Rimularia Nyl.
(RIMULARIACEAE)

After Hertel & Rambold, 1990, and others

Rev. 5/94

Thallus superficial, whitish to dark brown, continuous to distinctly areolate or bullate, sometimes sorediate or isidiate, usually without epinecral layer, C+ red or C-, K+ red or K-, P+ yellow or P- (often gyrophoric acid, sometimes stictic or norstictic acid or other substances); medulla I+ violet or I-; hypothallus present or absent. Photobiont chlorococcoid.

Apothecia roundish to angular, the disk expanded or (in "Mosigia") at first punctiform; lecideine, sessile and stipitate, less often sunken in the thallus, or (especially in "Mosigia") lecanorine or aspicilioid, immersed; marginate, the discs plane, often (but not always) umbonate or gyrose. Apothecia round or elongated, the discs black; exciple lecideine or lecanorine; hypothecium brown to carbonaceous black, concolorous with and continuous with the exciple; paraphyses coherent, anastomosing, 2 um wide, the tips weakly thickened; epihymenium olive or brown. Paraphyses persistent. Hypothecium dark brown to black. Excipulum entirely dark, similar to that of Porpidia; hypothecium continuous with the true exciple; hymenium I+ blue; epihymenium brown; paraphyses richly branching and anastomosing, septate, usually thin (under 1 um) and non-moniliform, the apices pigmented but not swollen. Asci of the Rimularia-type, the tholus with strongly amyloid lateral areas and apical cap (or tube); outer wall of ascus thick, amyloid, broadly clavate (cylindrical-clavate according to David, 1992), with tholus of Rimularia-type (with an amyloid I+ cap which may have a slight tubular paling in the bottom center, the tube broadened to the base, a pale region, and then two lateral staining regions [actually a tubular region]; spores 8, non-halonate, ellipsoid, unicelluar, hyaline or sometimes brownish when old.

Pycnospores short-ellipsoid to bacilliform, simple, colorless, ca. 4 x 0.2 um. Mostly on siliceous rock or parasitic on other lichens over rock; a few species on bark or moss. Widely distributed, mainly in arctic-boreal to montane or alpine areas. (Including "Mosigia", with aspicilioid apothecia, and several species of uncertain placement, with thick, moniliform paraphyses).

1. Thallus papillate, isidiate, or sorediate. Apothecia often lacking. 2
1. Thallus not as above. Apothecia usually present. 5

2. On bark. Thallus occasionally sorediate; soredia dark brown and somewhat glossy, 15-25 um dima.; sorediate hyphae short-celled, brown pigmented; soralia rounded, mostly 0.1-0.25 mm diam. and ± confluent, rarely 0.2-0.45 mm diam. and well delimited. Thallus containing unknown UV+ whitish substance, or no substances. ..... see R. caeca

2. On rock or crustose lichens over rock. 3

3. On various crustose lichens (but this is not always recognizable in the herbarium) on exposed siliceous rocks. Medulla P+ yellow, K+ yellow to red, C-, or P-, K-, C+ rose, with

gyrophoric acid and varying proportions of norstictic acid; other reported substances are probably contaminants from host lichens. Areoles rough granulose-isidiate-furfuraceous to sorediate. Thallus rimose-areolate or irregularly areolate, to 0.8 mm thick, dark olive-brown to dark brown or blackish; areoles irregular in outline, flat to slightly convex, 0.4-0.5 mm across; surface minutely isidioid or granular, the granules (20-)30(-50) um diam. Hypothallus not visible. Photobiont cells 6-12 um diam. Nova Scotia. ..... "R". furvella

3. Directly on rock. Thallus C+ red (gyrophoric acid major), usually K-, P-. 4

> **4. Thallus thickish (0.1-0.4 mm), ± bullate-areolate, light brown to beige, or gray brown to dark brown, sterile with elongated papillae (isidia-like outgrowths), or becoming sorediate; or richly fruiting and then mostly with few or no soralia.** Thallus bullate-areolate; areoles irregularly angular, 0.3-0.7 mm broad, mostly scattered on a black hypothallus (occasionally visible between areoles), seldom flat, mostly convex to nearly spherical; upper surface rough or smooth; papillae 0.15-0.25 mm broad, 0.5 mm high, the tips finally convex, mostly with somewhat paler outgrowths, slightly erose, occasionally breaking into whitish (or yellowish) soralia 0.2-0.5 mm wide, or the soralia replacing the papillae. Thallus K-, P-, with gyrophoric acid only. ..... R. gibbosa
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> **4. Thallus thin (to 0.2 mm), cracked-areolate to dispersed areolate, gray-brown to dark brown or light brown, or occasionally yellowish to pinkish brown (paler brownish when wet), without papillae or soralia, or papillate-sorediate to finely isidiate.** Areoles 0.2-0.7(-1.2) mm wide, ± flat, swollen but not bullate, irregularly angular to at margin sublobulate; surface smooth to rough; black hypothallus present, visible at margin, not conspicuous between the areoles. Soralia 0.1 mm broad; isidia (0.05-)0.1(-0.15) mmbroad, to 0.2 mm high, cylindrical or spherical; prothallus dark brown to black. Medulla usually K-, P-, but rarely K+ red, P+ orange (norstictic). ..... R. badioatra

5. Apothecia with thalline margin (lecanorine), or sunken deep within the areoles (aspicilioid), without swollen proper margin. Thallus C+ red (gyrophoric acid). Apothecia at first punctiform, later wider, flat and often granular-folded uneven, blackish. Paraphyses 1.5 um wide. [Former genus Mosigia]. 2

5. Apothecia lecideine, with narrow but swollen proper margin, usually lacking thalloid margin and not embedded (but see R. impavida, R. furvella, and R. gyrizans). Thallus C+ red or C-. Apothecia usually slightly angular, black (or black-brown), small. [Rimularia s. str.]. [This does not seem a good choice to me]. 3

> **5. Thallus thickish, ± bullate-areolate, light brown to beige, or gray brown to dark brown.** Apothecia-bearing areoles to over 1 mm wide, larger than the others, rounded, constricted at base. Apothecia dispersed, attached by broad or narrow base, 0.5-1.2 mm broad, mostly umbonate or occasionally gyrodisk; disk slightly convex, black; margin remaining lecanorine, light gray-brown, matt. Exciple 180-220 um, dark brown towards outside, hyaline to pale brownish inside; hypothecium to over 350 um, dark brown; subhymenium hyaline to pale brown; hymenium 90-110 um, hyaline, pentrated by sterile, brown, vertical hyphal threads; epihymenium pale brown. Spores (14-)17-25(-30) x (8-)10.3-12.5(-14) um, ellipsoid, brownish when old. Medulla I-, K-, P-; containing only gyrophoric acid. On ± moist sloping surfaces of non-calcareous rocks. [Hertel &

Rambold include this species in Rimularia; other authors do not]. ..... R. gibbosa (Ach.) Coppins, Hertel & Rambold (Syn.: Mosigia gibbosa)

5. Thallus thin (to 0.2 mm), cracked-areolate to dispersed areolate, gray-brown to dark brown or light brown, or occasionally yellowish to pinkish brown (paler brownish when wet). Apothecia mostly solitary; disc semi- or entirely immersed, at first punctiform (0.05 mm), then widening to 0.25(-0.5) mm, black, matt, roundish, concave to umbonate or gyrose, not pruinose; larger apothecia with 25-30 um broad, sharply delimited, elevated, often notched, black thalloid margin. Exciple 30-60 um, the outer part dark brown, the inner part paler. Hypothecium dark brown; subhymenium hyaline to pale brown. Hymenium (70-)90-100(-110) um tall. Epihymenium brown, ca. 15 um thick. Paraphyses 1-1.5 um wide; apices to 3 um wide. Asci 50-70(-90) x 17-20 um. Spores (10-)12.5-20(-22) x (7-)8-11.5(-13) um, ellipsoid, hyaline or browning in age. Medulla I-. Containing gyrophoric acid (+ slight amount of lecanoric acid and in one case with norstictic acid). On sunny, exposed, siliceous or ± basic rocks and boulders in humid areas. Arctic-boreal. Newfoundland. ..... R. badioatra (Krempelh.) Hertel & Rambold (Synonym: Mosigia illita)

3. On bark or moss. 4
3. On rock, or lichens over rock. 5

4. On bark. Thallus crustose, mostly epiphloeodic, to 2 cm diam., white to sordid olive, composed of rounded, weakly convex, confluent verrucules, sometimes combining to form small areoles. Verrucules ca. 0.1-0.2 mm diam. Thallus margin often indistinct and overgrowing adjacent thalli of other crustose lichens. In section, thallus ca. 60-150 um thick, poorly differentiated; epinecral layer 5-20 um, sometimes lacking; uppermost cell layer sometimes brownish. Algae trebouxioid, 8-18 um diam., densely entangled by ± isodiametric hyphae. Apothecia sessile, 0.25-0.45(-0.6) mm diam., round to strongly flexuose, single, rarely in groups of 2-3, to more than 300/cm^2, mostly regularly distributed over thallus; disc flat to weakly convex, black, matt, erpuinose; margin persistent, 0.02-0.05 mm thick, black, matt. Excipulum 20-30(-40) um, with hyphae 2.5-6 um diam. and lumina 1.5-4 mm diam.; inner zone colorless and ± plectenchymatic; hypothecium colorless, 40-60(-70) um, with densely interwoven, short-celled hyphae 2-4 mm diam.; hymenium colorless to sordid greenish, 40-60 um, greenish blue to sordid brown in Lugol's iodine, blue in Lugol's 1:6 iodine, K- or K+ rose to violet; epihymenium dark brown, sometimes olive tinged, 5-15(-20) um; paraphyses frequently branched and anastomosing, short-celled, moniliform, (1.5-)2-3 um diam.; lumina 1-2 um; apical cells (3-)3.5-5.5 x 2.5-5.5 um; lumina 2-4 um. Asci Rimularia-type, 8 spored, 30-40 x 9-14 um (L:W = 1:2.5-3.5(-4); amyloid wall layer ca. 0.5 um thick; non-amyloid wall layer ca. 1.0 um thick; tholus (2-)6-8.5 um high; spores ellipsoid, colorless, simple, 7.5-10.5-13.5 x 4.5-5.5-7.5 um (L:W = 1:1.5-2(-2.4) i,; wall ca. 0.5 um thick. Thallus containing unknown UV+ whitish substance, or no substances. On conifers (fir, tamarck, spruce, pine), or occasionally on birch. Temperate eastern N. America, especially in Great Lakes area, Minnesota to New York, New England, Newfoundland, and New Brunswick. [David, 1992, would exclude this species based on paraphyses type]. ..... R. caeca (Lowe) Rambold & Printzen

4. On moss. Spores 11-12 x 5-6 um, ellipsoid to broadly ellipsoid. Thallus K+ orange-

red, moderately thick, verrucose, whitish or grayish. Apothecia to 0.7 mm, black, depressed to plane, the margin thick and elevated, persistent. Hypotheium hyaline to pale olivaceous. Epihymenium brownish black, granular. New York. ..... R. sphacelata (Th. Fr.) Hertel & Rambold (syn.: Lecidea sphacelata)

5. Paraphyses thin (under 1 um wide), non-moniliform. Not parasitic on other lichens. Spores becoming brown with age, (12-)16-30(-40) x (5-)10-18(-21) um, ellipsoid to almost subglobose, sometimes poorly developed and smaller. Areole surface ± smooth. Apothecia usually present, 0.3-0.5(-0.8) mm diam., dispersed or densely distributed, mostly adnate to sessile, with narrow base; disk flat, black, mainly umbonate, occasionally gyrose; margin well developed, ± 0.1 mm wide, serrate or radiately split. Exciple 40-100 um; subhymenium pale brownish to hyaline; hymenium 85-130(-150) um tall; epihymenium dark brwon. Thallus very thin, to 0.1(-0.15) mm, contiguous or indistinctly verrucose-areolate, sometimes nearly absent, whitish, beige, light brown, ash to dark gray or chestnut to dark brown to black (paler when wet and observed under hand lens), matt; occasional thalli with chinky, pale brown, shiny areoles 0.25-0.6 mm across; hypothallus dark, usually indistinct, sometimes visible between the areoles; medulla I-; containing gyrophoric acid or no substances. Photobiont cells 5-12 um diam., or some to 14 x 10 um. Pycnidia 80-100 um diam., immersed to semi-emergent, black; wall dark brown, K-; conidia 3.5-5 um long. On siliceous, especially basaltic, rocks. Newfoundland. .....R. limborina Nyl.

5. Paraphyses thicker (1-2 mm), becoming swollen and bead-like (moniliform) in upper part. Often parasitic on other lichens. [David, 1992, excludes the following species from Rimularia, based on paraphyses type]. 6

6. Areoles rough granulose-isidiate-furfuraceous to sorediate. Thallus rimose-areolate or irregularly areolate, to 0.8 mm thick, dark olive-brown to dark brown or blackish; areoles irregular in outline, flat to slightly convex, 0.4-0.5 mm across; surface minutely isidioid or granular, the granules (20-)30(-50) um diam. Hypothallus not visible. Photobiont cells 6-12 um diam. Apothecia often rare or lacking, scattered, adnate, not narrowed at base, 0.3-0.8(-1.5) mm diam., black, matt; disc flat to slightly convex; true exciple thin; thalloid exciple deceloped, dull black, narrow; exciple 20-45 um thick, dark brown towards outside, ± paler inside; hypothecium 60-130 um, pale to dark brown; subhymenium pale brown; epihymenium dark brown or olive-brown; hymenium (40-)60-75 um tall. Paraphyses branched and anastomosed, the apices not strongly capitate. Asci 50-60 x 15-18 um. Spores ellipsoid, hyaline, (10-)12-16(-20) x (5-)6.5-8(-10) um. Medulla P+ yellow, K+ yellow to red, C-, or P-, K-, C+ rose, with gyrophoric acid and varying proportions of norstictic acid; other reported substances are probably contaminants from host lichens. On various crustose lichens (but this is not always recognizable in the herbarium) on exposed siliceous rocks. Nova Scotia. ..... R. furvella (Nyl. ex Mudd) Hertel & Rambold

6. Areole surface ± smooth, not isidioid or granular. 7

7. Forming islets on thalli of Lecanora rupicola on siliceous rocks. Apothecia usually present, round to irregular, partly stacked up, 0.1-0.6 mm diam., at first sunken between the areoles, later adnate to ± sessile, not constricted at base, flat to convex, black, matt to shiny; true exciple raised, ± flexuose, black; thalloid exciple narrow, black. True exciple (outer part),

epithecium and hypothecium dark brown, K-; exciple 55-70 um thick, inner part brown to hyaline, no medullary part developed; hypothecium 100-230 um; subhymenium hyaline to brown; hymenium 50-60(-70) um tall. Paraphyses ca. 1-2 um wide, branched and anastomosing; cells in upper part swollen, to 4 um wide. Asci 40-55 x 12-16 um, Rimularia-type. Spores (7-)8.5-14.5 x 4.5-6(-7) um, ellipsoid. Thallus P-, K± yellow, KC-, C- or C+ rose; [usually?] containing gyrophoric acid. Thallus regularly bullate-areolate, to 0.25 mm thick, yellowish to brownish, dark chestnut brown or dark brown-grey, smooth, ± shiny, on black hypothallus; areoles rounded, convex, 0.2-0.4(-0.9) mm across. NW Territories, Newfoundland, Michigan, and widespread in the western U.S. ..... R. insularis (Nyl.) Rambold & Hertel

7. Not parasitic on other lichens (or at least not on L. rupicola). 8

> **8. Thallus C+ reddish (gyrophoric acid only, and in major amounts), K-, P-.** ..... (see R. badioatra)
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> **8. Thallus C- (but often with gyrophoric acid in minor amounts), K+ yellow or red (mainly with stictic acid; frequently with norstictic acid in minor ammounts).** 9

9. Spores 5.5-10 x (4.5-)6-8 um. Apothecia adnate to sessile with somewhat constricted base, 0.3-0.5(-0.7) mm diam.; disk ± flat, smooth. Thallus yellow-brown when wet, red-brown to brown or black-brown when dry (to unaided eye nearly black). Thallus well-developed, thin (to ± thick according to Ozenda & Clauzade), effuse, minutely verrucose to distinctly areolate-verrucose to bullate-areolate; verrucae roundish, smooth, slightly shiny, 0.15-0.3(-0.6) mm diam., slightly to usually strongly convex; edges not pale. Hypothallus black, conspicuous between the areoles and at thallus margin. Medulla I-. Thallus C-, K- or + yellowish. Proper margin of apothecia elevated, persistent, nitid. Disc black, matt. Thalloid margin conspicuous. Exciple 35-55 um, the outer part dark brown, the interior brown, the medullary part not developed. Hypothecium 50-110 um, ± brown-black. Subhymenium hyaline. Hymenium 50-60 um. Epihymenium dark brown. Spores hyaline, ellipsoid to subglobose. Hymenium (50-)60-70 um high. Exciple and hypothecium (often) confluent. Paraphyses indistinct, conglutinate, tips brown. Asci inflated-clavate. Spores ellipsoid to subglobose. Containing stictic, norstictic and gyrophoric acids in various combinations and concentrations. Hymenium I+ slightly blue, around asci I+ wine red. Apothecial parts K-, N-. On siliceous rock, not directly parasitic but often invading other crustose lichens, especially yellow Rhizocarpon spp. Arctic-alpine. NW Territories, Newfoundland, Colorado, Washington. ..... R. impavida (Th. Fr.) Hertel & Rambold

9. Spores (8-)9-11(-13) x (4.7-)6-7(-8) um. Apothecia immersed to broadly adnate or a few ± sessile, (0.2-)0.5 mm diam., to 0.8(-1.2) mm if tuberculate; disc flat to later slightly convex, frequently split and minutely wrinkled; umbonate to almost always convolute or ± gyrose. Thallus gray to gray-brown or somewhat reddish brown or dark brown. Thallus areolate, to 0.6 mm thick; areoles 0.2-1 mm diam., irregularly rounded to angular, flat to strongly convex, smooth; hypothallus black, visible or only poorly so between the areoles; medulla I-. Apothecia roundish (commonly elontated or irregular in outline), dispersed or grouped, black; true exciple thin, often grayish, often angular. Exciple 50-90 um, dark to black-brown towards outside, paler inside, K-, the medullary protion ± well developed; hypothecium 110-150 um, dark brown, K-; subhymenium hyaline, to 20 um; epithecium diffuse brown, K-; hymenium 35-70 um tall (according to Hertel & Rambold; 80-120 um according to ?); paraphyses 1.5-1.8 um wide,

richly branched and anastomosed, short-celled and often ± monilifrom above, with some cells to 4 um wide. Asci 50-60 x 18-25 um, clavate, Rimularia-type. Spores ellipsoid to subglobose. Pycnidia 60-150 um diam., immersed; wall brown above, becoming colorless below; conidia 5-8.5 x 0.8-1 um, bacilliform, simple, acrogenously produced. Cortex C-, medulla P± orange, K± yellow, C-, KC-, with stictic and ± norstictic acids and ± gyrophoric acids in varying proportions). On schistose rocks. Newfoundland. ..... R. gyrizans (Nyl.) Hertel & Rambold

ADD:

Spores 11-13 x 8-9 um. Thallus dark olive-gray, thin, subverrucose. Apothecia to 0.4 mm, black, the margin thick, persistent. Hypothecium hyaline. Epihymenium olive-brown to blue-green-black. Spores broadly ellipsoid. On bark of white birch, New York. ..... "Lecidea" pulla J. Lowe, Lloydia 2: 245 (1939) (probably = Rimularia fuscosora)

Literature

David, J. C. 1992. Rimularia. In: Purvis, et al., Lichen Flora of Great Britain and Ireland.

Hawksworth, D. & B. Coppins. 1992. Lecidea. In: Purvis, et al., Lichen Flora of Great Britain and Ireland.

Hertel, H. and G. Rambold. 1990. Zur Kenntnis der Familie Rimulariaceae (Lecanorales). Bibliotheca lich. 38: 145-189.

Hertel & Rambold. 1992.

Poelt, J. and A. Vezda. 1977. Bestimmungschlüssel europäischer Flechten. Erg. I. Cramer, Vaduz.

Rambold, G. and C. Printzen. 1992. Rimularia caeca, a corticolous lichen species from North America. Mycotaxon 44(2): 453-460.