/Biocrust of Western US Field Guide.pdf

Belnap, J. *et al.* 2001. Biological Soil Crusts: Ecology and Management. USDI, BLM and USGS. Technical Reference 1730-2. http://people.oregonstate.edu/~reuterr/NCSJC/docs/Biological Soil Crusts-Ecology and Management.pdf

—Tom Carlberg

USED WITH PERMISSION

Workshop participants look for biological soil crusts (BSCs) in the limestone hills at the Desert Studies Center.

Local Spinning Guild Dyes Yarn with Lichen Dyes

In January, members of the Treadles to Threads Spinning Guild gathered together in Lafayette to dye wool yarn with dyes they extracted from lichen. Lichen were responsibly sourced from Northern California and Oregon including *Evernia prunastri* (Oakmoss), *Flavopunctelia* sp. (Speckled Greenshield Lichen), *Letharia vulpina* (Wolf Lichen), *Lobaria pulmonaria* (Lungwort), and *Usnea* sp. (Old Man's Beard). Two different extraction methods were used to obtain dye from the lichen. The boiling water method was used for all lichen and simply entails boiling several handfuls of lichen in water for about one hour, then straining the mixture to remove the organic material. The ammonia extraction method was used for *Evernia* and *Flavopunctelia*. Each lichen was soaked in a solution of 1 part household ammonia per 1 part water for 4 to 10 weeks. The mixture of lichen and ammonia was aerated by stirring vigorously the first few days and then every few days during the process. The ammonia method produced a dye extract that changed from gray green at the time of mixing to a brown red and then burgundy red and finally grape juice purple after several weeks. Only a small amount of ammonia extracted dye was necessary to dye the wool and no mordant is necessary. The dye extracted by the boiling water method was used undiluted or diluted to give a lighter shade. Iron was added to some dye baths to darken the color to a rich tone. Yarn and dye were heated together for about one hour and left to cool overnight.

Inspiration for the dye day came from Alissa Allen's article, Getting Started with Lichen Dyes, in FUNGI Volume 7:2-3 Summer 2014 and from the books Lichen Dyes: The New Source Book (2011) by K.D. Casselman, and the book Natural Dyes, Sources, Tradition, Technology and Science by Dominique Cardon (2007).

Treadles to Threads Spinning Guild has been gathering as a group for over twenty years. We meet at the Thurman G. Casey Library in Walnut Creek, CA once a month and we have a fiber festival called Spinning at the Winery at Reltzlaff Winery in Livermore, CA every year. We are an informal but active guild that welcomes new and experienced spinners, as well as those who want to learn to spin yarn. In addition to the monthly meetings, we meet every Monday afternoon at members' homes for spinning and tea. This is a great way for beginning spinners to get help. Please feel free check out our blog at http://treadles2threads.blogspot.com

—W. Lacy

Mini skeins of sock weight wool yarn dyed with lichen dyes. From left to right, 1. *Evernia prunastri* (H2O extraction), 2-3. *Lobaria pulmonaria* (H2O extraction) , 4-6. *Flavopunctelia* sp. +/- iron (H2O extraction), 7-10. *Flavopunctelia* sp. (ammonia extraction), 11-15. *Letharia vulpina* +/- iron (H2O extraction), 16-17 *Usnea spp.* (H2O extraction).

Upcoming Events

Lichen Foray in the Dangermond Preserve
Santa Barbara County, autumn 2020 (tentative)

CALS is working with The Nature Conservancy (TNC) to plan a members-only lichen foray to "the last perfect place", the Jack and Laura Dangermond Preserve in Santa Barbara County. The trip is tentatively scheduled for autumn 2020, and dates will be confirmed as CALS and TNC work to ensure COVID-19 restrictions are lifted and safety measures are in place. The Jack and Laura Dangermond Preserve was established in 2017, protecting approximately 24,000 acres of wildlands at Point Conception, nestled between Vandenberg Air Force Base to the north and Hollister Ranch to the south. It encompasses over 8 miles of shoreline with rocky sheer cliffs, tidepools, and sandy beaches, 5,000 acres of grasslands, 6,000 acres of oak woodlands, and 9,300 acres of chaparral and scrublands. With elevations ranging from sea level to 1,900 feet, the Preserve contains primarily sandstones and shales, with numerous areas of exposed bedrock formations. The vegetation communities comprise over 650 species of vascular plants. However, the lichen flora of the Preserve is poorly known. A preliminary inspection in 2019 compiled a list of about 70 species, with hints of exciting discoveries. This 2020 trip will seek to document the flora by creating a baseline inventory and curated specimen set of all taxa found on the Preserve. More information on the Dangermond Preserve can be found at https://storymaps.esri.com/stories/2018/dangermond-preserve/index.html.

Eagle Hill Institute Weekend Workshop: Macro- and Microlichens
Led by Fred Olday
Steuben, Maine, October 23-25

From the Eagle Hill Institute flyer: "The structure, life history, and ecology of lichens will be covered in formal lectures and discussions. Field trips to a variety of habitats will introduce these organisms in their natural settings where students will be taught to recognize common lichen genera, describe their macro and microhabitat preferences, and learn basic collection techniques. Lab work will focus on the identification of representative lichens and the identification and curation of student collections. The goal of the seminar is to provide participants with the confidence, basic knowledge, and skill to pursue further study of lichens on their own. No prior experience in identifying lichens is assumed. This introductory workshop is designed for undergraduates in the biological sciences, people involved in natural history inventory work and interpretation, and for teachers or anyone whose appreciation of the outdoors has ever excited their curiosity about these unique organisms. The seminar will also provide a solid foundation for those contemplating more advanced coursework."

CALS Grants Committee report for the 2019 grant cycle

Hello everybody! Let me first introduce myself. My name is Rikke Reese Næsborg and I am both the new CALS Grants Chair and the Tucker Lichenologist at the Santa Barbara Botanic Garden.

This year, we received only one grant application, which requested $1,000. This is disappointing, and it suggests that we could have better motivated CA lichenology this past grant cycle. Perhaps not enough students were starting lichen projects last year, or maybe I did not sufficiently disseminate the call. Whatever the reason, I plan to distribute the call for applications more broadly next cycle, and I hope that you all will help spread the word.

The one application we did receive is an ambitious and well thought out project that has great potential to broaden our understanding of the edaphic effects on species distributions. The applicant requested only $1,000 even though he estimated the total costs to amount to $1,400. The CALS Board decided to grant the full $1,400 since no one else had applied.

I am happy to see lichenology moving forward with ambitious projects from a new generation of students, and I hope this trend will continue.

JASON DART

2019 CALS grant recipient Michael Mulroy surveys saxicolous lichen communities at Jade Cove in Monterey County.

A quantitative comparison of saxicolous lichen communities on serpentine and sandstone along a coast-inland gradient in Central California

Principal investigator: Michael Mulroy

Graduate Student, Biological Sciences Department, California Polytechnic State University, San Luis Obispo, CA 93407

Funding provided: $1,400.00

Summary: We plan to carry out a comparative qualitative and quantitative analysis of saxicolous lichen communities on serpentinite and sandstone rocks across a large-scale (~65 km) coast-inland environmental gradient of decreasing maritime influence. Lichen communities on both rock types will be sampled in three zones along the gradient. Quadrat sampling will be conducted in conjunction with a lichen inventory for each zone. We hypothesize that 1) maritime influence will cause lichen communities to be more species-rich and diverse closer to the coast, and 2) serpentinite and sandstone communities will be more similar in the coastal zone than the interior due to maritime influences overriding substrate-level effects.

This study aims to 1) improve understanding of maritime influence on saxicolous lichen community composition; 2) elucidate the role of substrate characteristics, including rock chemistry and surface texture, on lichen communities; 3) better understand lichen species distributions in Central California; and 4) develop a repeatable, quantitative method of measuring rock surface texture as it relates to lichen habitat suitability.

California Lichen Society Grants Program

The California Lichen Society offers small grants to support research pertaining to the lichens of California. No geographical constraints are placed on grantees or their associated institutions, but grantees must be members in good standing of the California Lichen Society. The Grants Committee administers the grants program, with grants awarded to an individual only once during the duration of a project. Grant proposals should be brief and concise.

Grant 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 *Bulletin of the California Lichen Society*, based on the results of your work.
- Budget. Summarize intended use of funds. If you received or expect to receive other grants or 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 capital equipment or high-end items such as computers, software, machinery, or for clothing.
- Academic status (if any). 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.
- Two letters of support from sponsors, academic supervisors, major professors, professional associates or colleagues should be part of your application. These should be submitted directly from the author to the committee Chair.
- Your signature, as the person performing the project and the one responsible for dispersing the funds. All of the information related to your application may be submitted electronically.

Review: Members of the Grants Committee conduct anonymous evaluation of grant proposals once a year based on completeness, technical quality, consistency with CALS goals, intended use of funds, and likelihood of completion. Grant proposals received by November 1 each year will be considered for that year's grant cycle. The Grants Committee brings its recommendations for funding to the Board of Directors of the California Lichen Society, which has final say regarding approval or denial.

Grant Amounts: CALS normally offers two grants of $750.00 and $1000.00 each year. Typically grants are awarded to two separate individuals, however depending on the quality of the applications and the amount of funding available, the committee maintains the option to disburse funds as appropriate. All grants are partially dependent on member contributions, therefore the amounts of these awards 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 an article to the *Bulletin of the California Lichen Society*. 3) Submit any relevant rare lichen data to California Natural Diversity Data Base using NDDB's field survey forms. See *http://californialichens.org/conservation* for additional information.

How to submit an application: Please email submissions or questions to the committee Chair at grants@californialichens.org by **November 1, 2020.** The current Chair is Rikke Reese Naesborg.

CALS 2020 Annual Meeting at the Hastings Natural History Reserve

Tom Carlberg
tcarlberg7@yahoo.com

JESSE MILLER

Ramalina menziesii in full glory.

Here's how CALS' 26th annual meeting went at Hastings Natural History Reservation in Monterey County. Our 26th birthday party was another success story, as have all the others. These really are unique events; the option of making it an overnight event (or *two* overnights!) seems to create an atmosphere of camaraderie and bonding, with plenty of opportunity and time for personal explorations. If you have not attended, I strongly encourage you to give it a try next year! Accommodations are sometimes luxurious, sometimes spartan, but the experience (based on our member's responses) is always unique.

Hastings, a part of the UC Natural Reserve System, is located in the Sierra de Salinas, on the northerly end of the Santa Lucia Range that makes up the Big Sur Wilderness of central coastal California. Located within the Carmel River watershed, Hastings includes the confluence of three seasonal creeks that feed into Finch Creek, and then the Carmel River. It contains excellent examples of habitats characteristic of the interior central Coast Range. Reservation ecosystems include annual and perennial grasslands, oak woodlands, chaparral, running streams, and also includes some rare flora, both vascular and non-vascular. Its landscape is unique, given that it has not been used for grazing in over 70 years. The land, along with many buildings built between the 1860s and 1950s, was donated by its namesake, the Hastings family.

The Reservation enjoys a moderate California climate with late summer temperatures reaching over 100°F and occasional winter snowfall. Steep south-facing slopes are covered by hard chaparral. Southeast and southwest-facing aspects support a mix of blue oak and scattered native savanna. North-facing ridges support dense mixed woodlands of live oak, poison

oak, madrone, cherry and buckeye. Riparian forests are dominated by valley oak, coast live oak and willow with sycamore. Deep in the recesses of these wetter lowlands are alder and maple trees.

This year, instead of lichen species lists and descriptions of hydrology and geology, CALS has chosen instead to enlist our members' support by asking for their impressions and experiences from this 26th annual meeting. No constraints were placed on their writing, with edits applied only to length. We received enthusiastic responses! So without further ado, here's what our members had to say about the event, presented in the order they were received...

Michael Mulroy had this to say: What a lovely CALS meeting! I will remember this year's meeting for my frantic attempts to sponge lichen knowledge (bring a fresh notebook next time dude!), a delightful, serendipitous morning bird walk (bird enthusiasts unite!), two lichen walks that might actually qualify as hikes (what!?), and lastly for a clarifying conversation about fog (there's a better pun to be had here…). All in an all-too-short 24 hours.

As someone new to the lichen world, though, the best part of this event was recognizing familiar faces. The community of lichen enthusiasts is small, very stoked, and full of wonderful people. I tip my hat to the folks at Hastings, our wonderful event organizers, and those who contributed to the inviting, fun atmosphere, which was everyone. Looking forward to the next one.

Krissa Klein told us: On my long drive heading to the meeting, I was beset by a sudden bout of impostor syndrome. As a relative newcomer to the world of lichens, what did I really have to offer?

These doubts were quickly dispelled upon my arrival. The thing that will always impress me the most about the Lichen Society attendees is the sheer breadth of interests and knowledge on display at every meeting. Lichens are certainly the focus, but everything else comes a close second, as shown by the number of people enticed into getting out of bed an hour early on Saturday by the promise of viewing the testicles of a road-killed skunk! Nearly every person there had other areas of interest as well, which meant that we all had something of value to offer, regardless of our "normal" jobs.

I went with the hope of learning more about lichens, which I most certainly did. But I had just as much fun staking out the late-night moth sheets, hunting millipedes by UV light, turning over logs in search of rare snails, and finding colonies of turret spiders. Since lichens themselves are a symbiotic mixture of several entirely different kingdoms, it seems quite appropriate that a gathering celebrating them should have such a delightfully symbiotic mixing of ideas and knowledge. I can't wait to find out what I will learn at the next one!

JESSE MILLER

Tentatively, *Xystocheir dissecta*.

This from ***Jennifer Rycenga***: Lichenologists are a curious bunch – they are curious about everything. It is, I think, that interest in something small and obscure itself – lichens – that imbues their personalities with a sense of wonder and urge to investigate. On Friday night, it was moths. On Saturday morning, a successful early-morning bird walk, then we returned to the barn to gawk with unrestrained curiosity over the carcasses of bobcats and skunks that Jen Hunter (Director of the Reservation) shared. As we moved into the afternoon, the group I traveled with chose an area of multiple habitats, and, true to lichenologist form, made slight headway (while avoiding anything aerobic), stopping at every bush and twig. Everyone loved learning in

the field from Jes Coyle, the evening's speaker, as she showed us examples of *Unguiculariopsis lettaui,* one of the lichenicolous fungi she studies.

Some folks wandered off, others clumped together, but I took a truly wayward path along a borderline of coyote brush. Then I saw a remarkable rock: my curiosity had hit Pay Dirt (which dirt ended up on my elbow!). I am too much the beginner to be doing chem testing, let alone microscopy and DNA sequencing yet (I am but a lowly Humanities professor, not a scientist). But oh! these rocks thriving with life in splendiferous diversity — this is what I love most about lichens!

PEGGY MACRES

Jennifer Rycenga and a remarkable rock.

From ***Allie Weill*** : When my travel buddy and I arrived at Hastings in the dark around 9 or 10, all the lights were on in the Schoolhouse, and inside we found friendly faces — some familiar, some new, some that you weren't sure whether you'd actually met before or not but it seemed like you had. I often describe the lichen community (the human one) as "the world's most welcoming secret club." It's not really a secret, of course, but you feel like you know something special most people don't know. And everyone there is excited to have you, to patiently tell you what they know, to share their enthusiasm for the simultaneous loveliness and weirdness of lichens.

On Friday, I asked for tips for a lichen class I was about to start teaching — I soon had more ideas for field trip locations than I knew what to do with. My group traipsed up the hill, pausing every so often to peer at lichens on rocks, faces down & butts up, or to put our noses to the bark of a blue oak. We lounged in the shade of an oak as we ate lunch. In the evening, we feasted on potluck foods and the annual birthday cake, mused on lichen reproduction following Jes Coyle's talk. Later, several of us pulled out our instruments and had a jam session, strategically inserting the word "lichens" into the lyrics of folk tunes.

I'd been all over Hastings twice before, during my dissertation fieldwork. But that was BL: Before Lichens. It's a joke, of course, but also not: it is kind of a wild thing, to not see a whole part of the landscape in front of you, and then learn to see what you'd missed. This year, at Hastings, I not only saw oaks and chamise and ceanothus and rocks but *Evernia, Ramalina, Xanthoparmelia, Caloplaca*.

It's only been a few months, but that weekend feels so far away now. Community and adventure now largely come in virtual forms as we stay at home to keep all of us safe. But I know that we'll be out on lichen forays again, faces down & butts up. For now, I've got *Xanthoria* and some *Physcia* and a little baby *Flavoparmelia* on the tree in front of my house, and I'm so glad I've learned to see them.

JESSE MILLER

Loriel Caverly and Allie Weill, up close and personal.

Jesse Miller had the following thoughts: Since the annual CALS meetings are held in January, field trips take place in low elevation ecosystems — usually oak woodlands. As a landscape ecologist, I always enjoy visiting a new oak landscape, and the Hastings Reserve was one of the best I've seen. The most ecologically striking thing about Hastings was the abundant understory of native bunchgrass (mostly *Stipa pulchra*), a testament to the long-term absence of livestock, and a stark contrast to the intensely grazed landscape at the Dye Creek Preserve, site of the 2017 meeting. I have seen patches of native grassland here and there across the state, but those at Hastings were more extensive than any I've seen.

As any observant naturalist knows, when you've seen one oak woodland, you haven't seen them all. On Friday night, I took out my UV light to look for lichens that fluoresce. I have found this can be a good way to find lichens I might not see in the daytime. Unfortunately, I didn't find any exciting after-dark lichens, but I did find an arthropod, which an entomologist friend tentatively identified as the millipede *Xystocheir dissecta*, shining brightly under my UV lamp. I had never seen UV-fluorescent arthropods before, but there were a number of them among the leaf litter under the oaks. Come for the lichens, and you don't know what else you'll find.

On Saturday I headed up Red Mountain with a group seeking to get deep into the wilds of Hastings. We explored the epiphytes on oaks, pointing out common lichen species to the newcomers among us, and examined lichens growing on huge decorticated oak logs. Eric Peterson was on pin lichen patrol, and pointed out a distinctive pin lichen that he identified as *Calicium tigillare* or *C. brachysporum*. There's really nothing better than a beautiful winter day in the oaks with the excellent company of lichen lovers.

JESSE MILLER

Native bunchgrass as far as the eye can see.

From ***Cat Chang***: The CALS Annual Meeting is one of my favorite field trips. I enjoy spending time with people who I haven't seen since the last meeting and nerding out with new people. Who doesn't love these beautiful organisms that fill a valuable ecological niche? Highlights included discussion of *Letharia vulpina* vs. *L. lupina* (it looks like *L. vulpina* is mostly lower elevation), chats about the developing COVID-19 situation, and exchanging lichen lifers.

Ken Kellman, Lise Peterson and I were strolling down to the gate when they mentioned they wanted to see *Waynea californica*. I said "Oh, that should be easy to find…" and in about 5 minutes, we found it on the bark of the oaks lining the road. I then mentioned that *Normandina pulchella* had been eluding me. Ken said "I always see that!" While they were focused on *W. californica*, I kept looking on the same trunk. And there it was, with its blue-green cloud ear shapes. Later in the day I was able to share it with Krissa Klein and RJ Adams who both oohed and aahed appropriately.

Next steps for CALS? I'd love to connect to more Central Coast and Southern California lichen peeps. Lichen Zoom Happy Hours? And if anyone in my area wants to see *Waynea* or *Normandina*, I am always down for it once the SIP is lifted. Stay healthy all!

JESSE MILLER

Ken Kellman's curiosity.

And finally, from ***Bob Siegel***: I do appreciate lichens – they stay very still when I try to take their pictures! There are two main things that draw me to these meetings: the people and the settings. Lichens may be the focus, but everything seems to be fair game — birds, reptiles, plants, slime molds, insects. Lichenophiles move really slowly. These are my kind of people! If I stop to take a picture (by which I mean dozens of pictures), I know they will still be just a few feet up the trail by the time I am done. Everyone seemed no less enamored with food; the Saturday night potluck was a gustatory orgy. And since I am paying homage, I would like to give shout outs to Jennifer Hunter, our Hastings host and skunk aficionado; guest speaker Jes Coyle; Krissa Klein, aka Graysquirrel and Cat Chang, aka catchang, both known previously to me only by their ubiquitous presence on iNaturalist; Kathy Faircloth, who showed me lots of interesting things to photograph, waited patiently while I harvested some lions mane, and connected me with MexMush; Peggy Macres and Jennifer Rycenga, who kept me constantly enlightened and entertained; roommate Ted Robertson; and JJ Johnson, who got me involved with CALS in the first place.

JENNIFER RYCENGA

Games Bob Siegel plays in the dark!

This year's meeting included time at Hastings Reservation and Laguna Seca. Both places are gems. We avoided getting drenched, but prior storms resulted in abundant mushrooms and slime molds and birds that thought it was spring (in January!). In retrospect, the timing seems even more fortuitous in terms of avoiding a "February seca" and the lockdown of March. At Hastings, I headed off to the enticingly named Poison Oak trail. It was well named, especially in areas where blocked by fallen trees. After spotting evidence of feral pigs, I turned a corner to encounter a group of them. Though alert to the potential danger, I was fortunate in that they thought I was scarier than I knew they were. It was an amazing celebration of people and nature, and I am very much looking forward to future editions.

JESSE MILLER

Another remarkable rock. From left to right: Allie Weill, RJ Adams, Parke Lewis-Deweese, Eric Peterson, Dena Paolilli, Loriel Caverly, and further uphill, Juniper Peterson.

President's Message

Dear CALS members –

What a different world we live in now. I don't need to go into details; each and all of you know what I am talking about, and I can only hope that this issue finds all of you and your families well and healthy.

Shelter-in-place already seems to have been around forever, and I seem to have forgotten how lucky I was to have made three lichen trips in the early months of 2020. First (and foremost, of course!) was our 26th annual meeting, held this year at Hastings Natural History Reservation in Monterey County. As always, it was a great success; for evidence of this, see the meeting report in this issue. Many enthusiastic members contributed, and my grateful thanks go out to **Michael Mulroy, Krissa Klein, Jennifer Rycenga, Allie Weill, Jesse Miller, Cat Chang,** and **Bob Siegel** for taking the time to record their experiences and insights.

A month later I presented at a 3-day soil crust workshop at the Desert Studies Center in the Mojave National Preserve, near Zzyzx. Too bad about the low species diversity of soil lichens (the Mojave is a dry desert), but the setting was phenomenal. After that I was back at Dye Creek Preserve, working on more soil crusts. Just in time to return home and *stay* home for the next two months. For the sake of teaching about lichens, I hope we will soon figure out ways to meet in groups without compromising the integrity of our health.

Perhaps this will happen in time for a proposed members-only outing to the Dangermond Preserve in Southern California? The suggested window (autumn 2020) is very tentative at present, with no hard dates, but it will certainly be a wonderful trip, spanning multiple days on this rarely-visited The Nature Conservancy property. Subject of course to the health of the many...

But judging from the contents of this Bulletin, interest in California lichens is continuing apace; there's an article on lichen dying; the *New and Interesting* section has many exciting reports for you to enjoy, there is news about three species of *Ramalina* from coastal California, additional news about an overlooked and charismatic small crustose lichen, the City Nature Challenges demonstrate that *anyone* can make contributions (yes, this means *you*), and **Kerry Knudsen** is (as always) challenging our understanding of Acarosporaceae.

Speaking of *New and Interesting*, it might interest you to know that the invitation to submit accounts of unusual lichen encounters for this issue was so overwhelming that we decided to split the submissions and continue the feature in this winter's Bulletin. While it may seem daunting to read these accounts, the *N&I* section is also intended to accommodate things that *you* find interesting or new. I think if you gave it a shot, you would find that others share your thoughts on what's interesting.

This fall we are having elections for the CALS Board of Directors. In a few months we will be contacting all of you via email, and including links to use for voting, including an option for write-in candidates. At our last election, we had a very strong voter turnout; we hope to repeat that this fall.

Keep an eye on your inbox for more info!
Tom

Tom Carlberg
President@californialichens.org

JOE FLYNN

The nitty-gritty reality of working with soil crusts. ZZyzx 2020.

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.

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Lichen observations from the seven California urban areas that participated in the 2020 City Nature Challenge

See article on pg. 8 of this issue. iNaturalist observation numbers are: Sacramento (43340316), San Francisco Bay Area (44636382), Inland Empire (44148118), Los Angeles County (44014359), Mendocino County (43238815), Orange County (43540564), San Diego County (44219667). Visit inaturalist.org/observations/[insert observation number] to see individual observations and help with their identification.

SACRAMENTO

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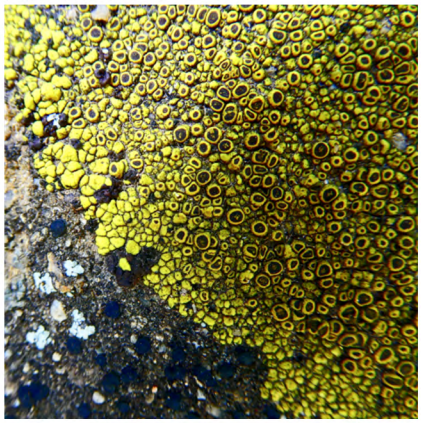
LOS ANGELES



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