

## LICHENS AND LICHENICOLOUS FUNGI OF THE NORTHWESTERN SANTA ANA MOUNTAINS

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**ABSTRACT:** 169 taxa are reported for the northwestern Santa Ana Mountains, comprising 156 lichens and 13 lichenicolous fungi. *Sarcogyne plicata* H. Magn. is removed from synonymy with *Sarcogyne privigna* (Ach.) A. Massal.

**KEYWORDS:** Biodiversity, California, Fremont Canyon, Floristics, Orange County, Weir Canyon.



**Fig. 1.** Fremont Canyon. Photo: Janet Good.

## INTRODUCTION

The Santa Ana Mountains are among the Peninsular Ranges in southern California extending over 64 km (40 miles), roughly from the Santa Margarita River in San Diego County to Santa Ana Canyon in Orange and Riverside counties. The highest peak in the range is Santiago at 1734 m (5,689 ft) (Lathrop & Thorne 1978; Boyd et al. 1995). The known vascular flora of the range consisted of 1044 known taxa in 1995 (Boyd and Roberts 1995).

The northwestern end of the Santa Ana Mountains is in Orange County along the Santa Ana River west of Sierra Peak and in the foothills and valleys bordering Santiago Creek on the edge of the coastal plain. Sandstones predominate. Oak



**Fig. 2.** Weir Canyon sandstone slabs. Photo: Rolf Muerter

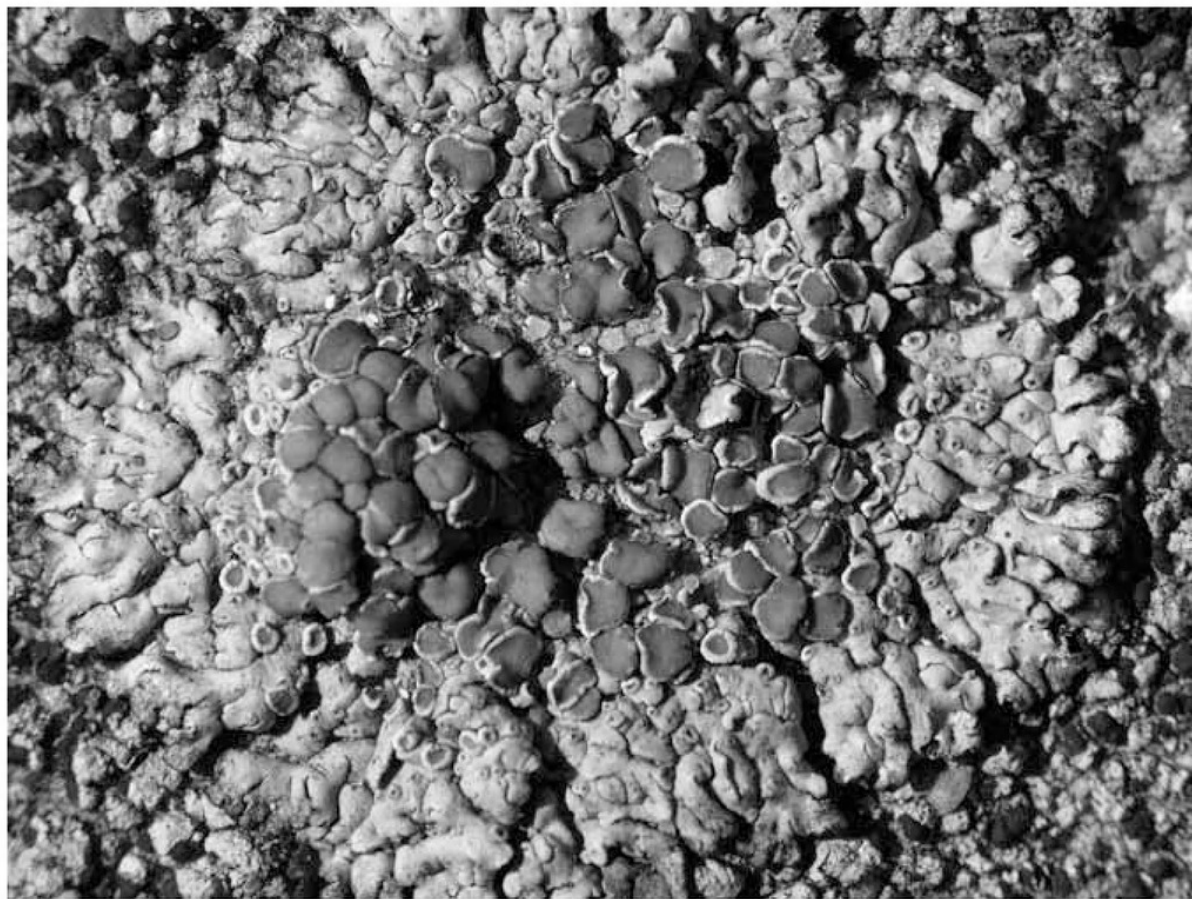
woodlands, grassland, chaparral, coastal sage scrub and riparian woodlands cover the hills and valleys. Two major canyons, Fremont Canyon (Fig. 1) and Weir Canyon on the Irvine Ranch (Fig. 2), were surveyed in 2006-2008. The elevational range of the study area was approximately 252 meters (827 feet) to 600 meters (1968 feet).

This was the first professional lichen inventory in Orange County. We collected 597 specimens of lichens and lichenicolous fungi, which were curated and databased at the Herbarium of the University of California at Riverside (UCR). Weir Canyon was surveyed in 2006. Fremont Canyon was surveyed in 2007 and 2008 after fire devastated the canyon in early 2006, and this part of the study was twice interrupted by the Weir Canyon fire in February 2007 and the Santiago fire in October 2007. Over 60 days were spent in the field. Collecting was intuitive and subjective. Some days no collections were made due to the devastation caused by the Fremont Canyon fire, which incinerated many acres of all lichens (Fig. 3). Thin-layer chromatography (TLC) was performed on selected specimens by J. C. Lendemer (NY) and J. A. Elix (CANB).



**Fig. 3.** Upper Fremont Canyon. Fire burned lichens off many boulders.  
Photo: Janet Good.

Corticolous or lignicolous lichens occur on bark or wood, even fence posts, and can be specific to certain vascular genera. Saxicolous lichens occur on various rock substrates and some species specifically occur on calcareous or acidic substrates (Fig 4). Terricolous lichens occur on soil. Some lichens are parasitic on other lichens, usually as juveniles, but become eventually independent and are termed lichenicolous lichens. Lichenicolous fungi are non-lichenized microfungi that are symbiotic with lichens and have co-evolved with them and are often host specific



**Fig. 4.** *Lecanora muralis*, a common saxicolous lichen on sandstone.

Photo: Rolf Muertter.

on the species or genus level. More information can be found on most species in the three volumes of the *Lichen Flora of the Greater Sonoran Desert Region* which has excellent but incomplete coverage of Southern California (Nash et al. 2002, 2004, 2007) or in the literature cited in this paper. More detailed information on individual collections is available online at the UCR Herbarium website ([http://sanders5.ucr.edu/lichensflat\\_index.php](http://sanders5.ucr.edu/lichensflat_index.php)). Abbreviations are used for Fremont Canyon (F) and Weir Canyon (W). Frequency is based on subjective observations.



## CHECKLIST OF THE LICHENS AND LICHENICOLOUS FUNGI OF THE NORTHWESTERN SANTA ANA MOUNTAINS

- Acarospora badiofusca* (Nyl.) Th. Fr. Saxicolous. Common (F & W).  
*Acarospora fuscata* (Schr.) Arnold – Saxicolous. The authority for this species needs investigation. Rare (W).  
*Acarospora hassei* Herre – Saxicolous. Infrequent on small granite pebbles and on sandstone outcrops (W).  
*Acarospora obnubila* H. Magn. – Saxicolous. Frequent. (F).  
*Acarospora obpallens* (Nyl. ex Hasse) Zahlbr. – Saxicolous, Terricolous. Often densely pruinose. Common (F&W).  
*Acarospora robiniae* K. Knudsen – Saxicolous. A coastal species. One population was found on top of a sandstone outcrop (F).  
*Acarospora rosulata* H. Magn. – Saxicolous. Treated as *A. bullata* Anzi, which we no longer recognize as occurring in North America. (Knudsen 2007; Knudsen et al. 2010). Rare (F).  
*Acarospora schleicheri* (Ach.) A. Massal. – Terricolous. Once common in southern California (Hasse 1913). Rare on alluvium on sandstone outcrop on north ridge of Fremont Canyon (F).  
*Acarospora socialis* H. Magn. – Saxicolous. Common (F & W).  
*Acarospora terricola* H. Magn – Terricolous. Infrequent (F & W).  
*Acarospora thelococcoides* (Nyl.) Zahlbr. – Terricolous. Endemic to California and Baja. Type collected by Orcutt in San Diego. Rare on alluvium on sandstone slabs. (F).  
*Acarospora veronensis* A. Massal. – Saxicolous. Infrequent on small stones (W).  
*Aspicilia confusa* Owe-Larss. & A. Nordin – Saxicolous. Common gray species, described from Tenaja Canyon in Santa Ana Mountains (F & W).  
*Aspicilia glaucopsina* (Nyl. ex Hasse) Hue – Terricolous, Saxicolous. Persisting on sandstone outcrops. Infrequent (F & W).  
*Aspicilia pacifica* Owe-Larss. & A. Nordin – Saxicolous. Maritime species. Infrequent (F & W).  
*Aspicilia phaea* Owe-Larss. & A. Nordin – Saxicolous. Only found on small stones scattered in chaparral on ridge of Fremont Canyon (F).  
*Buellia badia* (Fr.) A. Massal. – Saxicolous, lichenicolous. Common (F & W).  
*Buellia punctata* (Hoffm.) A. Massal. – Corticolous. Common especially on old or dead branches of *Adenostoma fasciculatum*, *Salvia mellifera* and *Sambucus mexicana* (F & W).  
*Buellia ryanii* Bungartz – Saxicolous. Only found on small stones of granite or rhyolite washed out of the sandstone. Infrequent (F & W).  
*Buellia sequax* (Nyl.) Zahlbr. – Saxicolous. Common (F & W).  
*Buellia tesserrata* Körb. – Saxicolous. Maritime species. Rare (F).

- Caloplaca arenaria* (Pers.) Müll. Arg. – Saxicolous. Common (F & W).  
*Caloplaca atroflava* (Turn.) Mong. – Saxicolous. On concrete. Rare (W).  
*Caloplaca bolacina* (Tuck.) Herre – Saxicolous. Maritime species. Frequent (W).  
*Caloplaca citrina* (Hoffm.) Th. Fr. – Saxicolous. Wetmore's concept of this species is heterogeneous and includes a common saxicolous leprose taxon found in Riverside County (Wetmore 2007). It is unclear whether this taxon is *C. citrina* s. str. *Caloplaca* taxonomists in Europe are skeptical that *C. citrina* even occurs in North America (Vondrak, pers. comm.) Rare (W).  
*Caloplaca crenulatella* (Nyl.) Oliv. – Saxicolous. Common (F&W).  
*Caloplaca decipiens* (Arnold) Blomb. & Forss. – Saxicolous. Frequent (F).  
*Caloplaca epithallina* Lynge – Lichenicolous fungus common on saxicolous crustose lichens (F & W).  
*Caloplaca microphyllina* (Tuck.) Hasse – Corticolous. Abundant on one *Quercus agrifolia* (W).  
*Caloplaca nashii* Nav.-Ros., Gaya & Hladun – Saxicolous. Common (F & W).  
*Caloplaca pyracea* (Ach.) Th. Fr. – Corticolous. This name is tentatively used in California for those species treated by Wetmore on bark as *Caloplaca holocarpa* (Wetmore 2007; Arup 2009). Common on *Quercus agrifolia*, chaparral and old coastal sage shrubs (F & W).  
*Caloplaca saxicola* (Hoffm.) Nordin – Saxicolous. Infrequent (F).  
*Caloplaca squamosa* (B. de Lesd.) Zahlbr. – Saxicolous. Frequent (F).  
*Caloplaca subsoluta* (Nyl.) Zahlbr. – Saxicolous. Rare (W).  
*Candelaria pacifica* Westberg – Corticolous, occasionally saxicolous. Common on *Quercus agrifolia*, chaparral and coastal sage shrubs (F & W).  
*Candelariella aurella* (Hoffm.) Zahlbr. – Saxicolous. Common (F & W).  
*Candelariella rosulans* (Müll. Arg.) Zahlbr. – Saxicolous. Infrequent (F).  
*Candelariella vitellina* (Hoffm.) Müll. Arg. – Saxicolous. Frequent (F & W).  
*Carbonea latypizodes* (Nyl.) Knoph & Rambold – Saxicolous. Common (F & W).  
*Cercidospora caudata* Kernst. – Lichenicolous fungus infrequent on apothecia of *Caloplaca squamosa* (F).  
*Chyrsotrix candelaris* (L.) J.R. Laundon – Corticolous. Probably heterogeneous in California and needs to be revised. Abundant on occasional *Quercus agrifolia* (W).  
*Cladonia acuminata* (Ach.) Norrlin – Terricolous. This specimen contained norstictic acid. The specimen was poor and could not be identified positively by morphology and our identification awaits verification by further collections. If positively identified the species would be new state record. (Tucker & Ryan 2006). Rare (W).  
*Cladonia chlorophaea* (Flörke ex Sommerf.) Spreng. – Terricolous. Infrequent (F & W).

- Cladonia fimbriata* (L.) Fr. – Terricolous and sometimes lignicolous. Infrequent (W).
- Cladonia hammeri* Ahti – Terricolous. Endemic to southern California and Baja. Infrequent (F & W).
- Cladonia nashii* Ahti – Terricolous. Common (F & W).
- Cladonia pyxidata* (L.) Hoffm. – Terricolous. Infrequent (F).
- Cladonia scabriuscula* (Delise) Nyl. – Terricolous. Commonly found on detritus beneath chaparral (F & W).
- Cladonia subfimbriata* Ahti – Terricolous. Infrequent. (W).
- Collema tenax* (Sw.) Ach. – Terricolous, sometimes saxicolous on sandstone. Frequent (W).
- Dermatocarpon americanum* Vain. – Saxicolous. Rare, though often common in southern California (F).
- Dimelaena radiata* (Tuck.) Müll. Arg. – Saxicolous. A dominant maritime species which occurs inland at scattered locations to Bautista Canyon at base of San Jacinto Mountains. Infrequent (F & W).
- Diploicia canescens* (Dicks.) A. Massal. – Corticolous. A maritime species. This is the farthest from coast it has been collected in southern California. Rare on *Malacothamnus fasciculatus* and *Quercus agrifolia*. (W).
- Diploschistes actinostomus* (Ach.) Zahlbr. – Saxicolous. Common on sandstone on upper ridges of Fremont Canyon (F).
- Diploschistes muscorum* (Scop.) R. Sant. – Terricolous, lichenicolous. Common lichen parasitic on *Cladonia* species (F & W).
- Diploschistes scruposus* (Schreb.) Norman – Saxicolous. Common (F & W).
- Diplotomma alboatrum* (Hoffm.) Flot. – Saxicolous. Syn. *Buellia alboatra*. The genus placement is still open to question and the species is in need of revision. One locally abundant population on sandstone (F).
- Endocarpon loscosii* Müll. Arg. – Terricolous. Frequent but often sterile, spreading by anastomosing rhizohyphae (F & W).
- Endocarpon pallidulum* (Nyl.) Nyl. – Saxicolous. Infrequent (F & W).
- Endocarpon pusillum* Hed. – Terricolous. Common (F & W).
- Flavoparmelia baltimorensis* (Gyel. & Förliss) Hale – Saxicolous. Locally abundant on shaded sandstone slab on a north-facing slope of Weir Canyon (W).
- Flavoparmelia caperata* (L.) Hale – Corticolous. Frequent on *Quercus agrifolia* (W).
- Flavopunctelia flaventior* (Stirt.) Hale – Corticolous. The most common macrolichen on *Quercus agrifolia* (F & W).
- Flavopunctelia soledica* (Nyl.) Hale – Saxicolous, corticolous. Rare (W).
- Fuscopannaria coralloidea* F. M. Jørg. – Terricolous. Rare (W).

- Gelatinopsis acarosporicola* Kocourk. & K. Knudsen –Lichenicolous fungus on *Acarospora socialis* described from and currently only known from Fremont Canyon (Kocourková & Knudsen 2009). Rare (F).
- Hyperphyscia adglutinata* (Flörke) H. Mayrh. & Poelt– Corticolous. Abundant on scattered *Quercus agrifolia* (F & W).
- Intralichen baccisporus* D. Hawksw. & M.S. Cole – Lichenicolous fungus infrequent on apothecia of *Caloplaca* species (F).
- Lecania brunonis* (Tuck.) Herre – Saxicolous. Common (F & W).
- Lecania cyrtella* (Ach.) Th. Fr. – Corticolous. Rare on dead branches of *Salvia mellifera* (W).
- Lecania hassei* (Zahlbr.) W. Noble – Saxicolous. Syn. *Lecania brattiae*. Common (F & W).
- Lecania naegelii* (Hepp.) Diederich & v.d. Boom. – Corticolous. Rare on *Malacothamnus fasciculatus* (W).
- Lecania toninioides* Zahlbr. – Terricolous, rarely saxicolous. Rare on sandstone (F).
- Lecanora caesiorubella* Ach. – Corticolous. Rare on *Quercus agrifolia* (W).
- Lecanora gangaleoides* Nyl. – Saxicolous. Frequent (F & W).
- Lecanora hagenii* (Ach.) Ach. – Corticolous, saxicolous. Frequent on sandstone and concrete (F & W).
- Lecanora munzii* K. Knudsen & Lendemer – Corticolous. On dead weathered chaparral wood on ground. Recently described from Claremont (Knudsen & Lendemer 2009). Rare (W).
- Lecanora muralis* (Schreb.) Rabenh. – Saxicolous. Common (F & W).
- Lecanora pseudistera* Nyl. – Saxicolous. Common (F & W).
- Lecanora simeonensis* K. Knudsen & Lendemer – Lignicolous. On wood of *Adenostoma fasciculatum*. We recently described this species from San Simeon (Lendermer & Knudsen 2009). The thallus was leprose and no fertile specimens were seen. This report extends the range south from Montaña de Oro in San Luis Obispo County. Infrequent on chaparral (W).
- Lecanora subimmergens* Vain. – Saxicolous. Common (F & W).
- Lecidea cinerata* Zahlbr. – Saxicolous. Rare California endemic originally described from the Santa Monica Mountains on the slope below the Hollywood sign (Hasse 1913). Rare (F).
- Lecidea fuscoatra* (L.) Ach. – Saxicolous, terricolous. Common (F & W).
- Lecidea laboriosa* Müll. Arg. – Saxicolous. Common (F & W).
- Lecidea tessellata* Flörke – Saxicolous. Common montane species above 6000 feet. Rare in survey area (F).
- Lecidella asema* (Nyl.) Knoph & Hertel – Saxicolous, rarely terricolous. Common (F & W).



- Lecidella stigmathea* (Ach.) Hertel & Leuckert – Saxicolous. Infrequent (F).
- Lepraria adhaerens* K. Knudsen, Elix & Lendemer – Saxicolous, terricolous. Common (F & W).
- Lepraria borealis* Lohtander and Tønsberg – Saxicolous. Rare on moss and sandstone. (W).
- Lepraria caesioalba* (B. de Lesd.) J.R. Laundon – Corticolous, saxicolous, terricolous. Two chemotypes. Frequent (F & W).
- Lepraria santamonicae* K. Knudsen & Elix – Saxicolous, terricolous. Frequent (F & W).
- Lepraria texta* K. Knudsen, Elix & Lendemer – Saxicolous, terricolous. Frequent (F),
- Lepraria xerophila* Tønsberg – Terricolous. Common maritime species. Rare (W).
- Leptogium arsenei* Sierk – Saxicolous. Rare (W).
- Leptogium palmatum* (Huds.) Mont. – Terricolous. Rare (W).
- Leptogium plicatile* (Ach.) Leight. – Saxicolous. Single small population on wet shaded calcareous sandstone in oak woodland. Rare (W).
- Leptogium tenuissimum* (Dicks.) Körb. – Terricolous. Rare (W).
- Lichenocodium lecanorae* (Jaap) D. Hawksw. – Lichenicolous fungus on apothecia of *Lecanora muralis*. Frequent (F).
- Lichenocodium lichenicola* (P. Karst.) Petrak & H. Sydow – Lichenicolous fungus infrequent on *Physcia dimidiata* (F).
- Lichenostigma cosmopolites* Hafellner & Calat. – Lichenicolous fungus frequent on *Xanthoparmelia* species (F).
- Lichenostigma rugosum* Thor – Lichenicolous fungus frequent on *Diploschistes* species (F).
- Lichenostigma subadians* Hafellner, Calat. & Nav.-Ros. – Lichenicolous fungus frequent on *Acarospora socialis* (F).
- Micarea micrococa* (Körb.) Gams ex Coppins – Corticolous. Rare on mature bark of old half-dead *Sambucus mexicana* (F).
- Miriquidica scotopholis* (Tuck.) B.D.Ryan & Timdal – Saxicolous. Common (F & W).
- Peltula bolanderi* (Tuck.) Wetmore – Saxicolous. Rare (W).
- Peltula euploca* (Ach.) Poelt – Saxicolous. Infrequent (F).
- Peltula obscurans* var. *hassei* (Zahlbr.) Wetmore – Saxicolous. Infrequent (F).
- Peltula obscurans* (Nyl.) Gyeln. var. *obscurans* – Saxicolous. Rare (W).
- Phaeophyscia hirsuta* (Mereschk.) Essl. – Corticolous. Infrequent on *Quercus agrifolia* (W).
- Phaeophyscia sciastra* (Ach.) Moberg – Saxicolous. Rare (W).
- Physcia adscendens* (Fr.) H. Olivier – Corticolous, infrequently saxicolous. Common on *Quercus agrifolia*, chaparral and coastal sage shrubs (F & W).

- Physcia biziana* (A. Massal) Zahlbr. – Corticolous. Rare on *Adenostoma fasciculatum* (W).
- Physcia dimidiata* (Arnold) Nyl. – Saxicolous. Common (F & W).
- Physcia tribacia* (Ach.) Nyl. – Saxicolous. Infrequent (F & W).
- Physconia isidiigera* (Zahlbr.) Essl. – Corticolous, saxicolous. Frequent on sandstone and *Quercus agrifolia* (F & W).
- Placidium lacinulatum* (Ach.) Breuss – Terricolous. Common (F & W).
- Placidium squamulosum* (Ach.) Bruess – Terricolous. Infrequent (W).
- Placopyrenium noxium* Breuss – Saxicolous. Second known population in California (Breuss 2009). Rare (F).
- Placynthiella hyporhoda* (Th. Fr.) Coppins & P. James – Terricolous. Infrequent (W).
- Placynthiella uliginosa* (Schrad.) Coppins & P. James – Terricolous, saxicolous. Frequent (W).
- Polysporina simplex* (Davies) Vězda – Saxicolous. Common (F & W).
- Polysporina subfucescens* (Nyl.) K. Knudsen & Kocourk. – Lichenicolous fungus common on saxicolous crustose lichens (F & W).
- Psora californica* Timdal – Terricolous. Infrequent (F & W).
- Psora luridella* (Tuck.) Fink – Saxicolous, Terricolous. Frequent (F & W).
- Psorothicia montinii* (A. Massal.) Forss. – Saxicolous. Infrequent (W).
- Psorotichia schaeereri* (A. Massal.) Arnold – Terricolous. Infrequent (W).
- Rinodina* species – Terricolous. Endemic to California and will be described by John Sheard. Rare (F & W).
- Rinodina gennarii* Bagl. – Saxicolous. Maritime species, infrequent on concrete of old flood control wall and on rhyolite (F & W).
- Rinodina intermedia* Bagl. – Terricolous. Infrequent (F & W).
- Sarcogyne arenosa* (Herre) K. Knudsen & Standley – Saxicolous. Common (F & W).
- Sarcogyne plicata* H. Magn. – Saxicolous. The name *Sarcogyne privigna* (Ach.) A. Massal. was applied to this taxon (Knudsen & Standley 2007) and *S. plicata*, described from Upland, was treated as a synonym (Knudsen & Lendemer 2005). Recent unpublished molecular analysis of specimen from Fremont Canyon showed it was not conspecific with *S. privigna* in Fennoscandia (Westberg, pers. comm.) In this paper we resurrect *S. plicata*, but it may not apply to all taxa in California. Frequent (F & W).
- Sarcogyne reebiae* K. Knudsen – Saxicolous. Described from Weir Canyon (Knudsen & Standley 2007). Infrequent (W).
- Sarcogyne regularis* Körb. – Saxicolous. Infrequent (W).
- Sarcogyne similis* H. Magn. – Saxicolous. Common (F & W).
- Strangospora deplanata* (Almq.) Clauz. & Cl. Roux – Corticolous. Rare on mature bark of old half-dead *Sambucus mexicana* (F).

- Stigmidium fuscatae* (Arnold) R. Sant. – Lichenicolous fungus on *Acarospora obpallens*. We will revise this taxon in southern California. Rare (F).
- Stigmidium squamariae* (B. de Lesd.) Cl. Roux & Triebel – Lichenicolous fungus on apothecia of *Lecanora muralis*. Infrequent (F).
- Stigmidium xanthoparmelium* Hafellner – Lichenicolous fungus on *Xanthoparmelia* species. Infrequent (F).
- Teloschistes chrysophthalmus* (L.) Th. Fr. – Corticolous. Rare on *Malacothamnus fasciculatus* (W).
- Thelomma mammosum* (Hepp ex Hartung) Tibell – Saxicolous. Coastal species. Infrequent (W).
- Thelomma santessonii* Tibell – Saxicolous. Maritime species. A single population was discovered on ridge of Fremont Canyon (F).
- Toninia tristis* (Th. Fr.) Th. Fr. – Saxicolous. Infrequent. (F).
- Trapelia coarctata* (Turner ex Sm.) M. Choisy – Saxicolous, terricolous. Frequent (F & W).
- Trapelia glebulosa* (Sw.) J.R. Laundon – Saxicolous, terricolous. Frequent (F & W).
- Trapelia placodioides* Coppins & P. James – Saxicolous, terricolous. Locally common, but probably rare in survey area after the Weir Canyon fire because it occurred on slope within dense chaparral (W).
- Trapeliopsis bisorediata* McCune & Camacho – Saxicolous, terricolous. Rare on sandstone (W).
- Trapeliopsis flexuosa* (Fr.) Coppins & P. James – Lignicolous. On dead and old burnt wood (F & W).
- Trapeliopsis glaucopholis* (Nyl. ex Hasse) Printzen & McCune – Saxicolous, terricolous. Frequent (F & W).
- Trapeliopsis steppica* McCune & Camacho – Saxicolous, terricolous. This is the second population discovered in Santa Ana Mountains. Rare (F).
- Umbilicaria phaea* Tuck – Saxicolous. Infrequent. (F).
- Verrucaria calkinsiana* Servít – Saxicolous. Common (F & W).
- Verrucaria furfuracea* (B. de Lesd.) Breuss. – Saxicolous. Frequent (W).
- Verrucaria fusca* Pers. ex Ach. – Saxicolous. Frequent (F & W).
- Verrucaria fuscoatroides* Servít – Saxicolous. Infrequent (W).
- Verrucaria memnonia* (Flot. ex Körb.) Arnold – Saxicolous. On small hard granite rocks washed out of sandstone deposits. Infrequent (F & W).
- Verrucaria onegensis* Vain. – Saxicolous. Rare (F).
- Verrucaria turgida* Servít – Saxicolous. Rare (F).
- Verrucaria viridula* (Schrader) Ach. – Saxicolous. Infrequent (F).
- Xanthoparmelia amableana* (Gyeln.) Hale – Saxicolous. Infrequent (F).
- Xanthoparmelia cumberlandi* (Gyeln.) Hale – Saxicolous. Common (F & W).
- Xanthoparmelia lineola* (E.C. Berry) Hale – Saxicolous. Infrequent (F).

*Xanthoparmelia mexicana* (Gyeln.) Hale – Saxicolous. Common (F & W).

*Xanthoparmelia neotartica* Hale – Terricolous. Infrequent (F & W).

*Xanthoparmelia novomexicana* (Gyeln.) Hale – Saxicolous. Infrequent (F).

*Xanthoparmelia subplitti* Hale – Saxicolous. Infrequent (F).

*Xanthoparmelia verruculifera* (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch – Saxicolous. Rare (F).

*Xanthoria polycarpa* (Hoffm.) Th. Fr. ex Rieber – Corticolous. Infrequent on *Malacothamnus fasciculatus* and *Adenostoma fasciculatum* (W).

*Xanthoria tenax* L. Lindblom – Corticolous. Common on willows and chaparral before the Weir Canyon fire (W).

## CONCLUSIONS

We report 169 taxa in 56 genera for the northwestern Santa Ana Mountains, comprising 156 lichens and 13 lichenicolous fungi. Two species were described new to science, *Sarcogyne reebiae* from Weir Canyon (Knudsen & Standley 2007) and *Gelatinopsis acarosporicola* from Fremont Canyon (Kocourková & Knudsen 2009). Four recently described species have paratype locations in Fremont Canyon and Weir Canyon: *Lepraria adhaerens* (Knudsen et al. 2007), *L. santaemonicae* (Knudsen & Elix 2007), *L. texta* (Knudsen & Elix 2007), and *Lecanora munzii* (Knudsen & Lendemer 2009). John W. Sheard (SASK) is currently in the process of describing the terricolous *Rinodina* species included in the checklist which is also known from the Santa Monica Mountains. Previously *Carbonea latypizodes* (Knudsen et al. 2008), *Cercidospora caudata* (Etayo et al. 2007), *Lichenostigma rugosum* (Knudsen & Kocourková 2008) and *Trapelia placodioides* (Knudsen 2006) were reported new for California from Fremont Canyon and Weir Canyon. We believe the total species diversity would have been higher if Fremont Canyon had been surveyed before the devastating fire. Some lichens considered rare in Weir Canyon may have been locally extirpated by the fire of 2007, especially species on bark and wood.

While the authors consider plants and animals the most important biological resources on public lands, lichens are a significant resource in relatively undisturbed habitats. Over 1500 taxa of lichens, lichenicolous fungi, and allied microfungi have been reported from California (Tucker & Ryan 2006) and the numbers of known taxa increase regularly, despite any reductions of numbers through taxonomic advances. For instance, based on continuing research, 298 taxa occur in the Santa Monica Mountains (Knudsen & Kocourková 2009) and 387 taxa on Santa Rosa Island (Knudsen unpublished). The lichens and lichenicolous fungi we report in this paper may comprise fewer than half of the species that occur in the Santa Ana Mountains. We expect the total diversity of lichens and



lichenicolous fungi to be at least 280 species, over one fourth of the total diversity of the vascular flora (which includes native and non-native plants). All lichens and lichenicolous fungi reported here are apparently native to the range.

Only one floristic study of lichens has been published on the Santa Ana Mountains, based on a short survey of the Santa Rosa Plateau (Weber & Bratt 1987). Many of that paper's taxonomic concepts and species concepts are now archaic due to rapid advances in lichen taxonomy spearheaded by the Sonoran lichen flora project (Nash et al. 2002, 2004, 2007). Weber and Bratt reported approximately 78 species. Without a revision of the specimens and based on our knowledge of the Santa Rosa Plateau, approximately 49 species they reported also occur in the northwestern Santa Ana Mountains. The main difference is the lichen flora on oaks is more diverse on the Santa Rosa Plateau because of apparently higher relative annual humidity (particularly from fog incidents) and the occurrence of Engelmann oaks and scrub oaks besides *Quercus agrifolia*. Our checklist can be used as the foundation of a preliminary checklist of the whole range as well as for Orange County. This paper represents the first installment of our continuing floristic study of the Santa Ana Mountains. Our next paper will be a study of the Santa Rosa Plateau.

Before grazing and the dominance of invasive plants, the valley grasslands in Fremont Canyon and Weir Canyon may have supported more extensive biological soil crusts of lichens and bryophytes, native grasses and annuals. Terricolous lichens were probably common in biological soil crusts and included species extirpated from study area like *Aspicilia praecrenata* (Nyl. ex Hasse) Hue. Most terricolous lichens are now rare or infrequent. Terricolous lichens now subsist as relics in microhabitats on thin-soiled slopes, on decaying sandstone, or on consolidated soil in pockets on sandstone outcrops. The most common terricolous lichen we found in Weir and Fremont Canyons was the pioneering *Cladonia nashii*, which can grow on slopes of loose alluvium and road cuts as well on decaying or re-consolidated sandstone.

The Tecate cypress (*Cupressus forebesii*) grove was visited before the Fremont Canyon fire devastated it. The trees did not support lichens.

Two lichens, *Lecanora munzii* and *L. simeonensis*, were collected in upper Weir Canyon. These species are lignicolous, growing on the wood of older chaparral and coastal sage shrubs. They are rare, like *Cyphelium brachysporum* Nád. (Lendemer et al. 2008) described from Murrieta, probably because more frequent fires are reducing mature stands where their substrates are found. Both these species may have been extirpated from Weir Canyon by the fire of 2007 and were

not documented from Fremont Canyon.

A number of maritime species, common on the coast of southern California and on the Channel Islands, occur in the northwestern Santa Ana Mountains, approximately 14-17 miles (22-27 km) inland from the coast. All were rare or infrequent.

We only report 13 species of lichenicolous fungi. The number of lichenicolous fungi reported here does not include at least five taxa probably new to science we discovered in Fremont Canyon (after the fire) which were all rare. We were unable to collect sufficient material for descriptions. The first, *Endococuius thelommae* Kocourk. & K. Knudsen, has been accepted for publication in Germany in a forthcoming volume of *Bibliotheca Lichenologica*. Sufficient type material was finally collected on Santa Rosa Island.

Lichens grow very slowly, especially in Mediterranean climates based on our observations, with most lichens growing only micro-millimeters in an average rain year and probably not at all during drought episodes. The recovery of the lichen biota in the northwestern Santa Ana Mountains will be a slow process taking decades. It is tragic that both of these fires were caused by humans, the Weir Canyon fire by arson and the Fremont Canyon fire through mismanagement of a controlled burn.

## ACKNOWLEDGMENTS

We thank our reviewers, Brendan Hodkinson (DUKE) and Caleb Morse (KANU). We thank for their help with identifications Othmar Breuss (Austria), Jack Elix (Australia), J.C. Lendemer (NY), Christian Printzen (Germany) and John Sheard (Canada). We thank ecologist Trish Smith (Nature Conservancy) for her constant support of our research. This project was supported by grants from The Nature Conservancy.

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# CROSSOSOMA

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*Journal of the Southern California Botanists, Inc.*



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Volume 35, Number 2

Fall-Winter 2009

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Knudsen, Kerry and Kocourková, Jana. 2009. "Lichens and Lichenicolous Fungi of the Northwestern Santa Ana Mountains." *Crossosoma* 35(2), 66–81.

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