

## II-A. ON ROCK.

### Thallus lobed, squamulose, or subfruticose-umbilicate

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**Thallus lobed or radiating-plicate at margin, or squamulose to subfruticose-umbilicate.** Thallus sometimes K+ red (norstictic acid). Spores and spermatia various.

#### **1. Thallus lobed or radiate-plicate at margin, not squamulose or subfruticose-umbilicate. ....2**

**1. Thallus  $\pm$  squamulose to subfruticose-umbilicate, with plane to often convex or inflated areoles, sometimes lobulate towards margin.** With phenocortex (composed partly of dead algal cells). Thallus K+ yellow to red, P+ orange (norstictic acid), C-. Apothecia lecanorine; disc black, sometimes slightly pruinose. Ascospores 8, polarilocular, Physcia-type, with warted walls. Spermatia short, acutely or bluntly ellipsoid to obovate spermatia. Coast of southern California and Baja California. .... (Mobergia)

**2. Lobes very distinct, elongated,** very narrow (mostly to ca. 0.5 mm or less), gray-brown; soredia or isidioid granules often present. Apothecia usually absent. Thallus with pseudoparenchymatous true cortex. ....(Hyperphyscia)

**2. Lobes indistinct or short; thallus radiate-plicate at margin,** rimose to areolate in center, greenish yellow, white, or gray-brown, without soredia or granules. Apothecia usually present and numerous. Spores thin-walled, without isthmus between loculi. ....Dimelaena

**II-B. ON ROCK.**  
**Thallus crustose.**

**Thallus immersed or crustose, at most areolate to verrucose or subsquamulose, without distinctly swollen areoles.**

**1. Spores without obvious locules, the walls very thin, evenly thickened.** (If thallus lobate or radiate-plicate at margin, see Dimelaena). ..... 2

**1. Spore with obvious locules, at least when immature, the walls thickened at either apex or transverse wall, or both,**

Spores polarilocular, often with strongly or unevenly thickened walls (or walls sometimes uniformly thin, but always multi-layered). Thallus K- or K+ yellow, but not K+ red (norstictic acid lacking). Spermatia bacilliform. Rinodina s. str. [If apothecia lecideine but immersed, see Hafellia]. ..... 2

**2. Spores elongate-ellipsoid (L:W >2), lightly pigmented; apothecia lecanorine;** spores extremely thin-walled, with a single-layered wall. .... Rinodinella

**2. Spores broadly ellipsoid (L:W <2), darkly pigmented; apothecia cryptolecanorine-lecanorine.** ..... 3

**3. Thallus brown; proper exciple and hypothecium often brown; spores averaging 12.5-13.4 x 7.0-7.5  $\mu$ m.** Thalline margin of apothecium irregularly notched, sometimes poorly formed. Spores of Beltramia or Buellia type (walls evenly thin, or thickened at apices; lumina round), 12-15 x 5-7  $\mu$ m, with finely warted surface; hymenium not interspersed. Thallus thin, verruculose or granulose to scant, brown to brownish gray, K-. Apothecia to 0.75 mm, crowded, almost entirely covering thallus; disks  $\pm$  level, black; margin concolorous with thallus, persistent. On siliceous rock, strongly manured tops. .... Buellia subdeflectens (Vainio) Sheard ined. (Syn. Buellia cacuminum (Th. Fr.) Sheard)

**3. Thallus gray; proper exciple lightly pigmented; hypothecium hyaline; spores averaging 16.4-17.3 x 11.0-11.6  $\mu$ m.** Apothecial margins concolorous with thallus. .... R. quandriensis Sheard ined.

**4. Thallus citrine yellow,** rimose-areolate to squamulose; areoles flat to slightly convex, sublobate or minutely lobed, scattered on a thin, blackish hypothallus. Associated with cyanobacteria [in the "hypothallus"?]. Apothecia 0.3-0.8 mm diam., constricted at base; disc slightly concave to flat, dark reddish brown to black; margin thick, concolorous with thallus, becoming wrinkled and flexuous, Hypothecium yellowish to brownish. Spores ellipsoid, polarilocular, Physcia-type, (18-)20-24.9-30.7 x 10-11.8-14  $\mu$ m. Massachusetts to Georgia; Montana. .... R. chrysomelaena (Ach.) Tuck.

- 4. Thallus a shade of gray or brown, or not evident. ....5**
- 5. Thallus partly covered by minute (<0.1 mm) blackish granules with N+ red, aeruginose pigment, otherwise dark gray; spores *Physcia*-type (*milvina*-type according to Poelt & Vezda), becoming thin-walled, 13-19 x 6.5-10 µm, averaging 17.7-19.2 x 9.3-10.2 µm. Thallus parasitic on *Aspicilia*, blackish, isidiate-scurfy. Apothecia rare, to 0.8 mm wide, slightly sunken, with protruding, thick, scruffy thalloid margin and ± flat, black disks. .... *R. obnascens* (Nyl.) Oliv.**
- 5. Thallus without granules. (*R. zwackhiana* with soredia). .... 6**
- 6. Epihymenium blue (to blue-green), N+ rose. ....7**
- 6. Epihymenium brown (to brown-green), N-. ....8**
- 8. Thallus distinctly epilithic, thick, ochraceous to brown (or gray according to Poelt & Vezda), areolate (to squamulose), becoming sorediate.** Apothecia sparse, to 0.7 mm diam., borne singly in areoles, broadly to narrowly sessile; disks black-brown; thalline margin concolorous with thallus, entire. Spores (12-)16-17(-21.5 x 7.7-13 µm, of *Dubyana*, *Beltramia* or *Buellia* type (walls ± thin, lumina rounded to angular); hymenium inspersed; epihymenium blue (-green), K+ violet, or red-brown to dark brown and K-; apical cells of paraphyses with or without brown caps. Areoles rounded to angular. On dry, steep limestone surfaces, Arizona to S. Dakota. ....*R. zwackhiana* (Krempelh.) Koerber
- 8. Thallus endolithic, or scurfy, light gray.** Apothecia sessile, the margin dark gray, very thin. Spores (16-)22.5-28.5(-35) x 8-11 µm, polarloocular, lumina rounded, walls equally thickened when mature. Epihymenium K+ violet. Utah. ....*R. athallina* Magnusson
- 9. Thallus K+ red (norstictic acid).** Spores *Physcia*-type. .... (*Mobergia*)
- 9. Thallus K+ yellow (atranorin) or K-.** Spores various. .... 10
- 10. Thallus K+ yellow. .... Key II-B-1**
- 10. Thallus K-. .... Key II-B-2**

**II-B-1. ON ROCK.**  
**Thallus crustose, K+ yellow (atranorin).**

- 1. Spores mischoblastiomorph. .... 2**  
**1. Spores otherwise. .... 4**

**2. Spores averaging 25.2-26.6 x 13.7-14.4 um. On marine rocks and cliffs in Pacific Northwest. .... R. caesiocinerea**  
 Sheard ined.

**2. Spores averaging 19.5-20.5 x 10.8-11.7 um. On habitats other than marine rocks and cliffs. .... 3**

**3. Areoles and apothecia < 0.5 mm wide; outer part of apothecial margin frequently carbonized and concolorous with disk; areoles thin and plane.** Thallus thin, rarely thick and evanescent, whitish, pale gray to ochraceous or brown, rimose-areolate or sometimes discrete or of contiguous areoles, flat, or areoles sometimes slightly vaulted effuse; prothallus sometimes limiting, dark, entire. Apothecia 0.3-0.45(-0.8) mm diam., sessile, frequent and sometimes contiguous, very variably constructed (biatorine to lecideine or lecanorine); thalline exciple 0.05-0.1 mm thick, frequently concolorous with disk, entire and persistent; disk dark brown, becoming black, persistently flat; epihymenium pale brown; hymenium 70-115 um; hypothecium 20-90 um, I-; asci 60-90 x 18-26 um; spores 19-25 x 9-14 um with thick walls, lumina not angular, mischoblastia-type. Thallus K- or ± yellow (atranorin). On somewhat shaded, moist, hard, siliceous rocks, especially metal-rich. .... R. oxydata (Massal.) Massal.

**3. Areoles and apothecia > 0.5 mm wide; thalline apothecial margin always concolorous with disc but sometimes incomplete or absent; areoles thick and ± verrucose.** Thallus usually thick, gray-white, areolate, verruciform to granulose, K- or + yellow; amphithecium rarely pigmented in part, then N+ rose in section. Thallus indeterminate; granules contiguous to scattered, flattened, large, matt; hypothallus absent. Apothecia common, subsessile often becoming ± sessile, 0.5-0.8 mm; discs plane, black, "velvety"; thalline margin entire, irregular, thick to thin, often finally excluded; proper margin thin, black; hymenium 85-90 um; epithecium dark brown; hypothecium hyaline; spores 8, Mischoblastia-type (walls thick apically, laterally and medianly; apical walls indented inward; lumina round to hourglass-shaped); septum indistinct, appearing as a hazy darkened region medially, occasionally medially dilated; 22-28 x 11-15 um, light gray-brown. Northern and eastern; also in British Columbia. .... R. verrucosa Sheard ined.

**4. Spores narrowly ellipsoid, averaging < 21 um long, Physcia-type (with thickened apical walls, distinctly angular lumina and ± thin lateral walls, 15-27 x 7.5-13 um; thallus thin or thick, whitish, light gray to ochraceous, usually well developed, effuse, rimose-**

cracked, and flat or of  $\pm$  discrete verrucae, often with slightly indented edges, or warty-areolate to almost squamulose, the squamules sometimes narrowed at the base into stipes; prothallus inconspicuous. Thallus P-. Apothecia to 0.6-1.5 mm diam., broadly sessile, sometimes contiguous, or often crowded to coalescing; disk black, flat, becoming slightly convex, often distorted; thalline margin concolorous with thallus, 0.05-0.1 mm wide, entire to irregularly notched, persistent; proper margin  $\pm$  definite; hymenium 80-100  $\mu$ m; hypothecium 60-135  $\mu$ m; hypothecium and hymenium I+ blue; asci 75-80 x 16-19  $\mu$ m, inner walls uniform; spores 17-27 x 8-13  $\mu$ m, locules persistently angular with thick apical walls. Thallus K+ yellow, P+ yellow (atranorin, chloratranorin, zeorin) (Thallus is K- according to Wetmore; most other authors say K+ yellow). On coastal, hard, siliceous, often serpentine, rocks, also to be expected on overhanging rocks at high altitudes. .... R. confragosa (Ach.) Koerber

**4. Spores broadly ellipsoid, averaging > 22  $\mu$ m long, not Physcia-type. .... 5**

**5. Spores pachyspermous, thick-walled, becoming 3-septate; lower cortex of thalline margin not expanded. Southern Rocky Mountains.** Spores 19-27 x 10-16  $\mu$ m. Thallus light to dark gray, verrucose, determinate, on dark hypothallus, K+ yellow, C-, P+ yellow. Apothecia sessile, becoming constricted, to 0.6 mm, dark brown to black, margin concolorous with thallus. Arizona. .... R. verruciformis Sheard, ined.

**5. Spores dubyana-type, 1-septate, expanded at septum; lower cortex of thalline margin typically massively expanded. Pacific coast.** .... R. bolanderi Magnusson

**II-B-2. ON ROCK.**  
**Thallus crustose, K- (without atranorin).**

**1. Spores bicincta-type**, often swollen at transverse wall when young and usually with pigmented bands around each locule at least at maturity. (also see *R. ocellata*). ..... 2

**1. Spores otherwise.** ..... 5

**2. Thallus becoming subsquamulose; areoles > 1.2 mm wide.**

Spores 15-19 x 8-10 µm, mostly thin-walled. Thallus brown, thick, ± areolate. Apothecia adnate to sessile, to 1 mm diam., concave to plane, black; thalline margin concolorous with thallus, at first swollen, persistent or later crowded back. Thallus thick, rimose-areolate, weakly effigurate at margin, mostly dark brown to black-brown, rarely gray to gray-brown; cortex paraplectenchymatous. On ± calcareous rocks, Southwestern, and Greenland. Closely related to *R. calcigena*, differing in having a thick, areolate, and marginally lobed thallus. .... *R. castanomela* (Nyl.) Arnold

**2. Thallus strictly crustaceous; areoles < 1.2 mm wide.** .....3

**3. Spores averaging < 17.0 µm long.** ..... 4

**3. Spores averaging > 17.0 µm long.** Thallus rimose-areolate, pale ochre to ochre-white, K-, C-, P-. Apothecia to 0.5 mm, black. Spores 18(-25) x 10-12 µm. Utah. .... *R. constrictula* Magnusson

**4. Areoles persistently plane; apothecial disks concave becoming plane; spores averaging 14.9-15.3 x 9.4-9.6 µm.**

Thallus thick, of contiguous convex areolae to 0.8 mm wide, light or dark orange due to oxydate, partly shining, eroded. Apothecia erumpent and remaining broadly attached, to 0.7 mm; proper exciple 20 µm, widening to 40 µm above; disk black, flat to high convex; thalloid margin soon disappearing, cellular but cells poorly defined; hypothecium hyaline; epihymenium dark brown; hymenium 80-85 µm, hyaline, I+ blue; paraphyses 3-3.5 µm, tips 5.5-7 µm and very dark; asci clavate; spores of *bicincta*-type with a very much narrowed waist and 2 bands of pigment, one across each of the two cells, a porus also present, 13-17 x 8.5-10.5 µm. On calcareous rocks, Greenland. .... *R. ochracea* Lynge

**4. Areoles convex; apothecial disks becoming distinctly convex; spores averaging 12.8-13.3 x 8.6-8.9 µm. Spores 12-15 x 6-11 µm. Thallus determinate, rimose-areolate, sordid yellowish brown, moderately thick, K-. Apothecia appressed sessile, to 0.5 mm, pruinose or not, thalline margin persistent. Spores constricted. S. California. .... *R. luridata* Mayrh. et al. (syn.: *R. euryspora*)**

5. **Spores mischoblastiomorph.** (also see R. iowensis). ..... 6  
5. **Spores otherwise.** ..... 7

**6. Apothecia sessile; outer part of margin frequently carbonized and concolorous with disk. Thallus thin, ± ochre or brownish, of discrete areolae or rimose-areolate, whitish, gray, ochre to brown; amphithecium typically pigmented, peripheral part N- in section.** Spores 17-25 x 9-14 um. .... (R. oxydata (Massal.) Massal.)

**6. Apothecia innate (cryptolecanorine); margin poorly developed but never carbonized.** Thallus light gray, warty areolate; medulla K± reddish. Apothecia to 0.7 mm diam., usually one, rarely more, per areole; disk black, ± level, light gray pruinose; spores 17-22 x 9-12 um. On siliceous rocks, in dry, hot areas, commonly overgrowing other lichens. .... R. cana (Arnold) Arnold

7. **Spores averaging over 25 um long.** ..... 8

7. **Spores averaging under 25 um long.** .....9

**8.** Spores Physcia-type, with apical walls remaining thick (Diploicium type, with evenly thin walls, round lumina, according to ?), 30(22-39) x 13-15(-17) um. Apothecial margin concolorous with thallus. Thallus light brown (tan), continuous or cracked, plane; cortex brownish, of conglutinate hyphae. Northeastern. ....R. ascociscana (Tuck.) Tuck.

**8.** Spores of Physcia type, with distinctly angular lumina and thin lateral walls. Apothecial cortex or medulla I+ pale blue. Usually not on rock. ....(R. turfacea, not mentioned under saxicolous species in Sheard's latest key)

9. **Spores becoming swollen at transverse wall in KOH.** ..... 10

9. **Spores not swollen in KOH.** ..... 11

**10. Spores averaging < 18 um long; apical walls finally becoming thin; apothecia sessile. Coastal.** Spores of Physconia type or Dirinaria type (Dubyana type b, with angular lumina and thin lateral walls), but internal wall thickening similar to that found in Physcia type, 11-17(-20) x 6-9(-11) um, tending to swell around the middle in K. Thallus whitish to light or dark gray or ochre, often tinged olive or brown, thin, continuous or more often rimose-areolate, flat, sometimes inconspicuous, effuse or not, not always coherent, sometimes reduced to small squamules; prothallus indistinct. Thallus K-, P-. Apothecia to 0.35-0.6(-0.8) mm, at first ± immersed, then adnate to sessile, frequent and often contiguous and crowded; disks dark- to black-brown, plane, soon convex; thalline margin persistent to

depressed, ca. 0.05 mm wide, concolorous with thallus, entire; proper margin lacking; hymenium (60-)70-95 µm; hypothecium 25-95 µm; hymenium and hypothecium K+ blue; asci 50-70 x 15-21 µm, inner walls uniform. Pycnospores 4-5 x 1 µm. No substances. On ± calcareous, ± manured or nutrient-rich surfaces (e.g., walls or cliffs). Frequent. .... R. gennarii Bagl.

**10. Spores averaging > 18 µm long; apical walls persistently thick; apothecia adnate. Never coastal. Thallus gray-white, granulose, K-.** Apothecia plane then convex, black, epruinose, 0.5 mm, the thalline margin entire, persistent. Spores 15-18(-21) x 6-8(-9) µm, the walls thick. .... R. brouardii B. de Lesd.

**11. Spores bischoffii-type, with pigmented band around transverse wall; apical walls thin from first.** ..... 12

**11. Spores lacking pigmented band around transverse wall; apical walls thickened at least early in development (except R. quandriensis).** ..... 13

**13. Spores averaging < 18.5 µm, darkly pigmented at transverse wall; apothecia to 0.5 mm diam.** Spores of Bischoffii type (with well developed porus and darkly pigmented zone around septum), 14-23 x 8-13 µm. Hymenium inspersed. Thallus disappearing, endolithic to distinctly epilithic and whitish, pale gray to gray-brown, mealy, granular-warty, of discrete, scurfy granules, rarely thin, rimose-cracked and even. Apothecia to 0.45-0.6(-0.8 mm) diam., broadly sessile, sometimes contiguous, lecanorine to biatorine appearing; thalline margin 0.05-0.1 mm wide, entire but becoming excluded, at first concolorous with thallus, later becoming darker and concolorous with disk; disk black, flat becoming convex; hymenium 85-115 µm, inspersed with oil droplets; hypothecium 75-100 µm, a colorless stipe sometimes developing below; epihymenium red-brown to brown, 15-35 µm; paraphyses tips capitate, to 5 µm wide; asci 50-70 x 18-22 µm; spores 14.5-20 x 10-12.5 µm, thin walled at apices. No substances. On calcareous substrates, particularly hard limestones, chiefly on drier sites in low places, but also isolated penetrations up into the alpine zone. .... R. bischoffii (Hepp) Massal.

**13. Spores averaging > 18.5 µm, lightly pigmented at transverse wall (the wall not seen in some spores); apothecia to > 0.5 mm diam. (to 0.6 mm diam. according to Poelt & Vezda).** Spores 18-25 x 10-14 µm; thallus pale gray and consisting of single areoles, or endolithic; apothecia distinctly sessile; disk finally convex, brown-black; thalline margin persistent to depressed; proper margin definite; hymenium inspersed. Thallus brown or gray where eroded, scant, only around base of apothecia or of scattered granules 0.3 mm diam., rarely thicker, verruciform or areolate, shining or dull. Apothecia 1-3 per areola, at first innate and erumpent, becoming



sessile, to 0.9 mm broad; margin either of same color as disk or as thallus; thalloid exciple cellular and with an epicortex; proper exciple 10-20  $\mu\text{m}$ , broadening to 15-50  $\mu\text{m}$  above; disk black, flat becoming convex, sometimes pruinose; hypothecium hyaline, developing a stipe; epihymenium dark brown; hymenium inspersed; paraphyses 2.0-3.5  $\mu\text{m}$ , tips 4-6.5  $\mu\text{m}$  and very dark; asci clavate; spores of bischoffii-type, i.e., with outer walls at septum invaginated and darkened, forming a lightly pigmented band around center of spore, a porus also being present, 16-24 x 9.5-13  $\mu\text{m}$ . On calcareous rock, arctic. .... R. calcigena (Th. Fr.) Lynge

**14. Spores averaging < 18.0  $\mu\text{m}$ . .... 15**

**14. Spores averaging > 18.0  $\mu\text{m}$ . .... 18**

**15. Spores with rounded lumina and thick lateral walls from first,  $\pm$  pachysporaria-type. .... 17**

**15. Spores with angular lumina at first and thin lateral walls, Physcia-type. .... 18**

**16. Spores averaging 15.7-17.5 x 8.8-9.3  $\mu\text{m}$ , pachysporaria-type. .... R. siouxiana Sheard ined.**

**16. Spores averaging 16.4-17.3 x 11.0-11.6  $\mu\text{m}$ , rarely thickened at septum when young, .... R. quandriensis Sheard ined.**

**17. Spores broadly ellipsoid. Epiphytic on saxicolous crustose lichens (e.g., Aspicilia caesiocinerea). Apothecia to 0.4 mm diam., sessile; thalline exciple concolorous with thallus; disk black; epihymenium reddish brown; hymenium 70-80  $\mu\text{m}$ ; hypothecium to 75  $\mu\text{m}$ ; paraphyses 1.5-2  $\mu\text{m}$  wide, apices 4-6  $\mu\text{m}$  wide; spores Physcia-type, 14.5-20 x 7.5-11  $\mu\text{m}$ . No substances. .... R. parasitica Mayrh. & Poelt**

**17. Spores elongate-ellipsoid. Not epiphytic.** Thallus thin, rimose or rimose-areolate, pale gray to dark brown, sometimes with a mauve tinge, occasionally appearing as if frosted; areoles 0.25-0.8 mm diam.; prothallus  $\pm$  well developed, black. Apothecia 0.3-0.4 mm diam., sessile, often widely scattered; thalline exciple persistent, entire, concolorous with thallus; disk flat to slightly convex, brown-black; epihymenium 10-20  $\mu\text{m}$  tall, dark brown; hymenium 60-80  $\mu\text{m}$ ; hypothecium 50-80  $\mu\text{m}$ , colorless; asci 45 x 13-17  $\mu\text{m}$ ; spores Physconia-type, 13-18 x 6-9  $\mu\text{m}$ , narrowly ellipsoid, not so strongly thickened near septum but also slightly thickened apically, torus diffuse, outer surface roughened. No substances. On hard siliceous rocks, usually on sheltered,  $\pm$  vertical surfaces of cliff-faces or underhangs. .... R. interpolata (Stirton) Sheard

**18. Apical walls of spores remaining thick; proper exciple and**

**hypothecium frequently lightly pigmented. Thallus thick, dark brown,** areolate, verruciform, K-; cortex cellular. Apothecia sessile, to 1.5 mm. Spores with end thickenings and dark zone at septum, 20(17-24) x 7-9 um. On siliceous rocks. .... R. tephraspis (Tuck.) Herre

**18. Apical walls of spores becoming thin at maturity; proper exciple and hypothecium never pigmented.** ..... 19

**19. Thallus light gray-brown. Limited to coastal rocks and cliffs from California to British Columbia.** ..... R. pacifica Sheard ined.

**19. Thallus dark gray-brown to brown. Arctic-alpine.** ..... 20

**20. Spores with typical angular, Physcia-type locules at first and thin lateral walls, cells of equal size, and walls not pitted; apothecial disks persistently plane.** Spores (14-)16-20(-22) x (6-)8-11(-12) um, of milvina type (with porus; walls thickened at apices and septum; lumina  $\pm$  angular), with finely warty surface; thallus fairly thick, granulose to verrucose-glebulose or areolate-warty, dark brown to blackish olive, on a black hypothallus. Apothecia broadly sessile, flat to slightly convex, to 1 mm diam., crowded, slightly immersed to broadly superficial; thalline exciple entire, in part swollen, prominent; hymenium 90-120 um; hypothecium to 200 um,  $\pm$  colorless; disk flat to slightly convex. Thallus K-, P-, C-, KC\_. On siliceous rocks, often slaty, nutrient-rich, particularly bird perches, arctic-alpine (New Mexico to Alaska), partially nonspecifically overgrowing other lichens. .... R. milvina (Ach.) Th. Fr.

**20. Spores with variously shaped locules at first but relatively thick lateral walls, cells often of slightly unequal size, and walls pitted; apothecial disks becoming convex.** Greenland. See Thomson 1997 for full description. .... R. arnoldii Mayrh. & Poelt

## ADD:

On basalt and limestones, Greenland. See Thomson 1997 for description. .... R. diskoensis Sheard ined.

Thallus usually sterile, sepia-brown with slightly frosted appearance, glebulose-areolate with frequent coarse soredia or short isidia; margins of short, 1-2 mm long, contiguous, convex areolae. On well-manured, bird-dunged rocks along arctic shores. Greenland. .... R. balanina (Wahlenb.) Vainio

On calcareous sandstone, Greenland. See Thomson 1997 for description. .... R. lyngei Sheard ined.

## ADD? (species not mentioned in Sheard's latest unpublished key):

Apothecia 0.3-0.8 mm. Spores bicincta-type or mischoblastia-type (walls strongly thickened at apices and septum). Apothecia immersed. On siliceous rock. (R. iowensis s. lato). ..... 1

**1. Spores Mischoblastia type (thick-walled; lumina boomerang-shaped), with thin pale zone at septum, 16-18 x 9 um.** Apothecial disc persistently plane. Thallus regularly areolate, gray or gray-brown, K-. Great Lakes region. .... R. cana (Arnold) Arnold (syn. R. iowensis Zahlbr.)

**1. Spores "at least for a short time" bicincta-type (walls thick at septum and apices, with dark band through center of each cell; lumina angular), 13-17 x 8-11 um.** Thallus areolate to squamulose, thickish, pale gray, gray, or gray-brownish. .... R. ocellata (Hoffm.) Arnold ("auct." may = R. verrucosa Sheard ined.; (Hoffm.) Arnold was accepted as a species by Poelt & Vezda)

Spores with thin, rounded apical walls, 12-18 x 5.5-8.5 um. Thallus thin, ochraceous, areolate, K- or + yellow, P-. Apothecia sessile, to 0.3 mm, black, plane or convex, the margin concolorous with the thallus, persistent or not. .... R. occulta (Koerber) Sheard

Thallus indistinct or almost absent. Apothecium margin always pigmented, flexuous. On coarse grained rocks. .... R. oxydata (syn. R. destituta (Nyl.) Zahlbr.)

Thallus thin, rimose-areolate, plane with flattened appearance but margins  $\pm$  free from substratum, light gray or oxidized to ochre, K+ yellow. Spores 20-25 x 9-11 um. Apothecia  $\pm$  crowded, round to irregular, to 0.4 mm, immersed to adnate, concave, black, the margin thick, concolorous with

thallus,  $\pm$  uneven. Spores oblong-ellipsoid. Hypothecium hyaline. S. Carolina. .... R. oxydata (syn R. ochrocea Willey, which is not the same as R. ochracea Lynge)

Spores 15-18 x 7.5-8.5  $\mu$ m. Thallus thin, smooth to minutely granulose, continuous or scattered, dirty gray to dull black. Apothecia to 0.25 mm, numerous, round to somewhat irregular when crowded, partly immersed to adnate; disc dull black or slightly gray-pruinose, concave to  $\pm$  flat, the margin rather thick, entire, prominent, concolorous with thallus. Hypothecium and hymenium hyaline. Spores irregularly arranged, oblong-ellipsoid, usually constricted at septum. On sandstone, Kentucky. .... R. tephrae (syn. R. kentuckyensis Fink)

Spores averaging more than 20  $\mu$ m long; thallus usually of  $\pm$  discrete, small verrucae but sometimes rimose; apothecium disc often brown. .... R. novoconfragosa Sheard, ined.

R. penardiana Müll. Arg. (listed as a synonym of R. bischoffii by Fink, but accepted as a separate species by Egan; not mentioned in Sheard's latest key; type not seen by Sheard)

Arctic. See Thomson 1997 under R. endophragma for description. .... R. constrictula Magn. (syn. R. endophragma Lamb.--see Mayrhofer & Sheard, 1988, The Bryologist 91(2): 106-112; not mentioned in Sheard's latest key).

#### **TYPES PRESUMABLY DESTROYED:**

Apothecia to 0.2 mm, black, the margin thin. Spores ?. Thallus gray-white, thin, rimose-areolate, on black hypothallus. Apothecia immersed. On siliceous rock, New Mexico. .... R. vegasii B. de Lesd.

Thallus glaucous-white, K+ yellow, dispersed areolate. Apothecia sessile, black, epruinose, to 0.3 mm, concave then convex, thalline margin rather thick. Spores Mischoblastia type? ellipsoid, sometimes curved, not constricted, the lumina narrower next to septum, 18-21 x 8-9  $\mu$ m. On siliceous rocks, New Mexico. .... R. silicicola B. de Lesd.

Thallus indistinct. Apothecia to 0.25 mm, appressed, becoming convex, margin concolorous with disc, disappearing. Spores 13-16 x 5-6  $\mu$ m, walls rather thick, not constricted at septum. On siliceous rocks, New Mexico. .... R. americana B. de Lesd.

Thallus granulose. Apothecia pruinose, to 0.4 mm, black, plane then convex, margin thin, white, entire. Spores not constricted, wall thick. Thallus dark gray to yellowish, thin, granulose, not limited. On siliceous rocks, New

Mexico. .... R. lecanoides B. de Lesd.

Spores 10-12 x 5-6  $\mu$ m. Thallus areolate or indistinct, white or gray, K-. Apothecia black, to 0.2 mm, plane, the thalline margin entire, thin, becoming excluded. Spores rather thick-walled. On siliceous rock, New Mexico. .... R. minutissima B. de Lesd.

**EXCLUDED:**

Thallus thin, composed of smooth, greenish gray to ashy, squamule-like areoles,  $\pm$  scattered on a conspicuous black hypothallus. Apothecia 0.5-1.2 mm diam., adnate to sessile; disc flat to convex, dark brown to black; margin thin, concolorous with thallus, becoming crenulate, often finally disappearing. Hypothecium yellowish. Spores ellipsoid to oblong-ellipsoid, 14-22 x 8-12  $\mu$ m. On rocks and rarely on trees. N. American reports are misidentifications. .... [R. atrocinerea (Hook.) Koerber]