

Roccella DC.
(ARTHONIALES: ROCCELLACEAE)

After Darbishire (1898), Hale (1979), and Hale & Cole (1988)

Rev. 5/94

Thallus fruticose, upright and tufted, or pendent; branches flattened and strap-shaped or \pm terete; surface pale to dark gray, mauve, or brownish; cortex of transverse hyphae; attached by a basal sheath (disk). Cortex of anticlinal hyphae, arising from outermost part of medulla and not always forming a distinct layer; in addition, irregular patches of hyphae oriented partly parallel to the surface may also occur on the cortex. Soralia sometimes present.

Ascomycete an apothecium-like pseudothecium, \pm round or somewhat irregular to elongate, sessile, lateral; margin thalloid or with a proper exciple; hypothecium dark brown to black, dense, well developed; paraphysoids branched, sparsely anastomosing, ca. 2 μ m thick; asci clavate, thick-walled, fissitunicate, I-, with an internal beak and a small I+ blue ring in the thickened apex; spores 8, oblong to fusiform, transversely 3(-several)-septate, hyaline or pale brown, thin walled.

Pycnidia immersed, lateral; fulcrum exobasidial; pycnosporangia cylindrical-bacilliform, curved. Various para-depsides and tridepsides, fatty acids, chromones. Erythrin, lecanoric acid, roccellic acid, and less often various other substances. Photobiont Trentepohlia. On bark or rock, coastal, mostly tropical-subtropical or Mediterranean.

Distinguished from Dendrographa by (among other things) the [usually?] C+ red reaction of the cortex or soralia. Distinguished from Ramalina s. lato by the grayish or brownish color (lacking usnic acid).

There are several taxa, e.g., from the Channel Islands of California, that do not seem to key out to any of the species treated here.

I. Attachment area with yellow hyphae.

1. Thallus with apothecia, without soralia. 2

1. Thallus without apothecia, with soralia. 4

2. Apothecia lecideine. Usually sterile and sorediate according to the British book. On bark or wood. North American records doubtful. (R. phycopsis)

2. Apothecia lecanorine. Apothecia \pm elevated and constricted at the base. Discs pruinose. 3

3. Branches erect, mostly 1-2 mm wide (rarely to 5 mm), rather regularly and richly dichotomously branched. Apothecia to 1 mm wide. Cortical hyphae 4-6 μ m wide. Algal layer to 100 μ m thick. Hypothecium to 120 μ m thick in center. Spores 26-28 x 4 μ m. On wood. Branches whitish, flattened. R. peruensis

3. Branches suberect to pendulous, appearing to be split or lobed, frequently with numerous narrower portions arising on one or both sides of a flat stalk, giving a fimbriate appearance; to (3-)6-10(-15) mm wide. Apothecia 1-2.5 mm wide. Cortical hyphae 2-4 μ m wide. Algal layer to 40-50 μ m thick. Hypothecium to 200 μ m thick in center. Spores 28-32 x

- 5-8 um. On rock.** Channel Islands, CA and Baja California. R. fimbriata
- 4. Branches to 5 cm long, terete, sometimes angular or slightly flattened, pale blue-gray.** Erythrin, roccellic acid and \pm lecanoric acid. Dubiously reported from North America. (R. phycopsis)
- 4. Branches \geq 7 cm long, \pm flattened, or if becoming terete towards tips then brownish.** 5
- 5. Branches \pm flattened and grayish or whitish throughout, rather slender and soft. On bark or wood (or rock?).** In coastal scrub near sea level, Channel Islands south to Baja California. R. babingtonii
- 5. Branches becoming brown and terete toward tips, rather coarse and stiff. On rock.** Erythrin and lecanoric acid. On rock. S. Calif., Mexico. R. difficilis Darbish.

II. Attachment Area Without Yellow Hyphae (With Cross-references to Yellow-hyphae Species if Attachment Area Not Collected)

II-A. Thallus With Apothecia

- 1. On wood, very rarely on rock.** Spores 40 um long. Thallus greenish to glaucous-green. North American records doubtful. (If apothecia lecideine, see R. phycopsis; if attachment area not collected, and spores are 26-28 um long and thallus is whitish, see R. peruensis). (R. montagnei)
- 1. On rock, very rarely on wood.** 2
- 2. Branches mostly flat, but often only at the tips.** 3
- 2. Branches \pm terete.** Apothecia sessile. 5
- 3. Apothecia elevated, constricted at the base.** 4
- 3. Apothecia \pm sessile.** 5
- 4. Branches erect, brown, flattened, to \pm terete towards tips, 1-2 mm wide; spores 18-20 x 3-4 um. Discs always entirely epruinose.** Southern CA and Baja California. R. decipiens
- 4. Branches suberect to pendulous, whitish, grayish or yellowish, strongly flattened, 2-5 mm wide; spores 20-30 x 4-7 um. Discs heavily pruinose.** (see yellow hyphae species: R. fimbriata)
- 5. Branches often terete.** R. portentosa
- 5. Branches always flattened.** Apothecia without white border. Discs epruinose. North American reports doubtful. (R. fuciformis)
- 6. Medulla compact, without holes or gaps.** R. portentosa
- 6. Medulla loose.** American reports doubtful. (R. tinctoria)

II-B. Thallus Without Apothecia; With Soralia, or Sterile

1. Thallus C-; soralia C+ red. Branches 1-1.5(-6?) cm wide. Branches flattened and mostly thin. On rock. North American records doubtful. (R. fuciformis)

1. Thallus C+ red; soralia, if present, C+ red or C-. Branches < 0.5 cm wide (?--need to check on R. tinctoria). 3

2. Branches flattened and mostly thin. On wood. Thallus glaucous green to green. Branches 0.2-0.3 cm wide. North American records doubtful. (R. montagnei)

2. Branches terete, or flattened only at the tips. On rock. Thallus \pm dark or brownish. 3

3. Soralia C+ red. Medulla compact, without holes or gaps. Branches 0.1-0.2(-0.65) cm wide. Thallus pale, becoming ashy gray or brown. R. portentosa

3. Soralia C-. Medulla loose. Thallus brown. North American records doubtful. (If attachment area not collected and thallus pale, see R. phycopsis). (R. tinctoria)

If attachment area not collected, also see R. babingtonii (see Hale for C reactions) and R. difficilis

ADD?: At least one additional species, apparently undescribed or not previously reported from the continent.

Detailed descriptions:

R. babingtonii

Thallus white to light gray, tufted to pendulous, 7-12 cm long; branches flattened and grayish or whitish throughout, rather slender and soft, 1-4 mm wide with occasional smaller branches toward the base, the surface wrinkled to pitted with abundant white capitate soralia. Apothecia rare. Spores 26-28 x 4 um. Erythrin and roccellic acid (lecanoric according to Hale, 1979). On wood, bark or rock. in coastal scrub near sea level, Channel Islands south to Baja California.

(= R. peruensis according to Darbishire 1898; Hale's description fits within Darbishire's description of that species, and I'm not sure why Hale used the name R. babingtonii or why Esslinger & Egan accept both species as separate; according to Darbishire R. peruensis occurs only on bark or wood)

R. decipiens

Thallus fruticose, affixed at the base. "Protothallus" (basal attachment organ) lacking algae, ecorticate, covered with matted tow-like hairs; medulla, especially near the substrate, becomes streaked with black. Stalks 1-2 per protothallus, especially richly branched just above the attachment organ; erect, branched, complanate, loriform, 12 cm tall, 1-2 mm wide, brown, tips almost terete, often markedly hooklike curved; cortex of transverse (anticlinal) hyphae, these 3-5 um wide, brown; algal layer distinct, 60-80 um thick; algal cells to 22 um long, appearing only firmly clasped by fungal hyphae; medulla hyphae intricate, rather long and closely interwoven, 2-6 um wide, with very narrow lumina; in older stalks also occur smaller, compact hyphal bundles. At the base of the stalks the cortex of the stalks goes over into a uniformly thick, black layer of c. 2 um thick, entirely tangled hyphae.

Apothecia common, marginal or lateral, 1 mm diam., orbicular, constricted at base; margin white, elevated; discs brown, pruinose; hypothecium brown-black, 30-150 um thick; parathecium hyaline or brown, 10-18 um thick; amphithecium containing algae; hymenium 60 um; epithecium 30-40 um, brown; paraphyses branched, 1.6 um wide, apices 2-3.6 um wide; asci 16 um wide; spores 8, fusiform, hyaline, 3-septate, 18-20 x 3-4 um.

Spermogonia common, lateral, immersed, appearing as tiny, scarcely visible brown dots, simple, 120 um high, 130 um wide; wall hyaline, 16-18 um thick; sterigmata articulate only at the base, base, 20-25 um tall, 0.7 um wide; spermatia bacilliform, curved, 12-14 x 0.5 um.

On rock, southern California; Baja California.

R. difficilis

Thallus fruticose, attached at base. Attachment area well developed, c. 30 um thick; cortex of anticlinal hyphae 4 um wide; algal layer distinct, 100 um thick, well developed, dense; medulla dense, of intricate hyphae 4 um wide, lowest layers intense yellow. Stalks erect, branched, somewhat flattened, 8-10 cm tall, 0.5-1(-2) mm wide, caespitose, forming small cushions fastened to the stone by a basal disc, often all hooklike curved to one side, dichotomously divided, branching mostly irregular, apices terete, firm, brown; soralia lateral and marginal, orbicular, mostly convex; soredia spherical, 40-50 um diam.; cortex distinct, 15-30 um thick, of anticlinal hyphae 4-6 um wide, usually with pale tips, with granular deposits between them; algal layer distinct, 30-80 um thick, algal cells 8-14 um long; medulla rather loose, hyphae 2-10 um wide, often forming compact, longitudinal bundles.

Apothecia unknown.

Spermogonia lateral, immersed, 150 um high, 120 um wide, wall pale, 10 um, brown at ostiole.

On rock, S. California and Mexico.

R. fimbriata

Thallus fruticose, affixed by a basal disk. Basal attachment region well developed, thick, growing at the margins, blackened on outside and next to substrate; cortex of straight hyphae; algal and medullary layers present; cortex and algal layer together 120-140 um thick; internally intense yellow, the hyphae 2-3 um thick, with thin but hard wall; blackened hyphae slightly thinner; algal layer not very dense. Stalks becoming crowded (obscuring the basal disk), straight or often curved toward one side, tough and hard, slightly brittle, not easily bent, constricted towards base but soon expanded, broadening gradually, complanate, branched \pm in one plane, appearing to be split or lobed, frequently with numerous narrower portions arising on one or both sides of a flat stalk, giving a fimbriate appearance; to (3-)6-10(-15) mm wide, to 10 cm tall, broadest generally about 4-5 cm above attachment disk, apically narrower and somewhat terete; lateral branches always much narrower than main stems; surface faint yellowish or greenish gray, sometimes merging into a deeper but faint reddish brown, often darker on one side than the other, more greenish throughout when moist; cortex to 40-50 um thick in median part of flattened stalks but with algae penetrating as close as 20 um from the surface; hyphae straight, anticlinal, fasciated, moderately conglutinate, forming a smooth outer surface, 2-4 um diam. with lumina 1.5 um (narrower towards the algal layer). Algal layer distinct, to 40-50 um thick; hyphae to 2 um diam., with haustoria. Photobiont Trentepohlia, ca. 4 x 10 um diam., ovoid. Cortex and algal layer much thinner at the edges of flattened stalks. Medulla of anastomosing longitudinal hyphae 6-7 um diam. with lumina barely 1 um, mixed with thinner ones; hyphae firmly conglutinated into strands, forming a chondroid tissue. Soralia absent.

Apothecia generally on the lateral edges of the flattened stalks, or later forming on the laminal surface (especially on the broadest stalks), slightly constricted at the base and somewhat stipitate, round, to ca. 1 mm wide; disk black, white-pruinose; margin pale, somewhat elevated, smooth, then crenate. Thalline exciple present, smooth and entire, then crenate; containing algae. True exciple to 30 um thick, slightly brown. Hypothecium black, to 200 um thick in center, thinner and grading into exciple laterally. Hyphae of exciple and hypothecium firmly conglutinate, without air pockets. Hymenium 60 um tall. Epihymenium ca. 40 um. Paraphysoids branched, tips brown. Asci 10 um thick. Spores often not developed, 8, hyaline, 28-32 x 5-8 um, 4-celled, slightly curved, fusiform.

Pycnidia (often located very close to the ascocarps but then generally no longer active; younger ones with pycnosporos usually nearer the tips where mature apothecia do not yet occur) simple, flask-shaped, 170-200 um high, 100-120 um broad, immersed but ostiole slightly elevated; wall hyaline, conglutinate, ca. 25 um thick; ostiole colorless; pycnosporos bacilliform, slightly curved, 12-14 x 0.5 um.

On maritime rocks, On rocks, especially volcanic headlands exposed to fog, in coastal scrub from near sea level to 200 ft elev. Channel Islands, CA and Baja California (Cedros Island and Guadalupe Island).

[Description after Tehler, 19]

Branches whitish, grayish or yellowish, strongly flattened; spores 20-30 x 4-7 um. Discs

heavily pruinose. Erythrin (lecanoric according to Hale). Thallus 7-14 cm long, rather soft (stiff according to ?); branches smooth to rugose with age. Apothecia; disc black under the pruina. On rocks, especially volcanic headlands exposed to fog, in coastal scrub from near sea level to 200 ft elev.

[Description after Hale]

R. peruensis Kremp.

Thallus fruticose, affixed at the base. Attachment organ well developed, broad, plane; cortex 40-60 μ m thick, composed of anticlinal hyphae 4-6 μ m wide with granular masses between them; algal layer distinct, continuous, 100 μ m thick; medulla composed of intricate hyphae 2-4 μ m wide, extending deep into the cracks in the substrate; lower part with numerous yellow hyphae, the yellow color visible to the naked eye. Stalks erect, branched, flattened and very thin especially in the lower parts, 6-12(-14) cm tall, 1-2(-5) mm wide, caespitose, rather richly and regularly dichotomously branched, apices (or often the entire branch in finer forms) terete, soft, white or pale green; soralia lateral, orbicular, similar in position and size to the apothecia, elevated, convex or often plane; soredia globose, 30-50 μ m diam., sharply delimited from the medulla; cortex of transverse hyphae, these 4-6 μ m wide, branched, with granular masses between them, algal layer well developed, to 100 μ m thick, algal cells to 20 μ m long, ellipsoid; medulla hyphae 2-8 μ m wide, often conglutinated into longitudinal bundles.

Apothecia lateral and mostly marginal, orbicular, 0.5-1 mm diam., elevated, constricted at base; disc convex, pruinose; excipular hyphae c. 8 μ m thick; hypothecium brown-black, 120 μ m thick in middle, 30 μ m thick at the margin; parathecium hyaline or slightly brownish, 15-20 μ m thick; hymenium 80 μ m; epithecium brown, 20 μ m, rather compactly constructed; paraphyses branched, 1.2 μ m wide, tips 3-4 μ m; asci 16-20 μ m; spores 8, 3-septate, hyaline, fusiform, somewhat curved, 26-28 x 4 μ m.

Spermogonia lateral, immersed, simple, ostioles c. 80 μ m, brown, cavity 150 μ m high, 120 μ m wide, wall pale, 8 μ m thick; sterigmata sparsely articulate, 20 x 0.8 μ m; spermatia bacilliform, curved, 12-15 x 0.8 μ m.

On wood. California and Mexico.

Darbishire (1898) says that the soralia are very frequent but separate from the apothecia and spermogonia; possibly this means that his concept included two taxa, one fertile (R. peruensis s. str.) and one sorediate (R. babingtonii)

R. portentosa

Thallus fruticose, affixed at the base. Attachment area with cortex 10-20 μ m thick, of anticlinal hyphae, algal layer to 140 μ m thick, algal cells 16-22 μ m long; medulla rather loose, hyphae hyaline, 1.8-3.6 μ m wide in upper part, with lumina 1.5 μ m wide, near the substrate hyphae 4-6 μ m wide, turning brown, with lumina often scarcely 0.9 μ m wide forming a 40-50 μ m thick, compact, dark brown layer, from which the hyphae penetrate the substrate. Branches caespitose, forming a dense turf on the compact basal disc, erect, branched, at first dichotomously divided from the base, way from the base scarcely branched; setiform, loriform, terete, rarely complinate, especially near the tips, unilaterally incurved, 12-45 cm tall, (0.5-)1-2(-6.5) mm wide, pale, then, \pm dark colored (ashy gray or brownish, turning reddish brown in herbarium and staining the packet paper); soralia orbicular, 0.5-1 mm wide, with slightly deepened disc which is mealy-crumbly; cortex 15-30 μ m thick, of anticlinal hyphae 2-4 μ m diam.; algal layer 55-70 μ m thick (to 160 μ m in older parts), forming a loose tissue not very

distinctly delimited from cortex; medulla compact, without holes or gaps, with chondroid, conglutinate hyphal bundles running longitudinally; hyphae 2-6 μm diam. in younger branches, to 10 μm in older branches.

Apothecia lateral, suborbicular and scarcely flexuous, 3 x 2 mm across, \pm sessile, margin white, 0.1 mm wide, often slightly elevated, containing a c. 100 μm thick algae-free layer of very loose tissue; hypothecium brown-black, 60-600 μm thick in center, hyphae 3.5-6 μm thick; parathecium brown-black, 15 μm thick; ascogenous layer very pale, 90 μm thick; hymenium 90 μm ; epithecium brown, 40-50 μm ; paraphyses branched, 0.6 μm wide, tips 2 μm ; asci 10-12 μm wide; spores 8, fusiform, hyaline, 3-septate, 18-24 x 4-8 μm , narrowed to 1.8 μm wide at tips.

Spermogonia lateral, immerse, simple; ostiole 6 μm wide, brown; wall pale, 9 μm thick; sterigmata sparsely articulate, 16-18 x 1.5 μm ; spermatia bacilliform, curved, 12-14 x 0.6 μm .

Erythrin, roccellic acid, lecanoric acid. Thallus and soredia C+ red.

On rock, Baja California.

Literature

Darbishire, O. V. 1898. *Mongraphia Roccelleorum*. Stuttgart.

Darbishire, O. V. 1935. The Templeton Crocker Expedition of the California Academy of Sciences, 1932. No. 23. The Roccellaceae. With notes on specimens collected during the expedition of 1905-1906 to the Galapagos Islands. *Proc. Calif. Acad. Sci.*, 4th Ser., 21(23): 285-294.

Hale, M. 1979. *How to Know the Lichens*.

Hale, M. and M. Cole. 19 . *Lichens of California*.

Purvis, O. W. 1992. Roccella. In: Purvis, et al., *Lichen Flora of Great Britain and Ireland*.

Rogers, 19 . *Genera of Australian Lichens*.

Tehler, A.