

Lichens of the Rancho Marino and Los Osos Oaks Reserves, San Luis Obispo County, California

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ABSTRACT

Several California Lichen Society members and friends explored the lichen communities of coastal San Luis Obispo County, California, on a foray in March, 2018. Lichen observations were focused on two areas: the University of California Kenneth Norris Rancho Marino Reserve in Cambria, California, and the Los Osos Oaks State Natural Reserve near Morro Bay, California. Coastal San Luis Obispo County represents an important region for lichen conservation because it contains diverse lichen communities with a number of rare species, and remnants of lichen habitats that have been fragmented by urban development. This foray highlights the conservation value of numerous coastal habitats for lichen diversity. Coastal chaparral, hypermaritime rocky shorelines, and undisturbed vegetated dune systems in particular host a notable number of rare and endemic lichen species.

INTRODUCTION

California's central and south coast provides habitat for diverse lichen communities, including a number of rare species (Carlberg & Knudsen 2007, Hasse 1916, Herre 1907, Knudsen & Kocourková 2011, Knudsen & Lendemer 2006, 2007). Numerous coastal southern California lichens are considered species of conservation concern (i.e. *Sulcaria spiralifera*, *Graphis*

saxorum, *Mobergia calculiformis*; California Native Plant Society 2018) in part because urban development has caused extensive fragmentation of natural habitats (e.g., McCune and Schoch 2009). Further, shrublands that provide some of the most important lichen habitat in southern California are sensitive to wildfire, and increases in fire frequencies in California threaten lichen populations (Knudsen and Magney 2006, Miller et al. 2018). Despite these concerns, the diversity and distributions of lichen communities on the south-central coast remain incompletely understood, and further research to document species ranges and population vigor is needed.



Figure 1. Coastal sage scrub habitat at the Rancho Marino Reserve.

Several California Lichen Society members and friends explored the lichen communities of coastal San Luis Obispo County, California, on a foray in March, 2018. Lichen observations were focused on two areas: the University of California Ken Norris Rancho Marino Reserve in Cambria, California (hereafter Rancho Marino), and the Los Osos Oaks State Natural Reserve near Morro Bay, California (hereafter Los Osos).

Rancho Marino is a 202 hectare (500 acre) UC Reserve that stretches for two miles southward along the coast from the small town of Cambria, and inland from the coast to the first major ridgeline at 213 meters (700 feet) elevation. The Reserve contains several distinct habitat types, most prominently, from a lichenologist's perspective, Monterey pine (*Pinus radiata*) and live oak (*Quercus agrifolia*) forest, and coastal sage scrub (Figure 1), dominated by California sagebrush (*Artemisia californica*) and poison oak (*Toxicodendron diversilobum*). The reserve also contains a substantial coastal prairie, which is dominated by annual grasses. Old wooden fence posts throughout the preserve provide substrate for a remarkably diverse assortment of lichens (Figure 2), and a number of lichen species were found growing on sandstone in the



Figure 2. Old wooden fence post covered in lichens at the Rancho Marino Reserve.

salt-spray zone on the immediate coast, as well as on low-lying sandstone outcrops on steep slopes in the vicinity of the coastal sage scrub community.



Figure 3. Epiphytic lichens are abundant in the old growth coastal chaparral at the Los Osos Oaks Reserve.

At Los Osos, we primarily explored lichens in a coastal chaparral habitat, a shrubland community that is distinct from coastal sage scrub both in terms of dominant vascular plants and lichen species composition. The old growth coastal chaparral at Los Osos is dominated by buckbrush (*Ceanothus cuneatus*) and chamise (*Adenostoma fasciculatum*). The *Ceanothus* at Los Osos are clearly quite old, with stout stems sometimes taking on an almost arboreal appearance. Lichen biomass is high on the shrubs at Los Osos (Figure 3), and a number of rare and exciting lichen species were encountered (Figure 4).

Below, we present accounts of species of particular interest that were encountered at Rancho Marino and Los Osos (Figure 5 and back cover photos). We also present a full list of species we encountered at Rancho Marino. Since our explorations at Los Osos were limited to a small portion of the Reserve, we do not include a full species list for Los Osos.

INTERESTING SPECIES

Buellia oidalea (Nyl.) Tuck., at Rancho Marino (back cover). This conspicuous, handsome *Buellia* was growing happily all over a few weathered Monterey pine logs on the hillside above the field station. (We found it also on twigs in the chaparral at Los Osos.) It probably wouldn't be considered uncommon, but it does have a very narrow range, confined to the coast from Oregon to Baja. It is a delight to put under the scope, because it has strikingly large muri-form spores (oddly, with somewhat paler tips), densely interspersed hymenium, and a satisfying C+ orange reaction owing to presence of xanthones.

Collemopsidium foveolatum (A. L. Sm.) F. Mohr, at Rancho Marino. Check those barnacles in the tidal zone! Ken and Jason scoured the point near the Rancho Marino field station and found quite a few populations of limpets with tiny pits in their shells. We dutifully pried a few off and brought them back to the lab, but failed to detect any algae. We foolishly concluded that these were unlichenized, perhaps a parasitic Ascomycete similar to *Stigmidium*. But apparently that isn't uncommon with this species, which has such a scant thallus and its perithecia are completely immersed in little pits etched in the host's shell. McCune (2017) has a photo on p. 43.

Heterodermia namaquana Breuss, at Los Osos (Figure 5c). There were quite a number of tiny specimens of this cute little species on twigs in the old growth coastal chaparral at Los Osos. In the field the cilia are conspicuous. It is much more compact and shrubby than the more widespread *H. leucomela* (which is also present at Los Osos). Both species seemed abnormally dwarfed at this location. *H. namaquana* is found only along the coast of southern California, Baja California and South Africa.

Hypogymnia minilobata McCune & Schoch, at Los Osos. What a treat to see this species at its type locality! It is reminiscent of *H. occidentalis*, but like many things in the coastal chaparral, oddly dwarfed. *H. minilobata* is known only from a handful of coastal locations from San Luis Obispo to San Diego. Note especially its abundant gaping perforations at the lobe tips.

Hypogymnia mollis L.H. Pike & Hale, at Los Osos (back cover). This species is characteristic of coastal chaparral in southern California and Baja California. According to McCune (2009) it may be most closely related to *H. minilobata*. However, *H. mollis* has abundant soft laminal soredia (*H. minilobata* has no soredia and is usually fertile instead). It is also a good deal more common. Los Osos is the type locality for this species, where it is common on twigs in coastal chaparral (Pike and Hale, 1982).

Lecanora expallens Ach., at Rancho Marino. This species is fairly rare on the southern California coast. (Judging by google search results, it must be more common in the British Isles.) We found it by the field station - just two small patches on a Monterey cypress (*Hesperocyparis macrocarpa*) twig. Like most rare things, it



Figure 4. Lichen enthusiasts can scarcely restrain themselves from diving into the chaparral at Los Osos upon discovering a population of the rare *Sulcaria isidiifera*.

was, of course, collected by accident! (With an unremarkable specimen of *Buellia punctata* in this case.) It is a thin sorediate crust which produces usnic acid. Because its nonsorediate thallus is endophloedic and the soralia are confluent, it appears to be essentially leprose in the field. It is usually mistaken for a *Lepraria* or *Pyrrhospora quernea*. Chemistry is the only way to reliably identify sterile specimens. In addition to usnic acid, *L. expallens* contains zeorin and the xanthone thiophanic acid (C+ orange). Our specimen gave only a very weak, ambiguous C reaction, so it should be considered tentative until confirmed with thin-layer chromatography.

L. simeonensis K. Knudsen & Lendemer, at Rancho Marino (Figure 5d). There was a thriving fertile population of this on weathered Monterey pine logs on the hillside above the field station. Like *L. expallens* (see above), it is a sorediate, usnic acid-containing *Lecanora*. However this species has a well-developed rimose-areolate thallus, forms capitate soralia and lacks xanthonenes (C-). It was described only recently by Lendemer and Knudsen (2009) from San Simeon State Park just four miles to the north.

Melanelixia subaurifera (Nyl.) O. Blanco et al., at Rancho Marino (Figure 5e). On fence wood at a cattle crossing. A widespread and common brown parmelioid lichen in temperate and boreal regions of the Western Hemisphere, *M. subaurifera* reaches the southwestern limits of its range in Southern California. This is not the most southerly report for this species, but there are very few reports further south in California; from Morro Bay, Hollister Ranch, Santa Barbara, the mountains above Los Angeles, and in Arizona from the Santa Rita Mountains south of Tucson.

Micarea nitschkeana (J. Lahm ex Rabenh.) Harm., at Los Osos (Figure 5f). This was found growing on a twig in the coastal chaparral. It is a tiny button crust, distinguished from the very similar *M. denigrata* by having 3-septate spores instead of 1-septate spores and typically growing on twigs instead of wood (Fryday and Coppins 2007). While very widespread, occurring in Asia, Europe and even Tasmania, this species appears to be rare in coastal California, with only a handful of records from Sonoma County to the Channel Islands. Our specimen was collected accidentally with *Hypogymnia mollis*, so perhaps it is merely overlooked.

Opegrapha sp., at Rancho Marino (Figure 5g and back cover). In California, *Opegrapha* is generally found on trees, so when we found this striking black lirellate lichen growing on sandstone in the spray zone below the field station, we knew it was something interesting. Our specimen has 5-septate spores $15-17 \times 4-5 \mu\text{m}$, often-branched apothecia ca. $1.0 \times 0.3 \text{ mm}$, with slit-like disk and distinctively cracked exciple. The only species known from California with 5-septate spores that size is *O. xerica*, however that species has unbranched apothecia and grows on trees. *O. brattiae* and occasionally *O. herbarum* will grow on rocks, however they both have 3-septate spores (Ertz and Egea 2007). In the British Flora, Pentecost and James (2009) discuss *O. cesareensis*, which looks very similar and grows in the right habitat (the "xeric supralittoral zone"). However, they stress a characteristic lilac tinge in the thallus of their material (ours has entirely endolithic thallus), and photos and descriptions make no mention of the cracked exciple seen in our specimen. This specimen clearly requires further research.

Pachnolepia pruinata (Pers.) Frisch & G. Thor, at Rancho Marino. We found two beautiful spe-

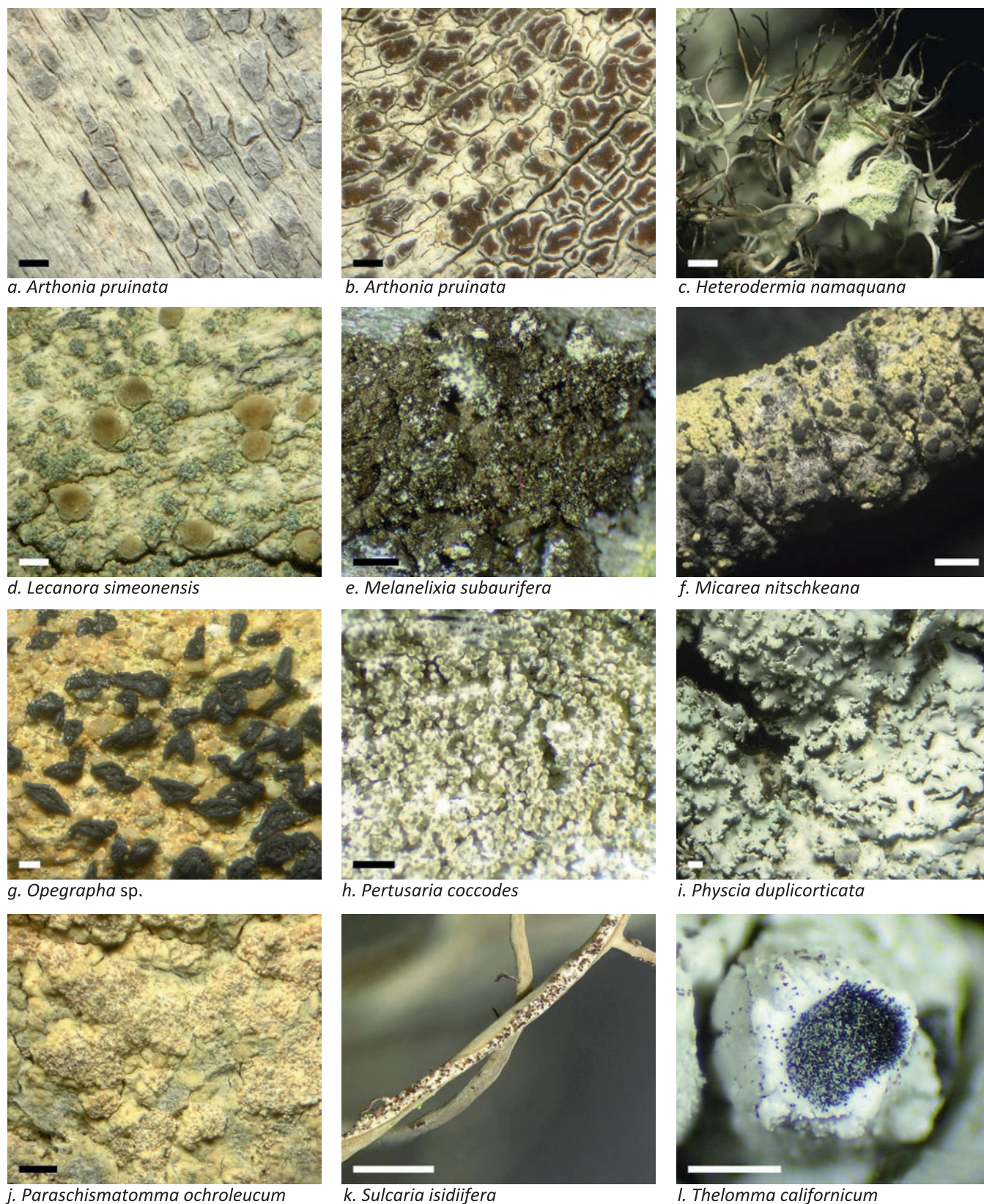


Figure 5. Interesting lichens encountered in coastal San Luis Obispo County, California. All scale bars represent 0.5 mm. All photos by Jason Hollinger, except for e, h, and l by Tom Carlberg.

cimens of this growing on fence posts near the field station that could scarcely have looked more different in the field. One was heavily pruinose with scattered cracked apothecia, the other was epruinose with dense polygonal apothecia. However, both have *Trentepohlia*, are C+ bright red, and have I+ red hymenium and 4-septate, ovoid, $\sim 15 \times 5 \mu\text{m}$ spores. According to Grube (2007), this is the most common species of *Arthonia* sensu lato in the region.

Paraschismatomma ochroleucum (Zahlbr.) K. Knudsen, Ertz & Tehler, at Rancho Marino (back cover). This white, sorediate crust was abundant on Monterey cypress near the sea. It is characterized by the presence of *Trentepohlia* as its photobiont, lecanoric acid (C+ bright red) and verruculose thallus. The soralia are initially discrete, but become confluent in age, eventually essentially covering the entire thallus. The soredia darken from white in the shade to peppered-gray in exposed situations. One of our specimens (Hollinger 19834) was fertile, however no mature spores were seen. Compare with *Schizopelte crustosa* below.

Pertusaria coccodes (Ach.) Nyl., at Rancho Marino (Figure 5h). On wood of a down Monterey pine log in an open field. A rare lichen for California! A diminutive off-white crust whose thallus is barely visible through the forest of brown-tipped isidia which comprises most of what you see in the field. It has 45 synonyms listed in the Consortium of North American Lichen Herbaria (CNALH 2018). This species has an oceanic distribution, and appears most frequently (74% of reported global records) in Norway, Sweden, Denmark, and Germany, but rare in the United States (9% of reported records) and extremely rare in California (1.5%). In northern California it might easily be mistaken for *Loxosporopsis corallifera*

Brodo, Henssen & Imshaug, which has proportionately longer and more cylindrical isidia than *P. coccodes*. The two species also differ chemically and in their responses to UV light; *P. coccodes* is K+ red, UV-, and *L. corallifera* is K-, UV+ off-white. See Tucker (2017) for additional analysis and comparisons.

Physcia duplicorticata Weber & Thomson, at Los Osos (Figure 5i). This was found growing on the leaning bole of a large live oak. This relatively rare coastal California endemic has been discussed recently in the CALS bulletin by Knudsen et al (2016) and Esslinger (2017). It is primarily known from around the Bay Area; it was described by Weber and Thomson (1975) from Point Reyes. Knudsen et al (2016) reported it from the Santa Monica Mountains.

Schizopelte crustosa Ertz & Tehler, at Rancho Marino. We found one specimen of this on Monterey pine bark on the hill above the field station. It is very similar in some ways to *Paraschismatomma ochroleucum*, especially when sorediate. Both have *Trentepohlia*, lecanoric acid (C+ bright red), white thallus, and multi-septate spores. However, *S. crustosa* has shorter, less-septate spores which turn brown in age. When sterile, *S. crustosa* can be distinguished from *P. ochroleucum* by having a smoother (less verruculose) thallus. Both species are endemic to the southern California and Baja California coast.

Sulcaria isidiifera Brodo, at Los Osos (Figure 5k and back cover). This is the crown jewel of Los Osos. This spectacular, narrowly endemic hair lichen is known from only a handful of localities in this region. We thrashed through the dense old growth chaparral for some time looking for it. We were fooled repeatedly by the similar-looking *S. spiralifera* before we finally

stumbled on the type population. Both species grow deep within the shelter of old growth chamise (*Adenostoma*) and mountain mahogany (*Cercocarpus*), often requiring a distinct disregard for clothing and dignity to get a close enough look to check for the characteristic, striking isidia which line the long, twisting pseudocyphellae of *S. isidiifera*. Additionally, *S. isidiifera* tends to be a bit more shrubby, coarser, and perhaps on average paler than *S. spiralifera*. By contrast, *S. spiralifera* tended to have a slightly more reddish tinge and somewhat finer more pendulous branches which matted together a little.

Sulcaria spiralifera (Brodo & D. Hawksw.) Myllys, Velmala & Goward, at Los Osos. At any other site, where not overshadowed by *S. isidiifera*, this species would be a rare and noteworthy find! It is found only in scattered sites along the coast from California to Washington. It is separated from the similar *S. badia* by the presence of norstictic acid (in Los Osos Oaks material; K⁺ yellow turning red and producing abundant needle-shaped crystals in a squash mount) or alectorialic and barbatolic acids (the *Bryoria pseudocapillaris* chemotype) and shorter pseudocyphellae (Myllys et al. 2014). *S. badia* contains only atranorin (K⁺ yellow, KC⁻, P⁻ or very weak, slow yellow).

Thelomma californicum (Tuck.) Tibell, at Rancho Marino (Figure 5l and back cover). On a wood fence post of the eastern boundary fence of Rancho Marino. A not uncommon species restricted (mostly) to the West Coast of North America, from Humboldt Bay to Baja California (but see also Knudsen 15833 UCR-242148 (CNALH 2018), in the southern Sierra Nevada Mountains). The asci disintegrate as the spores mature, forming an apothecium that is a loose powdery mass of spores (a mazaedium).

AUTHORSHIP STATEMENT

JM organized the foray and all authors attended and contributed to lichen identifications; JH (and Ken Kellman) performed the vast majority of the identifications. JM wrote the first draft of the introduction to the paper. JH and TC wrote the first drafts of the species accounts. All authors contributed to editing and revising the entire paper.

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Ken Kellman contributed significantly to the species lists presented in this paper. We are grateful to Don Canestro and Rancho Marino for welcoming us to the Reserve and supporting this project, and we thank Los Osos for allowing us to collect lichens. Don Canestro, the Reserve Manager at Rancho Marino, died unexpectedly shortly after this project was completed. He stewarded the Reserve for almost two decades, facilitating a great variety of research and sharing expert ecological knowledge with many visitors. He will be greatly missed.

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Appendix. Lichen species encountered at the University of California Ken Norris Rancho Marino Reserve in San Luis Obispo County, California. Species without collection numbers were observed but not collected. All collections have been retained in the authors' personal herbaria, and duplicates of some KMK collections have also been deposited at UCSC. JH=Jason Hollinger, KMK=Ken Kellman, and TC=Tom Carlberg.

Taxon	Authorities	Collection number
<i>Acarospora socialis</i>	H. Magn.	JH 19822, KMK 8867
<i>Amandinea punctata</i>	(Hoffm.) Coppins & Scheid.	JH 19827, KMK 8841, TC 05641
<i>Arthonia pyrrhuliza</i>	Nyl.	TC 05658
<i>Aspicilia pacifica</i>	Owe-Larss. & A. Nordin	JH 19819a, 19821
<i>Athallia pyracea</i>	(Ach.) Arup, Frödén & Søchting	JH 19828
<i>Buellia abstracta</i>	(Nyl.) H. Olivier	JH 19813
<i>Buellia cf. halonia</i>	(Ach.) Tuck.	JH 19812
<i>Buellia oidalea</i>	(Nyl.) Tuck.	KMK 8856, JH 19839
<i>Buellia pullata</i>	Tuck.	JH 19811
<i>Buellia stellulata</i>	(Taylor) Mudd	JH 19811, 19818
<i>Calicium abietinum</i>	Pers.	KMK 8842, JH 19807
<i>Calicium glaucellum</i>	Ach.	KMK 8853
<i>Calicium tigillare</i>	(Ach.) Pers.	
<i>Caloplaca saxicola</i>	(Hoffm.) Nordin	JH 19823
<i>Chrysothrix xanthina</i>	(Vainio) Kalb	JH 19837
<i>Cliostomum griffithii</i>	(Sm.) Coppins	JH 19809, TC 05656
<i>Collemopsidium foveolatum</i>	(A. L. Sm.) F. Mohr	
<i>Dimelaena radiata</i>	(Tuck.) Müll. Arg.	JH 19811, 19819
<i>Diploicia canescens</i>	(Dickson) A. Massal.	
<i>Diploschistes muscorum</i>	(Scop.) R. Sant.	JH 19817
<i>Evernia prunastri</i>	(L.) Ach.	
<i>Flavoparmelia caperata</i>	(L.) Hale	
<i>Flavopunctelia flaventior</i>	(Stirton) Hale	TC 05638
<i>Heterodermia leucomela</i>	(L.) Poelt	
<i>Hypogymnia enteromorpha</i>	(Ach.) Nyl.	TC 05639
<i>Hypogymnia heterophylla</i>	L. Pike	KMK 8854
<i>Lecania cf. Franciscana</i>	(Tuck.) K. Knudsen & Lendemer	JH 19792, 19793
<i>Lecania cf. Pacifica</i>	Zahlbr. ex B.D. Ryan & van den Boom	
<i>Lecanora caesiorubella</i>	Ach.	JH 19830, TC 05636
<i>Lecanora confusa</i>	Almb.	JH 19838
<i>Lecanora expallens</i>	Ach.	JH 19827
<i>Lecanora simeonensis</i>	K. Knudsen & Lendemer	JH 19841
<i>Lecidella asema</i>	(Nyl.) Knoph & Hertel	JH 19814
<i>Lecidella scabra</i>	(Taylor) Hertel & Leuckert	JH 19815
<i>Lichenostigma maureri</i>	Hafellner	JH 19808
<i>Lichenostigma subadians</i>	Hafellner, Calatyud & Nav.-Ros.	JH 19822
<i>Melanelixia subaurifera</i>	(Nyl.) O. Blanco et al.	TC 05663
<i>Micarea denigrata</i>	(Fr.) Hedl.	JH 19842

Appendix, continued...

Taxon	Authorities	Collection number
<i>Mycocalicium subtile</i>	(Pers.) Szatala	
<i>Myriolecis dispersa</i>	(Pers.) Śliwa, Zhao Xin & Lumbsch	JH 19816
<i>Niebla cephalota</i>	(Tuck.) Rundel & Bowler	
<i>Ochrolechia arborea</i>	(Kreyer) Almb.	TC 05652
<i>Opegrapha erosa</i>	Egea & Ertz	TC 05659
<i>Opegrapha herbarum</i>	Mont.	JH 19824
<i>Opegrapha niveoatra</i>	(Borrer) J.R. Laundon	JH 19825
<i>Opegrapha</i> sp.		JH 19794
<i>Opegrapha xerica</i>	Torrente & Egea	KMK 8840
<i>Pachnolepia pruinata</i>	(Pers.) Frisch & G. Thor	KMK 8870
<i>Paraschismatomma ochroleucum</i>	(Zahlbr.) K. Knudsen, Ertz & Tehler	JH 19826, 19834, 19835
<i>Parmotrema hypoleucinum</i>	(Steiner) Hale	
<i>Pertusaria coccodes</i>	(Ach.) Nyl.	TC 05646
<i>Physcia phaea</i>	(Tuck.) J.W. Thomson	KMK 8865
<i>Placynthiella uliginosa</i>	(Schrader) Coppins & P. James	
<i>Polycauliona candelaria</i>	(L.) Frödén, Arup, & Søbchting	KMK 8868b
<i>Polycauliona ludificans</i>	(Arup) Arup, Frödén & Søbchting	KMK8864
<i>Polycauliona luteominia</i>	(Tuck.) Arup, Frödén & Søbchting	KMK 8842, JH 19791, 19812
<i>Pseudothelomma ocellatum</i>	(Körber) M. Prieto & Wedin	KMK 8869; JH 19832
<i>Pyrrhospora querneae</i>	(Dickson) Körber	JH 19840
<i>Ramalina canariensis</i>	J. Steiner	
<i>Ramalina farinacea</i>	(L.) Ach.	
<i>Ramalina leptocarpha</i>	Tuck.	
<i>Ramalina menziesii</i>	Tuck. non Taylor	
<i>Ramalina pollinaria</i>	(Westr.) Ach.	
<i>Ramalina subleptocarpha</i>	Rundel & Bowler	
<i>Rinodina gennarii</i>	Bagl.	JH 19812
<i>Sarcogyne regularis</i>	Körber	KMK 8874
<i>Schizopelte crustosa</i>	Ertz & Tehler	JH 19806
<i>Stigmidium epixanthum</i>	Hafellner	JH 19822
<i>Thelomma californicum</i>	(Tuck.) Tibell	KMK 8859, TC 05637
<i>Thelomma mammosum</i>	(Hepp) A. Massal.	JH 19818
<i>Trapeliopsis flexuosa</i>	(Fr.) Coppins & P. James	TC 05657
<i>Usnea fragilescens</i>	Hav. ex Lynge	
<i>Usnea perplexans</i>	Stirton	
<i>Usnea rubicunda</i>	Stirton	
<i>Verrucaria acrotella</i>	Ach.	JH 19811
<i>Verrucaria calkinsiana</i>	Servít	JH 19812
<i>Verrucaria prominula</i>	Nyl.	JH 19795
<i>Verrucaria viridula</i>	(Schrader) Ach.	JH 19821



Lichens from Rancho Marino and Los Osos Oaks

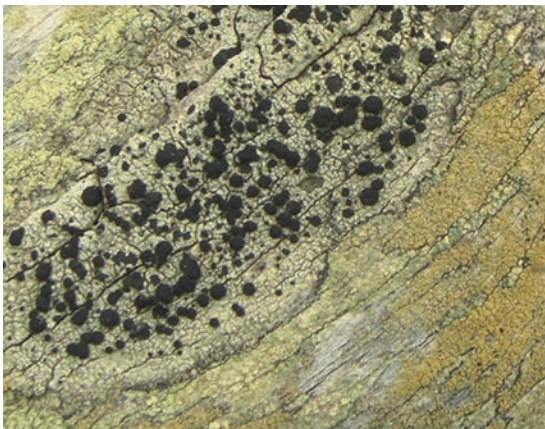
Some of the interesting lichens encountered by CALS members and friends in coastal San Luis Obispo County, California. All scale bars represent 0.5 mm. All photos by Jason Hollinger.



Thelomma californicum loves fence posts



Hypogymnia mollis at its type locality



Buellia oidealea on Monterey pine logs



Paraschismatomma ochroleucum on Monterey cypress logs



Sulcaria isidiifera at its type locality; a very narrow endemic



An unknown *Opegrapha* sp. on sandstone in the spray zone