

## BRYOPHYTES OF THE SANTA MONICA MOUNTAINS

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**ABSTRACT:** A preliminary species list is provided for bryophytes of the Santa Monica Mountains, along with illustrations of representatives of many of the genera to serve as an introductory guide to the group. Presently 109 species of bryophytes are known from the Santa Monica Mountains. This does not count some of the species from difficult genera with many samples of uncertain identification remaining to be studied further. *Bryoerythrophyllum ferruginascens* (Strit.) Giac. is reported new for California. A comparison of the Santa Monica Mountains bryophyte flora with those of Santa Cruz County, at the same elevation but higher latitude, and Mount San Jacinto, at the same latitude but higher elevation, indicates that the Santa Monica Mountains flora shares more of its species with Santa Cruz County but lacks a great many species that are common in that wetter climate, and that the Santa Monica Mountains flora is remarkably dissimilar in composition to the flora of Mount San Jacinto.

**KEYWORDS:** Bryophytes, California, mosses, Santa Monica Mountains

### NARRATIVE ANALYSIS OF THE FLORA

The Santa Monica Mountains, on the southern coast of California within Los Angeles and Ventura counties, fall within the semi-arid mediterranean climate regime where a non-bryologist might not expect to find very many bryophytes. Yet, bryophyte species richness is not particularly inhibited by regional aridity when wet spots exist within the region. The Santa Monica Mountains have a complex geomorphology of ridges and narrow drainages, several of which have perennial or nearly perennial water flow. A few northern species find suitable habitat in the deeper cooler drainages. In addition, a few species from warm, dry places to the west and south also find suitable microhabitats. These two elements contribute to a checklist that is currently at 109 species. Although perhaps surprising to non-bryologists, this number is not extraordinary for a region of such strong relief (Shevock 2003).

The Santa Monica Mountains are home to all three kinds of bryophytes: hornworts, liverworts and mosses. Four out of seven species of hornworts found in California (Doyle and Stotler 2006) have been collected in the Santa Monica Mountains. Two of these, *Anthoceros punctatus* L. and *Phaeoceros carolinianus* (Michx.) Prosk. s. l., are nearly worldwide in their distribution. The other two have a much narrower range. *Anthoceros fusiformis* Austin has a North Pacific distribution and is known from Japan and the Pacific Coast of North America, and *Phaeoceros pearsonii* (M. Howe) Prosk. is known from Washington to California (Doyle and Stotler 2006).

Although not abundant in the Santa Monica Mountains, hornworts are widely scattered along most streams and ditches, generally on disturbed summer-dry soil and at the edges of seepages, usually shaded by shrubs or trees.

Leafy liverworts, a group of 87 species in California (Doyle and Stotler 2006), are represented in the Santa Monica Mountains by only three species. *Porella bolanderi* (Austin) Pearson, occurring in shaded ravines and north-facing slopes, is the only relatively common and abundant local leafy liverwort. Of the 41 thallose liverwort species in California, 13 have been confirmed from the Santa Monica Mountains. Several species, such as *Asterella californica* (Hampe) Underw. and *Cryptomitrium tenerum* (Hook.) Austin ex Underw., occur on moist shaded sloping soil, while the genus *Riccia* is common on sunnier, flatter soil that floods during heavy rains.

Most of the bryophyte species in the Santa Monica Mountains are mosses. Like the rest of California (Norris and Shevock 2004), the Pottiaceae is the most species-rich family in the Santa Monica Mountains, with 32 species in 14 genera. Pottiaceae contains many species tolerant of long droughts, and not surprisingly, several species are among the most common and abundant in the range. Three of the *Didymodon* species, two species of *Syntrichia* and several species of *Tortula*, for example, occur nearly throughout the mountains and are easily noticed along trails and drainages. Two of the species in this family, *Eucladium verticillatum* (Hedwig in Bridel) Bruch & W. P. Schimper and *Crumia latifolia* (Kindberg) W. B. Schofield, are much less tolerant of drying and are confined to perennially wet microhabitats.

Brachytheciaceae is another common family of mosses in the Santa Monica Mountains, with 13 species reported from the range. Bryaceae and Orthotrichaceae are likewise represented by several species, while most of the other families are represented by one or two infrequent species, restricted to certain microhabitats, regardless of apparently abundant suitable habitat. For example, *Leptobryum pyriforme* (Hedwig) Wilson, common farther north and a nearly cosmopolitan species that does well on disturbed sites such as creek banks, has been observed in small patches only in three locations in the Santa Monica Mountains. *Encalypta rhamnifolia* Schwägrichen, the only representative of its family in the Santa Monica Mountains, has been observed only in three locations although there are plenty of similar habitats throughout the range. Other species tolerant of arid conditions that one would expect to find in the Santa Monica Mountains have not yet turned up in the collections. *Encalypta vulgaris* Hedwig, for example, frequently found in the western United States and Mexico and known to be more tolerant of arid conditions than *Encalypta rhamnifolia* Schwägrichen (Flowers 1973), has not yet been reported from the Santa Monica Mountains. *Bryolawtonia vancouveriensis* (Kindberg) Norris & Enroth and the feathery *Dendroalsia abietina* (W. J. Hooker) E. Britton in Brotherus, both endemic to Western North America and abundant along the central and north coast of California, are examples of species for which the Santa Monica Mountains are near the southern extension of their range. They are known here only from a few locations in deep narrow perennial drainages with dense canopies.

It is instructive to compare the bryoflora of the Santa Monica Mountains to two other well-documented bryofloras. Mount San Jacinto (in Riverside County), whose bryophytes were studied by Harpel (1980), is at the same latitude but more inland and mostly at a higher elevation than the Santa Monica Mountains. Santa Cruz County, whose bryophytes were catalogued by Kellman (2003), is coastal and at roughly the same elevation as the Santa Monica Mountains but at higher latitude and thus is much moister and cooler. Santa Cruz County, at 190 species, far outnumbers both the Santa Monica Mountains and Mount San Jacinto, each of which have species lists that are around 100. Furthermore, both Santa Cruz County and Mount San Jacinto have several more genera and families represented in their flora than we have found in the Santa

Monica Mountains. The greater bryophyte diversity of California's central coast is probably due to the temperate moister climate and our better understanding of the Santa Cruz County flora. Kellman's (2003) collections in the 1990's more than doubled the number of county records available for study and significantly increased our understanding of the region.

The Santa Monica Mountains share about a third of their species with Mount San Jacinto and nearly two thirds of their species with Santa Cruz County. Elevation appears to be an important factor in separating bryogeographic zones. Most of the shared species are low to mid-elevation, cosmopolitan or widely distributed species (e.g. *Bryum argenteum* Hedwig, *Didymodon tophaceus* (Bridel) Lisa, *Grimmia pulvinata* (Hedwig) J. E. Smith, *Scleropodium touretii* (Bridel) L. Koch, *Weissia controversa* Hedwig). A few of the species shared by all three areas are endemic to western North America, for example *Scleropodium obtusifolium* (Mitten) Kindberg in Macoun, a rosy prostrate moss that forms trailing mats over boulders along streams, and *Anacolia menziesii* (Turner) Paris, a moss that fills the cracks in rocks, easily recognized for its abundant rusty red rhizoids that form a dense tomentum on the lower stems. The other endemic species, such as *Bestia longipes* (Sullivant & Lesquereux) Brotherus (Norris and Enroth 1990, Schofield 2004) and *Dendroalsia abietina* (W. J. Hooker) E. Britton in Brotherus (Schofield 1992), occur in both the Santa Monica Mountains and Santa Cruz County, but have not been found in the Mount San Jacinto area which has higher elevations and colder winters.

In a few cases, a species abundant in Santa Cruz County or Mount San Jacinto occurs in the Santa Monica Mountains, but for the most part the suitable habitat is occupied by another species with similar habitat requirements. *Antitrichia californica* Sullivant in Lesquereux, known mainly from the west coast of North America (Norris and Shevock 2004), is common along the central coast, but barely makes it into the Santa Monica Mountains and is not abundant in any of its locations here. Instead, the apparent suitable habitat is often occupied by *Pterogonium gracile* (Hedwig) J. E. Smith, a species endemic to west coast of North America from southernmost Canada to southern California (Zander 2006) and shared with Santa Cruz County.

Of the three areas, the Santa Monica Mountains have the fewest species not found in either of the other two. This may be partly an artifact of the majority of the local flora belonging to the difficult genera, such as *Bryum*, *Didymodon*, *Tortula*, and *Trichostomum*, with many samples of uncertain identification remaining to be studied. Presently, the Santa Monica Mountains share nearly twice as many species with Santa Cruz County (65 species) as it shares with Mount San Jacinto (33 species). However, a more thorough survey of seasonal habitats and identification of unresolved collections may reveal the Santa Monica Mountains' bryoflora to be more closely related to the floras of arid lands such as Baja California than to either Santa Cruz County or Mount San Jacinto.

Below we give a list of the bryophytes that we have confirmed identifications for from the Santa Monica Mountains. This is accompanied by a gallery of drawings of representative species of the genera one is most likely to encounter hiking through the range. So far as we can tell at this time, the number of species and the composition of the bryoflora are not unusual for a semiarid west coast region of its size. Nevertheless, we have found species that are major range extensions, specifically, *Didymodon bistratosus* J.-P. Hébrard & R. B. Pierrot formerly only known from Mediterranean Europe (Zander et al. 2005), *Bryoerythrophyllum ferruginascens* (Stirt.) Giac. not previously recorded from California, and *Bryum microchaeton* Hampe a species normally of higher moister regions to the south.



## PRELIMINARY CHECKLIST

Nomenclature follows Norris and Shevock (2004) for mosses, and Doyle and Stotler (2006) for liverworts and hornworts. When vouchers have already been deposited in the Herbarium of California State University Northridge (SFV), we cite a specimen following the family name.

### Mosses

- Aloina ambigua* (Bruch & W. P. Schimper) Limpricht [Pottiaceae]  
*Aloina bifrons* (De Notaris) Delgadillo [Pottiaceae] Sagar 1232 (SFV)  
*Aloina rigida* (Hedwig) Limpricht [Pottiaceae]  
*Amblystegium juratzkanum* W. P. Schimper [Amblystegiaceae] McGraw 25 (SFV)  
*Amblystegium serpens* (Hedwig) Bruch & W. P. Schimper [Amblystegiaceae] Sagar 508 (SFV)  
*Anacolia baueri* Hampe [Bartramiaceae] Sagar 423 (SFV)  
*Anacolia menziesii* (Turner) Paris [Bartramiaceae] Sagar 85 (SFV)  
*Antitrichia californica* Sullivant in Lesquereux [Leucodontaceae] Sagar 1048 (SFV)  
*Bestia longipes* (Sullivant & Lesquereux) Brotherus [Brachytheciaceae] Sagar 408 (SFV)  
*Brachythecium albicans* (Hedwig) Bruch & W. P. Schimper [Brachytheciaceae] Sagar 244 (SFV)  
*Brachythecium asperrimum* (C. Muller Hal.) Sullivant [Brachytheciaceae] Sagar 81 (SFV)  
*Brachythecium bolanderi* (Lesquereux) A. Jaeger [Brachytheciaceae] Sagar 333 (SFV)  
*Bryoerythrophyllum columbianum* (F. J. Hermann & F. Lawton) Zander [Pottiaceae] Sagar 1087 (SFV)  
*Bryoerythrophyllum ferruginascens* (Stirt.) Giac. [Pottiaceae] Sagar 518 (SFV)  
*Bryoerythrophyllum recurvirostrum* (Hedwig) Chen [Pottiaceae] Sagar 1066 (SFV)  
*Bryolawtonia vancouveriensis* (Kindberg) Norris & Enroth [Neckeraceae] Wishner 2005/09/23.15 (duplicate in SFV)  
*Bryum microchaeton* Hampe [Bryaceae]  
*Bryum argenteum* Hedwig [Bryaceae] Sagar 758 (SFV)  
*Bryum barnesii* Wood in W. P. Schimper [Bryaceae] Sagar 384  
*Bryum capillare* Hedwig [Bryaceae] Sagar 950 (SFV)  
*Bryum* comparable to *kunzei* [Bryaceae] Sagar 1041 (SFV)  
*Bryum lisae* [Bryaceae] Sagar 670 (SFV)  
*Bryum muehlenbeckii* [Bryaceae] Sagar 880  
*Bryum pseudotriquetrum* (Hedwig) Gärtner, B. Meyer & Scherbius [Bryaceae] Sagar 1072  
*Bryum pyriferum* Crundwell & H. Whitehouse (= *B. valparaisense*) [Bryaceae] McGraw 18  
*Ceratodon purpureus* (Hedwig) Bridel [Ditrichaceae]  
*Claopodium whippleanum* (Sullivant) Renauld & Cardot [Leskeaceae] Sagar 370 (SFV)  
*Conardia compacta* (C. Muller Hal.) H. Robinson [Campyliaceae] Sagar 377 (SFV)  
*Crossidium squamiferum* (Viviani) Juratzka [Pottiaceae] Sagar 360 (SFV)  
*Crumia latifolia* (Kindberg) W. B. Schofield [Pottiaceae] Sagar 736 (SFV)  
*Dendroalsia abietina* (W. J. Hooker) E. Britton in Brotherus [Cryphaeaceae] Sagar 406 (SFV)  
*Didymodon australasiae* (W. J. Hooker & Greville) Zander [Pottiaceae] Sagar 387 (SFV)  
*Didymodon bistratosus* J.-P. Hébrard & R. B. Pierrot [Pottiaceae] Sagar 838 (SFV)  
*Didymodon brachyphyllus* (Sullivant in Whipple) Zander [Pottiaceae] Sagar 702 (SFV)  
*Didymodon nicholsonii* Culmann [Pottiaceae] Sagar 30 (SFV)  
*Didymodon norrisii* Zander [Pottiaceae] Sagar 821 (SFV)  
*Didymodon rigidulus* Hedwig [Pottiaceae] Sagar 839 (SFV)  
*Didymodon tophaceus* (Bridel) Lisa [Pottiaceae] Sagar 714 (SFV)  
*Didymodon vinealis* (Bridel) Zander [Pottiaceae] Sagar 117 (SFV)  
*Ditrichum ambiguum* Best [Ditrichaceae] Sagar 369 (SFV)



- Encalypta rhaptoarpa* Schwägrichen [Encalyptaceae] Wilson 4332 (SFV)  
*Eucladium verticillatum* (Hedwig in Bridel) Bruch & W. P. Schimper [Pottiaceae] Sagar 11 (SFV)  
*Fabronia pusilla* Raddi [Fabroniaceae] Wilson 4292 (SFV)  
*Fissidens bryoides* Hedwig [Fissidentaceae] Sagar 347 (SFV)  
*Fissidens crispus* Montagne [Fissidentaceae] McGraw 14 (SFV)  
*Fissidens sublimbatus* Grout [Fissidentaceae] Sagar 576 (SFV)  
*Funaria hygrometrica* Hedwig [Funariaceae] Sagar 751  
*Funaria muhlenbergii* Turner [Funariaceae] Sagar 837  
*Gemmabryum* Species A according to Spence & Ramsy Sagar 831  
*Grimmia laevigata* (Bridel) Bridel [Grimmiaceae] Sagar 575 (SFV)  
*Grimmia lisae* De Notaris [Grimmiaceae] Sagar 425 (SFV)  
*Grimmia ovalis* (Hedwig) Lindberg [Grimmiaceae] Sagar 57 (SFV)  
*Grimmia pulvinata* (Hedwig) J. E. Smith [Grimmiaceae] Sagar 417 (SFV)  
*Grimmia trichophylla* Greville [Grimmiaceae] Sagar 365 (SFV)  
*Gymnostomum calcareum* Nees & Hornschuch [Pottiaceae] Sagar 1040 (SFV)  
*Hedwigia detonsa* (Howe) W. R. Buck & Norris [Hedwigiaceae] Sagar 399 (SFV)  
*Hennediella stanfordensis* (Hedwig) Zander [Pottiaceae] Sagar 1052 (SFV)  
*Homalothecium aeneum* (Mitten) E. Lawton [Brachytheciaceae] Sagar 382 (SFV)  
*Homalothecium arenarium* (Lesquereux) E. Lawton [Brachytheciaceae] Sagar 290 (SFV)  
*Homalothecium nuttallii* (Wilson) A. Jaeger [Brachytheciaceae] Sagar 65 (SFV)  
*Homalothecium pinnatifidum* (Sullivant & Lesquereux) E. Lawton [Brachytheciaceae] Sagar 170 (SFV)  
*Leptobryum pyriforme* (Hedwig) Wilson [Meesiaceae] Sagar 76 (SFV)  
*Leptodictyum humile* (Palisot de Beauvois) [Amblystegiaceae] Sagar 500 (SFV)  
*Leptodictyum riparium* (Hedwig) Warnstorf [Amblystegiaceae] Sagar 484  
*Microbryum davallianum* (J. E. Smith in Drake) Zander [Pottiaceae] Wilson 3725 (SFV)  
*Microbryum starkeanum* (Hedwig) Zander [Pottiaceae] Sagar 1097 (SFV)  
*Orthotrichum affine* Schader ex Bridel [Orthotrichaceae] Sagar 211 (SFV)  
*Orthotrichum bolanderi* Sullivant [Orthotrichaceae] Sagar 372 (SFV)  
*Orthotrichum flowersii* Vitt [Orthotrichaceae] Sagar 241 (SFV)  
*Orthotrichum hallii* Sullivant & Lesquereux in Sullivant [Orthotrichaceae] Sagar 708 (SFV)  
*Orthotrichum rupestre* Schleicher ex Schwägrichen [Orthotrichaceae] Sagar 414  
*Orthotrichum tenellum* Bruch ex Bridel [Orthotrichaceae] Sagar 504  
*Phascum cuspidatum* Hedwig [Pottiaceae] Sagar 176 (SFV)  
*Pleuridium subulatum* (Hedwig) Rabenhorst [Ditrichaceae] Sagar 1129 (SFV)  
*Pohlia camptotrachela* Renauld & Cardot) Brotherus [Mniaceae] Sagar 1026 (SFV)  
*Pohlia wahlenbergii* (Weber & D. Mohr) Andrews in Grout [Mniaceae] Sagar 1110 (SFV)  
*Pterogonium gracile* (Hedwig) J. E. Smith [Leucodontaceae] Sagar 410 (SFV)  
*Rosulabryum elegans* (Nees ex Bridel) Ochyra Sagar 358  
*Rosulabryum torquescens* (De Not.) Spence Sagar 94  
*Schistidium cinclidodonteum* (C. Müller Hal. in Röhl) B. Bremer [Grimmiaceae] Sagar 206 (SFV)  
*Scleropodium californicum* (Lesquereux) Kindberg [Brachytheciaceae] Sagar 289  
*Scleropodium cespitans* (Wilson ex C. Müller Hal.) L. Koch [Brachytheciaceae] Sagar 373 (SFV)  
*Scleropodium julaceum* E. Lawton [Brachytheciaceae] Sagar 456 (SFV)  
*Scleropodium obtusifolium* (Mitten) Kindberg in Macoun [Brachytheciaceae] Sagar 261 (SFV)  
*Scleropodium touretii* (Bridel) L. Koch [Brachytheciaceae] Sagar 319 (SFV)  
*Syntrichia princeps* (De Notaris) Mitten [Pottiaceae] Sagar 184 (SFV)  
*Syntrichia ruralis* (Hedwig) Weber & D. Mohr [Pottiaceae] Sagar 398 (SFV)  
*Timmia anomala* (Bruch in W. P. Schimper) Limpricht [Pottiaceae] Wilson 4302 (SFV)  
*Timmia crassinervis* (Hampe) L. Koch [Pottiaceae] Sagar 49 (SFV)

- Tortula atrovirens* (J. E. Smith) Lindberg [Pottiaceae] Wilson 4322 (SFV)  
*Tortula californica* E. B. Bartram [Pottiaceae] Sagar 16 (SFV)  
*Tortula guepinii* (Bruch & W. P. Schimper) Brotherus [Pottiaceae] Sagar 1068 (SFV)  
*Tortula inermis* Bridel [Pottiaceae] Sagar 304 (SFV)  
*Tortula muralis* Hedwig [Pottiaceae] Sagar 223  
*Tortula systylia* (W. P. Schimper) Lindberg [Pottiaceae] Sagar 1093  
*Trichostomum crispulum* Bruch in F. A. Mueller [Pottiaceae] Sagar 1127 (SFV)  
*Weissia condensa* (Voit in J. W. Sturm) Lindberg [Pottiaceae] McGraw 30 (SFV)  
*Weissia controversa* Hedwig [Pottiaceae] Sagar 505 (SFV)

### Liverworts

- Asterella bolanderi* (Austin) Underw. [Aytoniaceae]  
*Asterella californica* (Hampe) Underw. [Aytoniaceae] Sagar 553 (SFV)  
*Asterella palmeri* (Hampe) Underw. [Aytoniaceae]  
*Cephaloziella divaricata* (Sm.) Schiffn. var. *divaricata* [Cephaloziellaceae] Sagar 259 (SFV)  
*Cephaloziella turneri* (Hook.) Müll. Frib. [Cephaloziellaceae] Sagar 260  
*Cryptomitrium tenerum* (Hook.) Austin ex Underw. [Aytoniaceae] Wilson 4273 (SFV)  
*Fossombronia longiseta* (Austin) Austin [Fossombroniaceae] Wilson 3719 (SFV)  
*Porella bolanderi* (Austin) Pearson [Porellaceae] Sagar 449 (SFV)  
*Porella cordaeana* (Huebener) Moore [Porellaceae] Sagar 202  
*Riccia campbelliana* M. Howe [Ricciaceae] Sagar 107 (SFV)  
*Riccia nigrella* DC. [Ricciaceae] Sagar 108 (SFV)  
*Riccia sorocarpa* Bisch. [Ricciaceae] Wilson 3716 (SFV)  
*Riccia trichocarpa* M. Howe [Ricciaceae] Sagar 111 (SFV)  
*Sphaerocarpos cristatus* M. Howe [Sphaerocarpaceae] Sagar 2 (SFV)  
*Sphaerocarpos texanus* Austin [Sphaerocarpaceae] Sagar 870 (SFV)  
*Targionia hypophylla* L. [Targioniaceae] Sagar 103 (SFV)

### Hornworts

- Anthoceros fusiformis* Austin [Anthocerotaceae] Sagar 564 (SFV)  
*Anthoceros punctatus* L. [Anthocerotaceae]  
*Phaeoceros carolinianus* (Michx.) Prosk. [Notothyladaceae] Sagar 552 (SFV)  
*Phaeoceros pearsonii* (M. Howe) Prosk. [Notothyladaceae] Wilson 3730 (SFV)

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## LITERATURE CITED

- Doyle, W. T. and R. E. Stotler. 2006. Contributions toward a bryoflora of California III. Keys and annotated species catalogue for liverworts and hornworts. *Madroño* 53:89-197.
- Flowers, S. 1973. *Mosses: Utah and the West*. The Blackburn Press, Caldwell, NJ.
- Harpel, J. A. 1980. A preliminary floristic study of the mosses in the San Jacinto Mountains: A thesis presented to the faculty of California State Polytechnic University, Pomona, CA.
- Kellman, K. M. 2003. A catalog of the mosses of Santa Cruz County, California. *Madroño* 50:61-82.
- Norris, D.H. and J. Enroth. 1990. Description of *Bryolawtonia* Norris & Enroth (Thamnobryaceae), with observations on the genus *Bestia*. *The Bryologist* 93:328-331.
- Norris, D. H. and J. R. Shevock. 2004. Contributions toward a bryoflora of California: II. A key to the mosses. *Madroño* 51:133-269.
- Schofield, W.B. 1992. *Some common mosses of British Columbia*. The Royal British Columbia Museum: Victoria, BC, Canada.
- Schofield, W.B. 2002. *Field guide to liverwort genera of Pacific North America*. University of Washington Press: Seattle, WA.
- Schofield, W.B. 2004. Endemic genera of bryophytes of North America (north of Mexico). *Preslia Praha* 76:255-277.
- Shevock, J.R. 2003. Moss geography and floristics in California. *Fremontia* 31(3):12-20.
- Zander 2006. Bryophyte flora of North America online. Missouri Botanical Garden, St. Louis, MO.
- Zander, R. H., J.A. Jiménez, and T. Sagar. 2005. *Didymodon bistratosus* (Pottiaceae) in the New World. *The Bryologist* 108:540-543.



## Plate 1: Acrocarpous (upright) mosses

### *Aloina rigida* (Hedwig) Limpricht [Pottiaceae]

*Aloina* are plants of dry soil barrens that may flood seasonally. They have deeply concave leaves with incurved margins folding over a cushion of photosynthetic filaments. The genus could be confused with *Pterygoneurum* or *Crossidium*, but instead of photosynthetic filaments, *Pterygoneurum* has sheets of cells on the midrib rather than filaments, and lacks the overarching leaf margins present in *Crossidium*. Neither *Pterygoneurum* or *Crossidium* have been found in the Santa Monica Mountains yet. *Aloina bifrons*, also known from the Santa Monica Mountains, has a hyaline awn, and rather than on soil, it occurs on exposed dry volcanic rock.

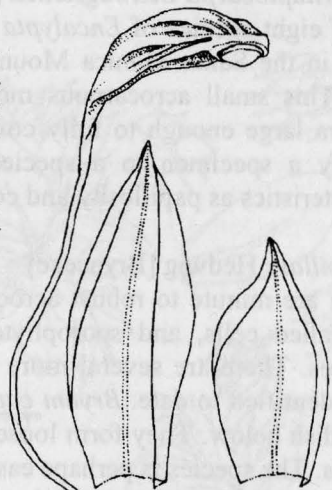
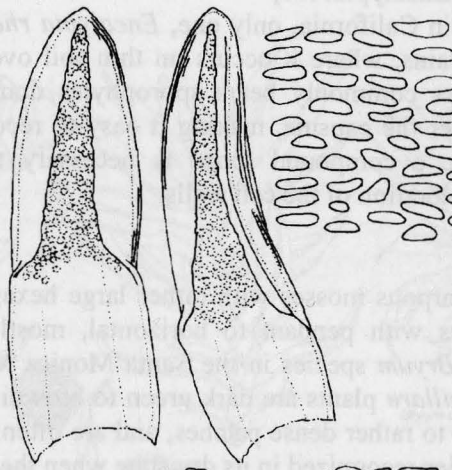
### *Fissidens sublimbatus* Grout [Fissidentaceae]

Only two genera of mosses recorded from the Santa Monica Mountains have leaves in one plane, *Fissidens* and *Bryolawtonia*, the later of which is much branched and rare in the region. Along with having flat shoots, *Fissidens* has leaves laid out like those of an iris, and the leaves have two lamina of different sizes (dorsal and ventral) fused together along the midrib, forming a pocket that clasps the stem. Three species of *Fissidens* are known from the Santa Monica Mountains; all of them occur in moist habitats, mainly on soil, but sometimes on rock, and *Fissidens crispus* has been found on loose gravelly soil submerged in a seasonal trickle. Common and abundant anywhere in the range where moisture is available, *Fissidens* is often the first species to colonize a shaded trailcut. By far the most common *Fissidens* in the range is *Fissidens sublimbatus*. Its dorsal lamina tapers to extinction before it reaches the midrib. It is also a plant of drier habitats than either *Fissidens bryoides* or *Fissidens crispus*.

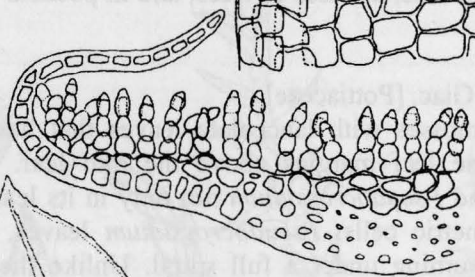
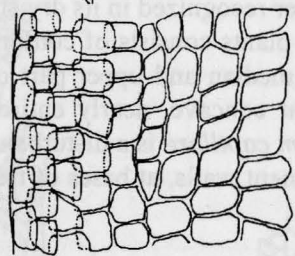
### *Funaria hygrometrica* Hedwig [Funariaceae]

Out of the six North American genera in the family Funariaceae, only *Funaria* has been reported from the Santa Monica Mountains, but at least *Entosthodon bolanderi* has also been collected in southern California and along much of the California coast ranges and could occur here. *Funaria hygrometrica* is a globally common species in disturbed areas, along roadsides, ditches, trail edges, and in openings in woodlands and coastal scrub. It is an acrocarpous moss with individual plants visible with the naked eye, and it produces copious sporophytes with strongly curved, twisted setae, and capsules that are widest near the mouth. The orange coloring of the capsules and setae are also highly diagnostic. It is furthermore quickly recognized for its asymmetric capsule that has a dome-shaped operculum set at a diagonal, a feature that separates it from all other local mosses including the much smaller and much less common *Funaria muhlenbergii*.

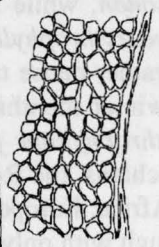
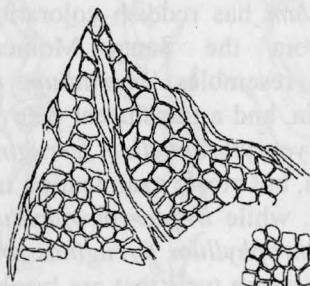
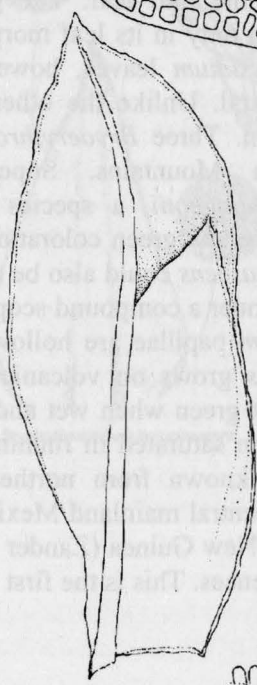
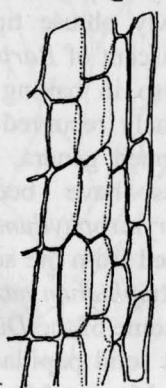
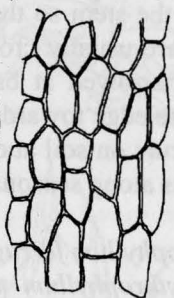
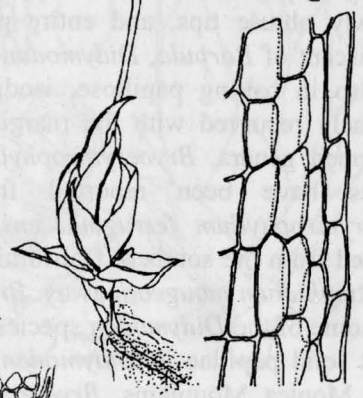
Encyrtus thymus Schwärzchen (Encyrtidae)  
Out of eight species of Aestropyx, Encyrtus thymus is the only one found in the United States. It is a small, slender, black wasp with a pointed abdomen. The female is larger than the male. The wasp is found on dry, open places, under shrubs, or sometimes in open places.



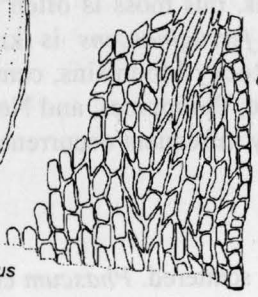
*Aloina rigida*



*Funaria hygrometrica*



*Fissidens sublimbatus*



## Plate 2: Acrocarps

### *Encalypta raptocarpa* Schwägrichen [Encalyptaceae]

Out of eight species of *Encalypta* in California, only one, *Encalypta raptocarpa*, has been found in the Santa Monica Mountains, where it occurs on thin soil over exposed volcanic rock. This small acrocarpous moss commonly bears sporophytes donned with a pointed calyptra large enough to fully cover the capsule, making it easy to recognize. However, to identify a specimen to a species, a compound scope is necessary to see such minute characteristics as papillosity and coloration of the cell walls.

### *Bryum capillare* Hedwig [Bryaceae]

*Bryum* are minute to robust acrocarpous mosses with rather large hexagonal to rectangular thin-walled cells, and sporophytes with pendant to horizontal, mostly long pear-shaped capsules. There are several more *Bryum* species in the Santa Monica Mountains than have been identified to date. *Bryum capillare* plants are dark green to brownish above and brown to reddish below. They form loose to rather dense patches, and are often mixed in with other mosses. The species is perhaps easier recognized in its dry state when the leaves twist spirally around the stem so that a patch of plants consists of contorted little knobs. *Bryum capillare* leaves are usually crowded in the median and upper part of the stems. They are oblong to ovate, narrowed at base, somewhat concave, nearly entire, and sometimes with a hint of crenulate edge toward the tip. *Bryum capillare* is a disturbance-oriented cosmopolitan species that occurs on soil and rock, on cement walls, at bases of trees, and in pockets of dirt in rock outcrops along seasonal drainages.

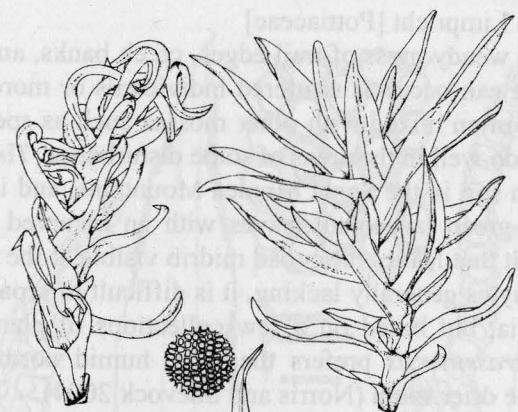
### *Bryoerythrophyllum ferruginascens* (Stirt.) Giac. [Pottiaceae]

*Bryoerythrophyllum* are acrocarpous mosses with lanceolate leaves that have rounded to narrowly obtuse tips, and entire plane leaf margins above the mid leaf. The genus is reminiscent of *Barbula*, *Didymodon* and *Pseudocrossidium* not only in its leaf morphology, but also in having papillose, isodiametric cells. *Pseudocrossidium* leaves, however, are extremely recurved with the margin turning under a full spiral. Unlike the other above-mentioned genera, *Bryoerythrophyllum* has reddish coloration. Three *Bryoerythrophyllum* species have been reported from the Santa Monica Mountains. Superficially, *Bryoerythrophyllum ferruginascens* resembles *Amphidium mougeotii*, a species not yet reported from the southern California, and a translucent pale yellow-green coloration would give *Amphidium mougeotii* away. *Bryoerythrophyllum ferruginascens* could also be confused with some of the *Didymodon* species, but closer examination under a compound scope would reveal solid papillae in *Didymodon*, while *Bryoerythrophyllum* papillae are hollow. In the Santa Monica Mountains, *Bryoerythrophyllum ferruginascens* grows on volcanic rock in seasonal drainages and forms rather dense turfs that are bright green when wet and reddish brown when dry. During the winter months, this moss is often saturated in running water. Nearly circumarctic, *Bryoerythrophyllum ferruginascens* is known from northern Asia, Alaska, Greenland, the Appalachians, the Rocky Mountains, central mainland Mexico south to Veracruz, Bolivia, parts of Africa, Europe, Philippines, and New Guinea (Zander 2006). It appears to be widespread although with only infrequent occurrences. This is the first report of it from California.

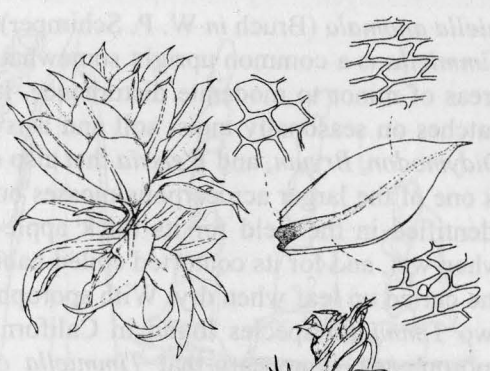
### *Phascum cuspidatum* Hedwig [Pottiaceae]

This extremely small moss is gregarious or scattered. *Phascum cuspidatum*, with its ovate to oblong-lanceolate leaves reaching over the sporophyte hiding the capsule from view, is rarely found without sporophytes. The tiny moss occurs only in the spring on dry soil among grasses, under shrubs, or sometimes in open places.

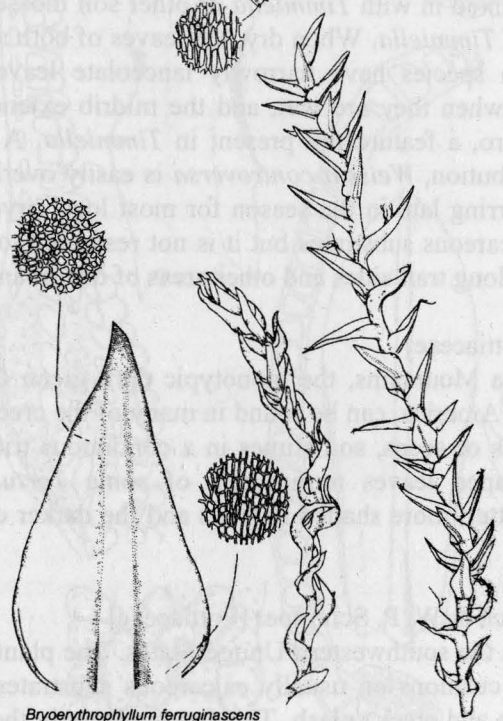




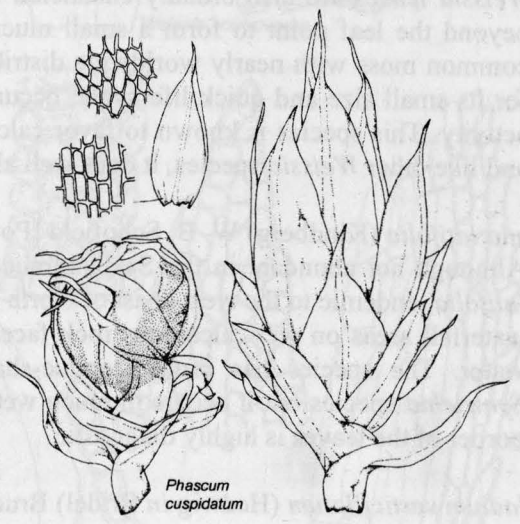
*Encalypta raptocarpa*



*Bryum capillare*



*Bryoerythrophyllum ferruginascens*



*Phascum cuspidatum*

**Plate 3: Acrocarps**

*Timmiella anomala* (Bruch in W. P. Schimper) Limpricht [Pottiaceae]

*Timmiella* is a common upright somewhat weedy moss of trail edges, creek banks, and other areas of minor to moderate disturbance. It can occur as scattered individuals or more dense patches on seasonally moist soil and it is often mixed with other mosses such as species of *Didymodon*, *Bryum*, and *Weissia* that also do well in the areas of some disturbance. *Timmiella* is one of the larger acrocarpous mosses on soil in the Santa Monica Mountains, and is easily identified in the field for its thick apple-green lanceolate leaves with an incurved margin when wet, and for its contorted coiled habit that leaves the broad midrib visible at the back of the curled up leaf when dry. With sporophytes generally lacking, it is difficult to separate the two *Timmiella* species found in California, but based on a few collections of plants with sporophytes, it appears that *Timmiella crassinervis* prefers the more humid north, while *Timmiella anomala* tends to be found in the drier south (Norris and Shevock 2004).

*Weissia controversa* Hedwig [Pottiaceae]

*Weissia* is often collected unintentionally, mixed in with *Timmiella* or other soil mosses, and in its dry state, it looks like a tiny version of *Timmiella*. When dry, the leaves of both species are strongly incurved and contorted. Both species have narrowly lanceolate leaves, but *Weissia* leaves are also broadly channeled when they are wet, and the midrib extends just beyond the leaf point to form a small mucro, a feature not present in *Timmiella*. A rather common moss with nearly worldwide distribution, *Weissia controversa* is easily overlooked for its small size and quick life cycle, occurring late in the season for most local bryophyte activity. This species is known to favor calcareous substrates but it is not restricted to them, and like other *Weissia* species, it does well along trail sides and other areas of disturbance.

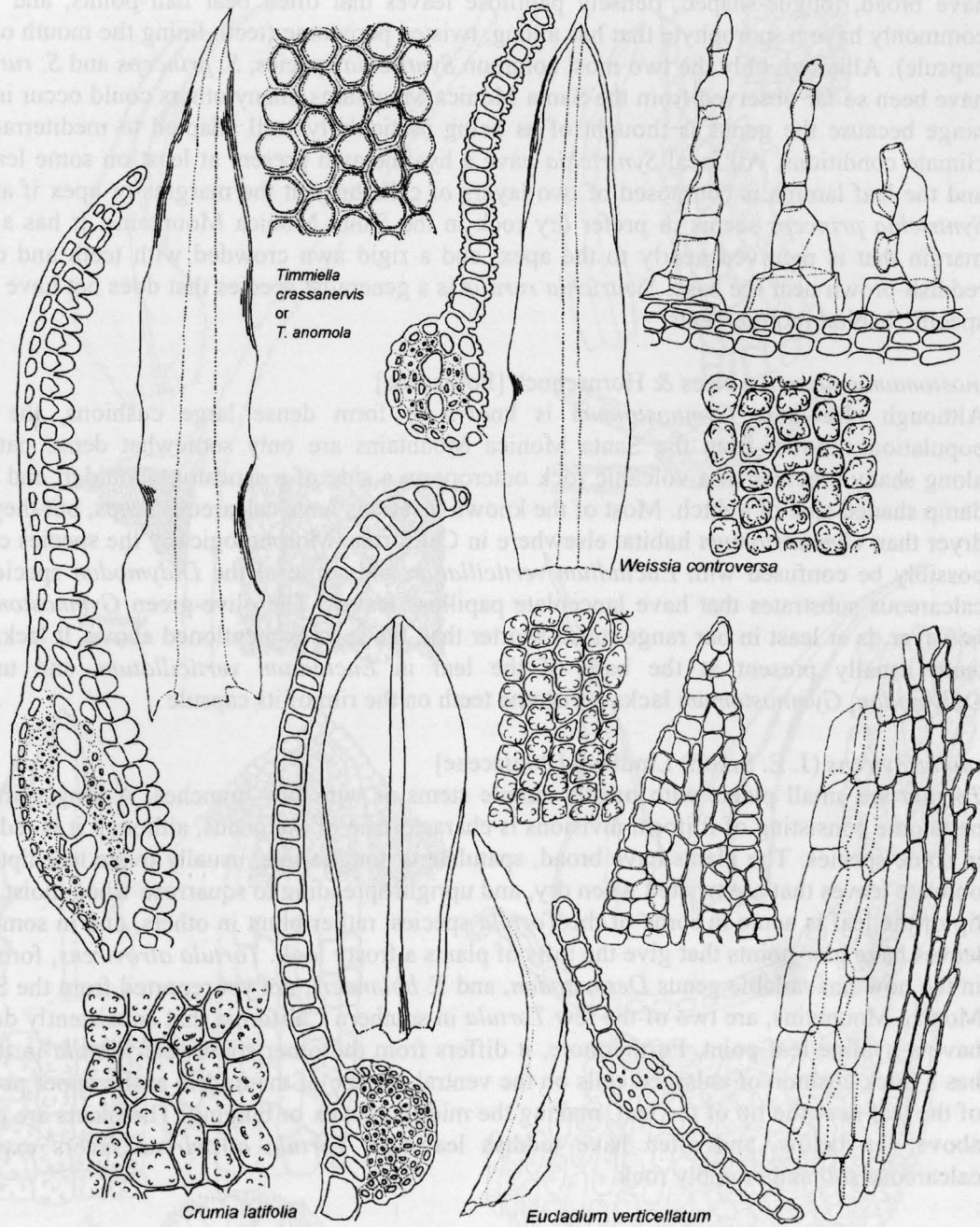
*Crumia latifolia* (Kindberg) W. B. Schofield [Pottiaceae]

Although not abundant in the Santa Monica Mountains, the monotypic dark green *Crumia latifolia*, endemic to the west coast of North America, can be found in many of the creeks and waterfall areas on wet calcareous rock faces or seeps, sometimes in a continuous trickle of water. The species has broad, tongue-shaped leaves reminiscent of some *Tortula* and *Syntrichia* species but it occurs in much wetter, more shaded habitats and the darker colored border of the leaves is highly diagnostic.

*Eucladium verticillatum* (Hedwig in Bridel) Bruch & W. P. Schimper [Pottiaceae]

Only one *Eucladium* species is known from the southwestern United States. The plants form lime encrusted, lumpy tufts and extensive cushions on usually calcareous substrates along edges of waterfalls, and on rocks with seeps and creek splash. This moss occurs in the Santa Monica Mountains in most of the major drainages and is easily recognized for its habit and dark green coloration. *Eucladium verticillatum* leaves are long and narrow, with flat crenulate margins, and strongly papillose which makes the leaf opaque. In the Santa Monica Mountains, the species could be confused with *Didymodon tophaceous*, which has a similar morphology and can occur in the same location or near by. *Didymodon tophaceous*, however, lacks the mucro (a clear cell that forms a short point) at the tip of the *Eucladium* leaf as well as the few teeth at the base of the leaf typical to *Eucladium*.

*Synsphaeria praeceps* (De Notaris) Mitten (Pottiaceae)  
*Synsphaeria* has several species similar to *Tortula*, from which it was recently segregated. Both have broad, fan-like leaves that often lack hair-points, and both commonly have a single row of large, rounded cells at the mouth of the capsule. All species have a single row of large, rounded cells at the mouth of the capsule. *Synsphaeria* has been found in the Mediterranean region, and is also found in the Alps and the Pyrenees. It is a very common moss in some parts of the Alps and the Pyrenees.



*Dubautia* (Pottiaceae)  
As with *Crumia* and *Weissia*, several *Dubautia* species have been reported from the range, along with other similar species with lanceolate leaves that have densely papillose quadrate cells and entire, often somewhat recurved margins. Green to dark green, occasionally red to yellowish-brown, this member of a difficult genus with varying habitus preferences has the look of an antitropical upright moss, and can form considerable patches on rocks, along creek banks, and tree cuts.



#### Plate 4: Acrocarps

##### *Syntrichia princeps* (De Notaris) Mitten [Pottiaceae]

*Syntrichia* bears many similarities with *Tortula*, from which it was recently segregated. Both have broad, tongue-shaped, densely papillose leaves that often bear hair-points, and both commonly have a sporophyte that has a long, twisted peristome (teeth lining the mouth of the capsule). Although only the two most common *Syntrichia* species, *S. princeps* and *S. ruralis*, have been so far observed from the Santa Monica Mountains, many others could occur in the range because the genus is thought of as being particularly well adapted to mediterranean climate conditions. All local *Syntrichia* have a hyaline awn present at least on some leaves, and the leaf lamina is composed of two layers of cells only at the margins or apex if at all. *Syntrichia princeps* seems to prefer dry rock in the Santa Monica Mountains. It has a leaf margin that is recurved nearly to the apex, and a rigid awn crowded with teeth and often reddish-brown near the base. *Syntrichia ruralis* is a generalist species that does not have very specific habitat requirements.

##### *Gymnostomum calcareum* Nees & Hornschuch [Pottiaceae]

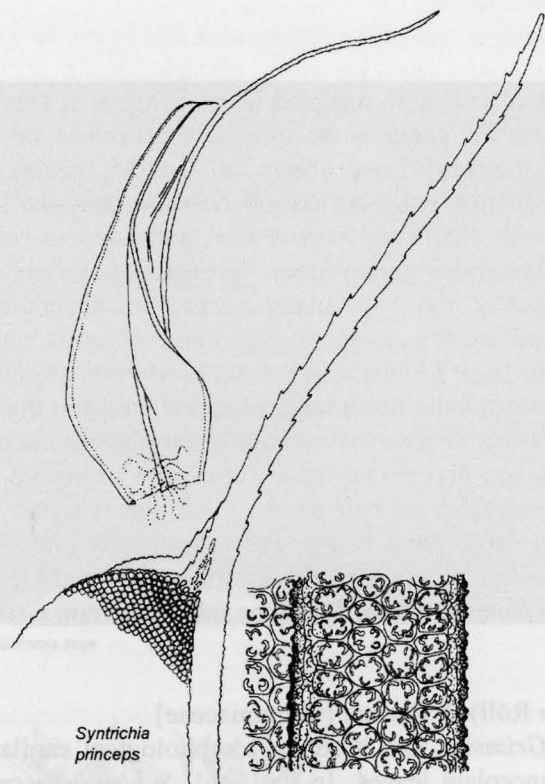
Although elsewhere *Gymnostomum* is known to form dense large cushions, the few populations known from the Santa Monica Mountains are only somewhat dense patches along shady crevices of a volcanic rock outcrop, on a side of a sandstone boulder, and on a damp shaded side of a ditch. Most of the known locations have calcareous seeps, but they are dryer than *Gymnostomum* habitat elsewhere in California. Morphologically the species could possibly be confused with *Eucladium verticillatum* and some of the *Didymodon* species of calcareous substrates that have lanceolate papillose leaves. The olive-green *Gymnostomum*, however, is at least in our range much shorter than the species mentioned above. It lacks the teeth usually present at the base of the leaf in *Eucladium verticillatum*, and unlike *Didymodon*, *Gymnostomum* lacks peristome teeth on the rim of its capsule.

##### *Tortula atrovirens* (J. E. Smith) Lindberg [Pottiaceae]

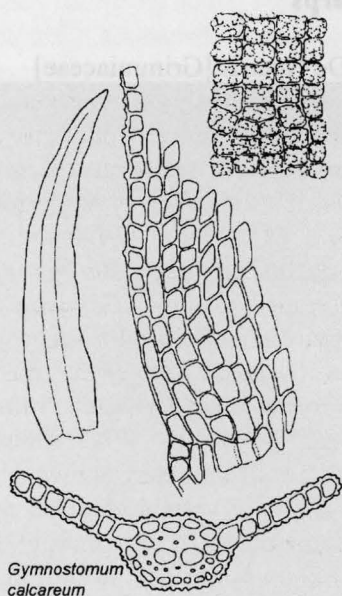
*Tortula* are small plants with mostly simple stems or with few branches. A long spiraling peristome consisting of filiform divisions is characteristic of the genus, although it is reduced in some species. The plants have broad, spatulate or tongue-like, usually ovate to elliptic or obovate leaves that are twisted when dry, and upright spreading to squarrose when moist. The tip of the leaf is acute in some of the *Tortula* species, rather blunt in others, and in some the leaves have hair-points that give the tufts of plants a frosty look. *Tortula atrovirens*, formerly in the now unavailable genus *Desmatodon*, and *T. bolanderi*, not yet reported from the Santa Monica Mountains, are two of the few *Tortula* in southern California that consistently do not have a hyaline leaf point. Furthermore, it differs from the other southwest *Tortula* in that it has a thick cushion of enlarged cells on the ventral surface of the midrib at the upper portion of the leaf near the tip of the leaf, making the midrib convex or bulging. The plants are green above, tan below, and often have reddish leaf tips. *Tortula atrovirens* favors exposed calcareous soil and crumbly rock.

##### *Didymodon vinealis* (Bridel) Zander [Pottiaceae]

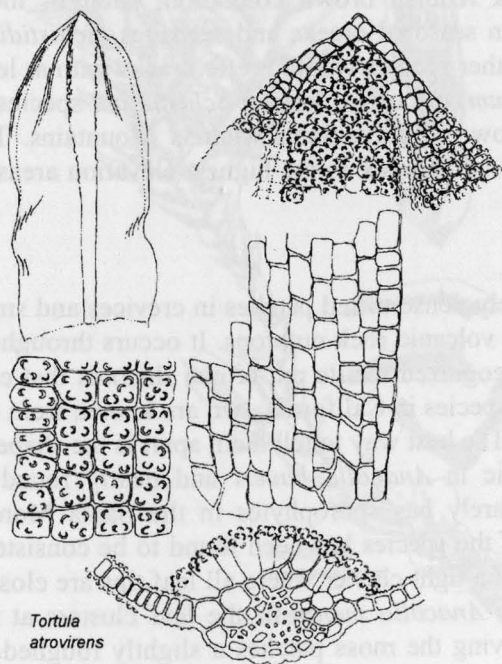
As with California as a whole, *Didymodon* in the Santa Monica Mountains is one of the most common and most diverse of moss genera. Several *Didymodon* species have been reported from the range, along with other similar species with lanceolate leaves that have densely papillose quadrate cells and entire, often somewhat recurved margins. Green to dark-green, or occasionally red- to yellowish-brown, this member of a difficult genus with varying habitat preferences has the look of an archetypal upright moss, and can form considerable patches on rocks, along creek banks, and trail cuts.



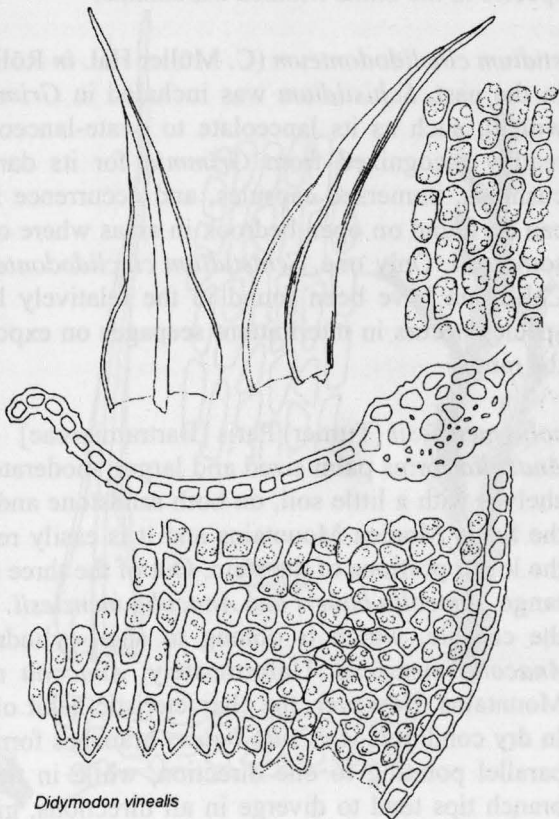
*Syntrichia princeps*



*Gymnostomum calcareum*



*Tortula atrovirens*



*Didymodon vinealis*

## Plate 5: Acrocarps

### *Grimmia lisae* De Notaris [Grimmiaceae]

*Grimmia* is a notoriously difficult genus. Out of the 36 reported for California, at least five occur in the Santa Monica Mountains where the genus is the most common moss on rock. Most *Grimmia* prefer temperate parts of the world, and nearly half of the species have restricted distributions. Yet, a single rock outcrop can host several *Grimmia* species. In the Santa Monica Mountains, *Grimmia* is well distributed across the landscape in various habitats. It occurs on rock outcrops in chaparral, riparian areas, woodlands, and on open, exposed outcrops. Although *Grimmia* typically may have many phenotypes depending on particular environmental conditions, with sufficient patience one can come to terms with the local species. *Grimmia lisae* is the most common *Grimmia* in the Santa Monica Mountains. The species forms loose dark green tufts on generally north facing, shaded boulders that may be exposed part of the day. When moist, *Grimmia lisae* leaves twist open making the plants look like patches of miniature pinwheels; when dry, the leaves are erect and appressed. This species has a highly variable leaf tip ranging from no hair-point to one that is rather long, stout, and denticulate. Its leaf margin also varies from being recurved on only one side to being recurved on both sides. In profile, the leaf midrib of *G. lisae* forms an outward tending arc rather than the mild S-shape typical of *Grimmia trichophylla*, the other common *Grimmia* species in the Santa Monica Mountains.

### *Schistidium cinclidodonteum* (C. Müller Hal. in Röll) B. Bremer [Grimmiaceae]

In the past, *Schistidium* was included in *Grimmia*, and it shares morphological similarities with it, such as its lanceolate to ovate-lanceolate leaves. In the field, *Schistidium* can be readily recognized from *Grimmia* for its dark reddish brown coloration, habit of loose cushions, immersed capsules, and occurrence in seasonal creeks and seepages. *Schistidium* can be found on open bedrock in areas where other species would prefer cracks with at least some soil. Only one, *Schistidium cinclidodonteum*, out of ten known *Schistidium* species in California have been found in the relatively low elevation Santa Monica Mountains. The species occurs in intermittent seepages on exposed bedrock in the highest elevation areas of the range.

### *Anacolia menziesii* (Turner) Paris [Bartramiaceae]

*Anacolia* forms palm-sized and larger, moderately dense tufted patches in crevices and small shelves with a little soil, on both sandstone and volcanic rock outcrops. It occurs throughout the Santa Monica Mountains and it is easily recognized for its red-brown rhizoids that coat the lower portions of the stem. Out of the three species in California, two are known from the range, *Anacolia baueri* and *Anacolia menziesii*. The best way to tell them apart is the shape of the capsule, which is oblong to short-cylindric in *Anacolia baueri* and nearly round in *Anacolia menziesii*. Unfortunately, *Anacolia* rarely has sporophytes in the Santa Monica Mountains. However, the characteristic habit of the species has been found to be consistent. In dry condition, *Anacolia baueri* branches form a tight cluster where all leaf tips are closely parallel pointing to one direction, while in the *Anacolia menziesii* the leaf clusters at the branch tips tend to diverge in all directions, giving the moss patches a slightly roughed-up appearance.



## Plate 5: Acrocarps

### *Grimmia lisae* De Notaris [Grimmiaceae]

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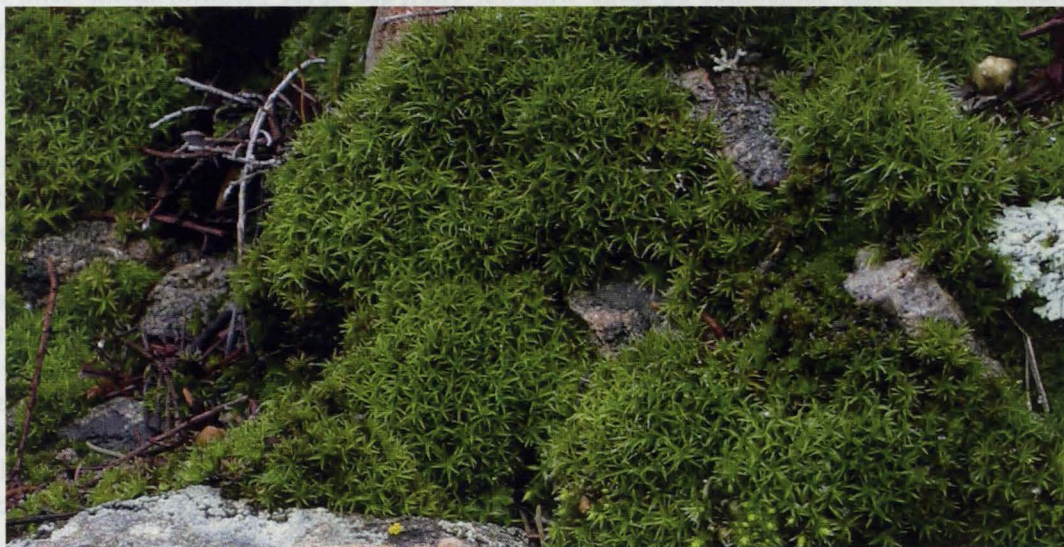
### *Anacolia menziesii* (Turner) Paris [Bartramiaceae]

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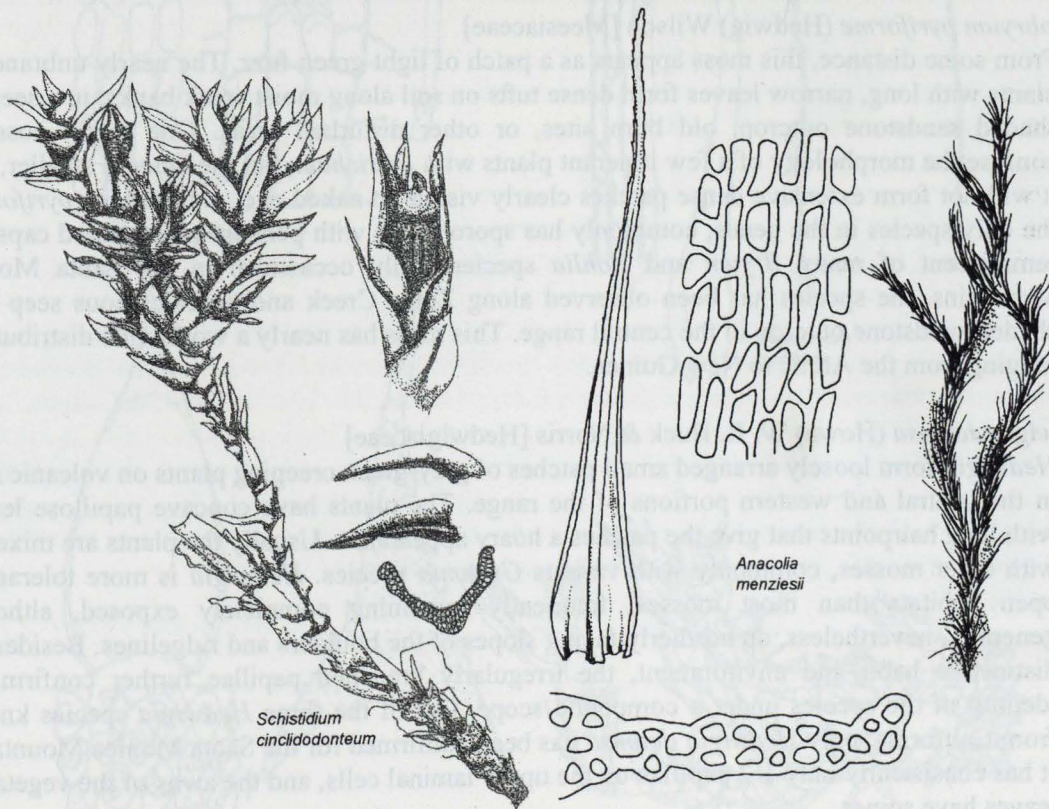


*Orthotrichum testatum* (Besch ex Bridel) [Orthotrichaceae]

In the Santa Catalina Mountains, Orthotrichum is one of the few mosses that occur on trees—mainly on oak and juniper. The plants are plentiful in the semi-arid



*Grimmia lisae*



*Schistidium cinclidodonteum*

*Anacolia menziesii*



## Plate 6: Acrocarps

### *Orthotrichum tenellum* Bruch ex Bridel [Orthotrichaceae]

In the Santa Monica Mountains, *Orthotrichum* is one of the few mosses that occur on trees—mainly on oak and sometimes on large willows. They are never plentiful in the semi-arid conditions of the range, yet *Orthotrichum* is relatively species-rich among our genera. Even so, only six out of the 31 species reported for California occur here. *Orthotrichum* are dark green scattered tufts in bark crevices of course bark and on rock, depending on the species. In Northern California, the plants can grow quite large and produce considerable branching, but the plants in our mountains are only little branched and mostly quite small. The ovate-lanceolate to oblong lanceolate leaves are generally crowded and often contorted when dry. They are mostly acute, usually keeled, and mostly with an entire margin. *Orthotrichum* species commonly have sporophytes available, which is fortunate because many of the characteristics used to identify *Orthotrichum* to species are sporophytic. In many cases, a compound scope is necessary to look at these characteristics, but several larger characteristics can be helpful, such as the position of the capsules in respect to the surrounding perichaetial leaves. Furthermore, the capsules can be broadly ovoid to oblong-cylindric, sometimes pear-shaped, and often ribbed. *Orthotrichum tenellum* grows in light- to dark-green tufts on bark. It has small, blunt, stiffly erect leaves, and a naked (or sparsely hairy) calyptra (cap-like covering) nearly covering the capsule. *Orthotrichum rupestre* is the most common species found on rocks.

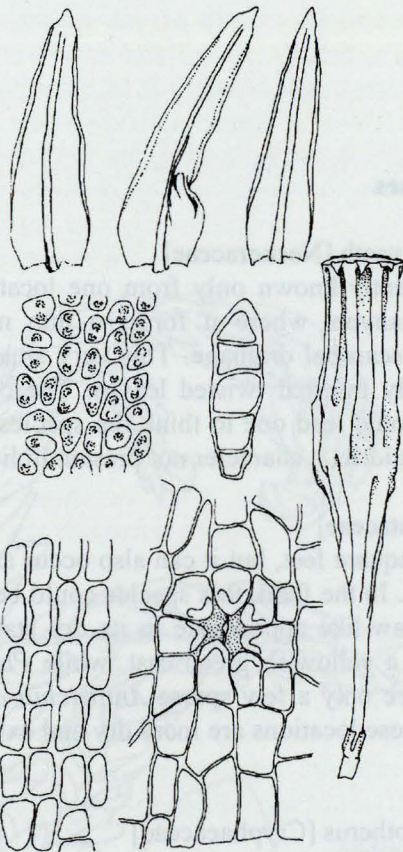
### *Leptobryum pyriforme* (Hedwig) Wilson [Meesiaceae]

From some distance, this moss appears as a patch of light-green fuzz. The nearly unbranched plants with long, narrow leaves form dense tufts on soil along moist creek banks, in a seep on shaded sandstone outcrop, old burn sites, or other disturbed areas. One might possibly confuse the morphology of a few itinerant plants with *Ditrichum*, but the latter is smaller, and it will not form extensive dense patches clearly visible to naked eye. *Leptobryum pyriforme*, the only species in the genus, commonly has sporophytes with pendent pear-shaped capsules reminiscent of many *Bryum* and *Pohlia* species. Only occasional in the Santa Monica Mountains, the species has been observed along Zuma Creek and on calcareous seep in a shaded sandstone outcrop in the central range. This moss has nearly a worldwide distribution, ranging from the Arctic to New Guinea.

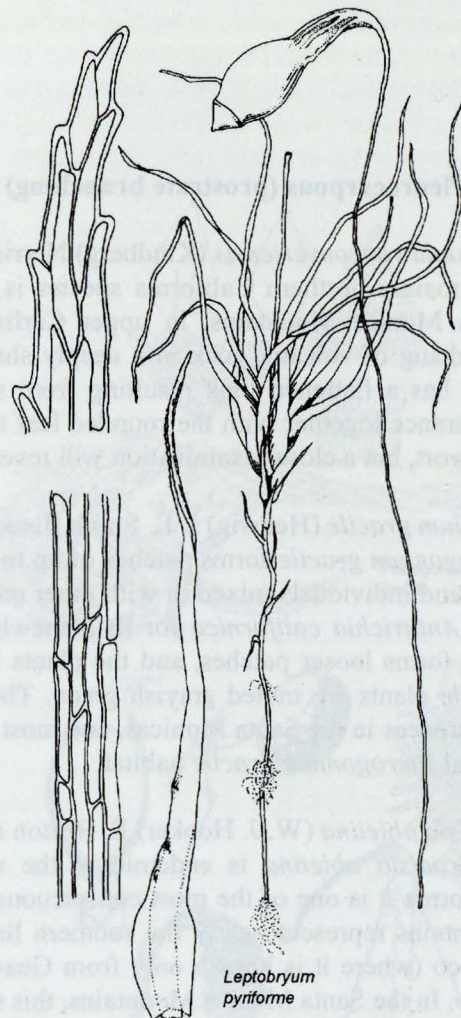
### *Hedwigia detonsa* (Howe) W. R. Buck & Norris [Hedwigiaceae]

*Hedwigia* form loosely arranged small patches of grey-green creeping plants on volcanic rock in the central and western portions of the range. The plants have concave papillose leaves with long hairpoints that give the patches a hoary appearance. Usually the plants are mixed in with other mosses, commonly with various *Grimmia* species. *Hedwigia* is more tolerant of open habitats than most mosses, frequently remaining completely exposed, although generally, nevertheless, on northerly facing slopes of the boulders and ridgelines. Besides the distinctive habit and environment, the irregularly branched papillae further confirm the identity of the species under a compound scope. Out of the three *Hedwigia* species known from California, only *Hedwigia detonsa* has been confirmed for the Santa Monica Mountains. It has consistently only 1-2 papillae on the upper laminal cells, and the awns of the vegetative leaves have spines.

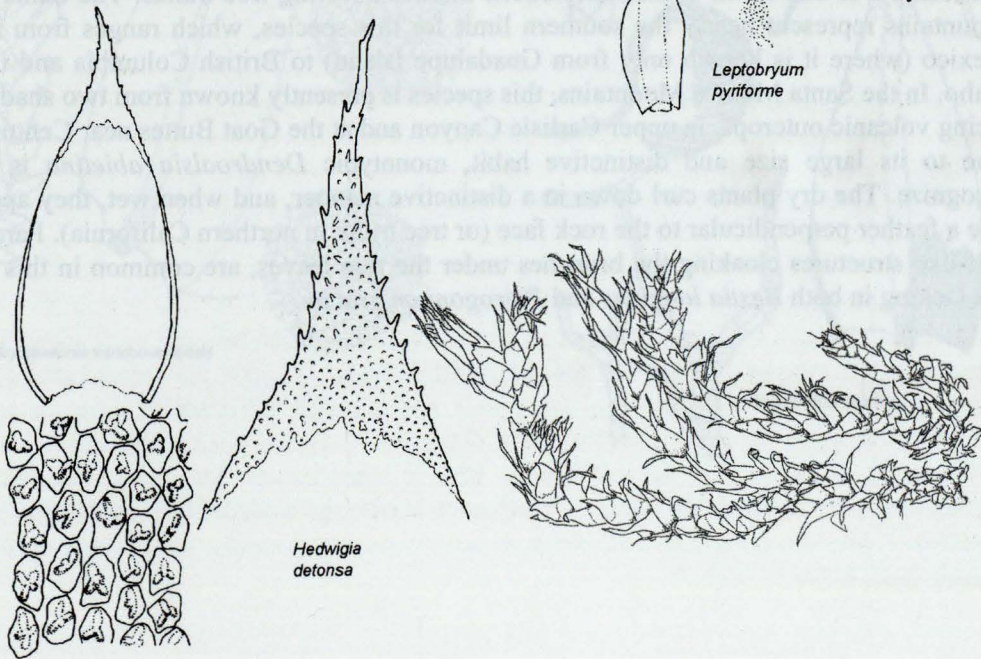




*Orthotrichum tenellum*



*Leptobryum pyriforme*



*Hedwigia detonsa*

Plate 6: *Acrocarpus*

*Orthotrichum tenellum* Bruch ex Bridel [Orthotrichaceae]

In the Santa Monica Mountains, *Orthotrichum* is one of the few mosses that occur on trees—mainly on oak and structures of large willows. They are most plentiful in the semi-arid conditions of the coast, but *Orthotrichum* is relatively common among the pines. Even so, only a few specimens of *Orthotrichum* are known from California. *Orthotrichum* are dark green and have a flattened, somewhat flattened appearance. The leaves are dark green and have a flattened appearance. The leaves are dark green and have a flattened appearance.

**Plate 7: Pleurocarpous (prostrate branching) mosses**

*Bryolawtonia vancouveriensis* (Kindberg) Norris & Enroth [Neckeraceae]

This mainly northern California species is presently known only from one location in the Santa Monica Mountains, in upper Carlisle Canyon, where it forms a thin mat on an underhang of volcanic rock in a deeply shaded seasonal drainage. This very small prostrate moss has a flattened look resulting from spirally inserted twisted leaves. The complanate appearance together with the rounded leaf tips could lead one to think the species is a leafy liverwort, but a closer examination will reveal a midrib, a character not present in liverworts.

*Pterogonium gracile* (Hedwig) J. E. Smith [Leucodontaceae]

*Pterogonium gracile* forms patches of up to 2-3 square feet, but it can also occur as scattered tufts and individuals mixed in with other mosses. In the field, this species could be confused with *Antitrichia californica* for its somewhat claw-like appearance in its dry state, but the latter forms looser patches, and the plants have a yellowish green cast, while *Pterogonium gracile* plants are muted grayish green. There are only a few sparse *Antitrichia californica* occurrences in the Santa Monicas, and most of these locations are more dry and exposed than typical *Pterogonium gracile* habitat.

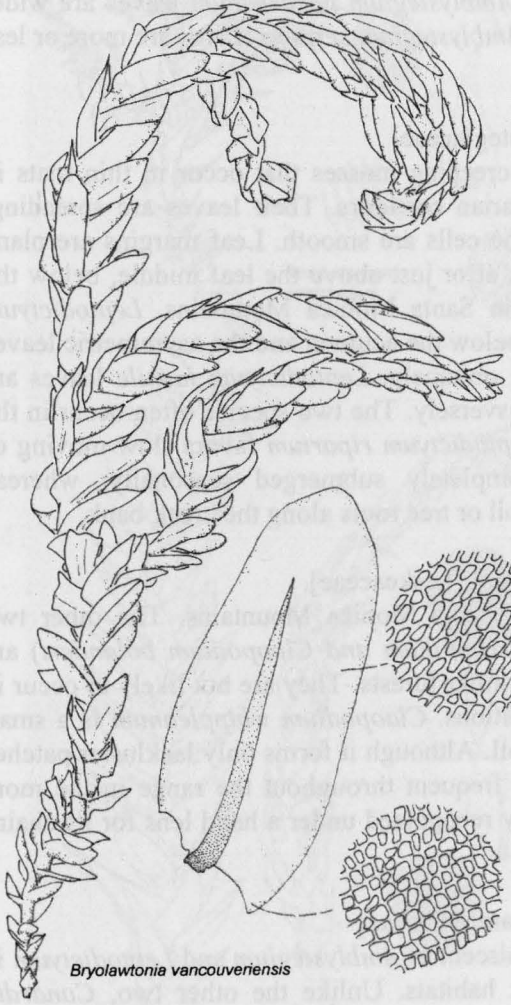
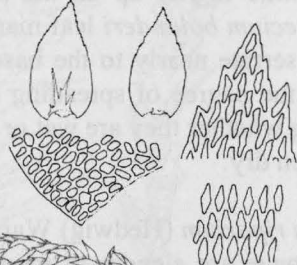
*Dendroalsia abietina* (W. J. Hooker) E. Britton in Brotherus [Cryphaeaceae]

*Dendroalsia abietina* is endemic to the west coast of North America, and in northern California it is one of the most conspicuous mosses covering tree trunks. The Santa Monica Mountains represent nearly the southern limit for this species, which ranges from northern Mexico (where it is known only from Guadalupe Island) to British Columbia and inland to Idaho. In the Santa Monica Mountains, this species is presently known from two shaded north facing volcanic outcrops, in upper Carlisle Canyon and at the Goat Buttes near Century Lake. Due to its large size and distinctive habit, monotypic *Dendroalsia abietina* is easy to recognize. The dry plants curl down in a distinctive manner, and when wet, they appear flat like a feather perpendicular to the rock face (or tree trunk in northern California). Paraphyllia, leaf-like structures cloaking the branches under the true leaves, are common in this species, but lacking in both *Bestia longipes* and *Pterogonium gracile*.

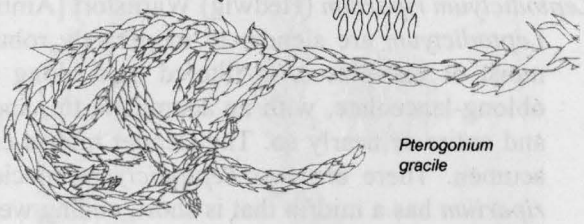


*Amphitetrasium* [Amphitetrasium] W. P. Schimper [Amphitetrasium]

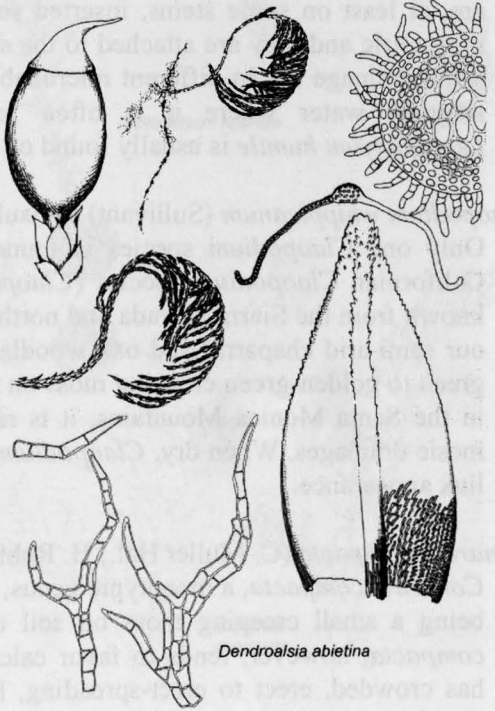
*Amphitetrasium* are small, creeping, irregularly branched masses of wet places. Not very common in the Santa Monica Mountains, they can be found now and then on wet creek banks or submerged in seasonal flow. Their leaves are ovate to lanceolate with an acuminate tip and plane, sometimes entire (sometimes entire) margins, and a slender midrib extending nearly to mid-leaf. *Amphitetrasium* could be confused with *Amphitetrasium* [Amphitetrasium] but the latter tends to occur a little higher up on the creek bank on damp to moist soil or between tree roots. *Amphitetrasium* are more strongly branched than those in *Amphitetrasium*. The two *Amphitetrasium* species in the region can be told apart by the shape of the leaves. *Amphitetrasium* leaves are wide-spreading, whereas *Amphitetrasium* leaves are narrow.



*Bryofawtonia vancouverensis*



*Pterogonium gracile*



*Dendroalsia abietina*

being a small, creeping, irregularly branched mass of wet places. Not very common in the Santa Monica Mountains, they can be found now and then on wet creek banks or submerged in seasonal flow. Their leaves are ovate to lanceolate with an acuminate tip and plane, sometimes entire (sometimes entire) margins, and a slender midrib extending nearly to mid-leaf. *Amphitetrasium* could be confused with *Amphitetrasium* [Amphitetrasium] but the latter tends to occur a little higher up on the creek bank on damp to moist soil or between tree roots. *Amphitetrasium* are more strongly branched than those in *Amphitetrasium*. The two *Amphitetrasium* species in the region can be told apart by the shape of the leaves. *Amphitetrasium* leaves are wide-spreading, whereas *Amphitetrasium* leaves are narrow.



## Plate 8: Pleurocarps

### *Amblystegium juratzkanum* W. P. Schimper [Amblystegiaceae]

*Amblystegium* are small, creeping, irregularly branched mosses of wet places. Not very common in the Santa Monica Mountains, they can be found now and then on wet creek banks or submerged in seasonal flow. Their leaves are ovate to lanceolate with an acuminate tip and plane, serrulate (sometimes entire) margins, and a slender midrib extending nearly to mid-leaf. *Amblystegium* could be confused with *Brachythecium bolanderi*, but the latter tends to occur a little higher up on the creek bank on damp to moist soil or between tree roots. *Brachythecium bolanderi* leaf margins are more strongly serrate than those in *Amblystegium*; they are serrate nearly to the base. The two *Amblystegium* species in the range can be told apart by the degree of spreading of the leaves; *Amblystegium juratzkanum* leaves are wide-spreading whether they are wet or dry, whereas *Amblystegium serpens* leaves are more or less erect when dry.

### *Leptodictyum riparium* (Hedwig) Warnstorf [Amblystegiaceae]

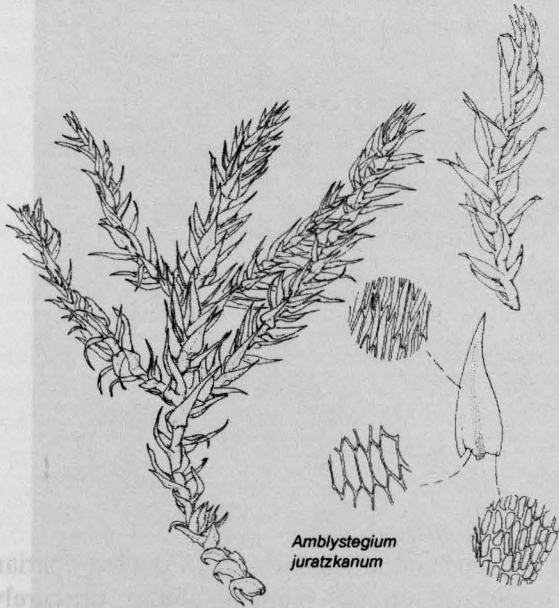
*Leptodictyum* are slender to moderately robust creeping mosses that occur in thin mats in moist or wet places, in filtered light along riparian corridors. Their leaves are spreading, oblong-lanceolate, with an acuminate tip, and the cells are smooth. Leaf margins are plane and entire or nearly so. The slender midrib ends at or just above the leaf middle, below the acumen. There are two *Leptodictyum* species in Santa Monica Mountains. *Leptodictyum riparium* has a midrib that is short, ending well below the acumen and the asymmetric leaves are, at least on some stems, inserted somewhat obliquely. *Leptodictyum humile* leaves are symmetric and they are attached to the stem transversely. The two species often occur in the same drainage but in different microhabitats. *Leptodictyum riparium* favors slow-moving or stagnant water where it is often found completely submerged seasonally, whereas *Leptodictyum humile* is usually found on moist soil or tree roots along the creek bank.

### *Claopodium whippleanum* (Sullivant) Renauld & Cardot [Leskeaceae]

Only one *Claopodium* species is found in the Santa Monica Mountains. The other two Californian *Claopodium* species (*Claopodium crispifolium* and *Claopodium bolanderi*) are known from the Sierra Nevada and north coast conifer forests. They are not likely to occur in our semi-arid chaparral and oak woodland conditions. *Claopodium whippleanum* is a small green to golden-green creeping moss on moist soil. Although it forms only lackluster patches in the Santa Monica Mountains, it is relatively frequent throughout the range in the more mesic drainages. When dry, *Claopodium* is easily recognized under a hand lens for its chain-link appearance.

### *Conardia compacta* (C. Muller Hal.) H. Robinson [Campyliaceae]

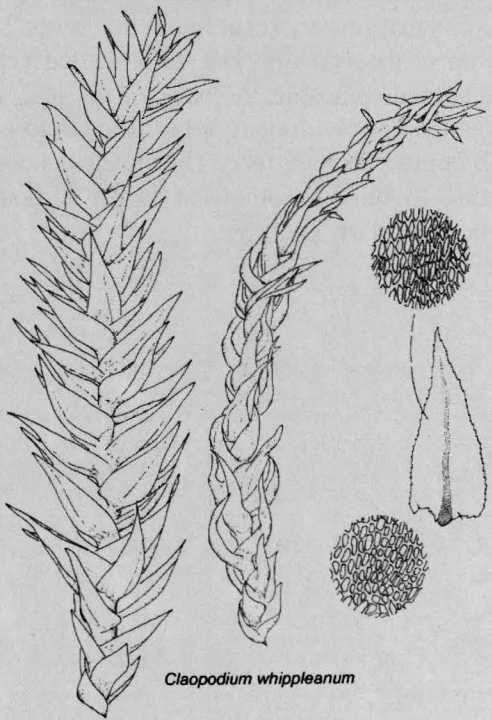
*Conardia compacta*, a monotypic genus, is reminiscent of *Amblystegium* and *Leptodictyum* in being a small creeping moss on soil of moist habitats. Unlike the other two, *Conardia compacta*, however, tends to favor calcareous and alkaline substrates. *Conardia compacta* has crowded, erect to erect-spreading, lanceolate to ovate-lanceolate, decurrent leaves and double teeth at the edge of the leaf base at least in some leaves. The plants commonly bear filamentous propagula at the back of the leaves above the middle. If a compound scope is available, *Conardia compacta* will prove to have papillose rhizoids, while other similar local mosses have smooth rhizoids.



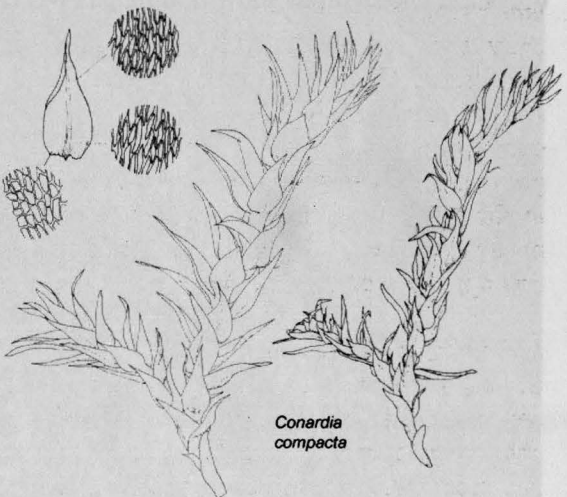
*Amblystegium juratzkanum*



*Leptodictyum riparium*



*Claopodium whippleanum*



*Conardia compacta*



## Plate 8: Pleurocarps

### *Amblystegium furciferum* W. P. Schimper [Amblystegiaceae]

*Amblystegium* are small, creeping, irregularly branched masses of wet places. Not very common in the Santa Monica Mountains, they can be found now and then on wet creek banks or submerged in seasonal flow. Their leaves are ovate to lanceolate with an acuminate tip and plane, serrulate (sometimes ciliate) margins, and a slender midrib extending nearly to mid-leaf. *Amblystegium* could be confused with *Brachythecium*, but the latter tends to occur a little higher up on the creek bank on drier to moist soil between tree roots. *Brachythecium* has shorter leaf margins are more strongly serrate than those in *Amblystegium*; they are serrate nearly to the base. The two *Amblystegium* species in this plate can be told apart by the degree of spreading of the leaves. *Amblystegium* leaves are wide-spreading whether they are wet or dry, whereas *Amblystegium* leaves are more or less erect when dry.

### *Leptodictyum riparium* (Mittwag) Warwick [Amblystegiaceae]

## Plate 9: Pleurocarp

### *Bestia longipes* (Sullivant & Lesquereux) Brotherus [Brachytheciaceae]

The monotypic *Bestia longipes* occurs on both volcanic and sandstone rock in shaded riparian drainages. The stem leaves and the branch leaves are similar: blunt or obtuse, obscurely plicate, ovate-lanceolate, and with an acute tip. The margins are recurved in the lower 2/3 and serrate at the apex. The stout midrib extends up to the leaf tip. The thick-walled cells are rhombic and their projecting ends appear as scattered spines on the back of the leaf. *Bestia* occurs often near by *Pterogonium gracile* in shaded narrow drainages but it tends to occupy slightly moister, more shaded parts of the same boulder or rock face. The species is common along the central California coast and endemic to only a somewhat larger region. The opposing photographs show *B. longipes* wet (above) and dry (below).

### *Conardia compacta* (Sullivant & Lesquereux) Brotherus [Campylopusaceae]

*Conardia compacta*, a monotypic genus, is reminiscent of *Amblystegium* and *Leptodictyum* in being a small, creeping, moss on soil of moist habitats. Unlike the other two, *Conardia compacta* has a more or less upright habit and a more or less upright habit. *Conardia compacta* has erect, blunt to obtuse, spreading, lanceolate to ovate-lanceolate, decurrent leaves and double teeth at the edge of the leaf base at least in some leaves. The plants commonly bear filamentous propagulae at the back of the leaves above the middle. If a compound scope is available, *Conardia compacta* will prove to have papillose rhizoids, while other similar local mosses have smooth rhizoids.





*Besleria longipes* wet



*Besleria longipes* dry

things with other great species which may decompose it, contributing to its relatively low abundance.



## Plate 10: Pleurocarps

### *Homalothecium pinnatifidum* (Sullivant & Lesquereux) E. Lawton [Brachytheciaceae]

Most *Homalothecium* are distinctively pinnate with short regular golden branches that twist upward. The exception is the more stringy *Homalothecium arenarium*. *Homalothecium*'s leaf shape varies from lanceolate to elongate triangular, and has strong plicae at the concave base. Through a compound scope one can detect a series of spines on the midrib. This feature that is particularly helpful with *H. arenarium*, which has several spines closely arranged at the tip of the midrib while the spines in the others are inconspicuous and mostly single. Dry *H. pinnatifidum* branches are markedly hook shaped with plants loosely attached to rock faces. In general, *Homalothecium* species tend to prefer drier sites than our *Brachythecium* species which can range from seasonally submerged to mesic to somewhat dry sites.

### *Scleropodium touretii* (Bridel) L. Koch [Brachytheciaceae]

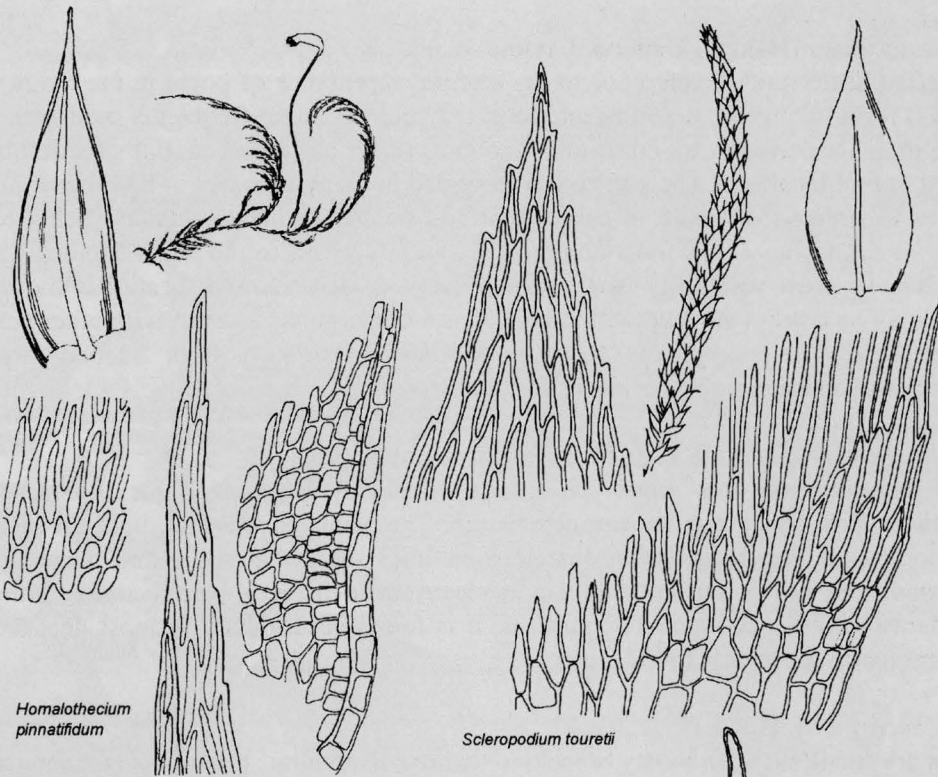
*Scleropodium* are prostrate creeping mosses forming glossy shag that lays flat and downwardly pointing over rock or soil. The tight rope-like branches are telltale for the genus. Furthermore, the plants have smooth, broadly ovate to ovate-lanceolate, concave leaves that have plane, entire to serrulate edges. *Scleropodium* is perhaps the most common pleurocarpous moss in the Santa Monica Mountains, well distributed through out the range. Out of the six California species, all but one (*Scleropodium colpophyllum*) have been reported from the range. *Scleropodium touretii* is one of the larger *Scleropodium* species in the Santa Monica Mountains with only *Scleropodium obtusifolium* being sometimes larger. *Scleropodium touretii* forms lush thick patches, mainly on soil and not generally submerged, and tend to be rather uniform with all the branches having a strongly rope-like appearance. At least some stems have leaves with a short-acuminate tip curving outward away from the stem. *Scleropodium obtusifolium* grows in places that are seasonally submerged. The other smaller species are more likely to be on rocks in shady areas.

### *Brachythecium albicans* (Hedwig) Bruch & W. P. Schimper [Brachytheciaceae]

*Brachythecium* are prostrate and mostly mesophilic. Although the genus is difficult worldwide, our four *Brachythecium* species (*Brachythecium albicans*, *B. asperrimum*, *B. bolanderi*, and *B. velutinum*) are fairly distinctive. When wet, *Homalothecium* (especially *Homalothecium arenarium*) could be confused with *Brachythecium*. *Brachythecium albicans*, like other *Brachythecium* species in the range, has a midrib that usually ends at 1/2 to 3/4 of the leaf length, but it is the only one with the plicae extending up at least 1/4 of the leaf length. The others have no plicae, or the plicae are restricted to the leaf base. *Brachythecium albicans* leaves are narrow to linear, they have a nearly entire awn, and when the leaves are dry, they overlap closely in an orderly manner. The other very common species, *Brachythecium bolanderi*, is a much smaller moss and has leaf tips that spread in many directions.

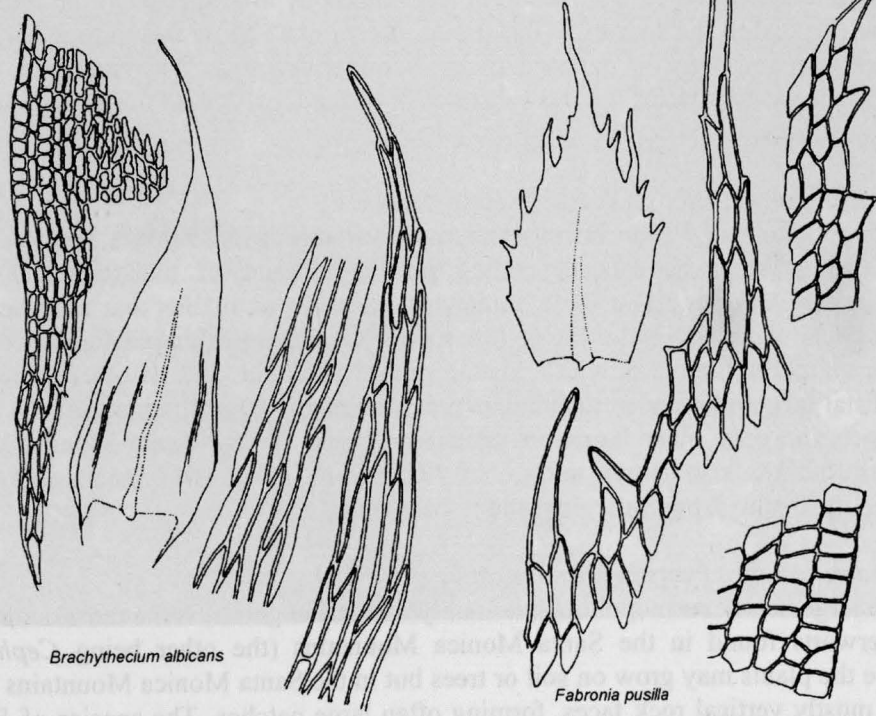
### *Fabronia pusilla* Raddi [Fabroniaceae]

*Fabronia* is divided into only three species, and so far only *Fabronia pusilla* has been collected in the Santa Monica Mountains. The tiny creeping silvery hair moss that forms thin mats in crevices and downwardly facing rock overhangs occurs principally in mediterranean climates and reaches its northern limit in southern British Columbia where it has been listed as endangered. Magnification of this very small moss will reveal broadly ovate leaves with long marginal teeth and elongate thin-walled cells. A species usually of seasonally dry habitats, *Fabronia pusilla* is elsewhere found also on tree bark, especially on oaks, but in the Santa Monica Mountains it appears to prefer rock. It occurs as small patches and often mingles with other bigger species which may outcompete it, contributing to its relatively low abundance.



*Homalothecium pinnatifidum*

*Scleropodium touretii*



*Brachythecium albicans*

*Fabronia pusilla*



## Plate 11: Liverworts and a hornwort

(clockwise, from upper left):

### *Asterella californica* (Hampe) Underw. [Aytoniaceae]

*Asterella* ("little star" in reference to the starlike appearance of pores in the thallus of some species) form light green colonies on moist soil, and are found frequently in shaded locations in the drainages, along trail-cuts and sometimes under shrubs in coastal sage scrub in more shaded humid locations. The genus is widespread in many climates in both hemispheres, but reaches its greatest diversity in subtropical and milder temperate regions (Schofield 2002). *Asterella californica* is the most common thalloid liverwort in the Santa Monica Mountains, but it shows great variability in abundance between seasons and locations, and vegetative plants may be easily confused with other species of the genus or even with other genera such as *Targionia*. The sporophytes, however, are born on strongly 4- or 5-lobed carpocephala (umbrella-like heads) on stalks above the thallus.

### *Cryptomitrium tenerum* (Hook.) Austin ex Underw. [Aytoniaceae]

When reproductive, this monotypic genus is quickly recognized for the rather flat or shallowly domed spring-green carpocephalum. The plants have a thin, light green, flattened, dichotomously branching thallus that is sometimes somewhat shiny and purplish beneath. *Cryptomitrium* grows on soil and favors deep shade in very humid areas. Although not abundant in the Santa Monica Mountains, it is found occasionally in most deeper narrower drainages with some year round water.

### *Riccia trichocarpa* M. Howe [Ricciaceae]

*Riccia* are small, dichotomously branching thallose liverworts. The genus is the most species-rich of hepatic genera in California and is represented by four species in the Santa Monica Mountains. Typical to the species in this group, *Riccia* often grow mixed together or at least in the same general area on exposed rocky, summer-dry soil. Widespread in California, *Riccia trichocarpa* is perhaps the most distinctive of the local *Riccia* for its long hairs lining the thallus margins.

### *Phaeoceros carolinianus* (Michx.) Prosk. [Notothyladaceae]

Thallus morphology of *Phaeoceros* is extremely variable even within a species across the seasons and different habitats depending on the amount of moisture and exposure. *Phaeoceros carolinianus* has a dark, somewhat bluish-green thallus that may be flat or in wetter areas undulate. Except for the yellow spores, the distinguishing features of this species (the large angular chloroplasts with a visible central pyrenoid, lack of tubers, spores with a spinose distal face and rounded tuberculate proximal face) all require the use of a compound microscope. The only other hornwort genus confirmed for the Santa Monica Mountains, *Anthoceros*, has blackish spores, and unlike *Phaeoceros*, it has large mucilage- or air-filled cavities on the thallus whose margins tend to be crisped.

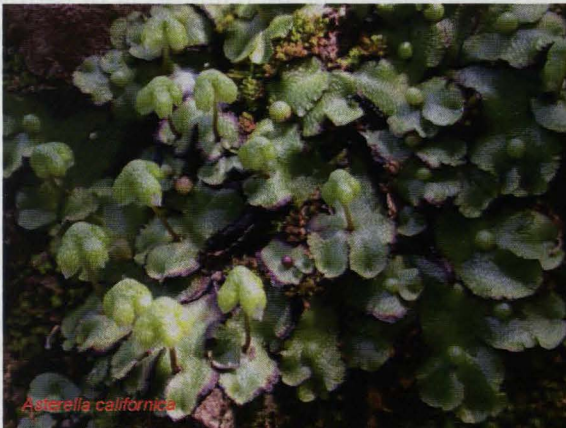
### *Porella bolanderi* (Austin) Pearson [Porellaceae]

*Porella*, a large nearly cosmopolitan but mainly east Asian genus, is the most common of the leafy liverworts found in the Santa Monica Mountains (the other being *Cephaloziella*). Elsewhere the plants may grow on soil or trees but in the Santa Monica Mountains they seem to prefer mostly vertical rock faces, forming often large patches. The species of *Porella* are often difficult to identify because of their plasticity which makes several of them nearly fade from one to the next.

(Continued on next page)



DUDLEYA, WITH SPECIAL REFERENCE TO THE SUBGENUS IN THE SANTA MONICA MOUNTAINS



*Asterella californica*



*Chylomnium tenerum*



*Targionia hypophylla*



*Riccia trichocarpa*



*Porella holanderi*



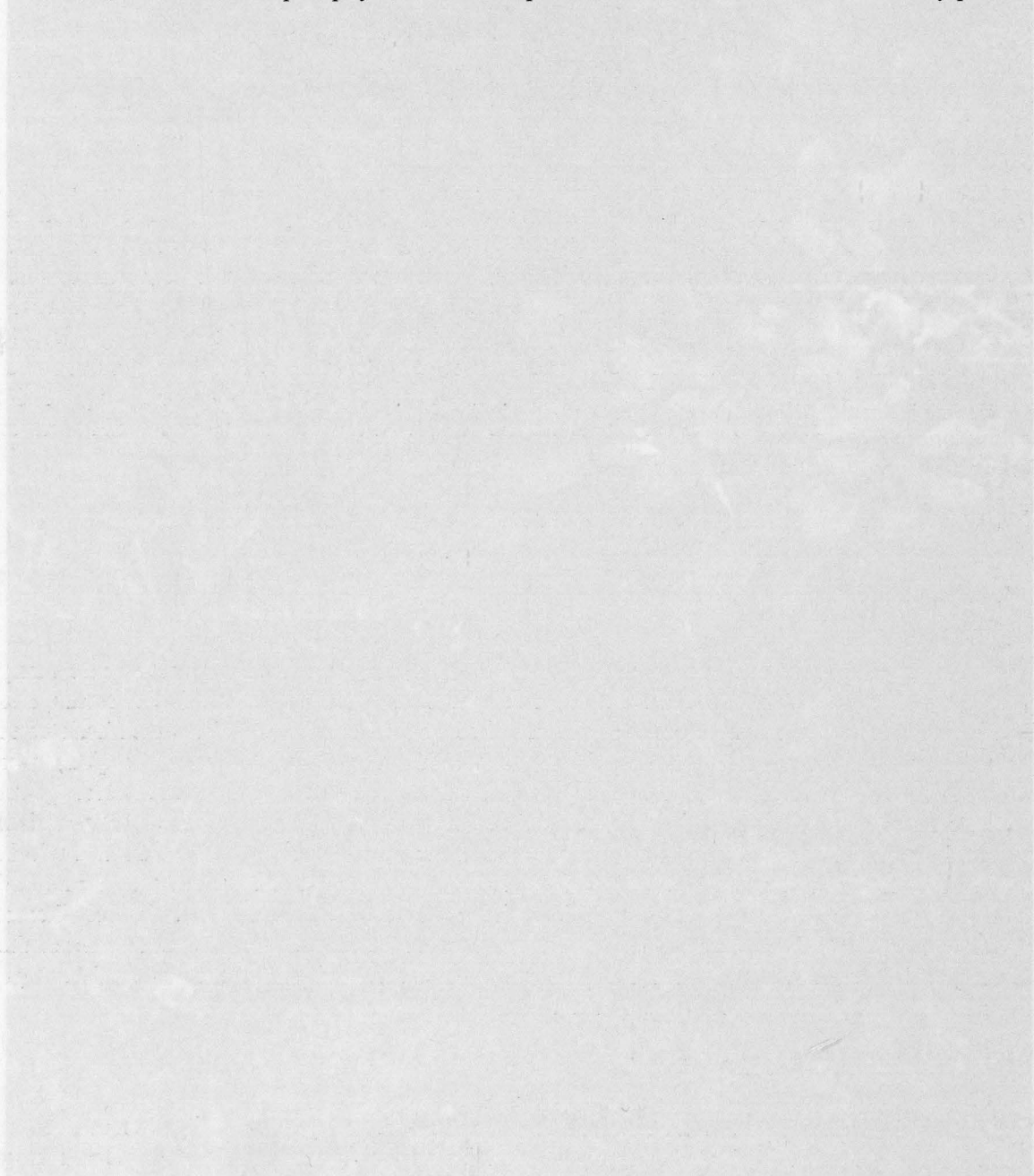
*Phaeoceros saccatum*

(Thiede 2004; Moran 1973, 1983). The tendency to allopatry is due partially to convergent (Joh 2004; Wagner 1974) or plants of these genera occur under similar climatic conditions that have led to the parallel evolution of morphological characteristics adapted to these conditions (Joh 2004). Within the genus it is difficult to define species and subspecies clearly because plants often occur in isolated populations with localized differentiation. Closely related taxa tend to intergrade with each other without clear-cut distinctions between the taxa (Thiede 2004). In 1983,



*Targionia hypophylla* L. [Targioniaceae]

The green to blue-green vegetative plants of *Targionia hypophylla* are reminiscent of narrow young *Asterella* plants, but tend to be more elongate and strongly incurved when dry. The reproductive plants, however, bear the unmistakable *Targionia* signature of a purplish black blister, the immersed sporophyte, under the tip of the thallus branch, which is usually present.



...found in the Santa Monica Mountains (the other being *Cephalozia*).  
Elsewhere the plants may grow on soil or rock but in the Santa Monica Mountains they seem  
to prefer mostly vertical rock faces, forming often large patches. The species of *Porolia* are  
often difficult to identify because of their pleurocory which makes several of them nearly fade  
from one to the next.

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