

Parmotrema Massal.
(LECANORALES: PARMELIACEAE)

After Hale, and Harris (1990)

Rev. 5/94; descriptions somewhat incomplete

Thallus foliose, dorsiventral, heteromerous, lobed, radiate to spreading, closely to more often loosely adnate to somewhat ascending, usually large; upper surface grayish (atranorin) or yellow-green (usnic acid), smooth, shining or dull, plane, undulate or wrinkled, with or without isidia or soredia, sometimes maculate or weakly and irregularly cracked in places, but without a regular network of cracks or markings; lobes broad (10-30 mm), apically rotund; margins entire or variously incised or ornamented; lower surface black, with a distinct brown or pale bare zone below the tips; upper and lower surfaces with a palisade-plectenchymatous cortex; rhizines simple, often rather sparse, often coarse, central; margins often with simple cilia. Pored epicortex well developed; pseudocyphellae absent. Cell walls containing Cetraria-type lichenan (medulla I+ blue). Medulla white or pigmented.

Apothecia laminal, substipitate to stipitate, often perforate, \pm round; disc concave, brown; margin thalloid, smooth to wrinkled, sometimes maculate; hypothecium pale; paraphyses branched; asci clavate, unitunicate, I+ blue; tholus I+ blue; spores 8, ellipsoid, hyaline, rather thick walled, 20-35 x 12-18 μ m.

Pycnidia laminal, immersed; fulcrum endobasidial, bayonet-like; pycnospores sublageniform (5-8 x 1 μ m) to filiform (12-20 x 1 μ m). Cortex with atranorin or usnic acid; medulla with orcinol depsides, orcinol depsidones, β -orcinol depsides, xanthones, β -orcinol depsidones, aliphatic acids, pulvinic acid derivatives, anthraquinones. Photobiont Trebouxia. On bark, wood or rock, in humid or sub-humid areas, temperate to tropical. Type species: P. perforatum.

Superficially similar Rimeliella is distinguished by the dense effigurate maculae of the upper cortex and the dimorphous attachment organs. Rimelia is distinguished especially by the reticulately cracked-maculate upper cortex. Cetrelia differs in having punctiform pseudocyphellae on the upper surface. Platismatia can also be somewhat similar.

**I-A. Upper side of thallus grayish, K+ yellow; (atranorin);
isidiate, sorediate-isidiate, or pustulate.**

1. Medulla yellow, K-2

1. Medulla white, or with K+ purple pigment.3

2. Cilia present. Medulla deep lemon yellow, C-, KC-, K-, P-, with vulpinic acid.

Thallus adnate to loosely attached, 6-10 cm diam.; lobes rotund, 5-8 mm wide, soon irregularly branched; margins entire to dissected; cilia variable, 1-4 mm long; upper surface yellowish to turtle green, plane, dull, reticulately cracked in older parts (with yellow medulla showing through), sparsely to densely isidiate; isidia cylindrical, simple to branched, 0.03-0.05 mm diam., to 3 mm tall; lower side black and rhizinate at center, naked and brown in broad marginal zone. Apothecia absent. On bark. Rather rare on hardwoods in mature forests. Florida, west along immediate coastal areas to eastern Texas; Mexico. P. sulphuratum (Nees & Flotow) Hale

2. Cilia completely absent. Medulla pale orange yellow (unknown pigment), especially in upper part, C+ pink (gyrophoric \pm echinocarpic acid). Thallus loosely adnate, 10-15 cm broad; lobes rotund, 10-15 mm wide; margins entire; upper surface light mineral gray, plane, opaque, densely isidiate. Isidia 0.06-0.08 mm diam., to 3 mm high, simple to sparingly branched. Lower side black and sparsely rhizinate, brown and naked in broad marginal zone. Apothecia rare, imperforate. On conifers and hardwoods, common in open woods. Southeast coastal plain, S. Carolina to Florida, west to Texas; Mexico. P. endosulphureum (Hillm.) Hale

3. Lobe margins without cilia. Medulla C+ red (lecanoric acid). Thallus 8-20 cm across, loosely adnate; lobes rotund, 10-15 mm wide; margins entire; upper surface whitish mineral gray, plane, dull, densely isidiate; isidia papillate-granular to cylindrical, coarse, 0.06-0.10 mm diam., to 2 mm high, simple to rarely coralloid-branched; lower side black and sparsely rhizinate at center, brown, shiny and naked in broad marginal zone. Apothecia very rare, imperforate. On rock or bark. Very common in open woods and along roadsides. Throughout southeastern U.S., to Florida. P. tinctorum (Delise ex Nyl.) Hale

3. Lobe margins with cilia.4

4. Lower side uniformly \pm pale brown (rarely darkening toward center), usually short rhizinate to the margin. 5

4. Lower side black at center, brown and \pm naked in marginal zone. 7

5. Medulla KC+ red, with norlobaridone (cryptochlorophaeic acid according to Hale, 1964) and protolichesterinic acid, K-, P- or K+ red, P+ orange, with or without salazinic acid 6

5. Medulla KC-, K+ red, P+ orange, with salazinic acid only, UV-. Cortex often with traces of usnic acid. Thallus adnate to loosely adnate, 6-9 cm across; lobes rotund, 8-14 mm wide; cilia moderate to sparse, ca. 1 mm long; upper surface pale stramineous-green to gray-white, plane, shiny, white-maculate, becoming irregularly reticulately cracked; isidia simple to slightly branched, cylindrical, 0.1 x 0.3-0.6 mm, becoming numerous; lower surface pale brown or blackening in center; rhizines short, numerous, to margins. Apothecia absent. On bark. North

Carolina, Alabama, Florida; Mexico. Morphologically very similar to P. haitiense and P. subtinctorium.Rimeliella neotropica

6. Medulla K-, P-, containing an unknown substance and a fatty acid. Thallus adnate, 5-10 cm broad; lobes broad and rotund, 5-15 mm wide, 10-25 mm long, sparsely ciliate; cilia 0.5-2 mm long; upper surface mineral gray to olivaceous, shiny, whit maculate, densely isidiate; lower surface brown, rhizinate almost to the margin and with papillae near the margin. Medulla white. Apothecia rare. On bark or rock. N. and S. Carolina, Florida.P. haitiense (Hale) Hale

6. Medulla K+ red, P+ orange, with salazinic acid. Thallus adnate to loosely attached, 5-10 cm diam.; lobes rotund, 10-15 mm wide; margins crenate, sparsely ciliate; cilia 1.0-1.5 mm long; upper surface mineral gray but soon turning buff in herbarium, plane, shiny, distinctly white maculate, irregularly cracked with age, moderately to densely isidiate; isidia cylindrical, simple to branched, 0.04-0.07 mm diam., to 1.0 mm high, rarely ciliate apically; lower side uniformly pale brown, rarely darkening at center, densely short rhizinate to the margin or with a narrow naked or papillate marginal zone. Apothecia rare, imperforate. Fairly common on deciduous trees in open woods or along roadsides, throughout southeastern U.S., to Florida; southern Arizona and New Mexico.P. subtinctorium (Zahlbr.) Hale

7. Medulla K-. Isidia becoming sorediate. Upper cortex without a reticulate pattern of maculae and cracks; rhizines not squarrose. Isidia coralloid, marginal, 1-5 mm high, becoming sorediate, often ciliate. Medulla K-, KC+ red or orange-red, P-, C-, UV+ bright blue, with alecoronic and α -collatolic acids; pigmented parts of medulla K+ purple, with rhodophysein. Thallus orbicular to spreading, loosely attached, 6-15 cm diam.; lobes rounded, 5-12 mm wide; margins crenate to dissected-isidiate; cilia numerous, black, 1-3 mm long. Upper surface smooth, pale gray to whitish, matt, slightly reticulate cracked, isidiate, especially at or near margins, or sorediate-isidiate; isidia soon becoming granular and sorediate, at first small, simple, terete, delicate, brown-tipped, becoming ciliate; soralia marginal, derived from isidia, capitate or glomerulate, eventually becoming recurved. Lower surface black, with naked, tan or whitish, marginal zones; rhizines black, simple. Apothecia rare. On bark, rarely rock. In open woods; rather infrequent. Widespread in southeastern U.S. (N. Carolina to Florida, west to eastern Texas).P. mellisii (Dodge) Hale

7. Medulla K+ yellow or red, P+ orange. Isidia not becoming sorediate. 8

8. Upper cortex with a reticulate pattern of maculae and cracks; rhizines in part squarrose. With salazinic acid. (Rimelia subisidiosum)

8. Upper cortex continuous, or irregularly cracked on older lobes. 9

9. Thallus UV-, K+ persistent yellow, P+ yellow to orange (stictic acid agg.), C-, KC+ reddish or KC-. 10

9. Medulla UV+ yellow or orange in lower part (lichenoxanthone), K+ red, P+ orange, C-, KC- (salazinic acid). Thallus loosely adnate, 10-20 cm diam., coriaceous; lobes orbicular, 8-15 mm wide; margins crenate; cilia to 2 mm long; upper surface mineral gray or pale gray, matt, sometimes pruinose, \pm reticulately cracked with age; isidia cylindrical, simple or coralloid, to 0.3 mm long, often ciliate. Underside black, moderately rhizinate, with broad, naked, brown and

shiny marginal zone. Apothecia rare, imperforate. On rock or bark. Wisconsin and Virginia, south to Florida, west to Ozarks; MexicoP. ultralucens (Krog) Hale (syn.: P. subcrinitum auct.)

10. Medulla without norlobaridone in addition to stictic and constictic acid, and a range of accessory substances, including menegazziaeic acid. Thallus large, to 10 cm diam.; lobes broad, to 8 mm wide. Thallus membranaceous. Thallus adnate, loosely attached, orbicular to spreading; lobes rounded, contiguous; margins wavy (sinuous), brown, moderately ciliate; cilia fine, black, to 4 mm long; isidiate; upper side mineral gray to pale greenish gray or whitish, becoming reticulate-cracked centrally, moderately to densely isidiate; isidia marginal and laminal, small, protuberant, to 1 mm tall, cylindrical, brown-tipped, becoming coralloid-branched and eventually sublobulate, often with small (1 mm) black cilia at base; medulla white; lower surface brown-black, with bare, smooth, shining, wrinkled, pale brown marginal zone; rhizines simple to branched, sparse to dense, black. Apothecia rare, imperforate. Common on \pm mossy trunks of oaks, maples and other hardwoods as well as cedar, in open woods; sometimes on siliceous rock outcrops in sheltered and exposed sites in hypermaritime areas. Great Lakes area to New England, south to southern Appalachians and Ozarks; rather rare in coastal areas from British Columbia to California and Mexico.P. crinitum (Ach.) M. Choisy

10. Medulla with norlobaridone in addition to stictic acid. Thallus smaller; lobes narrower. Southeastern U.S. Rare. P. internexum (Nyl.) Hale

**I-B. Upper surface of thallus grayish, K+ yellow (atranorin);
sorediate or pustulate.**

1. **Margins ciliate.** Soredia chiefly marginal; pustules lacking.
2
1. **Margins without cilia.** Medulla white. Key I-B-2
 2. **Lower surface with broad, bare white zone 1 cm wide at the margin.**
3
 2. **Lower surface dark brown (rarely mottled brown and white) in the marginal zone.** 5
3. **Medulla K+ yellow then red, P+ orange (norstictic acid), C-, K-, UV-.** 4
3. **Medulla K-, P-, C-, KC+ reddish, with alectoronic acid.** Thallus as in P. hypotropum. Apothecia unknown. On oak in oak-pine forest, Louisiana and Virginia. P. louisianae (Hale) Hale
 4. **Medulla with norstictic only.** Thallus 6-12 cm across, loose to suberect; lobes broad, 10-15 mm wide, ascending, rounded, dissected, independent to contiguous; margins wavy to broadly crenate (sorediate lobes sinuate), sorediate, revolute; upper surface light mineral gray to brownish, sometimes turning pink in herbarium, shiny (to dull), smooth, wrinkling with age, strongly white-maculate; soralia linear, marginal; medulla white; rhizines simple, dark, sparse. Apothecia rare, perforate. Usually on bark, common on lower trunks and branches of hardwoods and conifers in open woods. Eastern U.S. (Massachusetts to Florida, west to midwestern states), and west in the south to southern California; Mexico. P. hypotropum (Nyl.) Hale
 4. **Medulla with stictic in addition to norstictic.** Cortex maculate. Sorediate. Lobes ascending, curly. On conifers, Atlantic coastal plain from Massachusetts to Mississippi; southern California and Baja California. P. hypoleucinum (Steiner) Hale
5. **Upper surface finely reticulately cracked to the lobe margin; rhizines becoming squarrose.** 6
5. **Upper surface continuous (irregularly cracked only on older lobes; rhizines not squarrose.** 8
 6. **Medulla K+ red, P+ orange (salazinic acid).** (Rimelia reticulata)
 6. **Medulla K-, P-, C-, KC-.** 7
7. **Medulla UV-, containing fatty acid (caperatic acid).** (Rimelia simulans)
7. **Medulla UV+ yellow, containing lichexanthone and diffractaic acid.**
(Rimelia diffractaica)
 8. **Upper side distinctly maculate.** Medulla K+ or K-. 9. **Lower side usually pale, rhizinate or papillate to the margin.** 9
 8. **Upper side dull, emaculate to faintly maculate.** Medulla K+ yellow or red or K-. 10

9. Medulla K+ yellow then red, C-, KC-, P+ pale orange red, with salazinic acid. Thallus loosely adnate, to 15 cm broad, rather coriaceous; lobes rotund, 10-12 mm wide; margins often ascending, subcrenate, sorediate; soralia elongate, in older specimens becoming crescent shaped; sorediate lobes involute; cilia 1.0-1.5 mm long; upper surface mineral gray turning buff in herbarium, plane, shiny, strongly white maculate, reticulately cracked with age; lower side uniformly pale to dark brown, rarely blackening, densely short rhizinate to the margin or with a narrow papillate zone along margins. Apothecia rare, imperforate. On bark. Georgia and Mexico. Rimeliella subsumpta

9. Medulla K-, KC+ red, C-, P-, containing norlobaridone (cryptochlorophaeic acid according to Hale, 1964) and protolichesterinic acid. Thallus loosely adnate, membranous, 8-12 cm wide; lobes round and broad, 5-12 mm wide; margins ciliate and sorediate; cilia to 2 mm long; soralia linear or becoming irregular and submarginal; upper surface pale greenish to yellowish gray, plane, shiny, strongly white-maculate, becoming rimose; lower surface pale brown to blackening in center, densely rhizinate; rhizines short, to margins. Apothecia unknown. Norlobaridone. On bark or rock. Texas, Nebraska. Rimeliella conferenda

10-a. Collected in the coastal plain and piedmont of southeastern U.S., from Virginia to Texas. 10-b

10-a. Collected in the Appalachian-Great Lakes region and/or western N. America (Washington to California, or Arizona). 11

10-b. Soredia produced in marginal (terminal) soralia on main lobes; sorediate lobes involute. Cilia very long, to 5 mm. Medulla K-, C-, UV+ bright blue-white (alectoronic acid), sometimes in part with orange-red K+ purple pigment (rhodophycin) scattered near lower cortex. Cortex not maculate. Thallus expanded, 10-30 cm wide, loosely attached; lobes broad and rotund, 12-20 mm wide; margins entire, sorediate; soralia linear, 0.2-0.5 mm wide; sorediate margins \pm involute; cilia conspicuous, 3-6 mm long; upper surface whitish to mineral gray, plane, rugulose with age; lower side black and sparsely rhizinate, brown and naked in broad zone along margins. Apothecia rare, imperforate. Common on palm and oak trees in open woods. SE coastal plain (N. Carolina to Florida, west to Texas); Mexico. P. rampoddense (Nyl.) Hale

10-b. Soredia produced mainly on small secondary lobes toward thallus center. Cilia shorter, produced irregularly in lobe axils. Medulla P+ red, with protocetraric and echinocarpic acids [protocetraric only according to Galloway], without pigments, K-. Traces of usnic acid rarely present in cortex. Thallus loosely attached, 10-20 cm broad; lobes rotund, 10-15 mm wide; margins entire at tips, laterally becoming lacerate, sorediate. Upper surface mineral gray or faintly yellowish gray, smooth, rather shiny, faintly white maculate or dull, reticulately cracked with age toward center. Lower surface black and sparsely rhizinate, brown to mottled ivory and naked in broad marginal zone. Soredia coarse, mostly in linear soralia or developing on short irregular laciniae. Cilia usually completely absent, or occasionally abnormally developed in the axils, 0.5-1.5 mm long. Apothecia rare, imperforate. On bark. Very common on trees in open forests, especially in Florida; also present along coastal plain N to N. Carolina and W to Louisiana. P. dilatatum (Vainio) Hale

11. Medulla K-, P-, C+ red or C-, KC+ red or red-violet (alectoronic and α -collatolic

acids, or norlobaridone \pm loxodin). Sorediate lobes becoming revolute with age. 12

11. Medulla K+ yellow or yellow then red, P+ orange. 13

12. Medulla UV+ white, KC+ red, with alectoronic and α -collatolic acids, sometimes in part with orange-red, K+ purple pigment (rhodophycin) scattered near lower cortex.

Soredia originating submarginally, mostly on marginal laciniae, eventually coalescing into extensive soralia; soralia farinose. Thallus loosely attached, 8-20 cm diam.; upper surface light mineral gray, shiny, faintly maculate; lobes 8-15 mm wide, with dentate marginal laciniae, 2-4 mm wide, 5-10 mm long, crowded toward center. Cilia rather sparse, 1.0-2.5 mm long. Lower side black and rhizinate at center, brown and naked in broad zone at margin. Apothecia very rare. On bark, in open coastal forests at lower elevations, especially in hypermaritime localities. Alaska to Mexico; eastern N. America. P. arnoldii (Du Rietz) Hale

12. Medulla UV-, KC+ reddish to purple, with norlobaridone, \pm loxodin

(cryptochlorophaeic acid according to Hale, 1965); protolichesterinic acid, without

pigments, K-. Soralia linear or in part capitate and submarginal. Lower side black, sparsely rhizinate at center, with a broad brown to ivory-white or mottled bare marginal zone; upper surface faintly to strongly white-maculate especially near base of apothecia, rarely becoming white pruinose, mineral gray, dull to quite shiny. Thallus loosely adnate, 6-10 cm diam.; lobes rotund, 7-12 mm wide; margins often subascending, crenate, sorediate; cilia rather sparse, 0.5-2 mm long. Apothecia rare, perforate. On bark. Arizona; Mexico. P. hababianum (Gyelnik) Hale

13. Lobes broad, to 10 mm wide, often suberect, with narrow or orbicular and irregular marginal soralia. Medulla K+ yellow then red, with salazinic acid. 14

13. Lobes narrower and crowded, 4-8 mm wide, with soredia chiefly produced on revolute tips of main lobes, \pm linear (but short). Medulla K+ yellow, with stictic acid. Stictic acid present. Thallus adnate to loosely attached, 5-15 cm diam.; lobes 8-15 mm wide; margins entire; cilia sparse, 0.3-2.0 mm long; submarginally sorediate; soralia soon eroding a large area; upper surface mineral gray, smooth, matt; lower surface black and moderately rhizinate, dark brown, shiny and naked in broad to narrow marginal zone. Apothecia very rare. Medulla K+ yellow, C-, KC-, P+ pale orange, with stictic acid. On bark or rock, in open hypermaritime forests at lower elevations. Nova Scotia to the Carolinas; British Columbia to California; Mexico. P. chinense (Osbeck) Hale & Ahti (syn.: P. perlatum, but the name has been proposed for conservation against chinense)

14. Soralia chiefly on marginal lobules or laciniae, mostly orbicular, irregular; salazinic acid present. Thallus loosely attached, 5-15 cm across; lobes 7-10 mm wide, rounded to irregularly branching, dissected, contiguous; margins often with marginal lobules 3-5 mm long, 1.5-2.0 mm wide; margins revolute, sparsely ciliate; cilia 1.0-1.5 mm long; upper surface mineral gray, dull to shiny, faintly maculate, reticulately cracked toward center with age; soralia near margins; margins or sorediate lobes revolute (turned downward); medulla white; lower surface brown-black; bare and dark brown in a broad or narrow zone near margins; rhizines sparse, mainly simple, older ones sometimes branched. Medulla K+ yellow then red, P+ yellow-

orange, with salazinic acid. Apothecia and pycnidia unknown. On bark and old wood in mesic deciduous forests of eastern U.S. (Massachusetts to Tennessee and Arkansas, west to Wisconsin, Iowa, Ohio and Kentucky). Virtually identical morphologically to P. arnoldii. P. margaritatum (Hue) Hale

14. *Soralia marginal (or terminal), narrow and linear.* Thallus loosely attached, 10-20 cm diam.; lobes rotund, 10-15 mm wide; margins often ascending and suberect, sorediate; soralia terminal, linear; cilia 2-3 mm long; upper surface mineral gray, dull, continuous to cracked with age toward center; lower surface black and sparsely rhizinate, dark brown to brown and naked in a broad marginal zone. Apothecia rare (known mostly from collections in western U.S.) very large, 10-30 mm across, stalked, usually perforate. Medulla K+ yellow then red, C-, KC-, P+ pale orange red, with salzinic acid. Common in the mountains, on bark of deciduous trees, especially oaks, in open, dry forests; also in swamps. Great Lakes to New England, S to southern Appalachians; Pacific coastal areas from California (to Washington state?--not mentioned by Goward, et al. for British Columbia). P. stuppeum (Taylor) Hale

**I-B-2. Upper surface of thallus grayish, K+ yellow (atranorin);
sorediate or pustulate.
Non-ciliate**

1. Medulla K+ red, P+ orange, C-, KC-, with salazinic or norstictic acid.

..... 2

1. Medulla K- or yellowish (atranorin) or brownish, P+ red (protocetraric acid) or P-.

..... 3

2. With salazinic acid. Soredia farinose; soralia elongate, Thallus loosely attached, expanded, 10-25 cm diam.; lobes broad and rotund, 12-20 mm wide; sorediate lobes sinuous, \pm involute; upper surface light mineral gray (often turning reddish), dull, continuous, cracked with age; lower surface black and sparsely rhizinate, naked and brown in broad marginal zone. Apothecia rare; discs imperforate. On bark or rock. Common on oak and palm trees in open woods and along roads. P. cristiferum (Taylor) Hale

2. With norstictic acid. Soredia \pm conglutinated; soralia irregular. Thallus adnate. Florida. P. rubifaciens (Hale) Hale [see Hale's subg. Amphigymnia treatment for fuller description]

3. Medulla P+ red (protocetraric). 4

3. Medulla P-. 6

4. Soredia farinose, yellowish. Upper surface yellowish. Soredia and cortex containing usnic acid. Thallus adnate to loosely adnate, to 15 cm. diam.; lobes rotund, 8-12 mm wide; margins sorediate laterally; soralia irregular to subcapitate, confluent, in part sublaminar, tinged distinctly yellowish; cilia lacking; upper surface mineral gray with a pale yellowish tinge to distinctly yellowish green, opaque, reticulately cracked toward center with age. Apothecia very rare, imperforate. On rock or bark. Florida. Rare. (P. dominicanum)

4. Soredia granular, white. Upper surface grayish. Usnic acid absent or occasionally in traces. Cilia usually sparsely and irregularly produced in lobe axils, but easily overlooked. Lower surface brown to mottled brown and white along the margins. 5

5. Echinocarpic acid and unknowns present in addition to protocetraric [protocetraric only according to Galloway]. Rarely with traces of usnic acid. (P. dilatatum)

5. Protocetraric acid only. Lacking usnic acid. Otherwise virtually identical to P. dilatatum. On trees. Southeastern U.S., S. Carolina to Florida, infrequent. [N. American reports of P. robustum are based on this species]. P. gardeneri (Dodge) Sérus.

6. Medulla C-, KC- (fatty acids, sometimes plus atranorin). Thallus adnate. Lower surface dark, sometimes white-mottled but without distinct pale marginal zone. Lobes to 10 mm wide. 7

6. Medulla C+, KC+ red (lecanoric acid). Thallus loosely attached. Lower surface black in center, light brown mottled to ivory or white in a broad zone along margins.

Lobes broad, 10-15 mm wide. Thallus 6-10 cm diam., loosely attached; lobes often ascending, rotund; margins sorediate, sinuate; soralia linear; upper surface very light mineral gray, plane, dull to shiny and \pm clearly maculate; lower side black and rhizinate at center, naked in broad marginal zone. Apothecia very rare. On bark. On trees in open pastures and long roads. Southeastern U.S. except coastal plain, western part of southern Appalachians, south to northern Georgia, west to Texas and Oklahoma; Mexico.P. austrosinense (Zahlbr.) Hale

7. Medulla K-, without atranorin, with caperatic acid. On bark. Thallus 5-10 cm broad (generally smaller than most Parmotrema spp.), adnate; lobes 3-5(-8) mm wide, rotund, crowded; margins suberect and sorediate; soralia often crescent-shaped and in part submarginal; cilia lacking; upper surface mineral gray to buff, smooth, dull; lower side black and rhizinate in center, brown or mottled ivory at margin. Apothecia rare, imperforate. Common on oak trees in open woods and on citrus trees in groves, SE coastal plain, S. Carolina to Florida and west to eastern Texas; Mexico. P. praesorediosum (Nyl.) Hale

7. Medulla K+ yellow, with atranorin and unknown fatty acid. On rock. Thallus adnate, to 6 cm broad; lobes irregular, rotund, 6-10 mm wide; margins entire to crenate, eciliate, sorediate; marginal soralia linear; upper surface whitish mineral gray, smooth, rugose with age, in part sorediate; laminal soralia orbicular. Medulla white. Lower side black and sparsely rhizinate, black, naked and shiny in broad marginal zone. On rock, in savanna and open woodland. P. mordenii (Hale) Hale

**I-C. Upper surface of thallus grayish, K+ yellow (atranorin);
lacking soredia, isidia and pustules.**

1. Cilia absent, even in lobe axils (use hand lens or hold up to bright light). Medulla K-, C-, KC+ rose (due to ?), P+ red (protocetraric acid). Thallus loosely adnate; upper surface smooth, with olivaceous or brownish cast. Lower surface brown-black to black in center, brown and bare in broad marginal zone. Apothecia common, substipitate; disc imperforate. 2

1. Cilia present on lobe margins and/or in axils (sometimes sparse). Medulla white, at most with patches of an ochraceous, K+ purple pigment near lower cortex 3

2. Thallus 10-20 cm broad; lobes broad and rotund, 15-18 mm wide; margins entire or lobulate or sublobulate; upper surface olivaceous mineral gray, irregularly cracked with age, dull; lower side black and sparsely rhizinate at center, brown in broad marginal zone. Apothecia common, 3-10 mm diam.; margin smooth. On bark. (P. zollingeri)

2. Thallus 4-12 cm across; lobes elongate to strap-shaped, crowded; margins wavy, entire to somewhat dissected, sometimes strongly dissected and lacinate; upper surface brownish gray, dull, not maculate; medulla white; lower surface brown-black, moderately rhizinate; rhizines simple to sparsely branched, dark. Apothecia very common. Pycnidia numerous on upper surface. On bark, common on trunks and branches in open woods and along roadsides. Throughout most of eastern U.S. (except extreme northern parts), S to Florida. (P. michauxianum)

3. Lower surface with a broad white rim. Lobes often suberect. Apothecia perforate. 4

3. Lower surface brown at margins. Lobes adnate. 6

4. Medulla KC-, C-, K+ red, P+ orange (salazinic acid).5

4. Medulla KC+ red (alecoronic acid), C-, K-, P- or K+ red, P+ orange, with accessory norstictic acid. Lower side black at center, with broad white margin; cortex shiny, maculate; amphithecium smooth or rugose; medulla KC+ red, with alecoronic acid (+ or - norstictic according to Harris, 1990). Thallus loosely attached, 6-12 cm diam.; lobes often suberect, rotund, 6-12 mm wide; margins crenate to lacinate; cilia 1-3 mm long; upper surface mineral gray, shiny, minutely pitted, strongly white-maculate, rugose with age; lower surface black and sparsely rhizinate at center, white to ivory and naked in broad marginal zone. Apothecia common, pedicellate, to 20 mm diam. Pycnidia common. Morphologically virtually indistinguishable from P. perforatum. On bark in canopy of deciduous trees, SE coastal Plain, N. Carolina to Florida, west to Texas.P. rigidum (Lynge) Hale

5. Medulla with norstictic acid only (or rarely acid deficient). Upper surface strongly maculate. Lower side with white rim or brown and naked. Thallus loosely attached to suberect, 8-12 cm across; lobes large, often monophyllous, 10-20 mm wide; margins entire to lacerate or even lacinate; cilia 2-4 mm long; upper surface light mineral gray or turning pinkish in herbarium, plane to rugose, shiny; lower side jet black and sparsely rhizinate at center, pure

white to ivory or rarely tan in distinct broad marginal zone. Apothecia numerous, stalked, 10-20 mm diam.; margin rarely ciliate, strongly rugose, maculate; disc perforate. Pycnidia numerous. On bark. Most common in canopy of oak trees, and on exposed trunks. Eastern N. America (Massachusetts to Florida west to Nebraska, Oklahoma and Texas. P. perforatum (Jacq.) Massal.

5. Medulla with stictic and constictic acids in addition to norstictic. Otherwise identical to P. perforatum. Eastern Texas and western Louisiana. Infrequent but locally abundant. P. praeperforatum (Culb.) Hale

6. Medulla K+ yellow then red, P+ orange. Apothecia, absent, or if present, disc perforate. 7

6. Medulla K-, C-, KC+ rose (due to ?), P+ red (protocetraric acid). Apothecia common, substipitate; disc imperforate. Thallus loosely adnate; upper surface with olivaceous or brownish cast. 8

7. Upper cortex shiny, maculate, finely reticulately cracked to the margin; rhizines in part squarrose. (Rimelia cetrata)

7. Upper cortex dull to rather shiny, without maculae, cracked only on older lobes. Thallus loosely adnate, coriaceous, 10-20 cm broad; lobes rotund, 10-14 mm wide, conspicuously dentate-laciniate towards center, the laciniae 5-10 x 1-2 mm; cilia 1-4 mm long; upper surface ashy white to mineral gray, plane, matt to rather shiny. Rhizines not squarrose; underside with a brown or mottled marginal zone. Apothecia present or absent, 5-15 mm diam., substipitate; margin rugose, white-maculate; spores less than 20 um long. Pycnidia abundant on marginal laciniae. Cortex at most P+ pale yellow (psoromic acid absent). Frequent and occasionally common, on trees, especially oaks, on dry open hillsides. Texas to Iowa and Ohio; Arizona; Mexico. P. eurysacum (Hue) Hale

8. Thallus 10-20 cm broad; lobes broad and rotund, 15-18 mm wide; margins entire or lobulate or sublobulate, cilia absent or sparse, in axils, 0.5-0.8 mm long, sometimes branched. Upper surface olivaceous mineral gray, smooth, irregularly cracked with age, dull; lower side black and sparsely rhizinate at center, brown and naked in broad marginal zone. Apothecia common, 3-10 mm diam.; margin smooth. On bark. (P. zollingeri)

8. Thallus 4-12 cm across; lobes elongate to strap-shaped, crowded; margins wavy, entire to somewhat dissected, sometimes strongly dissected and laciniate, eciliate, to sparsely ciliate in lobe axils; cilia short; upper surface brownish gray, dull, smooth, not maculate; medulla white; lower surface brown-black, moderately rhizinate, bare near margins; rhizines simple to sparsely branched, dark. Apothecia very common, somewhat stalked, saucer-shaped, imperforate. Pycnidia numerous on upper surface. On bark, common on trunks and branches in open woods and along roadsides. Throughout most of eastern U.S. (except extreme northern parts), S to Florida. P. michauxianum (Zahlbr.) Hale

II. Upper surface of thallus greenish yellow (usnic acid).

1. Marginal cilia present. Isidiate. Medulla P-, K-. 2

1. Marginal cilia absent. Sorediate. Medulla P+ orange-red (protocetraric acid),
K-. 3

2. Medulla C-, KC-, with protolichesterinic acid. Thallus loosely attached, 8-20 cm diam.; lobes rotund, 8-12 mm wide; margins isidiate-dissected on older lobes; cilia 1.0-2.5 mm long; upper surface yellowish green, plane, dull, reticulately cracked with age, densely isidiate; isidia simple to coralloid branched, 0.05-0.08 mm thick, 1 mm high or more, often apically ciliate; lower side black and rhizinate at center, shiny dark brown in broad marginal zone. Apothecia and pycnidia lacking. Rather rare on rock outcrops and on oak trunks in open woods or swamps. Southeastern U.S., to Florida P. xanthinum (Müll. Arg.) Hale

2. Medulla C+ and KC+ rose (gyrophoric acid). Thallus loosely attached, large; lobes broad, rounded, dissected, crowded; margins wavy; cilia long; upper surface yellow-green, somewhat shiny; towards center becoming wrinkled with age and isidiate-lobulate; isidia cylindrical to somewhat flattened, mostly marginal; medulla white; under surface brown-black; rhizines simple to branched, sparse, absent near margins. On bark or rock. Southeastern U.S., to Ohio. P. madagascariaceum (Hue) Hale

3. Usnic acid abundant. Without echinocarpic acid and unknowns. Thallus adnate to loosely adnate, to 15 cm. diam.; lobes rotund, 8-12 mm wide; margins sorediate laterally; soralia irregular to subcapitate, confluent, in part sublaminar, tinged distinctly yellowish; cilia lacking; upper surface mineral gray with a pale yellowish tinge to distinctly yellowish green, opaque, reticulately cracked toward center with age. Apothecia very rare, imperforate. Medulla KC+ red (due to ?). On rock or bark. N. Carolina, Florida; Mexico. P. dominicanum (Vainio) Hale

3. Only traces of usnic acid occasionally present. Echinocarpic acid and unknowns in addition to protocetraric. Soralia generally more irregular and sparse, mostly on short marginal lobes, white. (P. dilatatum)

ADD:

P. gardneri

Rimelia commensuratum (Hale in Dey) Hale

Literature

Culberson, W. 1973. Speciation in Parmelia perforata group. The Bryologist.

Elix, J. A. 1993. Genera of Parmeliaceae.

Esslinger, T. 1972. A new Parmelia with diffractaic acid. The Bryologist 75(1): 79-81.

Galloway, D. 1985. Flora of New Zealand Lichens.

Hale, M. E. 1964. A monograph of Parmelia subgenus Amphigymnia. Contrib. U.S. Nat. Herb. 36: 193-358.

Hale, M. E. 19_. Morden expedition to Dominican Republic. Parmeliaceae.

Hale, M. E. 1971. Two new species of Parmelia (lichens) from North America. Phytologia 22: 92.

Hale, M. E. 1971. Five new Parmeliae.

Hale, M. E. 1974. Notes on species of Parmotrema (Lichenes: Parmeliaceae) containing yellow pigments. Mycotaxon 1(2): 105-116.

Hale, M. E. 1977. New species in the lichen genus Parmotrema Mass. Mycotaxon 5(2): 432-448.

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

Hale, M. E. and A. Fletcher. 1990. Rimelia Hale & Fletcher, a new lichen genus (Ascomycotina: Parmeliaceae). The Bryologist 93(1): 23-29.

Krog, H. 1974. Parmelia ultralucens, a new lichen species in subgenus Amphigymnia. The Bryologist 77: 253-256.

Moore, B. 19 . Macrolichens of Florida.

Rogers, 19 . Genera of Australian Lichens.

Taylor, C. 19_. Lichens of Ohio. Foliose.

[Author?]. 19_. Macrolichens on mangroves. Proceedings of the Royal Society of Queensland.