

Solenopsora Massal.

After Purvis and James (1992)
(and eventually others, including Ryan, unpubl.)

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THALLUS crustose, small squamulose or placodioid with lobed margins firmly attached; **rhizines** mostly absent but present in S. holophaea and an undescribed Mexican species; **prothallus** absent or blue-black. **Upper surface** corticate. **Photobiont** chlorococcoid; cells most globose, a few ellipsoid.

APOTHECIA sessile. **Thalline exciple** present, sometimes becoming excluded. **Hypothecium** colorless to yellowish brown or reddish brown or orange-brown. **Hymenium** colorless to red-brown, I+ blue. **Epihymenium** yellowish brown to red-brown, sometimes interspersed with granules. **Paraphyses** simple, 1.5-2 μ m wide, with swollen apices (4-5 μ m wide) that often have an internally brown apical cap, simple, pigment within swollen tips. **Asci** clavate, \pm Catillaria-type but sometimes with a small ocular chamber. **Spores** 8, colorless, ellipsoid to fusiform, 1-septate, without thick epispore.

PYCNIDIA immersed in thallus; **conidiogenous** cells Type VI of Vobis, endobasidial; **conidia** 3-4 x 0.8-1 μ m, simple, colorless.

CHEMISTRY: Pannarin, terpenoids, and various substances, mostly unidentified.

ECOLOGY AND DISTRIBUTION: On rocks or soil in crevices in coastal or sunny areas, predominantly Mediterranean.

As circumscribed above, the genus is distinguished from Squamarina and placodioid Lecanora species by the septate ascospores, and from Psora by the same character and also by the presence of a thalline exciple, at least when young. It differs from Lecania mainly in having endobasidial pycnospores and a slightly different ascus type. Although placed by Poelt in the family Squamarinaceae, Solenopsora differs considerably from Squamarina, and I do not think it belongs in the same family.

I am in the process of studying the genus, especially in N. America, and expect to add to and modify the description of the genus and its species considerably in the future. At present the genus is heterogeneous, and the N. American taxa are mostly new ones I am describing. Because of the difficulty in distinguishing it from Lecania, for the moment I am also treating it and similar species of unknown affinities under the key to that genus. I have not yet decided whether various undescribed species with simple spores should be included under Solenopsora, but they are also treated in the Lecania key.

1. **Thallus clearly radiately lobed, tightly adherent to rock. Discs pruinose.** 2
1. **Thallus effuse, tightly to loosely adherent to rock or soil. Discs pruinose or not.** 5
 2. **Thallus only weakly or spottily pruinose. Spores 6-10 x 1.5-2.5 um.** Containing unknown phenolic substances. Asci Bacidia-type. Channel Islands, California. (see Lecania "brattii")
 2. **Thallus densely pruinose throughout. Spores mostly over 3 um wide.** 3
3. **Spores (often few present) simple.** Asci Catillaria-type. Containing unidentified phenolic substances. 4
3. **Spores 1-septate.** Asci Bacidia-type. Pycnosporos bacilliform, < 10 um long. 5
 4. **Spores (11-)12-13(-18) x (3-)4-5 um. Coastal (Santa Catalina I., California).** ["Lecanoroidea catalinae" Ryan & Nash ined.]
 4. **Spores (6-)8-10(-12) x 5-6(-7) um. Inland (Hidalgo, Mexico).** ["Lecanoroidea hidalgoensis" Ryan & Nash ined.]
5. **Hymenium 50-60 um high.** Spores (10-)12-14(-18) x 3-4 um. Thallus K-, C-, KC-, P+ orange, UV+ gray, containing pannarin, zeorin, and unidentified pink pigment. Asci Catillaria-type. On dry, hard, calcareous rocks, especially limestones, in exposed, dry, sunny, warm, mountainous areas. No N. American material seen by me. "S." candicans (perhaps should be treated in a separate genus, namely Placolecania)
5. **Hymenium 95-100 um high.** Spores 11-17 x 4-5 um. Thallus K-. On calcareous rocks and argillaceous shale, Southern California, coastal to montane. ("S." candicans sensu Hasse; not seen; possibly the same as "Lecanoroidea catalinae")
 6. **Thallus clearly squamulose or bullate-squamulose; squamules averaging over 1 mm wide and thick.** Often containing terpenoids or other lichen substances with purplish or bluish colors after charring. 7
 6. **Thallus crustose, lobed at margin, thin.** Mostly without lichen substances. Thallus dark blackish brown, epruinose. Spores 15-20(-26) x 4.5(-6) um. Spermatia straight, 8-10 um long. Hymenium to 85 um. Discs brownish black. (see "Lecania" hassei)
7. **Thallus of concave squamules, Psora-like.** Upper surface light to dark olive brown, deep yellowish brown or medium brown, not blackish. Discs medium to reddish brown or dark brown, epruinose. Spores 11-17(-24) x 4(-6) um, narrowly ellipsoid or ellipsoid-elongate, to fusiform. Thallus P-, K-, KC-, C-, UV-. (triterpenes and fatty acids, \pm atranorin, or no substances). On soil over bricks and rocks, and on soft rocks, near the coast. Reported from California; no N. American material seen by me. Solenopsora s. str. S. holophaea (Mont.) Samp.
7. **Thallus of plane to convex or bullate squamules, Toninia-like.** 8
 8. **Discs \pm densely pruinose, dark grayish brown to brownish black under the pruina. Squamules loosely adnate, substipitate, crenate-lobed; upper surface \pm grayish. Spores oblong. Pycnosporos bacilliform.** On siliceous soil or rock, coast of California. 7
 8. **Discs epruinose or almost, reddish brown to brownish black under the pruina. Squamules rather tightly appressed, not distinctly crenate or lobed; upper surface usually yellowish brown to reddish brown. Spores \pm broadly ellipsoid. Pycnosporos filiform (?).** Common on soil and rocks, coast of California and Baja California. (see Lecania dudleyi group)

9. Upper surface yellowish gray or light grayish yellowish brown, rather weakly and spottily pruinose and maculate; lower surface whitish to blackening; squamules somewhat imbricated. Discs dark grayish brown, densely pruinose; margins 0.1-0.2 mm wide, coarsely crenate towards inside, light grayish brown or concolorous with thallus; spores 11-20 x 4-5.5 um, 1(-3)-septate. Chem.: ? On rock and soil, Santa Cruz Peninsula. S. crenata (Herre) Zahlbr. [v. crenata]

9. Upper surface pale brownish gray, ± pruinose, appearing dirty whitish; lower surface whitish; squamules scattered to clumped. Discs brownish black, moderately pruinose; margin 0.2-0.3 mm wide, entire, grayish yellowish brown to brownish black next to disc, concolorous with thallus towards outside. Chem.: pannarin, zeorin, unknown. On rock, San Nicolas Island. [S. crenata "v. sannicolasensis" Ryan & Nash ined.]

Detailed Descriptions

Solenopsora candicans (Dickson) Steiner

THALLUS orbicular, closely attached throughout, forming distinct rosettes, to ca. 3-4(-7) cm across, ca. 1 mm thick in center, thinner towards margin; **thallus center** verrucose-subareolate to areolate; areoles subangular to irregularly rounded and coarsely crenate, ca. 1-2 mm across, plane, steep-sided; **lobes** distinct, clearly enlarged and radiating, entirely flat appressed or occasionally weakly overlapping, separated by fissures or coalescing with one another, closely contiguous, to 3-4 mm long, 1-1.5(-3) mm wide, thin, plane, weakly to strongly crenate-incised (palmately to subpinnately), the ultimate segments 0.5-1 mm wide; **upper surface** more or less smooth, continuous, densely (finely to coarsely) pruinose, appearing yellowish white (92) to white (), or towards the center pale yellow (89) with a slightly brownish tinge, under pruina yellowish gray (93); extreme tips of lobes sometimes blackened under the pruina; **upper cortex** uniformly ca. 30(-50) um thick, the upper part interspersed with grayish granules (insoluble in KOH), the structure difficult to see, the lower part hyaline; hyphae anticlinal, 2 um diameter, with narrow lumina; epinecral layer filled with coarse whitish granules; **algal layer** more or less continuous and uniform, ca. 50 um thick; **medulla** filled with granular material (insoluble in KOH), the hyphae ca. 3 um thick, rather thick-walled, densely interwoven; **lower cortex** absent.

APOTHECIA common towards thallus center, borne laminally, one to several on the central areoles or the bases of the lobes, immersed to adnate or more or less broadly sessile, to 1(-1.5) mm diam.; **disks** plane to slightly convex, epruinose to thinly bluish pruinose, with pruina appearing light grayish yellowish brown (79) to light or medium yellowish brown (76,77), under the pruina dark brown (59) to grayish brown (61) or brownish black (65); **thalline margin** white, pruinose, usually 0.1 mm wide on epruinose apothecia, to 2-3(-5) mm wide when pruinose, more or less level with disk, at first entire, later sinuous or becoming crenate towards the outside, reflexed and almost excluded; **proper margin** epruinose and medium yellowish brown (77) to brownish black (65), or (on apothecia with pruinose disks) becoming pruinose; **cortex** indistinctly delimited, ca. 40 um thick, interspersed; **algal layer** thick and continuous below hypothecium; **amphithecium** filled with granular material, the structure difficult to see; **excipulum** equal in width to the thickness of the hypothecium (?), mostly hyaline, composed of densely arranged, radiating to randomly oriented hyphae ca. 2 um diam. with narrow lumina; outermost cells dark brown; **hypothecium** 90-100(-300) um deep, dense; **hymenium** ca. 50-60

um high, hyaline; **epihymenium** 20-30 um thick, brown (fuliginous), K-, in pruinose disks becoming covered with coarse granules (insoluble in KOH); **paraphyses** free in water, ca. 2 um thick below, branched above, the tips clavate to capitate, to 3 um, brown; **spores** oblong-ellipsoid to oblong-fusiform (L:W = 2.6-2.8), distinctly 1-septate, (10-)12-14(-18) x 3-4(-4-5) um. (Smith gives the spores as 7-14 x 4-7 um but states that they are rare and often very poorly developed)

SPERMOGONIA (?) common towards thallus center, immersed, the ostioles black, coarse (ca. 0.1 mm).

SPOT TESTS AND CHEMISTRY: K-, C-; **medulla** Pd+ orange (pannarin) (according to C. Culberson & Culberson, 1969 and Galun, 1970) [BB-6: unknown dark blue-gray 7A,6B,8C = pannarin; gray-brown 6AB,7C [also found in *S. carpatica*]; unknown 3B; fatty acid 4A; black origin; BB-7: as in BB-6, plus yellowish unknown 6A,5B,6C], zeorin (according to C. Culberson & Culberson, 1969 and Galun, 1970), and unidentified pink pigment (C. Culberson, 1972c). Pannarin (major), dechloropannarin (Major), zeorin (major), Scn-1 (trace), Scn-2 (trace) (Kümmerling, 1991; "8 Aufsammlungen wie o. g., DC, Kümmerling 772 zusätzlich FMS")

DISTRIBUTION AND ECOLOGY: On sunny, exposed, hard calcareous rocks, especially limestones, often near the ground.

DISCUSSION: This is the type species of *Placolecania*, and if it were removed from *Solenopsora*, the combination *Placolecania candicans* is a legitimate name.

[*Solenopsora candicans* sensu Hasse]; not seen; possibly the same as "*Lecanoroidea catalinae*")

Thallus center areolate-rimose to squamulose; squamules becoming somewhat dispersed and lobulate. Apothecia sessile; disc dull brownish black, faintly pruinose; margin turgid, finely crenulate. Hymenium 95-100 um high. Spores 1-septate, 11-17 x 4-5 um. Spermatia 4-8 x 1 um. Thallus K-. On calcareous rocks and argillaceous shale, Southern California, coastal to montane.

Solenopsora crenata (Herre) Zahlbr.

[info. in square brackets is from Bratt 7930 ("v. *sannicolensis*")]

THALLUS: loosely attached, scattered to clumped, bullate squamulose; **squamules** turgid, radiating to erect and loosely imbricate, the upper parts horizontal to ascending, entire to coarsely crenate-incised, ca. 1-2[-4] mm long and wide, convex above [but often depressed towards center], ca. 0.5 mm thick, compressed to subterete in cross-section; groups of squamules united at the base by stipes to 4 mm high, 1-2 mm across; **Upper Surface:** smooth, continuous or with a few weak radial cracks near the margins of the squamules, weakly [to moderately strongly] pruinose-maculate in places [on raised areas], light grayish yellowish brown (79) to yellowish gray (93) [pale brownish gray under pruina], the margins more or less gray; **lower surface** slightly paler than upper surface, whitish, becoming dusky or blackening, sometimes thickened at the margins; stipes concolorous with lower sides of squamules; **Upper Cortex:** [not interspersed?], consisting of an upper, brownish part uniformly ca. 40 um thick, and a lower, hyaline part consisting of numerous [or few but wide and conical] bundles 50 [to 150] um long, penetrating to the medulla; [hyphae more or less anticlinally arranged, ca. 3-4 um diameter, the cells roundish to somewhat elongated, the lumina 1 um diameter]; [epinecral layer (?--gelatinized but with lumina still fairly distinct) 30 um thick, containing scattered whitish crystals]; **Algal layer:** ca. 40[-100] um thick, interrupted [to subcontinuous], consisting of algal clumps ca. 50 um diameter [or partly very irregular]; algae trebouxoid, ca. [8-]10-12 um diameter; **Medulla:** moderately loose, containing coarse grayish granules; hyphae thick-walled, 3-5 um thick; **Lower cortex** absent or poorly developed.

APOTHECIA: sessile, weakly constricted at the base, borne laminally one to several per squamule, 0.5-0.8 mm diameter, half concealed by erect thalline lobules, or sessile; **Discs:** plane to finally convex, [moderately to] densely finely bluish-white pruinose, appearing light bluish gray (190), under the pruina dark grayish brown (62) [to brownish black]; **Margins:** 0.1-0.3 mm wide, entire to crenulate or flexuous, sometimes becoming excluded, more or level with disk, concolorous with thallus or grayish brown (60,) [to brownish black next to disc]; **Cortex:** continuous with that of thallus, ca. 30 μ m thick, inspersed with yellowish brown granules [or not?]; [next to disc the hyphae with brown wall pigment] [epinecral layer 10 μ m thick in upper part, to 25 μ m thick in lower part]; **Algal Layer:** double, below cortex in lower part of margin (continuous with that of thallus) and below hypothecium, ca. 50-70 μ m thick, [weakly to] strongly interrupted; **Amphithecium** composed of densely arranged, more or less radiating hyphae ca. 2 μ m diameter; **Excipulum:** hyaline [with scattered refractive crystals]; hyphae densely arranged, more or less parallel, ca. 2 μ m [1 μ m] diameter; **Hypothecium:** hyaline to slightly brownish, bowl-shaped to broadly conical, to 200 μ m thick, very dense [or not] the lower part with coarse (3-5 μ m) irregularly globular crystals (?) with smoothish contours and surface, and with clumps of amorphous material that is N+ reddish with yellow mist; hyphae randomly oriented, 1-2[-4] μ m diameter, with very narrow, elongated lumina; **subhymenium** ca. 30 μ m [containing oil drops]; **Hymenium:** ca. 70 μ m high; [gelatin I+ pale blue]; **epihymenium** 10 μ m thick, reddish brown or darker, N-, the surface with coarse crystals; **Paraphyses:** loosely coherent, simple, [thin-walled], ca. [1]1.5 μ m thick below, the tips clavate [to capitate] thickened, to 3[-5] μ m, [olive-] brown [with a darker apical cap] or "colorless according to Herre", "sometimes septate" [penultimate cell also somewhat brownish], K-, N-; **Asci:** narrowly clavate [to subcylindrical], [40-]45[-50] x 10 μ m, the tips entirely I+ blue, without axial mass [outer wall non amyloid, but covered by a closely adhering layer of I+ strong blue gelatin]; **Spores:** often few, ellipsoid to oblong-ellipsoid to oblong-fusiform (L:W = 4-4.5), distinctly 1(-3)-septate, (11-)16-18(-19.5) x 4-5.5 μ m, [(10-)12-16 x 2.5-3.5 μ m, often slightly constricted at septum].

SPERMOGONIA: not seen; according to Herre (1910), **spermatia** 1-2.5 x 0.25-0.5 μ m.

SPOT TESTS AND CHEMISTRY: Thallus K- or weakly + yellowish, C-. Isotype (US) [BB-5: unknown dark blue-gray 7A,6B,8C (= pannarin?); gray-brown 6AB,7C [also found in *S. carpatica* and *S. candicans*]; zeorin; fatty acids 4&3A,4B,3-4&2-3C; unknown yellow 5&2-3B,5&3C]. [BL-114: pannarin, zeorin, unknown]

DISTRIBUTION AND ECOLOGY: Central coast of California, on crumbling sandstone and soil in crevices, _____m (50-100 ft); associated lichens include a squamulose *Caloplaca* sp. [and unidentified squamulose lichen]; [also associated with cyanobacteria]

DISCUSSION: This species is characterized by its loosely attached squamulose thallus, interrupted algal layer, pruinose disks, and septate spores.

The Bratt specimen from San Nicolas Island differs from the type in many respects, especially in the darkened apothecial margins, non-inspersed cortex (?), thick epinecral layer, mostly more continuous algal layer, thinner lower parts of the paraphyses (?), and narrower spores.

Solenopsora holophaea (Mont.) Samp.

THALLUS similar to that of *Lecidea lurida*, broad-lobed squamulose, not radially lobed; **squamules** clearly adnate to the substrate, concave, ca. 1-1.5 mm wide, the margins often curled up and thickened, coarsely crenate-incised; **upper surface** nitid to matt, smooth and continuous to somewhat rimose, epruinose, or slightly pruinose, chestnut-brown, in herbarium light to

moderate or deep yellowish brown (75-77) to moderate brown (58), light olive brown (94), or pale yellow (89); **lower surface** smooth, yellowish white (92) to light grayish yellowish brown (79) or light yellowish brown (76); **consistency** cartilaginous; **upper cortex**. ca. 75 um thick, the upper 20 um strong yellowish brown (unchanged in KOH), the hyphae clearly visible, mostly anticlinal, ca. 2 um diameter, with gelatinized walls and narrow, elongated lumina; epinecral layer 10 um; **algal layer** ca. 120 um thick, interrupted by hyphal bundles connecting the cortex and medulla; algal cells 10-12 um; **medulla** dense, the hyphae randomly oriented, ca. 2 um diameter, with distinct outer boundaries, the lowermost 15 um [lower cortex?] strong yellowish brown (unchanged in KOH).

APOTHECIA fairly common but not crowded, borne laminally and marginally on the central squamules, soon constricted sessile, at first lecanorine, then biatorine; **discs** epruinose, smooth, nitid to matt, dark brown (59) to moderate brown (58) or brownish black (65), plane then finally highly convex; **margin** concolorous with disk or slightly paler, deep brown (56), 0.1-0.2 mm wide, entire to flexuous, slightly raised especially when young, later disappearing; **cortex** ca. 50 um thick below, the outer 15 um strong yellowish brown (unchanged in KOH); epinecral layer 10 um; **algal layer** absent from margin but well developed below hypothecium, ca. 150 um thick, subcontinuous; **amphithecium** hyaline, of more or less radiating, gelatinized hyphae, ca. 3 um thick, with narrow lumina; **excipulum** hyaline, the parathecium ca. 30 um thick, composed of mostly parallel hyphae, interspersed with oil droplets; **hypothecium** to 200 um thick, dense, the hyphae randomly oriented; **subhymenium** I+ dark blue; **hymenium** 60 um, the gelatin I-; **epihymenium** 15-20 um, strong yellowish brown, unchanged in KOH; **paraphyses** free in water, septate, 2 um thick below [very slender according to Smith, Monogr. Brit. Lich.], the tips subglobose or truncate, 3-4 um thick, yellow-brown; **asci** clavate, 40 x 10 um, the apex entirely I+ blue **spores** biserially arranged, ellipsoid to ovoid-ellipsoid (L:W = 2.8-3.2), or slightly curved, (11-)12-15(-18) x 4-6 um [oblong-fusiform according to Smith, Monogr. Brit. Lich.], mostly distinctly 1-septate, one cell often slightly larger.

SPERMOGONIA immersed, the cavity ca. 150-200 um across, the wall hyaline; **spermatia** bacilliform, 3-4 um long; **fulcra** sterigmata short septate (Smith, Monogr. Brit. Lich.)

SPOT TESTS AND CHEMISTRY: Thallus K-, C-, KC-, P-. [BB-10: terpene 6A,8B,6C; fatty acids 7&4-5A,6&5B,6C]. Containing \pm atranorin and unidentified terpene (Purvis & James, 1972).

DISTRIBUTION AND ECOLOGY: On soil over rocks (e.g., in crevices) and on soft rocks, chiefly on slightly sheltered clefts in vertical cliffs or old walls, chiefly on or near the coast.

DISCUSSION: Often confused with Lecidea lurida, which occurs on inland calcareous rocks, is without a thalline exciple, has \pm globose, simple ascospores, and paraphyses which are very thick (3.5-5 um) throughout with a red-brown pigment external to the apices.

According to Purvis & James, "the placement of this species in Solenopsora is anomalous"; however, it (under its synonym S. requienii) is the type species of the genus!

"Lecanoroidea" Ryan & Nash, [gen. nov.?]

(very preliminary)

Differs from Lecanora and Lecania in having Catillaria-type asci [this needs to be confirmed for some species.] May belong in Solenopsora, and is externally somewhat similar to S. candicans (and has been previously misidentified as that species), but has simple spores.

"Lecanoroidea catalinae" Ryan & Nash ined. (= ? Solenopsora candicans sensu Hasse)

THALLUS crustose, marginally lobed. **Thallus center** rimose-areolate; **areoles** closely contiguous; **lobes** closely contiguous, rather narrow and elongate, somewhat convex; **upper surface** densely pruinose throughout.

APOTHECIA to 1 mm diam., \pm sessile but scarcely constricted; **discs** black, coarsely and moderately pruinose at least when young; **thalline margin** thick, \pm raised. **Asci** Catillaria-type. **Spores** (few present) simple [to 1-septate?], (11-)12-13(-18) x (3-)4-5 μ m.

CHEMISTRY: Containing only an unknown phenolic substance

ECOLOGY AND DISTRIBUTION: On rock, coast of southern California.

"Lecanoroidea hidalgoensis" Ryan & Nash ined.

THALLUS ca. 2.5 cm across, ca. 1 mm thick, forming distinct rosettes, tightly attached; **thallus center** rimose-areolate; areoles plane, more or less angular, 0.5-1 mm across; **lobes** contiguous, distinctly radiating, forming a uniform outline, plane, ca. 2 mm long, 0.5 mm wide, the tips often coarsely crenate; **upper surface** densely pruinose throughout, pure white on lobes, becoming more or less yellowish white (92) towards thallus center; **upper cortex** 20 μ m thick, with broad (ca. 50 μ m) protrusions penetrating to the medulla, densely interspersed with grayish granules (mostly insoluble in K), the structure indistinct in thick sections; **algal layer** ca. 20 μ m thick, strongly interrupted; algae 8-10 μ m diameter; **medulla** containing large (ca. 100 μ m) clumps of grayish-brownish material (insoluble in K and N); structure not distinct in thick sections; **lower cortex** absent.

APOTHECIA common in thallus center but not crowded, to 1 mm diameter; **discs** bluish black, lightly pruinose, appearing grayish (but older apothecia often parasitized and becoming epruinose and pure black), plane; **margin** 0.1 mm wide, becoming flexuous and somewhat irregular towards inside, persistent, level; **cortex** indistinct in thick sections; **algal layer** apparently absent (or at least not discernible in thick sections); **medulla** densely filled with whitish granules; **excipulum** hyaline, conglutinate; hyphae randomly oriented, ca. 3 μ m wide with narrow lumina; **hypothecium** ca. 50 μ m; **subhymenium** not distinctly delimited; **hymenium** 60-65 μ m high; **epihymenium** 5-10 μ m thick, not interspersed; covered by layer of granules; **paraphyses** 1-1.5 μ m thick; tips capitate, 3 μ m thick, olive to greenish black, K+ green, N+ red-violet; **asci** clavate, 50 x 12 μ m, the outer wall I+ pale blue, the tips entirely I+ dark blue; **spores** simple, with one or two oil drops, ellipsoid to subglobose or ovoid (L:W = 1.2-2), (6-)8-10(-12) x 5-6(-7) μ m.

SPOT TESTS AND CHEMISTRY: BL-55: atranorin (trace), unknown (yellowish gray after charring, 5A,5B,6C)

Literature

Purvis, O. W. and P. W. James. 1992. Solenopsora. In: Purvis, et al., Lichen Flora of Great Britain and Ireland.

Also see bibliography with Lecania key.