

## Taxonomic Notes on *Parmelia reparata* (Parmeliaceae, Lichenes) and the Related Species

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**Abstract** *Parmelia reparata* and the related species were revised taxonomically. As a result, two new combinations, *Canomaculina reparata* (Stirt.) Kurok. and *Parmotrema permaculatum* (Hale) Kurok., are proposed and three new species, *Parmotrema acutatatum*, *P. cornigerum* and *P. despectum*, are described. *Parmotrema eurysacum* (Hue) Hale, which has been variously applied, is clearly characterized.

**Key words:** *Canomaculina*, new combinations, new species, *Parmelia reparata*, *Parmotrema*

*Parmelia reparata* was described by Stirton (1877–1878) on the basis of two specimens collected in Australia and New Zealand. Hale (1965) in ‘A monograph of *Parmelia* subgenus *Amphigymnia*’ classified this species under series Ornaticolae, subsection Ornaticolae, section Subflavescentes in the subgenus *Amphigymnia* and typified the species by the designation of a lectotype. Nine specimens collected in Alabama in the United States, Mexico, Australia and New Zealand were cited. Subsequently, Hale (1971) described a new species, *Parmelia permaculata*, designating as the holotype one of the specimens cited in Hale (1965) as *P. reparata*. When Hale (1974) transferred most species of the subgenus *Amphigymnia* to the resurrected genus *Parmotrema*, no combination was proposed for *Parmelia reparata*.

Recently B. Hale & DePriest (1999) treated *P. reparata* as a synonym of *Canomaculina subcaperata* (Kremp.) Elix and on the basis of Hale’s unpublished notes reduced *Parmelia permaculata* to a synonym of *Parmotrema eurysacum* (Hue) Hale. Specimens reported as *Parmelia reparata* by Hale in 1965 were filed under *P. eurysacum* in US (P. T. DePriest pers. comm.). Thus, apparently there has been confusion in understanding *Parmelia reparata* and *Parmotrema eurysacum*. In the present study, I attempt to clarify the taxonomic features of *Parmelia reparata*, *Parmotrema eurysacum* and their related species. Based on new examinations of specimens of these species, two new combinations, *Canomaculina reparata* (Stirt.) Kurok. and *Parmotrema permaculatum* (Hale) Kurok., are proposed and three new species, *Parmotrema acutatatum*, *P. cornigerum* and *P. despectum*, are described. In addition, taxonomic features of *Parmotrema eurysacum* are clarified.

The present study is based principally on specimens filed under *Parmotrema eu-*

*rysacum* in US and those of *Parmelia reparata* and the related species preserved in TNS.

**Canomaculina reparata** (Stirt.) Kurok., comb. nov.

*Parmelia reparata* Stirt., Scott. Natural. 4: 201. 1877–78. Lectotype: Cave Mountain near Brisbane, Queensland, Australia, F. M. Bailey s.n. (BM).

*Parmelia virens* Müll. Arg., Flora 69: 255. 1886. Holotype: Toowoomba, Queensland, Australia, Hartmann in 1882 (G).

Thallus loosely adnate, mineral gray, coriaceous, 10–20 cm broad; lobes irregularly divided, rotund at the apices, broadly crenate and ciliate at the margins, cilia abundant and dense, 1.5–2.5 mm long; upper surface glossy, effigurate-maculate, more or less cracked with age, soredia and isidia lacking; lower surface black except for very narrow blackish brown apical zone, minutely wrinkled, short-rhizinate or papillate even near the apices, short rhizines less than 0.1 mm long, long rhizines formed  $\pm$  in group, thick, about 1 mm long. Thallus 160–220  $\mu\text{m}$  thick; upper cortex 21–26  $\mu\text{m}$  thick, gonidial layer subdiscontinuous, 8–20  $\mu\text{m}$  thick, medulla 100–140  $\mu\text{m}$  thick, lower cortex brownish, ca 13  $\mu\text{m}$  thick. Apothecia common, stipitate, 10–20 mm in diameter, amphithecium rugose, effigurate-maculate, disk brown to dark brown, perforate; hymenium 75–85  $\mu\text{m}$  high, asci ca 26 $\times$ 70  $\mu\text{m}$  in size, spores 6–8 $\times$ 15–18  $\mu\text{m}$ .

Chemistry. Atranorin, salazinic acid and consalazinic acid.

Since the lectotype of *Parmelia reparata* has an effigurate-maculate upper surface and dimorphic rhizines, the species can be placed in the genus *Canomaculina*. Previously, the species was considered as a synonym of *C. subcaperata* (Kremp.) Elix by B. Hale & DePriest (1999). However, the lower surface of *P. reparata* is jet black except for the very narrow dark brown apical zone (for 2–5 mm from the apex), whereas it is pale to dark brown for the most part, and blackish brown to black only near the center on very old lobes in *C. subcaperata*. In addition, dimorphic rhizines are more common in *C. subcaperata* than in *C. reparata*, in which they are observed only on certain lobes. Therefore, the present species can be considered as a distinct species differentiated in Australia and New Zealand, although it is closely related to *C. subcaperata*.

In 1991, Kurokawa (1991) reported the occurrence of *Rimeliella* (*Canomaculina*) *subcaperata* from Australia citing two specimens preserved in MEL. These specimens should be reexamined on the basis of the distinctions between the species described above. Thus, *C. subcaperata* is considered provisionally to be endemic to South America (Brazil, Paraguay and Uruguay).

Specimens examined. Australia. Queensland: Brisbane, F. M. Bailey s.n. in 1882 (BM); Maijala National Park, Mt. Glorious, elevation about 700 m, S. Kurokawa 5466 (TNS, US) and 5469, 5473 (TNS); O'Reilly's Place, Lamington National Park, E. Dahl s.n. (TNS). New South Wales: Tropical rain forest, Dorrigo Mt., Dorrigo Na-

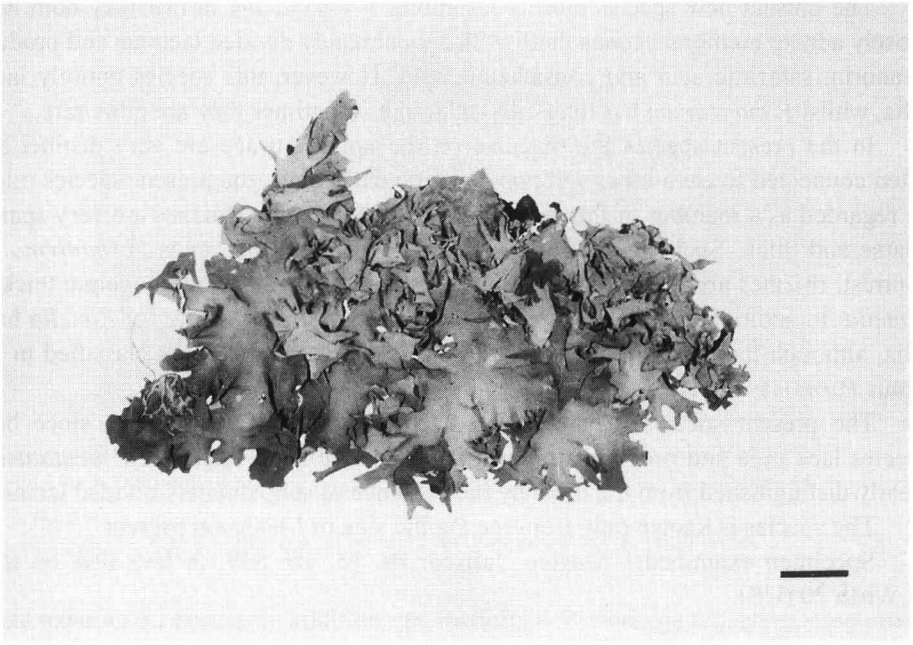


Fig. 1. Holotype of *Parmotrema acutatatum* Kurok. (Bar=1 cm).

tional Park, elevation about 800 m, S.Kurokawa 5244 (TNS). New Zealand. N. Island, R. Gobby s.n. (BM). Ashburton, S. Island, H. H. Allan s.n. in 1920 (BM).

***Parmotrema acutatatum* Kurok., sp. nov.**

Species habitu cum *Parmotremate eurysaco* optime congruens sed differt lobis eciliatis et superficie superiore distincte maculata.

Chemistry. Atranorin, salazinic acid and consalazinic acid.

Type. Mexico. Nayarit: Near Tepic, Rt. 15, km 865, on tree, M. Wirth 26—holotype in US and isotypes in US and TNS.

Thallus loosely adnate, membranaceous, grayish glaucous, 6–10 cm broad; lobes irregularly divided, eciliate, 5–10 mm wide, conspicuously lacinate at the margin, laciniae 5–15 mm long, often subpalmately divided, acuminate towards the apices, pale ochre and erhizinate on the lower surface; upper surface glossy, distinctly maculate, soredia and isidia lacking; lower surface naked and pale brown near the apices (for 3–10 mm) and black and very sparsely rhizinate near the center, rhizines black, coarse and short (less than 1 mm), papillae commonly formed on black lower surface. Thallus 180–240  $\mu\text{m}$  thick; upper cortex 20  $\mu\text{m}$  thick, gonidial layer continuous, 20–30  $\mu\text{m}$  thick, medulla 110–160  $\mu\text{m}$  thick, lower cortex brownish, ca 25  $\mu\text{m}$  thick. Apothecia not seen.

The present new species closely resembles *P. eurysacum* in that they both have loosely adnate membranaceous thalli with subpalmately divided laciniae and produce atranorin, salazinic acid and consalazinic acid. However, this species entirely lacks cilia, whilst *P. eurysacum* has long cilia, although sometimes they are quite rare.

In the present species the maculae on the upper surface are very distinct and often connected to each other and appears reticulate. Thus, the present species might be regarded as a member of the genus *Rimelia*. However, its rhizines are very sparse, coarse and thick. Such rhizines are typical of species in the genus *Parmotrema*. In contrast, rhizines are rather dense even near the lobe tips and only moderate thick in *Rimelia*. In addition, the present species lacks cilia, while all species of *Rimelia* have cilia, although they are sometimes rare. Thus, the present species is classified in the genus *Parmotrema* here.

The present species may be related to *P. latissimum* (Feé) Hale, since both species lack cilia and produce atranorin and salazinic acid. However, *P. acutatum* is clearly distinguished from the latter by the presence of subpalmately divided laciniae.

The species is known only from the Pacific side of Mexico at present.

Specimen examined. Mexico. Jalisco: Rt. 15, km 839, in lava bed, on tree, M. Wirth 70 (US).

### ***Parmotrema cornigerum* Kurok., sp. nov.**

Species cum thallo ut in *Parmotremate eurysaco* sed ab hac species lobis eciliatis et thallo acidum protocetraricum continenti differt.

Chemistry. Atranorin and protocetraric acid.

Type. Mexico. Chiapas: Scrub deciduous forest bordering rim of El Sumidero, El Sumidero canyon, north of Textula Gutiérrez, on deciduous trees, elevation 1220 m, M. E. Hale 20078 & T. R. Soderstrom — holotype in US.

Thallus loosely adnate on bark of trees, membranaceous, glaucous gray, 8–15 cm broad; lobes irregularly divided, eciliate, 5–12 mm wide, conspicuously lacinate, laciniae usually dichotomously or subpalmately divided, 6–14 mm long, canaliculate below and becoming terete near the apices; upper surface glossy, emaculate, rugose or more or less foveolate on older lobes, soredia and isidia lacking; lower surface distinctly wrinkled, pale buff or pale brown in quite wide zone (for about 1.5–2.5 and often more than 3 cm), black only on older lobes; rhizines rather rare, formed only on black lower surface, coarse and short (less than 0.5 mm long). Thallus 140–190  $\mu\text{m}$  thick; upper cortex 16–25  $\mu\text{m}$  thick, gonidial layer continuous, 13–15  $\mu\text{m}$  thick, medulla 130–150  $\mu\text{m}$  thick, lower cortex pale brown, ca 15  $\mu\text{m}$  thick. Apothecia stipitate, 10–16 mm in diameter, amphithecium distinctly rugose, emaculate, disk pale brown to brown, perforate; hymenium 90–100  $\mu\text{m}$  high, asci subcylindrical, 22–24  $\times$  50–70  $\mu\text{m}$  in size, spores ellipsoidal or more less ovoidal, 9–10  $\times$  20–21  $\mu\text{m}$ .

The present species may be confused with *P. eurysacum* because they both form similar subpalmate laciniae. However, its lobes lack cilia and their laciniae become

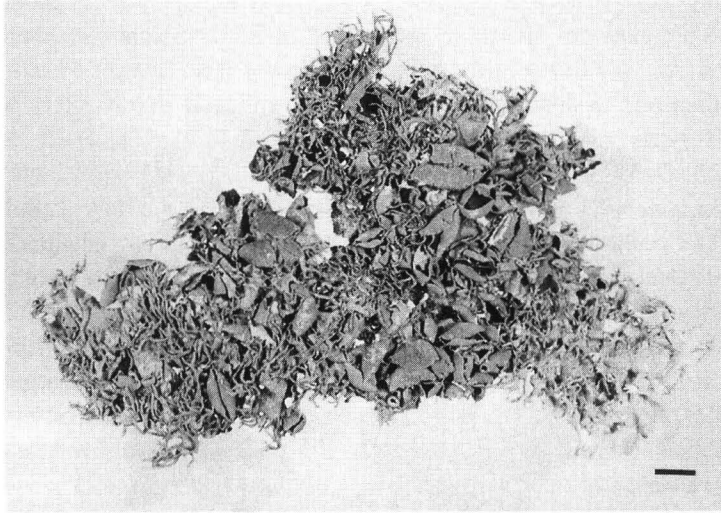


Fig. 2. Holotype of *Parmotrema cornigerum* Kurok. (Bar=1 cm)

terete towards the apices. In addition, the medulla is P + orange red, containing protocetraric acid rather than salazinic and consalazinic acids. Spores are much larger ( $9\text{--}10 \times 20\text{--}21 \mu\text{m}$ ) than those of *P. eurysacum* ( $7\text{--}9 \times 14\text{--}16 \mu\text{m}$ ).

This species resembles *Rimelia cetrata* (Ach.) Hale & A. Fletcher, which also forms distinct laciniae. However, *R. cetrata* is sparsely to densely ciliate and has a reticulately maculate upper surface. The main secondary product of *R. cetrata* is salazinic acid.

This new species is known only from Mexico at present.

Specimen examined. Mexico. Chiapas: Scrubby deciduous pasture, mist forest, Road to El Suspiro, 5–7 km north of Berriozábal, on deciduous trees, elevation 920 m, M. E. Hale 20115 & T. R. Soderstrom (US).

### ***Parmotrema despectum* Kurok., sp. nov.**

Species cum thallo ut in *Parmotremate eurysaco* sed ab hac species thallo plus minusve coriaceo, laciniiis aubpalmatim ramosis destituto et cilliis raris sparsisve et brevibus (1–3 mm longis) differt.

Chemistry. Atranorin, salazinic acid and consalazinic acid.

Type. U.S.A. Virginia: Along Rt. 623 near Rt. 301, King George Co., C. F. Reed 59408 — holotype in US.

Thallus adnate, coriaceous, mineral gray to glaucous gray, about 10 cm broad, irregularly divided; lobes 2.5–10 mm wide, crenate to gnawed at the margin, sometimes with rotund lobules  $1 \times 1$  to  $2 \times 3$  mm in size; upper surface glossy, sometimes faintly maculate, roughly rugose on older lobes, soredia and isidia lacking; cilia rare

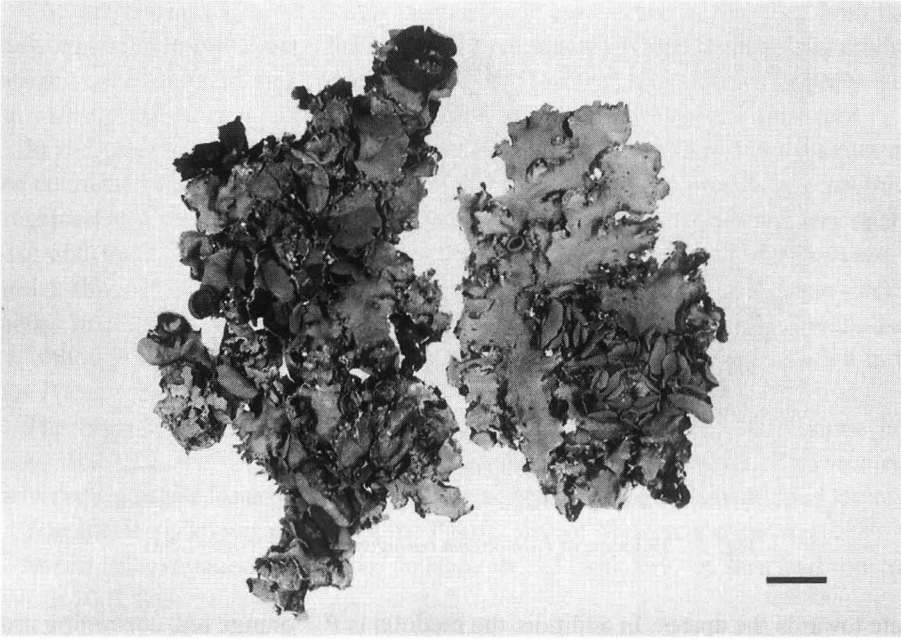


Fig. 3. Holotype of *Parmotrema despectum* Kurok. (Bar=1 cm).

or sparse, simple or very rarely branched, 1–3 mm long; lower surface black, sometimes ivory-mottled near the margin; rhizines simple, dense, 1–2 mm long. Thallus 260–300  $\mu\text{m}$  thick; upper cortex ca 50  $\mu\text{m}$  thick, gonidial layer subcontinuous, ca 25  $\mu\text{m}$  thick, medulla 190–300  $\mu\text{m}$  thick, lower cortex dark brown, ca 20  $\mu\text{m}$  thick. Apothecia sessile, 3–10 mm in diameter, amphithecium more or less rugulose, white-maculate, disk dark brown to blackish brown, perforate, often fissured in mature stage; hymenium ca 55  $\mu\text{m}$  high, asci subclavate, ca 33 $\times$ 53  $\mu\text{m}$  in size, spores 6–10 $\times$ 10–14  $\mu\text{m}$ .

The present species has been confused with *P. eurysacum*, probably because both species have ciliate lobes, produce atranorin, salazinic acid and consalazinic acid and show similar distribution pattern in southeastern United States and Mexico. However, it can be distinguished from the latter by 1) the  $\pm$  coriaceous adnate thallus, 2) the crenate to gnawed margins of lobes, 3) the rare to sparse short cilia (1–3 mm long) and 4) the absence of subpalmately divided laciniae. The thallus of this species is rather coriaceous, reflecting thicker lobes (260–300  $\mu\text{m}$  thick) compared with *P. eurysacum* (150–160  $\mu\text{m}$  thick). Spores are also somewhat smaller (6–10 $\times$ 10–14  $\mu\text{m}$ ) than in *P. eurysacum* (7–9 $\times$ 14–16  $\mu\text{m}$ ).

The present species is very common in the southern and southeastern United States, with its range extending to northern Mexico where *P. eurysacum* is much



more common.

Specimens examined. U.S.A. Maryland: Baltimore, on tree trunk, C. C. Plitt 300 (US). West Virginia: Near town of Cucumber, McDowell Co., on red oak, M. E. Hale 11505 (US). South Carolina: Near town of Spartanburg, Spartanburg Co., on hickory, M. E. Hale 7685 (US). Ohio: Springfield, ex Willey (US). Illinois: Bell Smith Springs, Pope Co., on *Quercus stellata* in dry woods, A. C. Skorepa 4256 (US); Canton, J. Wolf s.n. (US). Iowa: On trees, Fayette Co., B. Fink s.n. (three packets, US). Kentucky: Olympia, Bath Co., on living oak, M. J. Allen 212 (US). Missouri: Near town of Rayborn, Wright Co., on black oak, M. E. Hale 4259 (US); Near town of Viola, Barry Co., on elms, M. E. Hale 2580 (US). Arkansas: Ozark National Forest, Blanchard Springs, Stone Co., elevation 750 ft, D. Demaree 28860 (US); Near town of White Rock Mtn., Franklin Co., on *Quercus alba*, M. E. Hale 3674 (US); Near town of Winslow, Washington Co., on oak branches, M. E. Hale 2659 (US). Oklahoma: Near town of Ardmore, Carter Co., on post oak, M. E. Hale 4892 (US). Texas: Gillespie Co., G. Jermy 152456 (US); On state 1604, 4 miles west of the old Blanco Road, Burnet Co., live oak and mesquite, C. Fox T-42 (US). Arizona: Chiricahua Mts. Cave Creek, near headquarters, Southwestern Research Station, limestone outcrops and floodplain, Cochise Co., 6000 ft, Weber, Shushan & Anderson S24741 (US). Mexico. Zacatecas: On El Bote that overlooks Zacatecas and the new technological college, C. Fox M-314 (US). Michoacán: Mal Pais de Curucu, old lava flow badlands 12 km west of Uruapan, on lava, M. Wirth 340 (US). Baja California Sur: Top of the ridge of Sierra Laguna and east of Cerro Valde, *Quercus tuberculata* forest, on granite, T. H. Nash III 39614 (distributed as Nash: Lich. Exs., no. 278) (US). Michoacán: Dry pine-oak pasture on rocky hillside, km 223 on highway 190, about 61 km northwest of Zitácuaro, on rocks, elevation 2131 m, M. E. Hale 20861 & Soderstrom (US).

***Parmotrema eurysacum*** (Hue) Hale, *Phytologia* **28**: 336. 1974.

*Parmelia eurysaca* Hue, *Nuov. Arch. Mus. Paris*, ser. 4, **1**:194. 1899.

Chemistry. Atranorin, salazinic acid and consalazinic acid.

The present species is characterized by 1) loosely adnate membranaceous thalli (150–160  $\mu\text{m}$  thick), 2) emaculate upper surface, 3) lobes subentire or broadly crenate at the margins, 4) subpalmately divided long laciniae, 5) long, often branched cilia (1.5–5 mm long), which may be sparse to dense, 6) medium-sized spores (7–9 $\times$ 14–16  $\mu\text{m}$ ) and 7) the production of atranorin, salazinic acid and consalazinic acid. Lobes are irregularly divided but elongated and the margin may be subentire or somewhat crenate. Usually the cilia are quite long and are highly variable in density. The thallus typically forms subpalmately-divided, long laciniae. Occasionally the laciniae are short lobules with acuminate tips along the lobe margins.

The lower surface of lobes is black with a brown naked zone (for 3–5 cm) near the apices and, often, white-mottled along the margin. The laciniae are broadly white

or white mottled and naked on the lower surface. Rhizines are formed on the black lower surfaces and are moderate to dense. They are mostly simple and 1–3 mm long.

This species is quite common in Mexico with its range extending north to southeastern United States. It is reported from Brazil for the first time.

Representative specimens examined. U.S.A. Alabama: 5 miles W of Okatchie, Calhoun Co., sandstone ridge in open oak woods, M. E. Hale 33848 (US). Arkansas: MacNab., Hemmpstead Co., old tree tops, elevation 320, D. Demare 44674 (US). Texas: Austin, Cuero Co., E. Whitehouse 2286 (US); Near town of Tyler, Smith Co., M. E. Hale 5444 (US); Frio Canyon, 11 miles north of Leaky, Acal Co., L. Hubricht 13175 (US). Mexico. Tamaulipas: Vicinity of El Milagro, Cerro Zamora, Sierra de San Carlos, H. H. Bartlett 11098 (US); Near Rancho de Cielo above Gomez Farias, A. J. Sharp 507 (US). Veracruz: Scattered shade trees in coffee plantation, 64 km southwest of junction of highways 140 and 155, northeast of Huatusco, elevation 1310 m, M. E. Hale 19535 & Soderstrom (US); Obere Barranea de Fenampa, 900–1000 m, J. A. Purpus 55 (US). San Luis Potosi: Alvarez, alt. 8000 ft., E. Palmer 466 (US). Hidalgo: Cuyamaloya, an *Quercus*, C. G. Pringle (distributed as Cryptog. Exs. ed. Mus. Hist. Natur. Vindobonensi, no. 4447) (TNS, US). Sierra de Pachuca, alt. 2520 m, X. Madrigel 145 (US); El Hiloche, M. Martinez s.n. & 71 (US); Cuyamaloya, on rocks, C. G. Springle 10753 (US). Oaxaca: Mature pine-oak mist forest, Trail leading to Cerro San Felipe, overlooking Oaxaca, on deciduous trees, M. E. Hale 20692 & T. R. Soderstrom (US, TNS); The same locality, M. E. Hale 20709, 20785 & Soderstrom (US); Open dry deciduous forest on mountainside, 132 km northwest of Oaxaca on highway 190, elevation 2380 m, M. E. Hale 20829 & T. R. Soderstrom (US). Mexico: Sierra de Las Cruces, C. G. Pringle 168 (US); North of Acambay, R. F. Cain 27597a (US). Jalisco: San Sebastian, Sierra Madre Occidental, on living tree trunk, Y. Mexia 1904a (US). Michoacán: Mature pine forest in mountains, km 248 on highway 190, 65 km east of Morelia, on deciduous trees, elevation 2560 m, M. E. Hale 20988 & T. R. Soderstrom (US); On conifers, the same locality, M. E. Hale 21033 & T. R. Soderstrom (US, TNS); Cerro Azul, Morelia, G. Arséne 3730, 3984 (US); Mal Paris de Curucu, old lava flow badlands 12 km west of Uruapan, M. Wirth 337 (US). Brazil. Minas Gerais: Serra da Mantiqueira, oberhalb von Vila Monte Verde, etwa 30 km östlich von Camanducaia, 1970 m, K. Kalb & G. Plöst (distributed as K. Kalb: Lich. Neotropici 144) (US).

***Parmotrema permaculatum* (Hale) Kurok., comb. nov.**

*Parmelia permaculata* Hale, *Phytologia* **21**: 425. 1971. Holotype: Mexico, Veracruz, Open pasture, 9 km east of Jalapa along highway 140, on deciduous trees, elevation 1240 m, M. E. Hale 19406 & T. R. Soderstrom (US; isotype in TNS).

Thallus adnate, coriaceous, whitish gray, up to 20 cm broad; lobes irregularly divided, with rotund apices, broadly crenate and ciliate at the margin, 8–15 mm wide, lacking soredia, isidia and elongated laciniae; upper surface glossy, strongly macu-



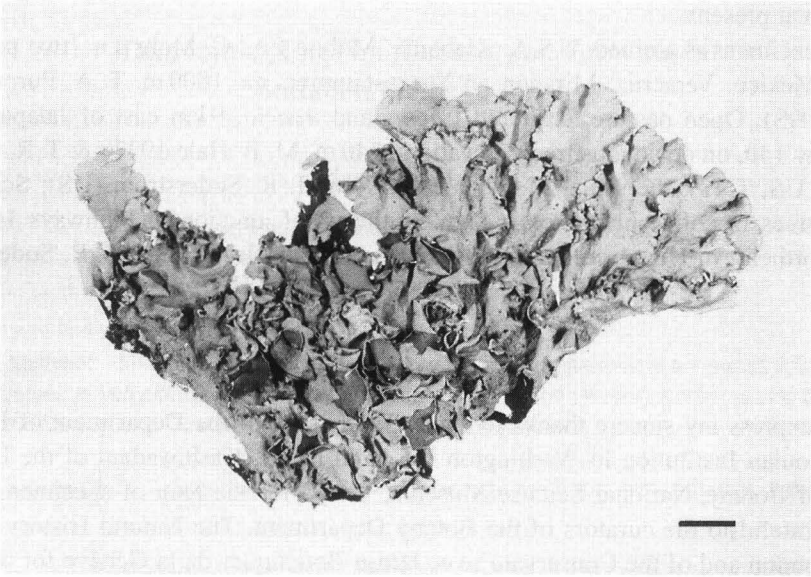


Fig. 4. Holotype of *Parmelia permaculata* Hale (Bar=1 cm).

late, rugose and reticulately cracked on older lobes; cilia more or less erect, moderate to dense, sometimes branched, 1–2 mm long; lower surface black but dark brown and naked near the apices (for about 5–7 mm), sometimes white-mottled along the margin; rhizines moderate, uniformly elongate, 1–2 mm long. Thallus 110–140  $\mu\text{m}$  thick; upper cortex variable in thickness, 10–20  $\mu\text{m}$  thick, gonidial layer subcontinuous, 7–20  $\mu\text{m}$  thick, medulla 65–120  $\mu\text{m}$  thick, lower cortex pale brown, ca 10  $\mu\text{m}$  thick. Apothecia sessile, 5–15(20) mm in diameter, amphithecium reticulately maculate, smooth to reticulately rugose, disk pale brown, perforate; hymenium ca 70  $\mu\text{m}$  high, asci subclavate, ca 23  $\times$  52  $\mu\text{m}$  in size, spores 8–10  $\times$  13–16  $\mu\text{m}$ .

Chemistry. Atranorin, salazinic acid and consalazinic acid.

The present species is confused easily with *Canomaculina subcaperata* because these species form similar lobes that are strongly maculate on the upper surface and rather densely ciliate along the margin of lobes. Both species produce atranorin, salazinic acid and consalazinic acid. *P. permaculatum* was reduced to a synonym of *C. subcaperata* by B. Hale & DePriest (1999). However, the dimorphic rhizines, which are characteristic of *Canomaculina*, are lacking in the present species, although some black verrucae are formed usually on the black lower surface. Thus the present species is considered to belong to *Parmotrema* rather than *Canomaculina*.

This species may be also confused with *P. eurysacum*. However, compared with the latter species, it has rather coriaceous thalli composed of lobes with strongly maculate upper surfaces that lack subpalmately divided laciniae.

The species is known only from Alabama in the United States and Veracruz in

Mexico at present.

Specimens examined. U.S.A. Alabama: Mobile Co., C. Mohr s.n. (two packets) (US). Mexico. Veracruz: Mirador, an Yuccastämmen, ca. 1000 m, T. A. Purpus 210 (US, TNS); Open pasture, scattered *Cactus* and *Acacia*, 9 km east of Jalapa along highway 140, on deciduous trees, elevation 1240 m, M. E. Hale 19378 & T. R. Soderstrom (US, TNS); the same, M.E. Hale 19394 & T. R. Soderstrom (US); Scattered shade trees in coffee plantation, 64 km southwest of junction of highways 140 and 155, northeast of Huatusco, elevation 1310 m, M. E. Hale 19529 & T. R. Soderstrom (US).

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