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Further Notes on *Parmelia* (Parmeliaceae) of Papua New Guinea

By

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黒川　遒*：パプアニューギニア産ウメノキゴケ属追記

The lichen genus *Parmelia* of Papua New Guinea has been rather well studied on the basis of modern taxonomy. In 1975, Kashiwadani made an outstanding contribution to the knowledge of *Parmelia* species in the present area and enumerated 43 species of the genus. Prior to his contribution, only eight species had been reported; one species (*P. connivens*) by Hale & Kurokawa (1964), four species (*P. cristifera, P. ramdpoddensis, P. subarnoldii,* and *P. tinctorum*) by Hale (1965), and three species (*P. cirrhata, P. citrella,* and *P. sinuosa*) by Wade & McVean (1969). In 1979, Kurokawa enumerated 61 species of *Parmelia,* including all species, but except for *P. intertexta* reported by Hale (1976a), known at that time. After 1979, he (Kurokawa 1984, 1985, 1986) revised some of these species and described two new species and reduced two of them as synonyms of other species. Consequently, 62 species of the genus are known at present in Papua New Guinea.

In the present paper, two species are described as new to science and seven are added to the *Parmelia* flora of Papua New Guinea. Additional localities are recorded for *P. connivens* and *P. reducens*, which have been already reported from this area. In addition, *P. gemmulosa, P. luteoviridis, P. planiuscula,* and *P. schizospatha* are taxonomically revised. *P. gemmulosa* is reduced as a synonym of *P. luteoviridis* and a specimen reported as *P. schizospatha* is identified with *P. planiuscula.* As a result, 69 species of *Parmelia* are presently known from Papua New Guinea. In the present paper, a brief phytogeographical note based on these 69 species and the artificial key to the species of Papua New Guinean *Parmelia* are also given. Specimens cited in this paper are preserved in TNS and the duplicates are in UPNG, unless otherwise indicated.

1) **Parmelia connivens** Kurok. (Fig. 1)

In Papua New Guinea, this species has been recorded only from Milne Bay District, the type locality, although it has been also known from Molucca Islands and Guam (Hale & Kurokawa 1964). Two additional specimens were collected in Morobe District.

Specimens examined. Morobe District: Singarica logging area of South Pacific Timber Co., about 50 km northeast of Lae, elevation about 40 m, S. Kurokawa 9540, 9541.

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2) **Parmelia endosulphurea** (Hillm.) Hale

Although a specimen collected in Papua New Guinea is composed of rather small pieces, it is apparently isidiate and atranorin, gyrophoric acid, and secalonic acid A (=entothein) are demonstrated by the TLC method in it. New to Papua New Guinea.

Specimen examined. Morobe District: Singarica logging area of South Pacific Timber Co., about 50 km northeast of Lae, elevation about 40 m, S. Kurokawa 9538.

3) **Parmelia erumpens** Kurok.

Parmelia erumpens is one of the commonest species of *Parmelia* in Australia and is also known from Java, Taiwan, and Japan (Kurokawa 1969). This record fills a gap of the Australia-eastern Asian distribution. New to Papua New Guinea.

Specimen examined. Morobe District: Between Wau and Kaisinik, elevation 1500–1700 m, S. Kurokawa 9650.

4) **Parmelia haysomii** Dodge

In the specimen cited below, usnic acid, caperatic acid, and protocetraric acid were demonstrated by the crystal tests and yellow pigments with K— reaction is observed in the lower half of the medulla in part. On the basis of these chemical features as well as the presence of pustules, the specimen was identified with *P. haysomii*. According to Filson (1982), this species is common on Macquarie Island and is distributed northwards to New South Wales and Australian Capital Territory. New to Papua New Guinea.

Specimen examined. Central District: Mt. Albert Edward, en route from tent site to summit area, elevation about 3600 m, S. Kurokawa 9520.

5) **Parmelia intertexta** Mont. et v. d. Bosch

The occurrence of this species in Papua New Guinea was reported under the name *Pseudoparmelia intertexta* (Mont. et v. d. Bosch) Hale by Hale (1976a), but this species was not included in the report by the author (Kurokawa 1979). One of the specimens cited below was distributed as Lich. Rar. Crit. Exs., no. 579 (Kurokawa & Kashiwadani 1984).

Specimens examined. Morobe District: Singarica logging area of South Pacific Timber Co., about 50 km northeast of Lae, elevation about 40 m, S. Kurokawa 9542 and 9545 (=Lich. Rar. Crit. Exs., no. 579).

6) **Parmelia luteoviridis** Kurok.

Parmelia gemmulosa Kurok. in Kurokawa, Studies Crypt. Papua New Guinea 134. 1979. Syn. nov.

Parmelia gemmulosa was separated from *P. luteoviridis* by the production of echinocarpic acid. Both species, however, contain gyrophoric acid, a rare substance in series Relicinae, subsection Bicornutae. In addition, they both have similar thalli consisting of sublinear lobes with rather dense cilia, which are strongly inflated at the base and are usually 0.4-0.8 mm long, very rarely reaching 1.0 mm. In the present paper, *P.*

gemmulosa is reduced as a synonym of *P. luteoviridis*, considering echinocarpic acid as well as its associated substance, conechinocarpic acid, as accessory components in *P. luteoviridis*.

Specimens examined. Specimens containing usnic and gyrophoric acids. Eastern Highland District: Kundibesa logging area, 22 miles east of Kainantu, elevation about 1560 m, S. Kurokawa 6090 (TNS, MEL), 6097 (TNS). Morobe District: Kaisinik, about 30 km southeast of Wau, elevation 1900-2000 m, H. Kashiwadani 10755, 10768 (TNS). Central District: About 2 km north of Woitape Airstrip, elevation 1200-1350 m, H. Kashiwadani 12281 (TNS). Western Highland District: Korn Farm, Mt. Hagen, elevation about 1700 m, S. Kurokawa 6155 (TNS).

Specimens containing usnic acid, gyrophoric acid, conechinocarpic acid, and echinocarpic acid. Eastern Highland District: Kundibesa logging area, 22 miles east of Kainantu, elevation about 1560 m, S. Kurokawa 6091 (TNS). Morobe District: Kaisinik, about 30 km southeast of Wau, elevation 1900-2000 m, H. Kashiwadani 10732, 10766, 10776 (TNS). Western Highland District: Korn Farm, Mt. Hagen, S. Kurokawa 6117 (TNS, MEL), 6118 (holotype of *P. gemmulosa* in TNS), 6119, 6120 (TNS).

7) **Parmelia malaccensis** Nyl.

This species has been known from Africa, India, Sri Lanka, Indonesia, and the Philippines. But, the range is now extended to Papua New Guinea. One of the specimens cited below was distributed as Lich. Rar. Crit. Exs., no. 580 (Kurokawa & Kashiwadani 1984).

Specimens examined. Morobe District: Singarica logging area of South Pacific Timber Co., about 50 km northeast of Lae, elevation about 40 m, S. Kurokawa 9543 and 9544 (=Lich. Rar. Crit. Exs., no. 580).

8) **Parmelia mellissii** Dodge

Even though the present species was considered to be not distributed in Papua New Guinea (Kurokawa 1979), the following specimens are identified with this species.

Specimens examined. Eastern Highland District: Obihaka Coffee Plantation, west of Goroka, elevation about 1500 m, S. Kurokawa 5922 (TNS, MEL). Morobe District: Middle Creek logging area, Bulolo, elevation about 850 m, S. Kurokawa 5761 (TNS). Central District: About 2 km north of the Woitape Airstrip, elevation 1200-1350 m, H. Kashiwadani 12273 (TNS).

9) **Parmelia neotinctina** Elix

This species is quite common in southern Australia and New Zealand (Elix 1981). New to Papua New Guinea.

Specimens examined. Central District: Mt. Albert Edward, en route from tent site to summit area, elevation 3500-3550 m, S. Kurokawa 9439, 9440, 9519; Mt. Albert Edward, summit area, elevation 3700-3800 m, S. Kurokawa 9486, 9487.

10) **Parmelia planiuscula** Kurok.

As already pointed out by Kurokawa (1979), this species closely resembles *P. luteoviridis*, because they both have rather large thalli with similar isidial lobules on the lobes as well as along the margin of lobes. It is easily confused with the latter species, since it produces conechinocarpic and echinocarpic acids which are also produced in some specimens of *P. luteoviridis*. In *P. planiuscula*, however, cilia formed along the lobe margin are quite long (0.7–1.5 mm sometimes reaching 2.0 mm long) and are gradually thickened towards the base. In contrast, cilia are usually 0.4–0.8 mm long and strongly inflated at the base in *P. luteoviridis*. While isidial lobules are rarely ciliate in *P. planiuscula*, in addition, they usually have black bulbae or bulbate cilia along the margin in *P. luteoviridis*. As to the chemical substances, conechinocarpic and echinocarpic acids are constant components and gyrophoric acid is never demonstrated in *P. planiuscula*. In contrast, gyrophoric acid is the constant component and conechinocarpic and echinocarpic acids are accessory ones in *P. luteoviridis*, as mentioned above.

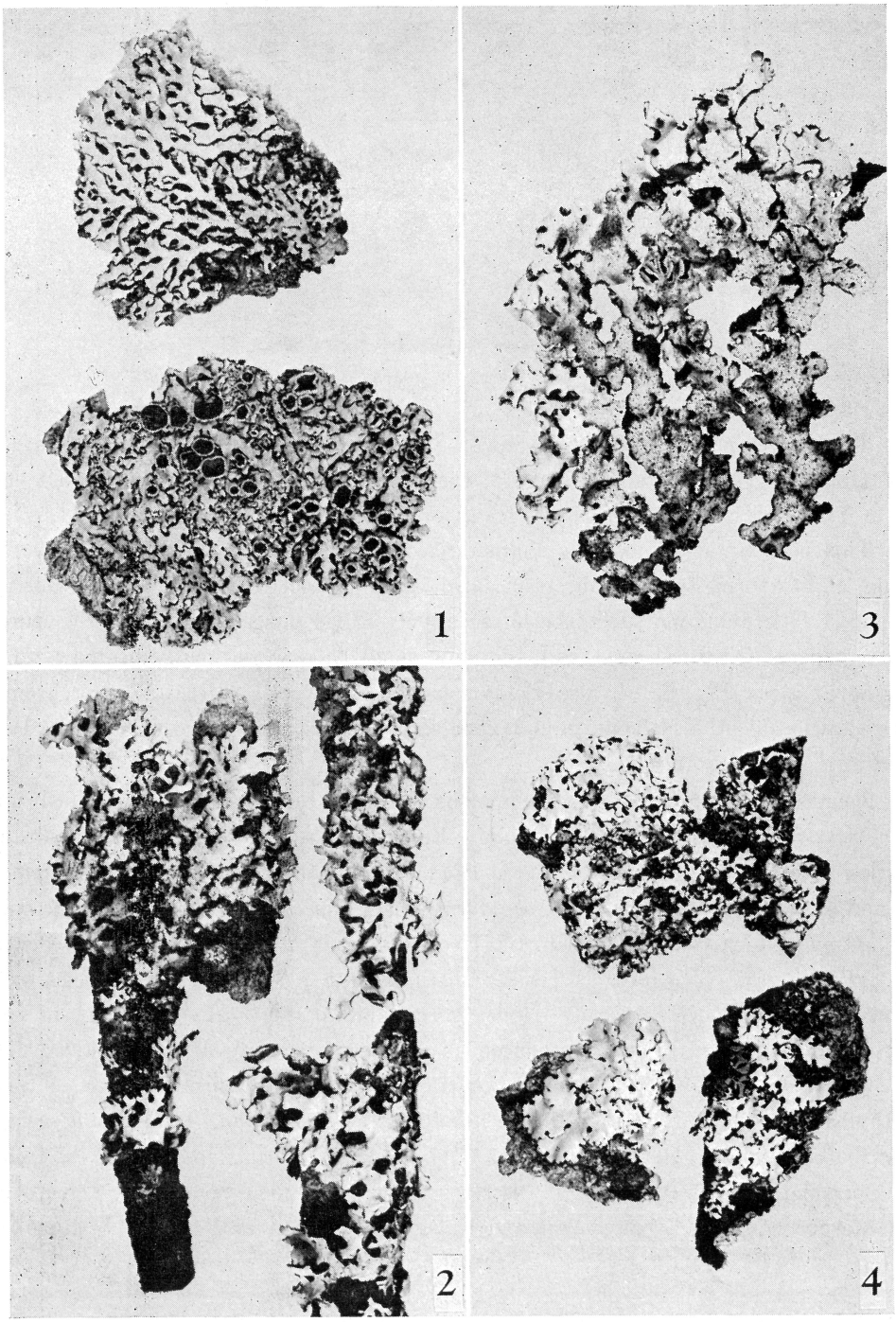
Kurokawa (1979) reported *P. schizospatha* Kurok. from Papua New Guinea based on Kashiwadani 10636. In *P. schizospatha*, cilia are very short (less than 0.4 mm long) and are distinctly inflated at the base and isidial lobules have black bulbae or bulbate cilia along the margin as in *P. luteoviridis*. In Kashiwadani 10636, however, cilia are gradually thickened towards the base and are mostly 1.0 mm long and isidial lobules are not ciliate. Therefore, the specimen is best regarded as *P. planiuscula*, even though it is rather fragmental.

Specimens examined. Eastern Highland District: Kundibesa logging area, 22 miles east of Kainantu, elevation about 1560 m, S. Kurokawa 6089, 6092 (TNS). Morobe District: Mt. Kaindi, Wau, elevation about 1600 m, H. Kashiwadani 10636 (TNS); Kaisinik, about 30 km southeast of Wau, elevation 1900–2000 m, H. Kashiwadani 10754, 10757, 10775, 10784 (TNS). Central District: Mt. Albert Edward, en route from the Woitape Airstrip to the summit, elevation 1600–2500 m, H. Kashiwadani 11582, 11685, 11930 (TNS); About 2 km north of the Woitape Airstrip, elevation 1200–1350 m, H. Kashiwadani 11617, 12049, 12259 (TNS); Around Woitape, elevation 1600–1700 m, S. Kurokawa 9266, 9267, 9271, 9302, 9303.

11) **Parmelia quaesita** Kurokawa, sp. nov. (Fig. 2)

Thallus laxe adnatus, corticola, glauco-griseus, stramineo-griseus in herbario, dichotome vel subdichotome lobatus, 4–9 cm diametro; lobi sublineari-elongati, 2–4 mm lati. Superficies superior opaca, emaculata, isidiata, isidiis cylindricibus vel coralloidibus; medulla alba; superficies inferior nigra nitidaque, dense rhizinata, rhizinis dichotome ramosis, 0.2–0.4 mm longis. Thallus 150–190 μm crassus; cortex superior 12–15 μm crassus; stratum gonidiale subcontinuum, 12–18 μm crassum; stratum medullare 110–150 μm crassum; cortex inferior niger, ca 20 μm crassus. Apothecia non visa.

Thallus K+lutescens; medulla K+lutescens, C−, KC−, P+aurantiaco-rubescens; thallus atranorinum, acidum fumarprotocetraricum, acidum succinprotocetraricum et materiam incognitam (acidum quaesiticum) continens.



Figs. 1-4. 1: *Parmelia connivens* Kurok. (S. Kurokawa 9541). ×1. 2: Holotype of *Parmelia quaesita* Kurok. ×1. 3: *Parmelia subphysodalica* Hale (S. Kurokawa 9434). ×1.2. 4: Holotype of *Parmelia woitapensis* Kurok. ×1.

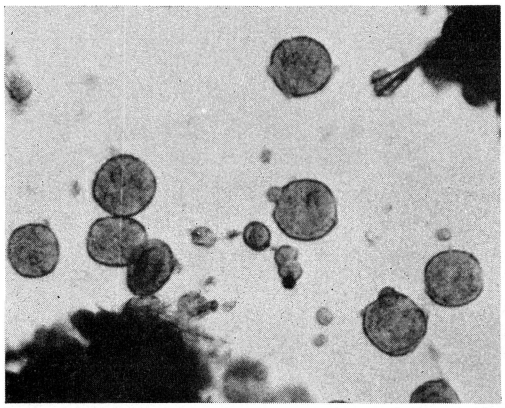


Fig. 5. Yellow balls yielded by quaesitic acid in o-T. ×300.

Type collection. Papua New Guinea, Central District, Mt. Albert Edward, en route from tent site to summit area, elevation about 3000 m, S. Kurokawa 9391—holotype in TNS and isotype in UPNG.

This peculiar new species is characterized by the presence of isidia and the production of atranorin, fumarprotocetraric acid, succinprotocetraric acid, and an unknown substance. The unknown substance is tentatively called quaesitic acid for the purpose of this paper. Quaesitic acid forms yellow small balls when gently heated with o-T under cover glass (Fig. 5). It also yields a pale yellow spot at Rf 0.17 on chromatograms developed in a solvent of n-hexane, ethyl ether, and formic acid (10 : 8 : 1) and heated after spraying 10% H_2SO_4.

Because of the presence of dichotomous rhizines, this species is classified under section Hypotrachyna, subgenus Parmelia. Fumarprotocetraric acid is a rare substance in section Hypotrachyna and has been reported as a major component in *P. baguioensis* Hale and *P. gondylophora* Hale. *P. baguioensis*, a Philippine species, is sorediate and *P. gondylophora*, which is distributed in the Neotropics and Africa, forms no soredia and isidia. *P. quaesita*, therefore, is readily distinguished from these two species by the presence of isidia. Morphologically it closely resembles *P. imbricatula* Zahlbr., in which fumarprotocetraric acid is rarely produced as an accessory component (Kurokawa 1986). In *P. imbricatula*, however, fumarprotocetraric acid accompanies barbatic and 4-*O*-demethylbarbatic acids, which both are not found in *P. quaesita*. *P. quaesita* seems to be distributed in higher elevations than in *P. imbricatula* at least in Papua New Guinea.

Specimens examined. Central District: the same as the type locality, S. Kurokawa 9379. Morobe District: Between Wau and Kaisinik; elevation 1500–1700 m, S. Kurokawa 9656.

12) Parmelia reducens Nyl.

The occurrence of the present species in Papua New Guinea was reported under the name *Hypotrachyna reducens* (Nyl.) Hale by Hale (1975a), but no specimen was cited. This species is quite common in open areas in higher elevations in Papua New Guinea.

Specimens examined. Central District: Mt. Albert Edward, en route from tent site to summit area, elevation about 3000 m, S. Kurokawa 9511, 9513, 9514, 9516; Mt. Albert Edward, summit area, elevation 3700-3800 m, S. Kurokawa 9463.

13) **Parmelia subphysodalica** Hale (Fig. 3)

This rare species of section Hypotrachyna has been reported only from the type locality in southern Chile (Hale 1974). A specimen cited below has a greenish yellow thallus composed of sublinear lobes with dichotomous rhizines. The lobes are rather well developed and are 2-4 mm wide. On the chromatograms developed with a mixture of n-hexane, ethyl ether, and formic acid (5:4:1), usnic acid and physodalic acid were clearly demonstrated as reported by Hale (1974). In addition a trace of protocetraric acid, which is often associated with physodalic acid in other species of *Parmelia*, was also demonstrated. Although type material is sterile, the present specimen bears well developed apothecia. Description of apothecia and ascospores is given below.

Apothecia adnate, 2-4 mm in diameter, margin more or less denticulate, amphithecium sparsely isidiate, disc dark brown, concave; hymenium 50-60 μm high; asci subclavate, 8-spored, 13-15×42-50 μm; spores simple, colourless, 5-6×12-14 μm.

Specimen examined. Central District: Mt. Albert Edward, en route from tent site to summit area, elevation about 3050 m, S. Kurokawa 9434.

14) **Parmelia woitapensis** Kurokawa, sp. nov. (Fig. 4)

Thallus adnatus, corticola, cinereo-albicans, 2-5 cm diametro; lobi sublineari-elongati, 1.2-4 mm lati. Superficies superior opaca vel subnitida, emaculata, isidiata, isidiis cylindricibus; medulla alba; superficies inferior nigra, dense rhizinata, rhizinis nigris nitidisque, dichotome ramosis, 0.1-0.4 mm longis. Thallus 120-150 μm crassus; cortex superior ca 10 μm crassus; stratum gonidiale continuum, 10-15 μm crassum; stratum medullare 85-110 μm crassum; cortex inferior nigro-fuscus, ca 15 μm crassus. Apothecia non visa.

Thallus K+lutescens; medulla K−, C+rubescens, P−; thallus atranorinum et acidum lecanoricum continens.

Type collection. Papua New Guinea, Central District, around Woitape, elevation about 1600 m, S. Kurokawa 9306—holotype in TNS and isotype in UPNG.

This new species is easily confused with *P. bogotensis* Vain., which is one of the commonest species of section Hypotrachyna in Mexico, Central America, West Indies, and South America south to Chile (Hale 1975a). These two species are isidiate and produce atranorin and lecanoric acid in common. However, the results of the TLC tests show the lack of evernic acid in *P. woitapensis*, whereas lecanoric acid is always associated with evernic acid not only in *P. bogotensis* but also in all other related species such as *P. chicitae* Hale, *P. pulvinata* Fée, *P. rockii* Zahlbr., and *P. taylorensis* Mitchell. In *P. woitapensis*, in addition, the thallus is more closely adnate and the rhizines are much shorter. While *P. bogotensis* is widely distributed in American tropics, *P. woitapensis* seems to be endemic to Papua New Guinea.

Phytogeographical Note

As mentioned above, *Parmelia* species known from Papua New Guinea are 69 in number at present. These species can be accomodated in certain types of distribution in the world. One of the major groups constitutes species widely distributed in tropical, subtropical, or temperate regions. These species are:

P. aurulenta Tuck., *P. cirrhata* Fr., *P. clavulifera* Räs., *P. conformata* Vain., *P. crinita* Ach., *P. cristifera* Tayl., *P. dilatata* Vain., *P. dissecta* Nyl., *P. endochlora* Leight., *P. endosulphurea* (Hillm.) Hale, *P. fasciculata* Vain., *P. formosana* Zahlbr., *P. goebelii* Zahlbr., *P. isidiza* Zahlbr., *P. imbricatula* Zahlbr., *P. mellissii* Dodge, *P. physcioides* Nyl., *P. permutata* Stirt., *P. rampoddensis* Nyl., *P. reticulata* Tayl., *P. revoluta* Flörke, *P. rockii* Zahlbr., *P. sancti-angelii* Lynge, *P. sinuosa* (Sm.) Ach., *P. sorocheila* Vain., *P. subarnoldii* des Abb., *P. subsumpta* Nyl., *P. sulphurata* Nees et Flot., *P. tabacina* Mont. et v. d. Bosch, *P. texana* Tayl., *P. tinctorum* Nyl., *P. ultralucens* Krog, and *P. vexans* Zahlbr.

Another major group of *Parmelia* of Papua New Guinea constitutes southeastern or eastern Asian species. They are:

P. adducta Nyl., *P. citrella* Kurok., *P. connivens* Kurok., *P. corniculans* Nyl., *P. exsecta* Tayl., *P. fluorescens* Hale, *P. infirma* Kurok., *P. intertexta* Mont. et v. d. Bosch, *P. luteoviridis* Kurok., *P. majoris* Vain., *P. planiuscula* Kurok., and *P. subinflata* Kurok.

It is noteworthy that most of these species seem to be associated with montane dipterocarp forests in southeastern and eastern Asia. In contrast, two species, *P. connivens* and *P. intertexta*, are apparently low-land species and one species, *P. citrella*, is distributed in higher elevations between 2500 and 4300 m. Of these 12 species, on the other hand, four belong to series Relicinae, subsection Bicornutae and five belong to section Hypotrachyna. As discussed under the genus *Relicina* by Hale (1979b), series Relicinae shows high degree of endemism in southeastern Asia. The four species of the series, *P. connivens*, *P. fluorescens*, *P. luteoviridis*, and *P. planiuscula*, are all known from Indonesia or Sabah (*P. connivens* is known also from Guam) and Papua New Guinea is the easternmost locality for them. Five species belonging to section Hypotrachyna, *P. adducta*, *P. citrella*, *P. exsecta*, *P. infirma*, and *P. majoris*, similarly have their distributional centers in southeastern or eastern Asia, even though section Hypotrachyna shows high endemism in American tropics.

Thirteen of the 69 species are known only from Papua New Guinea at present. They are:

P. curtata Kurok., *P. deflectens* Kurok., *P. elacinulata* Kurok., *P. flaccidifolia* Kurok., *P. gloriosa* Kurok., *P. hirtifructa* Kurok., *P. insueta* Kurok., *P. kaisenikiana* Kurok., *P. praeinsueta* Kurok., *P. quaesita* Kurok., *P. radiculata* Kurok., *P. retrospinosa* Kurok. et Kashiw., and *P. woitapensis* Kurok.

As areas neighbouring to Papua New Guinea such as eastern Indonesia including

West Irian, the Philippines, Micronesia, Melanesia, and northern Australia have not yet been lichenologically well explored, some of these species will be found in these areas in the future. Among 13 species cited above, *P. praeinsueta*, a species lacking vegetative diaspores, and *P. insueta*, a sorediate species, constitute a species pair as already discussed by Kurokawa (1984). They can be considered at least at present to have evolved in Papua New Guinea. On the other hand, *P. flaccidifolia* can be regarded to be closely related to *P. acrotrycha*, since they both have similar thin papery thalli with sometimes branched long cilia and produce atranorin, fumarprotocetraric acid and fatty acids. Even though the ancestral species with no vegetative diaspores is not yet known, *P. flaccidifolia*, a sorediate species, and *P. acrotrycha*, an isidiate species, seem to have been differentiated from the common ancestor probably in the present area.

The following four species are distributed in American tropics as well as southeastern Asia and occur also in Papua New Guinea.

P. consimilis Vain., *P. constaricensis* Nyl., *P. microblasta* Vain., and *P. reducens* Nyl.

It is noteworthy that all of these species belong to section Hypotrachyna and three of them are isidiate. These species are much commoner in American tropics than in southeastern Asia. They seem to have distributional centers in the New World and have been distributed westwards to southeastern Asia through southern Pacific, whereas *P. adducta, P. citrella, P. exsecta, P. infirma,* and *P. majoris,* as mentioned above, have extended their ranges eastwards to Papua New Guinea.

Parmelia wallichiana Tayl., an isidiate species of subsection Imbricaria, shows a unique distribution pattern. It has been known from central and southern Africa, including Madagascar, southern and eastern Asia, including Japan and southern-most part of Mantchuria of China, and southern Pacific Area, including Papua New Guinea and Cape York Peninsula of Australia (Kurokawa 1967, Hale 1976b), but is not known from the New World. Among Papua New Guinean species of *Parmelia, P. malaccensis* shows a similar distribution, even though it was considered to have evolved in the Southeast Asian rain forests by Hale (1976a). However, it has been not known from temperate Asia and Australia.

Parmelia erumpens, P. haysomii, and *P. neotinctina* are very common in Australia and are found also in Papua New Guinea. One of these three species, *P. erumpens* is known also from Java, Taiwan, and Japan, as mentioned above. *P. acrotrycha* is another species common between Papua New Guinea and Australia. However, it can be considered to have evolved in Papua New Guinea, as mentioned above.

Parmelia subphysodalica, a rare South American species of section Hypotrachyna occurs in high elevations of Papua New Guinea. The occurrence is very interesting from a phytogeographical view point, since many other usnic acid producing species of the section such as *P. caraccensis* Tayl., *P. enderythrea* Zahlbr., *P. flavida* Zahlbr., *P. flavovirens* Kurok., *P. physodalica* Hale, and *P. velloziae* Vain. seem to have evolved in the New World and are restricted there.

Key to the Species of *Parmelia* in Papua New Guinea

1. Lobes linear elongate, distinctly canaliculate below 2
1. Lobes sublinear or subirregular, not canaliculate below 5
2. Lobes without soredia and isidia .....*P. cirrhata* Fr.
2. Lobes with soredia or isidia 3
3. Lobes isidiate .....*P. vexans* Zahlbr.
3. Lobes sorediate..... 4
4. Medulla C−, P+deep yellow, containing salacinic acid .....*P. sorocheila* Vain.
4. Medulla C+rose, P−, containing gyrophoric acid .....*P. curtata* Kurok.
5. Lobes without soredia, pustules, lobules, and isidia 6
5. Lobes with soredia, pustules, lobules, or isidia 17
6. Rhizines dichotomously branched 7
6. Rhizines simple, furcate, or rarely squarrosely branched..... 10
7. Thallus mineral gray; usnic acid absent 8
7. Thallus yellowish green; usnic acid present..... 9
8. Lobes subirregular; medulla C−, P+orange red, containing protocetraric acid .. .. *P. adducta* Nyl.
8. Lobes sublinear; medulla C− or +yellowish orange, P− or +yellow, containing barbatic acid, its related substances, and sometimes echinocarpic acid .... *P. physcioides* Nyl.
9. Thallus containing salacinic acid .....*P. citrella* Kurok.
9. Thallus containing norstictic and salacinic acid .....*P. reducnes* Nyl.
10. Thallus mineral gray; lobes subirregular, with a wide bare apical zone on the lower surface; usnic acid absent 11
10. Thallus yellowish green; lobes sublinear, rhizinate even near the apices on the lower surface; usnic acid present..... 13
11. Cilia distinct and long, 4-6 mm long; medulla KC+rose, P−, containing alectoronic acid .....*P. corniculans* Nyl.
11. Cilia short or very rare, less than 3 mm long; medulla KC−, P+orange red, containing protocetraric acid 12
12. Cilia very rare; diffractaic acid present .....*P. praeinsueta* Kurok.
12. Cilia sparse; diffractaic acid absent .....*P. elacinulata* Kurok.
13. Lobes eciliate .....*P. intertexta* Mont. et v. d. Bosch
13. Lobes ciliate; cilia inflated at the base 14
14. Medulla UV+, containing alectoronic acid .....*P. fluorescens* Hale
14. Medulla UV−, not containing alectoronic acid 15
15. Medulla C−, containing protolichesterinic acid .....*P. connivens* Kurok.
15. Medulla C+rose, containing gyrophoric acid 16
16. Medulla P+deep yellow .....*P. hirtifructa* Kurok.
16. Medulla P− .....*P. retrospinosa* Kurok.

17. Lobes isidiate, lobulate, or with coralloid outgrowth 18
17. Lobes sorediate or pustulate 46
18. Medulla pale yellow or brilliant yellow 19
18. Medulla white 20
19. Medulla pale yellow; lobes eciliate ..... *P. endosulphurea* (Hillm.) Hale
19. Medulla brilliant yellow; lobes ciliate ..... *P. sulphurata* Nees et Flot.
20. Thallus mineral gray; usnic acid absent 21
20. Thallus yellowish green; usnic acid present 40
21. Rhizines dichotomously branched 22
21. Rhizines simple, furcate, or squarrosely branched 28
22. Medulla P− 23
22. Medulla P+deep yellow to orange red 26
23. Lobes subirregular, 2-6 mm wide ..... *P. costaricensis* Nyl.
23. Lobes sublinear, 1-4 mm wide 24
24. Medulla C+red, containing lecanoric acid ..... *P. woitapensis* Kurok.
24. Medulla C− or C+pale yellow to yellow 25
25. Medulla C−, containing fatty acids ..... *P. infirma* Kurok.
25. Medulla C− or C+pale yellow to yellow, containing barbatic acid and its related substances ..... *P. imbricatula* Zahlbr.
26. Thallus containing barbatic acid and its related substances ..... *P. imbricatula* Zahlbr.
26. Thallus not containing barbatic acid 27
27. Protocetraric acid present ..... *P. consimilis* Vain.
27. Fumarprotocetraric acid present ..... *P. quaesita* Kurok.
28. Thallus with large coralloid outgrowth ..... *P. fasciculata* Vain.
28. Thallus without coralloid outgrowth 29
29. Lobes eciliate ..... *P. tinctorum* Nyl.
29. Lobes ciliate 30
30. Cilia not inflated at the base 31
30. Cilia inflated at the base 37
31. Lobes sublinear, 0.5-2.0 mm wide 32
31. Lobes subirregular, more than 3.0 mm wide 33
32. Lobes black below; medulla C+rose, P−, containing gyrophoric acid ..... *P. dissecta* Nyl.
32. Lobes pale brown below; medulla C−, P+orange red, containing protocetraric acid ..... *P. subinflata* Hale
33. Medulla K− or K+pale yellow 34
33. Medulla K+yellow turning red, containing salacinic acid 36
34. Medulla P+brick red, containing stictic acid ..... *P. crinita* Ach.
34. Medulla P+orange red 35
35. Cilia moderate to dense, 2-5 mm long; isidia often ciliate; thallus containing fumarprotocetraric acid ..... *P. acrotrycha* Kurok.

35. Cilia sparse, 0.5–2.0 mm long; isidia eciliate; thallus containing protocetraric acid ..... *P. kaisenikiana* Kurok.
36. Cilia formed mainly in axils, 0.3–0.8 mm long; thallus not containing lichexanthone ..... *P. wallichiana* Tayl.
36. Cilia moderate, 0.5–2.0 mm long; thallus containing lichexanthone ..... *P. ultralucens* Krog
37. Lobes black below ..... *P. tabacina* Mont. et v. d. Bosch
37. Lobes pale brown or brown below 38
38. Medulla C+rose, P−, containing gyrophoric acid ..... *P. goebelii* Zenker
38. Medulla C−, P+yellow or orange red 39
39. Medulla P+yellow, containing salacinic acid ..... *P. isidiza* Nyl.
39. Medulla P+orange red, containing protocetraric acid ..... *P. subinflata* Hale
40. Rhizines dichotomously branched 41
40. Rhizines simple, furcate, or squarrosely branched 42
41. Medulla K+yellow turning red, P+yellow or orange yellow, containing norstictic and salacinic acids ..... *P. microblasta* Vain.
41. Medulla K−, P+orange red, containing physodalic acid .. *P. subphysodalica* Hale
42. Lobes eciliate 43
42. Lobes ciliate 44
43. Thallus saxicolous; medulla K+yellow turning red, containing norstictic and salacinic acids ..... *P. neotinctina* Elix
43. Thallus corticolous; medulla K−, containing protocetraric acid; lowland species ..... *P. malaccensis* Nyl.
44. Lobes subirregular, 5–10 mm wide; isidia erect and cylindrical ..... *P. conformata* Vain.
44. Lobes sublinear, 1–3 mm wide; isidia frequently procumbent and lobulate 45
45. Isidia and lobules often with black bulbae or bulbous cilia; cilia of lobes strongly inflated at the base; gyrophoric acid present ..... *P. luteoviridis* Kurok.
45. Isidia and lobules rarely ciliate; cilia of lobes gradually inflated towards the base; gyrophoric acid absent ..... *P. planiuscula* Kurok.
46. Upper surface pseudocyphellate ..... *P. erumpens* Kurok.
46. Upper surface not pseudocyphellate 47
47. Upper surface reticulately maculate 48
47. Upper surface without reticulate maculae 49
48. Soralia marginal or submarginal, small; lower surface often with white or ivory rim ..... *P. clavulifera* Räs.
48. Soralia marginal or submarginal, spreading along the margin or on the surface of lobes; white or ivory rim on the lower surface of lobes not found ..... *P. reticulata* Tayl.
49. Thallus yellowish green; usnic acid present 50
49. Thallus mineral gray; usnic acid absent 53
50. Lower surface pale brown to brown ..... *P. subsumpta* Nyl.

50. Lower surface black 51
51. Lobes sublinear; rhizines dichotomously branched .....*P. sinuosa* (Sm.) Ach.
51. Lobes subirregular; rhizines simple or furcate..... 52
52. Thallus loosely adnate, sorediate; fatty acid absent.....*P. dilatata* Vain.
52. Thallus adnate, pustulate; fatty acid present .....*P. haysomii* Dodge
53. Rhizines dichotomously branched 54
53. Rhizines mostly simple or rarely furcate or squarrose..... 59
54. Thallus UV+brilliant yellow, containing lichexanthone ....*P. formosana* Zahlbr.
54. Thallus UV−; lichexanthone absent 55
55. Medulla pale yellow; yellow pigment K− .....*P. endochlora* Leight.
55. Medulla white; yellow pigment, if present, K+wine red 56
56. Medulla C+rose to red..... 57
56. Medulla C− or C+yellow to orange yellow..... 58
57. Medulla C+rose, containing gyrophoric acid.....*P. revoluta* Flörke
58. Medulla C+red, containing lecanoric acid.....*P. rockii* Zahlbr.
58. Thallus sorediate; white medulla K+yellow turning red, containing salacinic acid ..... *P. majoris* Vain.
58. Thallus pustulate; white medulla K−; barbatic acid present....*P. exsecta* Tayl.
59. Lobes eciliate 60
59. Lobes ciliate 62
60. Medulla P−; divaricatic acid present .....*P. texana* Tuck.
60. Medulla P+yellow to orange red 61
61. Medulla P+yellow, containing salacinic acid .....*P. cristifera* Tayl.
61. Medulla P+orange red, containing protocetraric acid .....*P. dilatata* Vain.
62. Medulla P− 63
62. Medulla P+yellow to orange red 69
63. Medulla pale yellow; yellow pigment K− 64
63. Medulla white; yellow pigment, if present, K+wine red 65
64. Medulla C−; zeorin present .....*P. aurulenta* Tuck.
64. Medulla C+rose; gyrophoric acid present .....*P. permutata* Stirt.
65. Medulla C−; alectoronic acid present..... 66
65. Medulla C+rose; gyrophoric acid present..... 68
66. Thallus more or less coriaceous; soralia strictly marginal..*P. rampoddensis* Nyl.
66. Thallus rather thin; soralia submarginal or formed at the tips of short isidial projections 67
67. Cilia less than 5 mm long; lower half of the medulla often yellow-pigmented; pigment K+wine red .....*P. mellissii* Dodge
67. Cilia often more than 5 mm long; medulla white, lacking yellow pigment ..... *P. gloriosa* Kurok.
68. Lower half of the medulla pale yellow; yellow pigment K−..*P. permutata* Stirt.
68. Medulla white but sometimes deep yellow in part; yellow pigment K+wine red.. ..... *P. sancti-angelii* Lynge

69. Medulla K+yellow turning red, P+yellow, containing salacinic acid..... 70
69. Medulla K−, P+orange red, containing protocetraric acid or fumarprotocetraric acid 71
70. Upper surface distinctly white-maculate; lower surface pale brown or brown .. .. *P. subsumpta* Nyl.
70. Upper surface emaculate or faintly maculate; lower surface black..... ..... *P. radiculata* Kurok.
71. Fumarprotocetraric acid present .....*P. flaccidifolia* Kurok.
71. Protocetraric acid present 72
72. Lobes moderately to densely ciliate 73
72. Lobes sparsely ciliate..... 74
73. Alectoronic acid present along with protocetraric acid .....*P. deflectens* Kurok.
73. Protolichesterinic acid present along with protocetraric acid ....*P. subarnoldii* des Abb.
74. Diffractaic acid present .....*P. insueta* Kurok.
74. Diffractaic acid absent .....*P. dilatata* Vain.

摘　　要

1979年に著者はパプアニューギニア産のウメノキゴケ属として61種を報告したが，その後さらに検討を加えて，2新種を加え，2種を他の種のシノニムとした。別に報告された1種を加えると，現在までに同地から知られている種は62種を数えることになる。

本論文では，さらに2新種を記載し，同地新産の7種を報告し，また一方では，今までに報告されている種を再検討して，*P. gemmulosa* を *P. luteoviridis* のシノニムとし，*P. schizospatha* として報告された標本は *P. planiuscula* に同定すべきであることを示した。その結果，パプアニューギニア産のウメノキゴケ属は69種となった。また，本論文では，これらの69種にもとづいて，植物地理学的な簡単な考察も試みた。すなわち，パプアニューギニアのウメノキゴケ属には，熱帯，亜熱帯，時には温帯域まで広く分布する33種の種群と，東南アジア，東アジアに分布の中心をもち，パプアニューギニアを分布の東限とする12種の種群の2つの主要な構成分が認められることを示した。また，この地方特産の種が13種を数えるが，これらは将来周辺地域でも発見される可能性をもっている。ただ，これらのなかで *P. praeinsueta* と *P. insueta* および *P. flaccidifolia* と *P. acrotrycha* はそれぞれ対をなす近縁の種であり，この4種はパプアニューギニア地域で分化したものと考えられる。一方，熱帯アメリカに分布の中心をもち，この地域を分布の西限とする種として4種をあげることができる。パプアニューギニアとオーストラリアは地理的には近いが，いわゆるオーストラリア系と考えられる種としては，*P. erumpens*, *P. haysomii*, *P. neotinctina* の3種しかあげることができない。さらに，南米から記載された稀種 *P. subphysodalica* がパプアニューギニアで発見されたことは，その近縁種の多くが新大陸特産であることを考え合わせると，とくに注目される。

なお，パプアニューギニア産69種のウメノキゴケ属地衣の検索表を作った。

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