

Philippine Species of *Parmotrema* (Ascomycota, Parmeliaceae)

Paulina A. Bawingan^{1*}, Mechell P. Lardizaval¹, Praxedes F. Rosuman²,
Weenalei T. Fajardo³, Andrea Azuelo⁴, John A. Elix⁵, and Jae-Seoun Hur⁶

¹Department of Biology, Saint Louis University, Baguio City, Philippines

²St. Paul's College, Vigan, Ilocos Sur, Philippines

³Pangasinan State University, Lingayen, Pangasinan, Philippines

⁴Central Mindanao University, Bukidnon, Philippines

⁵Research School of Chemistry, Australian National University, Canberra, ACT 2601, Australia

⁶Korean Lichen Research Institute, Suncheon National University, Suncheon, South Korea

This paper presents a taxonomic treatment of *Parmotrema* lichens (Ascomycota, Parmeliaceae) collected in the Philippines at high altitudes where they abound, particularly in the mountainous regions of northern Luzon and Mindanao. A total of 30 *Parmotrema* species were identified: twelve being new records. Results suggest that the Philippines has a potentially rich unknown lichen diversity that remains to be further investigated. Many lichen species are restricted to unexplored forested areas, which in the Philippines are facing alarming degradation; hence, it is extremely important for these habitats to be conserved.

Key words: chemotaxonomy, foliose lichens, morphotaxonomy, parmotrema lichens

INTRODUCTION

Parmotrema A. Massal. (1860) is a large genus of lichenized fungi in the family Parmeliaceae. The name *Parmotrema* refers to the perforate apothecia (Greek *parmos* = cup, and *trema* = perforation) (Feige 1998). *Parmotrema* was first segregated from *Parmelia* s.l. by Massalongo (1860) based on *P. perforata* as type. Hale (1974a) resurrected the genus and included in it all taxa incorporated in *Parmelia* subgenus *Amphigymnia* (Vain.) C. W. Dodge, including the *Parmelia reticulata* group previously included in *Parmelia* Ach. subgenus *Parmelia*. *Parmotrema* was subsequently subdivided by the separation of *Rimelia* (Hale & Fletcher 1990) and *Rimeliella* (Kurokawa 1991) or *Canomaculina* (Elix & Hale 1987; Elix 1997). A generic

reclassification of parmelioid lichens based on phylogenetic studies, however, has recombined *Rimelia*, *Canomaculina* (*Rimeliella*) as well as *Concamerella* into *Parmotrema* (Blanco et al. 2005). Another phylogenetic analysis based on morphological, molecular and chemical data showed that the genera *Flavoparmelia*, *Punctelia*, *Canoparmelia*, *Flavopunctelia*, and *Nesolechia* are seemingly also nested within the *Parmotrema* clade (Crespo et al. 2010). More studies, however, need to be undertaken to resolve generic classification and synonymy among the parmelioid lichens.

Parmotrema sensu lato species are characterized by their broad, rotund lobe apices, the absence of pseudocyphellae, presence or absence of maculae, isidia or soredia, the frequent occurrence of marginal cilia, the simple or dimorphous rhizines, the presence of a broad erhizinate or papillate marginal zone on the lower cortex (except

*Corresponding author: pbawingan@gmail.com

in the *Rimelia* and *Rimeliella* species group), and the thick-walled, ellipsoid ascospores (Brodo et al. 2001; Nash & Elix 2002). Cortical chemistry includes atranorin, chloroatranorin, usnic acid and lichexanthone (Louwhoff and Elix 1999). The medullary chemistry is highly variable and many chemosyndromes have been observed (Hale 1965; Krog & Swinscow 1981; Benatti et al. 2013).

There are currently more than 300 species of *Parmotrema* known worldwide (Nash & Elix 2002). The center of diversity is in the Neotropics, with numerous tropical and subtropical species (Blanco et al. 2005; Crespo et al. 2010). For the Philippines, Vainio (1909) described several species now accommodated in *Parmotrema*. Hale (1965, 1974b) also described five species of *Parmotrema* from the Philippines. Recent studies of Philippine lichens by foreign scientists assisted by Filipino biologists in the 1980s resulted in the discovery of several new species and a number of new records. Aptroot and Sipman (1989) reported *Parmotrema clavuliferum* (Räsänen) Streimann and *P. mellissii* (C. W. Dodge) Hale both collected from Mt. Santo Tomas, Benguet. Elix and Schumm (2001) described *P. negrosorientalum* Elix & Schumm from Negros Oriental and six new records for the Philippines; *P. cooperi* (J. Steiner & Zahlbr.) Sérus, *P. dilatatum* (Vain.) Hale, *P. lobulascens* (J. Steiner) Hale, *P. permutatum* (Stirt.) Hale, *P. rampoddense* (Nyl) Hale, *P. sancti-angelii* (Lyngé) Hale, *P. austrocetratum* Elix & J. Johnst (syn. *Rimelia austrocetrata* (Elix & Johnst.) Hale & Fletcher).

We started our lichen studies in 2000 and most of our collections were made in high altitude areas of the Cordillera Region where these broad-lobed foliose lichens are abundant. Our initial collections resulted in the description of *Rimelia pustulata* Elix & Bawingan (= *Parmotrema neopustulatum* Kurok.) with *P. ultralucens* (Krog) Hale, and *P. vartakii* Hale reported as new records (Elix et al. 2002).

From our own collections made over the last decade as well as other specimens reported from previous expeditions, we have prepared this comprehensive taxonomic listing of *Parmotrema* species in the Philippines (including the species previously included in *Rimelia*). Diagnostic characteristics as well as a key for the identification of these found species of *Parmotrema* are also presented. Few biologists study this group of lichenized fungi in the Philippines or even in the entire Southeast Asia; hence, this paper can be the first taxonomic report of these lichens in the Region. Younger Filipino researchers are showing interest on the study of lichens in the country; we hope this paper can serve as guide in their taxonomic studies.

MATERIALS AND METHOD

Lichen Collection

After securing the gratuity permit from the Department of Environment and Natural Resources (DENR) in 2000, we explored various forests in the provinces of Benguet, Mountain, and Ifugao. Collaboration with other universities enabled us to collect in the provinces of Nueva Vizcaya, Ilocos Norte, Pangasinan, Quirino, and Isabela. Dr. Andrea Azuelo of Central Mindanao University provided duplicates of collections from Mt. Apo and Mt. Kitanglad. All specimens examined are deposited in the Father Braeckman Museum of Natural History, Saint Louis University, Baguio City. Dr. John Elix, one of the authors, and Dr. Harrie Sipman of Freie University, Berlin, a lichenologist-consultant, confirmed most of the lichen identification.

Identification of the Lichens

Morphological and reproductive characters were observed using Motic and Meiji stereomicroscopes. Sections of the thallus and ascocarps were examined under the Motic trinocular or Olympus compound microscopes. The chemistry of the lichens was determined using spot tests. Spot test involves the use of reagents such as potassium hydroxide (K test), para-phenylenediamine (P test) and calcium hypochlorite (C test). A drop of these solutions was placed on the cortex and the medulla. The presence or absence of color changes may indicate the presence of certain lichen acids in the specimen. These determinations were verified by thin layer chromatography using solvents A and C following procedures described by Elix and Ernst-Russell (1993) and Orange et al. (2001). High-performance liquid chromatography (HPLC) was also undertaken for some species. Two solvent systems were used: (A) containing 1% aqueous orthophosphoric acid and methanol in the ratio 3:7; and, (B) methanol. The run started with 100% A and was raised to 58% B within 15 min, then to 100% B within a further 15 min, followed by isocratic elution in 100% B for a further 10 min. A photodiode array detector was used with spectrophotometric reading at 254 nm with a flow rate of 1ml/min. The lichen acids were identified based on their retention time (RT).

Based on the observed morpho-anatomic features and chemistry, the specimens were identified guided by available taxonomic keys and verified through lichen descriptions from various references (Hale 1965; Krog & Swinscow 1981, 1983; Elix & Johnston 1988; Elix 1994; Louwhoff & Elix 1999; Spielmann & Marcelli 2009; Sipman et al. 2013; Cyberliber not dated; Botanischer Garten und Botanisches Museum Berlin not dated). Lichen IDs and synonyms were obtained from Mycobank (not dated).

RESULTS AND DISCUSSION

A total of 30 species of *Parmotrema* were identified for the Philippines; 12 of these are new records for the country (marked with *). Among the different collection sites, Benguet Province in Luzon has the most number of *Parmotrema* species followed by Mt. Province (Figure 1). Few species were collected in the provinces of Cotabato and Bukidnon in Mindanao; however, some species are exclusively reported from the two provinces: *P. dilatatum* in Bukidnon; *P. cooperi*, *P. corniculans*, and *P. permutatum* in Cotabato; *P. lobulascens* in Bukidnon and Cotabato. Other species collected only from one province in the North include *P. elacinulatum* and *P. saccatilobum* in Benguet, and *P. vartakii* and *P. ultralucens* in Mountain Province. *P. negrosorientalum* was previously reported only in Negros Oriental in the Visayas. This suggests the need for further exploration of these and other provinces to look for similar and other rare species.

Most of the lichens were collected in forested areas in the different provinces; however, forest degradation in the Philippines is described to be alarming (Asian Development Bank 2009). The major cause is deforestation due to slash-and-burn farming, illegal logging, mining, forest fires, pest infestations, and typhoons. In March 2016, one of the collection sites, Mt. Apo in Cotabato, Mindanao was affected with massive forest fire due to hikers' negligence (Magbanua 2016). Another collection site, Mt. Santo Tomas in Benguet, a favorite biodiversity laboratory in the past by local and foreign scientists has now become a site of illegal developmental projects which caused massive tree cutting and man-made erosion (Aning 2014). Many similar activities are happening throughout the country and these endanger the natural habitats of lichens and other organisms.

Our data also shows that altitudinal ranges of the reported *Parmotrema* species vary (Table 1). Four species only were collected from areas with elevation below 1000

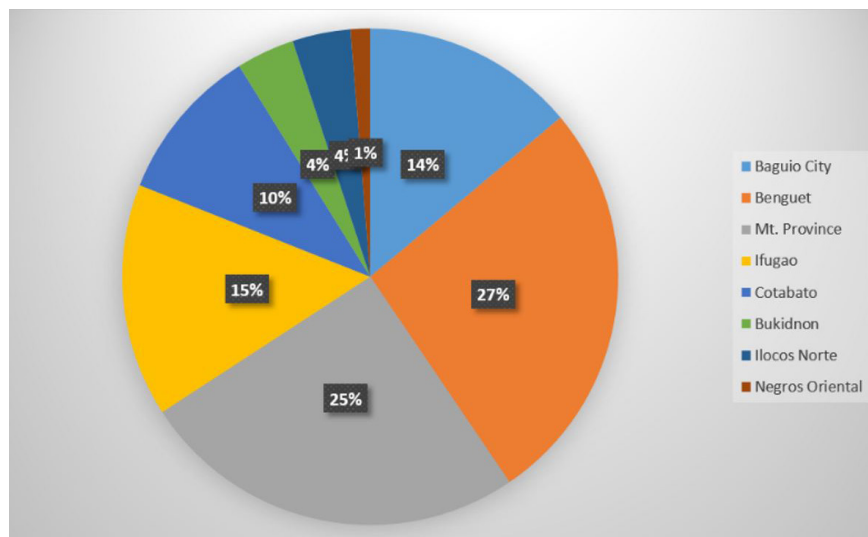


Figure 1. Percentage distribution of *Parmotrema* species according to province including Baguio City.

Table 1. Distribution of the different species according to elevation.

Elevation	<i>Parmotrema</i> species collected in different altitudes		
Below 1000 m	<i>P. overeemi</i>		
	<i>P. hypotropum</i>		
	<i>P. saccatilobum</i>	<i>P. parahypotropum</i>	
	<i>P. negrosorientalum</i>	<i>P. praesorediosum</i>	<i>P. crinitum</i>
1000 m to 2000 m		<i>P. tinctorum</i>	<i>P. cristiferum</i>
	<i>P. corniculans</i>		<i>P. gardneri</i>
	<i>P. elacinulatum</i>		<i>P. grayanum</i>
	<i>P. dilatatum</i>	<i>P. austrocetratum</i>	<i>P. maclayanum</i>
	<i>P. permutatum</i>	<i>P. cetratum</i>	<i>P. mellissii</i>
	<i>P. ultralucens</i>	<i>P. lobulascens</i>	<i>P. sancti-angelii</i>
	<i>P. vartakii</i>	<i>P. poolii</i>	<i>P. clavuliferum</i>
		<i>P. neopustulatum</i>	<i>P. reticulatum</i>
		<i>P. rampoddense</i>	
		<i>P. subarnoldii</i>	
Above 2000 m	<i>P. subrugatum</i>		

m while six species only from 1000 to 2000 meters in elevation. Species with wider altitudinal range include those collected from areas below 1000 to 2000 meters in elevation (three species); eight species from areas with elevation of 1000 to more than 2000 meters. Nine species showing widest altitudinal range were collected from all altitudinal zones. Altitudinal distribution shows that *Parmotrema* can be found from different altitudinal zones but most of the species are collected in higher altitude areas, i.e. from 1000 m and above.

THE SPECIES

Parmotrema austrocetratum Elix & J. Johnst., Mycotaxon 31 (2): 495 (1988) [MB#133588] = *Rimelia austrocetrata* (Elix & J. Johnst.) Hale & A. Fletcher (1990) [MB#102560]; *Parmelia austrocetrata* Elix & J. Johnst. [MB#373811]

Specimens examined: Loakan Rd., Baguio City 16° 23' 8.217"N, 120° 37' 0.459"E, 1398 m, *P. Bawingan* SLU-L00028; Mt. Santo Tomas, Benguet 16° 20' 4.9"N, 120° 33' 40.8"E, 2200 m, *P. Bawingan* SLU-L00203; Sagada, Mt. Province 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *P. Bawingan* SLU-L00312; Mt. Ugo, Benguet 16° 19' 13.47"N, 120° 48' 9.04"E, 2115m, *J. Bugtong* SLU-L00583; Camp John Hay, Baguio City 16° 23' 49.304"N, 120° 36' 40.895"E, 1469 m, *G. Racca* SLU-L00884; Sinto, Bauko, Mt. Province 16° 51' 42.0"N, 120° 52' 25.9"E, 2118 m, *P. Bawingan* SLU-L01189; Caliking, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01512, SLU-L01634; Monamon Sur, Bauko, Mt. Province 16° 49' 36.1"N, 120° 52' 43.3"E, 2360 m, *P. Bawingan* & *M. Lardizaval* SLU-L02508; Mt. Apo, Cotabato, 1866 m, *A. Azuelo* 71 (CMU, Bukidnon).

Other specimens: Cotabato Province: between Lake Venado and Mt. Apo, Cotabato 6° 69'- 7° 00'N, 125° 16'- 125° 20'E, 2200-2800 m *F. Schumm* & *U. Schwartz* CANB 6126; Mt. Apo, 7° 00'N, 125° 16'E *U. Schwartz* 5441 (Elix & Schumm 2001).

Diagnosis: Thallus loosely adnate, upper surface conspicuously reticulately cracked, eventually becoming areolate and flaking off exposing the medulla (Fig. 2A); there is no or there is very narrow erhizinate marginal in the lower cortex; black lower cortex with brown marginal area; rhizines black, simple to squarrose; no soredia or isidia; K+ yellow (atranorin), medulla K+ yellow to red, C-, P+ red-orange (major acid, salazinic).

****Parmotrema cetratum*** (Ach.) Hale, Phytologia 28 (4): 335 (1974) [MB#343018]

= *Parmelia cetrata* Ach. (1814) [MB#373825]; *Rimelia cetrata* (Ach.) Hale & Fletcher (1990) [MB#102561]

Specimens examined: Mt. Data, Bauko, Mt. Province,

16° 52' 48"N, 120° 50' 52"E, 2186 m, *P. Bawingan* SLU-L00122, SLU-L00217; Camp John Hay, Baguio City, 16° 23' 49.304"N, 120° 36' 40.895"E, 1469 m, *R. Ansagay* SLU-L00506; Sagada, Mt. Province 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *P. Bawingan* SLU-L00519, SLU-L00548; Camp John Hay, Baguio City, 16° 23' 49.304"N, 120° 36' 40.895"E, 1469 m, *S. Tamayo* SLU-L00611; Ampasit, Puguis, La Trinidad, Benguet. 16° 26' 54.137"N, 120° 34' 32.836"E, 1324 m, *C. Feliciano* SLU-L00794, SLU-L00802.

Diagnosis: Thallus loosely adnate, upper surface conspicuously reticulately cracked but not flaking off; there is no or there is very narrow erhizinate marginal in the lower cortex; black lower cortex with brown marginal area; rhizines black, simple to squarrose; no soredia or isidia; K+ yellow (atranorin), medulla K+ yellow to red, C-, P+ red-orange (major acid, salazinic).

Remarks: morphologically similar to *P. austrocetratum* but maculae not forming areolae or flaking off.

Parmotrema clavuliferum (Räsänen) Streimann, Bibliotheca Lichenologica 22: 93 (1986) [MB#129346] = *Parmelia clavulifera* Räsänen (1944) [MB#368556]; *Rimelia clavulifera* (Räsänen) Kurok. (1991) [MB#128246]

Specimen examined: Mt. Cabuyao, Tuba, Benguet, 16° 21' 33.363"N, 120° 33'E 52.841"E 2025 m, *P. Bawingan*, *P. Rosuman* & *Y. Flores* SLU-L00042, SLU-L00200; Virac, Itogon, Benguet, 16° 21' 55.387"N, 120° 39' 11.031"E, 992 m, *P. Bawingan* & *Y. Flores* SLU-L00125, *A. Cuevas* & *V. Tabor* SLU-L00322; Bana-ao, Tadian, Mt. Province, 16° 55.769'N, 120° 49.639'E, 1340 m, *P. Bawingan* SLU-L000271; Ampasit, Puguis, La Trinidad, Benguet, 16° 26' 54.137"N, 120° 34' 32.836"E, 1324 m, *C. Feleciano*, *M. Lardizaval*, & *A. Rebogio* SLU-L00798, SLU-L00810; Sitio Sayet, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01234, SLU-L01235, SLU-L01237, SLU-L01240, SLU-L01375, SLU-L01377, SLU-L011379, SLU-L01534, SLU-L01653, SLU-L01659; Yamashita Shrine, Kiangan, Ifugao, 16.779299°N, 121.081443°E, 700-800 m, *A. Kiaki* SLU-L02801; Sitio Pula, Asipulo, Ifugao, 16° 41.4' 28"N, 120° 4.9' 23"E, 798 m, *C. Oy-yeng* & *M. Balabag* SLU-L02286.

Other specimen: Mt. Santo Tomas, Benguet, 16° 18'N, 120° 35'E, 2100 m, *A. Aptroot* & *H. Sipman* S 21812c (Aptroot & Sipman 1989).

Diagnosis: Thallus loosely adnate, membranaceous to coriaceous, laciniate, capitate soralia commonly developing on tips of laciniae, upper surface with reticulate maculae, sometimes becoming cracks but no flaking off from the cortex (Fig. 2C); lower cortex black with white to light brown or mottled marginal zone; rhizines simple to squarrose; medulla K+ yellow to red,

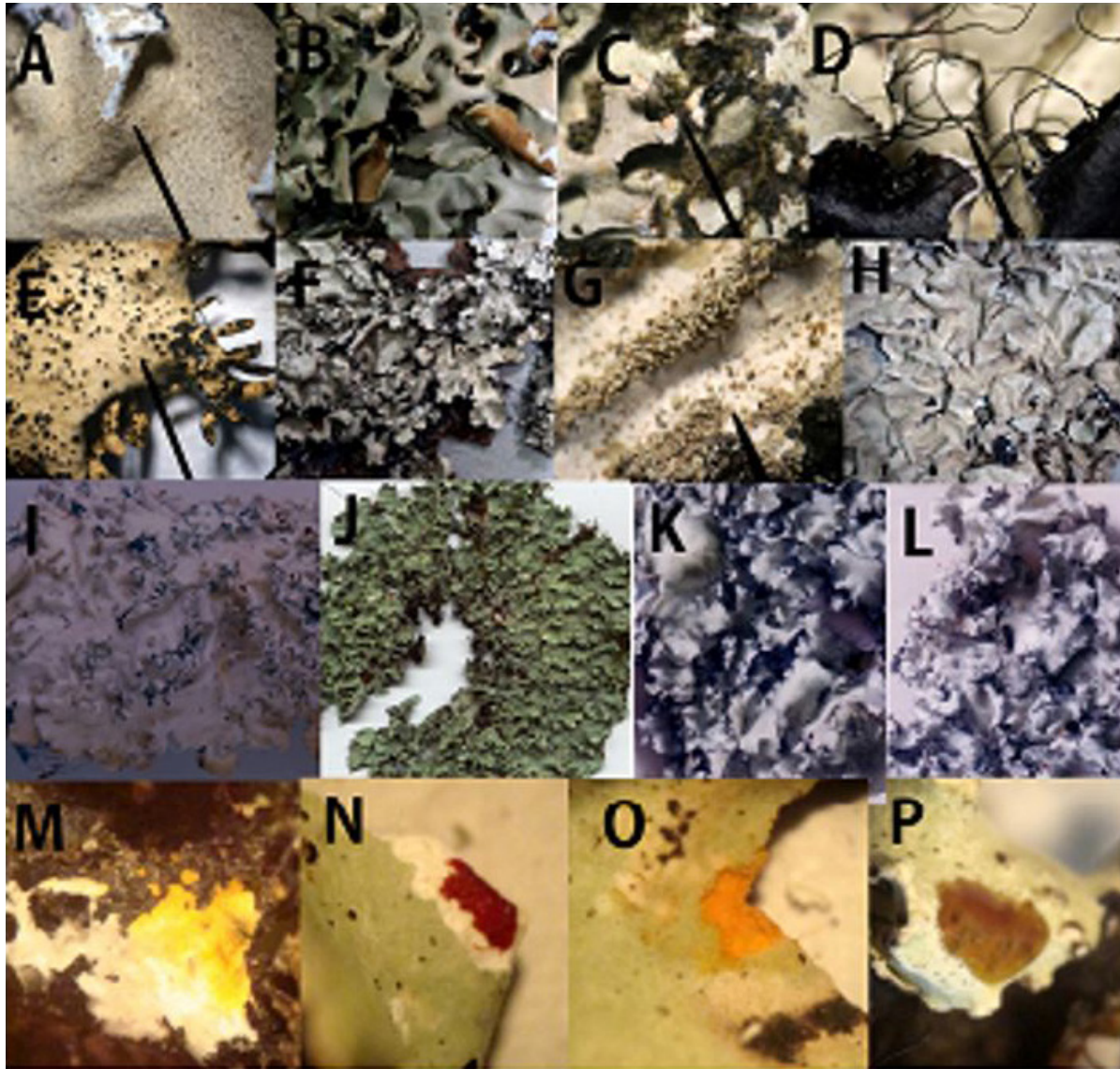


Figure 2. Representatives of *Parmotrema* species and their features: (A) *P. austrocestratum* showing flaking areolae; (B) *P. maclayanum* thallus and erhizinate marginal zone of the lower cortex; (C) *P. clavuliferum* showing capitate marginal soralia on lacinae; (D) conspicuous cilia in *P. subarnoldii*; (E) lobulated lacinae and pycnidia in *P. subrugatum*; (F) thallus of *P. crinitum*; (G) globose isidia of *P. ultralucens*; (H) isidiate lamina of *P. tinctorum* thallus; thallus of (I) *P. overemii*, (J) *P. gardneri*, (K) *P. vartakii*, and (L) *P. elacinulatum*; (M) pigmented lower medulla of *P. rampoddense*; (N) K+ yellow to red medulla of *P. cristiferum*; (O) P+ orange medulla of *P. cristiferum*; (P) KC+ brown medulla of *P. rampoddense*.

C-, P+ orange-red; major acid, salazinic.

Remarks: Morphologically similar to *P. reticulatum* but distinctly lacinate with capitate soralia, and white to mottled marginal zone in the lower cortex.

Parmotrema cooperi (J. Steiner & Zahlbr.) Sérus, The Bryologist 87 (1): 4 (1984) [MB#107091] = *Parmelia cooperi* J. Steiner & Zahlbr. (1926) [MB#397385]

Specimen examined (Elix & Schumm 2001): Cotabato Province: near Ilomavis, 7° 02'N, 125° 11'E, 730 m, F. Schumm & U. Schwartz CANB Schumm 5885.

Remarks: Elix (1994) describes this lichen to have loosely adnate thallus, sinuate and ascending margins, ciliate, soralia marginal to submarginal. Lower cortex black with narrow to wide brown erhizinate zone; rhizines simple. Medulla K-, C+ intense red, KC+ red, P-; major acid, lecanoric.

**Parmotrema corniculans* (Nyl.) Hale, Phytologia 28 (4): 335 (1974) [MB#343027]

= *Parmelia corniculans* Nyl. (1885) [MB#119691]

Specimen examined: Mt. Apo, Cotabato, 6° 56.652'N,

125° 13.815'E, 1820 m, *A. Azuelo193* (CMU, Bukidnon).

Diagnosis: Thallus coriaceous to membranaceous, margins ciliate, lacking isidia and soredia; white medulla; black lower cortex with narrow to wide erhizinate zone; rhizines black, simple, rarely branched, some growing upwards penetrating the thallus; medulla K-, C-, P-, lower medulla K+ purple; major acid, alectoronic.

**Parmotrema crinitum* (Ach.) M. Choisy, Bulletin Mensuel de la Société Linnéenne de Lyon 21: 175 (1952) [MB#368891] = *Parmelia crinita* Ach. (1814) [MB#119691]; *Imbricaria crinita* (Ach.) Arnold (1984) [MB#387011]; *Parmotrema crinita* (Ach.) M. Choisy (1952) [MB3273930]

Specimens examined: Burnham Park, Baguio City, 16° 24' 34.33"N, 120° 35' 41.345"E, 1430 m, *B. Pangsiw*, *Y. Flores*, & *P. Rosuman* SLU-L00025; Mt. Cabuyao, Tuba, Benguet 16° 21' 23"N, 120° 33' 32.8"E, 2025 m, *Y. Flores* & *P. Rosuman* SLU-L00099; Mt. Data, Bauko, Mt. Province, 16° 52' 48"N, 120° 50' 52"E, 2186 m, *P. Bawingan*, *Y. Flores*, & *P. Rosuman* SLU-L00220; Sagada, Mt. Province, 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *P. Bawingan* & *M. Lardizaval* SLU-L00428; Camp John Hay, Baguio City, 16° 23' 49.304"N, 120° 36' 40.895"E, 1469 m, *R. Ansagay* SLU-L00491, *D. Fianga-an* SLU-L00496, *L. Cervantes* SLU-L00497; Mt. Data, Mt. Province, 16° 52' 48"N, 120° 50' 52"E, 2186 m, *Y. Flores* & *P. Bawingan* SLU-L00664; Sitio Cayet, Caliking, Atok Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01636; Asipulo, Ifugao, 16° 41' 9.08"N, 121° 4.1' 23"E, 837 m, *C. Oy-yeng*, *F. Bengwayan* & *M. Balabag* SLU-L02791.

Diagnosis: Thallus adnate, margins crenate to isidiate; isidia dense often ciliate at the apices, laminal and marginal, becoming coralloid, occasionally dissolving into soredia (Fig. 2F); margins sparsely ciliate; white medulla; lower cortex black with wide brown erhizinate zone, rhizines black, simple; medulla K+ yellow, C-, P+ orange (major acid, stictic acid; minor, constictic acid).

Parmotrema cristiferum (Taylor) Hale, Phytologia 28 (4): 335 (1974) [MB#343031]

= *Parmelia cristifera* Taylor, London Journal of Botany 6: 165 (1847) [MB#120260]

Specimen examined: Mt. Cabuyao, Benguet, 16° 21' 23"N, 120° 33' 32.8"E, 2025 m, *Bawingan* SLU-L00027; Banao, Tadian, Mt. Province 16° 55.769'N, 120° 49.639'E 1117 m, *P. Bawingan* & *C. Bawingan* SLU-L00092, SLU-L000103; Sagada, Mt. Province, 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *P. Bawingan* & *P. Rosuman* SLU-L00130, SLU-L00143; Bontoc, Mt. Province 17° 05' 14"N, 120° 58' 32"E, 1087 m, *P. Bawingan* & *E. Singson* SLU-L00185; Tadian Central, Mt. Province, 16°

57' 57.886"N, 120° 48' 55.568"E, 1387 m, *P. Bawingan* & *Y. Flores* SLU-L00270; Ambangeg, Kabayan, Benguet. 16° 34' 34.464"N, 120° 53' 12.374"E, 2503 m, *P. Bawingan* & *Y. Flores* SLU-L00366; Bontoc, Mountain Province, 17° 05' 14"N, 120° 58' 32"E, 1087 m, *P. Bawingan* & *P. Rosuman* SLU-L00415; Banao, Tadian, Mt. Province, 16° 55' 41.997"N, 120° 49' 20.169" E, 1340 m, *P. Bawingan* SLU-L01591, SLU-L01593; Asipulo, Ifugao, 16° 41' 9.08"N, 121° 4.1' 23"E, 837 m, *C. Oy-yeng*, *F. Bengwayan* & *M. Balabag* SLU-L02795, SLU-L02804, SLU-L02808; Mankayan, Benguet 16° 52'N, 120° 47'E, 1320 m, *C. Oy-yeng* SLU-L02810; Adams, Ilocos Norte, 18° 27' 21.6"N, 120° 54' 22.4"E, 305 m, *P. Bawingan* & *M. Balabag* SLU-L01027.

Diagnosis: Thallus loosely adnate to adnate, lobes broadly rounded, main lobes eciliate, lateral lobes may be sparingly ciliate, cilia rarely longer than 2.5 cm; margins ascending, soralia linear, predominantly marginal; white medulla; lower surface black with wide brown erhizinate zone, rhizines sparse, black, simple; medulla K+ yellow then dark red, C-, P+ orange to orange-red; (major acid, salazinic; minor, consalazinic) (Fig. 2N, 2O).

Parmotrema dilatatum (Vain.) Hale, Phytologia 28 (4): 335 (1974) [MB#343038]

= *Parmelia dilatata* Vain. (1890) [MB#122344]

Specimen examined: Mt. Kitanglad, Bukidnon, 8° 10'N, 124° 56'E, 1870-2800 m, *F. Schumm* & *U. Schwartz* CANB Schumm 6303 (Elix & Schumm 2001).

Diagnosis: Louwhoff and Elix (1999) described the thallus to be membranaceous to coriaceous, margins entire to crenate, sometimes sublaciniate, eciliate; soralia marginal to submarginal, linear to subcapitate, soredia granular; medulla white or pale yellow; lower surface black, rhizines sparse, simple, black; medulla K+ dull yellow becoming yellow-brown; C-, P+ orange-red; protocetraric and echinocarpic acids.

**Parmotrema elacinulatum* (Kurok.) Streimann, *Bibliotheca Lichenologica* 22:94 (1986)

[MB#426776] = *Parmotrema submerrillii* Elix, *Mycotaxon* 47: 120 (1993) [MB#360126]

Specimen examined: Sitio Sayet, Caliking, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01251.

Diagnosis: Thallus loosely adnate, coriaceous, lobes subirregular to sublinear; lacking isidia, soredia, and laciniae; margins with dense, conspicuous cilia; medulla white; lower cortex black with wide erhizinate zone, rhizines black, simple; medulla K-, C-, KC-, P+ orange-red; major acid, protocetraric.

Remarks: no apothecia observed in the specimen examined.

**Parmotrema gardneri* (C.W. Dodge) Sérus, The Bryologist 87 (1): 5 (1984) [MB#107092]

Specimens examined: Mt. Cabuyao, Tuba, Benguet, 16° 21' 33.363"N, 120° 33' 52.841"E, 2025 m, *P. Bawingan*, *P. Rosuman* & *Y. Flores* SLU-L00018; Virac, Itogon, Benguet, 16° 21' 55.387"N, 120° 39' 11.031"E, 992 m, *P. Rosuman* & *Y. Flores* SLU-L00414; Sagada, Mt. Province, 17° 5' 52.87"N, 120° 54' 26.294"E 1592 m, *M. Coloma* SLU-L00631; Asipulo, Ifugao 16° 41' 9.96"N, 121° 4.1' 79"E, 796 m, *F. Bengwayan* & *M. Balabag* SLU-L02816.

Diagnosis: Thallus loosely adnate to adnate, coriaceous to sometimes membranaceous, lobes subirregular to sublinear, often sublaciniate, margin eciliate to very sparingly ciliate; soralia marginal to submarginal, linear to subcapitate; medulla white (Fig. 2J); lower surface rugose, black with brown erhizinate zone; rhizines sparse, black, simple, short (0.1-0.2 mm in length); medulla K+ pale yellow to pale brown, C-, KC+ red or brown, P+ orange-red (major acid, protocetraric).

**Parmotrema grayanum* (Hue) Hale, Phytologia 28 (4): 336 (1974) [MB#343059]

= *Parmelia grayana* Hue (1899) [MB#397645]

Specimens examined: Mt. Cabuyao, Tuba, Benguet, 16° 21' 33.363"N, 120° 33' 52.841"E, 2003 m, *P. Bawingan*, *P. Rosuman* & *Y. Flores* SLU-L00019; Loakan Road, Baguio City, 16° 23' 8.217"N, 120° 37' 0.459"E, 1386 m, *R. Julian* & *E. Puguon* SLU-L00024; Tadian, Mt. Province, Philippines. 16° 57' 57.886"N, 120° 48' 55.568"E, 1340 m, *P. Bawingan* & *Y. Flores* SLU-L00090; Mt. Sto. Tomas, Tuba, Benguet. 16° 20' 6" N, 120° 33' 38.99" E, 2206 m, *Y. Flores*, *P. Rosuman*, & *P. Bawingan* SLU-00263; Mt. Data, Bauko, Mt. Province, 16° 51' 22.0"N, 120° 51' 14.0"E, 2294 m, *Y. Flores* & *P. Bawingan* SLU-L00264, *P. Bawingan* & *Y. Flores*, *M. Lardizaval* SLU-L00660; PMA Compound, Baguio City, 16° 22' 0"N, 120° 37' 0"E, 1362 m, *P. Rosuman* & *Y. Flores* SLU-L00371, *K. Dumlaog*, *R. Amoncio*, & *W. Leyson* SLU-L01071; Virac, Itogon, Benguet, 16° 21' 55.387"N, 120° 39' 11.031"E, 992 m, *M. Ramos* & *F. Rabena* SLU-L00374; Mt. Ugo, Benguet, 16° 19' 13.47"N, 120° 48' 9.04"E, 2112 m, *J. Bugtong*, *J. Maslang*, & *M. Racoma* SLU-L00582; Sagada, Mt. Province, 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *G. Benedito* & *S. Cabral* SLU-L00638, *G. Benedito* & *P. Bawingan* SLU-L00638, SLU-L00640; Acop, Tublay, Benguet. 16° 28' 51.449"N, 120° 37' 53.457"E, 1336 m, *P. Bawingan* & *M. Lardizaval* SLU-00906; Kumyas, La Trinidad, Benguet 16° 30' 28.0"N, 120° 38' 10.0"E, 1207 m, *F. Bengwayan* SLU-L02809.

Diagnosis: Thallus adnate to loosely adnate, coriaceous; lobes rotund and crowded, margins ascending, crenate with conspicuous cilia; upper surface commonly white-pruinose, emaculate; soralia marginal to submarginal, linear to subcapitate; medulla white; lower surface rugose, black, with brown erhizinate zone; rhizines sparse, black, simple, short (1-2 mm in length); medulla K-, C-, KC-, P-; with fatty acids in the medulla.

Remark: Most of the specimens we collected were corticolous.

Parmotrema lobulascens (J. Steiner) Hale, Phytologia 28 (4): 337 (1974) [MB#343073]

= *Parmelia lobulascens* J. Steiner (1903) [MB#397816]

Specimen examined (Elix & Schumm 2001): Mt. Kitanglad, Bukidnon 8° 10' N, 124° 56' E, 870-2800 m, *F. Schumm* & *U. Schwartz*, CANB Schumm 6272; Mt. Apo, Cotabato, 7° 00' N, 125° 16' E, 2200 m, *F. Schumm* & *U. Schwartz* CANB Schumm 6071, 6084.

Diagnosis: Thallus coriaceous, loosely attached, with ciliate margins, secondary lobules common along lobe margin and on the lamina; upper surface maculate, soralia linear, marginal to submarginal; some parts of medulla ochraceous, margin of the lower surface brown to mottled; medulla UV+ white (alectoronic acid) (Krog & Swinscow 1981).

Parmotrema maclayanum (Müll. Arg) Hale, Phytologia 28 (4): 337 (1974) [MB#343078]

= *Parmelia maclayana* Müll. Arg. (1891) [MB#397833]; *Parmotrema maclayanum* (Müll. Arg) Phytologia 28 (4): 337 (1974) [MB#493068]

Specimens examined: Mt. Data, Mt. Province, 16° 52' 48"N, 120° 50' 52"E, 2186 m, *P. Bawingan* & *M. Lardizaval* SLU-L00415; Virac, Itogon, Benguet, 16° 21' 55.387"N, 120° 39' 11.031"E, 992 m, *A. Cuevas* & *V. Tabor* SLU-L00327; Sagada, Mt. Province, 17° 5' 52.87" N, 120° 54' 26.294" E 1592 m, *M. Lardizaval* & *A. Rebogio* SLU-L00566; Sitio Sayet, Atok, Benguet, 16° 35' N, 120° 42' E, 1450 m, *S. Laguardia* & *K. Velasco* SLU-L02786, *J. Domingo* & *E. Meniado* SLU-L02787, *J. Tambalong* & *S. Laguardia* SLU-L02788.

Diagnosis: Thallus moderately to loosely adnate, lobes round, weakly imbricate; margins suberect, sparsely ciliate, isidia and soredia absent; medulla white; lower surface black with dark brown erhizinate zone, rhizines black, simple, sparse (Fig. 2B); medulla K-, KC+ purple, P+ red; major acid, alectoronic.

Parmotrema mellissii (C.W. Dodge) Hale, Phytologia 28 (4): 337 (1974) [MB#343083]

= *Parmelia mellissii* C. W. Dodge (1959) [MB#368691]

Specimens examined: Sagada, Mt. Province, 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *Y. Flores*, *M. Lardizaval* & *P. Rosuman* SLU-L00147, *P. Bawingan* SLU-L00639; Virac, Itogon, Benguet, 16° 21' 55.387"N, 120° 39' 11.031"E 992 m, *P. Bawingan* & *P. Rosuman* SLU-L00326, *V. Tabor* & *P. Rosuman*, SLU-L00416; Mt. Data, Mt. Province, 16° 52' 48"N, 120° 50' 52"E, 2186 m, *Y. Flores* & *P. Bawingan* SLU-L00418; Tinoc, Ifugao, 16° 42' 12.595"N, 120° 58' 29.456"E, 1492 m, *H. Pugong* & *M. Taclobao* SLU-L00425; Mt. Ugo, Benguet, 16° 19' 13.47"N, 120° 48' 9.04"E, 2112 m, *J. Bugtong*, *J. Maslang*, & *E. Pagayonan* SLU-L00584; Burnham Park, Baguio City, 16° 24' 34.33"N, 120° 35' 41.345"E, 1430 m, *L. Magtoto* SLU-L00592, SLU-L00942; Ampasit, La Trinidad, Benguet, 16° 27' 0"N, 120° 34' 0"E, 1300 m, *C. Feleciano*, *M. Lardizaval*, & *A. Rebogio* SLU-L00797; Camp John Hay, Baguio City, 16° 23' 49.304"N, 120° 36' 40.895"E, 1469 m, *S. Tamayo* & *L. Magtoto* SLU-L00886; Yamashita Shrine, Kiangnan, Ifugao, 16.779299°N, 121.081443°E, 700-800 m, *A. Kiaki* SLU-L01253; Sitio Sayet, Atok, Benguet, 16° 35'N, 120° 42'E 1450 m, *M. Lardizaval* SLU-L01517, SLU-L01518, SLU-L01516, SLU-L01519, SLU-L01639; Aparngao, Ifugao, 16° 56' 52.3"N, 121° 03' 20.5"E, 1463 m, *A. Kiaki* SLU-L02422; Mt. Apo, A. Azuelo, CMU 33.

Other specimens: Mt. Santo Tomas, Benguet, 16° 18'N, 120° 35'E, 2100 m, *A. Aptroot* & *H. Sipman* A 20456, S 21808, S 21822, S 21823 (Aptroot & Sipman 1989).

Diagnosis: Thallus membranaceous, loosely adnate, lobes rounded; margins ascending, ciliated, cilia long and abundant; isidia on upper surface laminal to marginal, simple or branching to coralloid, often ciliated; medulla white with yellow-brown to orange brown pigmented areas; lower surface black with wide brown erhizinate zone; rhizines long, simple, black clustered in groups, scattered; medulla K-, C-, KC+ red, P-; major acids, alectoronic and α -collatolic.

Parmotrema negrosorientalum Elix & Schumm *Mycotaxon* 79: 253-260 (2001) [MB#474503] = *Parmotrema negrosorientalis* Elix & Schumm (2001) [MB#476100]; *Parmotrema negrosorientale* Elix & Schumm, *Mycotaxon* 79: 253 (2001) [MB#546186]

Specimen examined: Mt. Talinis, Negros Oriental, 9° 15'N, 123° 10'E, *F. Schumm* & *U. Schwartz*, herb. Schumm 7521, 7463, 7465, 7466, 7571 (Elix & Schumm 2001).

Remarks: Described as a new species by Elix and Schumm (2001). Holotype: herb. Schumm 7521. *P. negrosorientalum* was reported to be morphologically similar with *P. rampoddense* but differing in having a

large, coriaceous thallus, maculate upper surface, perforate apothecial discs, and much larger spores; it closely resembles *P. lobulascens* but the latter does not contain skyrin (Elix & Schumm 2001).

Parmotrema overeemii (Zahlbr.) Elix, Australasian Lichenology 42: 22-27 (1998) [MB#458345] = *Parmelia overeemii* Zahlbr. (1928) [MB#397997]

Specimens examined: Sablan, Baguio City, 16° 29' 18.674"N, 120° 30' 59.021"E, 853 m, *J. Bagsawan* SLU-L00234; Adams, Ilocos Norte, 18° 27' 18.74"N, 120° 54' 46.1"E, 414 m, *P. Bawingan* & *M. Balabag* SLU-L01030, 18° 27' 12.7"N, 120° 54' 17.9"E, 321 m, *P. Bawingan* & *M. Balabag* SLU-L01028.

Diagnosis: Thallus moderately to loosely adnate, membranaceous, partly blackened, lobes subirregular to sublinear, 4-10 mm wide; margins entire to crenate-incised, ciliated, occasionally lobulated (Fig. 2I); isidia and soredia absent; lower surface black with wide brown erhizinate zone, rhizines dense, black, simple; medulla K-, C-, KC+ red, P+ deep orange; major acid, protocetraric.

****Parmotrema parahypotropum*** (W.L. Culb.) Hale, *Phytologia* 28(4): 338 (1974) [MB#343101] = *Parmelia parahypotropum* W.L. Culb. (1973) [MB#342869]

Specimen examined: Sitio Sayet, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01521; Sitio Pula, Asipulo, Ifugao 16° 41.4' 28"N, 121° 4.9' 23"E, 798 m, *M. Balabag* SLU-L02326; Asipulo, Ifugao, 16° 41' 9.08"N, 121° 4.1' 23"E, 837 m, *C. Oy-yeng*, *F. Bengwayan* & *M. Balabag* SLU-L02790.

Diagnosis: Thallus moderately to loosely adnate, coriaceous; lobes sublinear, distinctly lacinate, labriform soralia developing on tips of laciniae, soredia farinose; lower surface black with white to mottled erhizinate marginal zone especially on laciniae; rhizines sparse, black, simple; medulla K+ yellow to red, C-, P+ yellow then orange; major acid, salazinic.

Parmotrema permutatum (Stirt.) Hale, *Phytologia* 28 (4): 338 (1974) [MB#343104]

= *Parmelia permutata* Stirt. (1878) [MB#398037]

Specimen examined (Elix & Schumm 2001): Mt. Apo, Cotabato, 7° 01'N, 125° 13'E, 1240 m, *F. Schumm* & *U. Schwartz*, herb. Schumm 5941.

Diagnosis: Thallus loosely adnate, membranaceous to coriaceous, lobes rounded, margins entire to crenate, ciliated; with marginal to submarginal linear soralia; upper medulla white, lower medulla yellow, orange-yellow, or salmon pink; lower surface medulla K-, C+ pink, KC+ pale red, P-; with gyrophoric acid.

**Parmotrema poolii* (C.W. Dodge) Krog. & Swinscow, The Lichenologist 15 (2): 130 (1983) [MB#109156] = *Parmelia poolii* C.W. Dodge [MB#373942]

Specimen examined: Barlig, Mt. Province, 17° 02' 23.97"N, 121° 08' 36.7"E, 1860 m, *P. Bawingan*, *Y. Flores*, & *M. Lardizaval* SLU-L00209; Camp John Hay, Baguio City, 16° 23' 49.304" N, 120° 36' 40.895"E, 1469 m, *R. Ansagay* SLU-L00498; Mt. Data, Bauko, Mt. Province, 16° 52' 48"N, 120° 50' 52"E, 2186 m, *P. Bawingan* & *Y. Flores* SLU-L00663; Sitio Sayet, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01227, SLU-L01365, SLU-L01367, SLU-L011523, SLU-L01640, SLU-L01645.

Diagnosis: Thallus loosely adnate, coriaceous, lobes rotund, wide, margin crenate-dentate, ciliated; with marginal linear to subcapitate soralia; pycnidia scattered, conidia sublageniform; lower surface black with broad brown to dark brown erhizinate marginal zone; rhizines black, simple; medulla K-, C-, KC+ red, P-; with alectoronic acid.

Remarks: *P. poolii* resembles *P. rampoddense* except in its sublageniform conidia and absence of skyrin in the medulla.

**Parmotrema praesorediosum* (Nyl.) Hale, Phytologia 28 (4): 338 (1974) [MB#343106]

= *Parmelia praesorediosa* Nyl. (1891) [MB#398093]

Specimens examined: Lubon, Tadian, Mt. Province, 17° 1' 40"N, 120° 4.7' 49"E, 1200-1300 m, *M. Taclobao* SLU-L00041; Bana-ao, Tadian, Mt. Province, 16° 55.769'N, 120° 49.639'E, 1340 m, *P. Bawingan* SLU-L00087; Virac, Itogon, Benguet, 16° 21' 55.387"N, 120° 39' 11.031"E, 992 m, *P. Bawingan* & *P. Rosuman* SLU-L00105; Sagada, Mt. Province, 17° 05' 03.6"N, 120° 54' 06.9"E, 1462 m, *P. Bawingan*, *P. Rosuman*, & *E. Singson* SLU-L00231; Asipulo, Ifugao, 16° 41' 9.08"N, 121° 4.1' 23"E, 837 m, *C. Oy-yeng*, *F. Bengwayan*, & *M. Balabag* SLU-L02793; Adams, Ilocos Norte, 18° 27' 18.7"N, 120° 54' 46.1"E, 414 m, *P. Bawingan* & *M. Balabag* SLU-L01031.

Diagnosis: Thallus adnate, coriaceous, lobes rounded, margins entire or crenate, lacking cilia; with marginal or submarginal soralia, linear to crescent-shaped; lower cortex black with white or mottled or brown erhizinate marginal zone; rhizines simple, black; medulla K-, C-, KC-, P-; major acids, protopraesorediosic and praesorediosic; with fatty acids.

Remarks: *P. praesorediosum* morphologically resembles *P. grayanum* except for its eciliate margins.

Parmotrema neopustulatum Kurok., Journal of Japanese Botany 81: 252 (2006) [MB#542306] = *Rimelia pustulata*

Elix & Bawingan (2002) [MB#484787]; *Parmotrema pustulatum* (Elix & Bawingan) O. Blanco, A. Crespo, Divakar, Elix & Lumbsch (2005) [MB#335080] illegitimate name

Specimen examined: Mt. Data National Park, Mt. Province, 16° 52'N, 120° 52'E, 2305 m, *P. Bawingan* & *Y. Flores* SLU-L00125; Bana-ao, Tadian, Mt. Province, 16° 55'N, 120° 49'E, 1516 m *P. Bawingan* SLU-L0073; Camp John Hay, Baguio City, 16° 23' 49.304" N, 120° 36' 40.895"E 1469 m, *S. Tamayo* SLU-L00882; Sitio Sayet, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01233, SLU-L01650, SLU-L01652.

Diagnosis: Thallus adnate, coriaceous, maculae reticulate becoming areolate and flaking off; soredia pustulate, pustules submarginal to laminal, soredia becoming corticate to form pseudoisidia; medulla K+ yellow to red, C-, KC+ red, P+ orange; major acid, salazinic.

Parmotrema rampoddense (Nyl) Hale, Phytologia 28 (4): 338 (1974) [MB#343114]

= *Parmelia rampoddensis* Nyl. (1900) [MB#398146]; *Diploschistes rampoddensis* (Nyl.) Zahlbr. (1924) [MB#384471]

Specimens examined: Mt. Data, Tadian, Mountain Province, Philippines. 16° 52' 48"N, 120° 50' 52"E, 2186 m, *P. Bawingan* SLU-L00216, *V. Tabor*, *Y. Flores*, *M. Lardizaval* SLU-L00417, *M. Lardizaval* & *M. Lardizaval* & *P. Bawingan* SLU-L00662; Mines View, Baguio City, 16.4197°N, 120.6273°E, 1400-1450 m, *V. De Villa* SLU-L00368; Sagada, Mt. Province, 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *P. Rosuman* & *E. Singson* SLU-L00421, SLU-L00422, 17° 05' 03.6"N, 120° 54' 06.9"E, 1462 m, *P. Bawingan* SLU-L00650; Camp John Hay, Baguio City, 16° 23' 49.304"N, 120° 36' 40.895"E, 1469 m, *R. Ansagay* & *D. Fianga-an* SLU-L00494, *L. Cervantes* SLU-L00495, *L. Magtoto*, *S. Tamayo*, & *G. Racca* SLU-L00765; Sitio Sayet, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01228, L-01229, L-1230, L-01231, L-1368, L-1369, L-01371, L-01524; Aparnga-o, Ifugao, 16° 56' 52.4"N, 121° 03' 19.1"E, 1463 m, *M. Lardizaval* SLU-L02382; Kumyas, La Trinidad, Benguet, 16° 30' 29"N, 120° 38' 6.0"E, 1238 m, *F. Bengwayan* SLU-L02805; Mt. Apo, Cotabato, *A. Azuelo* 273 (CMU).

Diagnosis: Thallus loosely adnate, coriaceous, lobes irregular, becoming involute, margins crenate with long, conspicuous cilia; sorediate, soredia farinose, soralia marginal, linear; medulla white, the area adjacent to the lower cortex red-orange (with skyrin) (Fig. 2M); black lower surface with wide brown erhizinate marginal zone, rhizines black, simple; medulla K-, C-, KC+ red, P-; with alectoronic acid and α -collatollic acid in the medulla.

Remarks: *P. rampoddense* is morphologically similar to *P. poolii* except that it has baciliform conidia and pigmented lower medulla indicative of skyrin.

Parmotrema reticulatum (Taylor) M. Choisy, Bulletin Mensuel de la Société Linéenne de Lyon 21: 175 (1952) [MB#357464] = *Parmelia reticulata* Taylor (1836) [MB#398165]; *Parmelia laevigata* var. *reticulata* (Taylor) Linds. (1866) [MB#435088]; *Rimelia reticulata* (Taylor) Hale & A. Fletcher (1990) [MB#102567]; *Parmotrema clavuliferum* (Räsänen) Streimann (1986) [MB#129346]

Specimens examined: Mt. Data Hotel Compound, 16° 51' 9"N, 120° 51' 47"E, 2200 m, *P. Bawingan* & *Y. Flores* SLU-L00233; Camp John Hay, Baguio City, 16° 23' 49.304"N, 120° 36' 40.895"E, 1469 m, *D. Fianga-an* & *R. Ansagay* SLU-L00493; Sagada, Mt. Province, 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *P. Bawingan* SLU-L00635, SLU-L00653, SLU-L-00654; Ampasit, Puguais, La Trinidad, Benguet, 16° 26' 54.137"N, 120° 34' 32.836"E, 1324 m, *C. Feleciano*, *M. Lardizaval*, & *A. Rebogio* SLU-L00796; Mt. Ugo, Benguet, 16° 19' 13.47"N, 120° 48' 9.04"E, 2112 m, *Y. Flores* & *J. Maslang* SLU-L00838, *J. Maslang* & *H. Wagas* SLU-L00845; Sinto, Bauko, 16° 51' 41.8"N, 120° 52' 25.5"E, 2128 m, *M. Lardizaval* & *P. Bawingan* SLU-L01191; Sitio Sayet, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01236, SLU-L01238, SLU-L1244, SLU-L01245, SLU-L01378, SLU-L01655, SLU-L01656; Sitio Pula, Asipulo, Ifugao, 16° 41.4' 28"N, 120° 4.9' 23"E, 798 m, *M. Balabag* & *F. Bengwayan* SLU-L02817; Aparnga-o, Ifugao, 16° 59' 58.4"N, 121° 03' 19.5"E, 1447 m, *R. Doplah* SLU-L02381, SLU-L02389; Mt. Apo, Cotabato, 1855 m, *A. Azuelo* 153 (CMU).

Diagnosis: Thallus loosely adnate, membranaceous to coriaceous, lobes imbricate with subsending margins, partly incised and lacinate; upper surface with reticulate maculae, sometimes becoming cracks but no flaking off from the cortex; sorediate, soralia marginal to submarginal, labriform to linear to subcapitate, soredia granular; lower surface black, rhizinate or papillate to the margin or with narrow brown erihizinate zone; rhizines simple or squarrose, long, dense, black; medulla K+ yellow to red, C-, P+ orange-red; major acid, salazinic.

****Parmotrema saccatilobum*** (Taylor) Hale, *Phytologia* 28(4): 339 (1974) [MB#343122]

= *Parmelia saccatiliba* Taylor (1847) [MB#398206]

Specimen examined: Virac, Itogon, Benguet, 16° 21' 55.387"N, 120° 39' 11.031"E, 992 m, *V. Valdez* & *G. Sepulchre* SLU-L00372.

Diagnosis: Thallus loosely adnate, coriaceous, lobes rotund, broad; margins entire, lacking cilia; isidiate,

isidia moderately dense, cylindrical, simple or becoming branched; lower surface black with wide erihizinate marginal zone; rhizines simple, brown, sparse; medulla K-, C-, KC+ red-brown, P+ brick-red; major acid, protocetraric.

Parmotrema sancti-angelii (Lynge) Hale, *Phytologia*, 28: 339 (1974) [MB#343123]

= *Parmelia sancti-angelii* Lynge (1914) [MB#398215]

Specimens examined: Bontoc, Mt. Province, 17° 5' 28.522"N, 121° 0' 38.063"E, 1087 m, *P. Bawingan* & *P. Rosuman* SLU-L00197, *P. Bawingan* & *M. Lardizaval* SLU-L00135; Bana-ao, Tadian, Mt. Province, 16° 55' 41.997"N, 120° 49' 20.169"E, 1340 m, *P. Bawingan* SLU-L00108, SLU-L00110; Sagada, Mt. Province, 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *P. Bawingan* & *P. Rosuman* SLU-L00140, *P. Bawingan* SLU-L01179; Barlig, Mt. Province, 17° 02' 23.97"N, 121° 08' 36.7"E, 1860 m, *P. Bawingan*, *M. Decaleng*, *Y. Flores*, & *M. Lardizaval* SLU-L00314; Ambangeg, Kabayan, Benguet, 16° 34' 34.464"N, 120° 53' 12.374"E, 2503 m, *P. Bawingan* & *Y. Flores* SLU-L00367; Virac, Itogon, Benguet, 16° 21' 55.387"N, 120° 39' 11.031"E, 992 m, *V. Tabor* & *P. Rosuman* SLU-L00429; Sitio Sayet, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval* SLU-L01660; Yamashita Shrine, Kiangan, Ifugao, 16.779299°N, 121.081443°E, 700-800 m, *A. Kiaki* SLU-L02810, SLU-L02811, SLU-L02815.

Other specimens: Mt. Apo, Cotabato, 7° 01'N, 125° 13'E, 1240 m, *F. Schumm* & *U. Schwartz* herb. Schumm 5941 (Elix & Schumm 2001).

Diagnosis: Thallus loosely adnate to adnate, membranaceous to coriaceous, lobes irregular, margins crenate, ascending, ciliated; sorediate, soredia farinose, soralia marginal, linear; lower surface black with brown or mottled erihizinate marginal zone; rhizines dense, simple, black; medulla KC+ pale red, KC+ pale red, P-; major acid, gyrophoric.

****Parmotrema subarnoldii*** (Abbayes) Hale, *Phytologia* 28 (4): 339 (1974) [MB#343129]

= *Parmelia subarnoldii* Abbayes (1961) [MB#345522]

Specimens examined: Sagada, Mt. Province, 17° 5' 52.87"N, 120° 54' 26.294"E, 1592 m, *P. Bawingan* & *P. Rosuman* SLU-L00142; Tadian, Mt. Province, 16° 52' 48"N, 120° 50' 52"E, 2186 m, *P. Bawingan* SLU-L00265; Mt. Data National Park, Mt. Province, 16° 52'N, 120° 52'E, 2305 m, *P. Bawingan* & *Y. Flores* SLU-L00419; Ampasit, Puguais, La Trinidad, Benguet, 16° 26' 54.137"N, 120° 34' 32.836"E, 1324 m, *C. Feleciano*, *M. Lardizaval*, & *A. Rebogio* SLU-L00778, SLU-L00813; Sitio Sayet, Atok, Benguet, 16° 35'N, 120° 42'E, 1450 m, *M. Lardizaval*

SLU-L01645; Aparnga-o, Ifugao, 16° 56' 52.4"N, 121° 03' 19.1"E, 1463 m, *R. Doplah* SLU-L02378;

Diagnosis: Thallus loosely adnate, membranaceous to coriaceous, lobes rounded or irregularly incised; margins entire or crenate, ciliated (Fig. 2D); sorediate, soredia farinose, soralia linear, marginal; medulla white, partly with yellow-orange pigment adjacent to lower cortex; lower surface black with brown or mottled erhizinate marginal zone; rhizines simple, rarely branched, sparse; medulla K-, C-, KC+ red-brown, P+ orange-red; major acid, protocetraric acid, with skyrin.

**Parmotrema subrugatum* (Kremp.) Hale, *Phytologia* 28 (4): 339 (1974) [MB#343135]

= *Parmelia subrugata* Kremp. (1868) [MB#398366]

Specimens examined: Barlig, Mt. Province, 17° 02' 23.97"N, 121° 08' 36.7"E, 1860 m, *M. Dicaleng* & *M. Lardizaval* SLU-L00266; Mt. Ugo, Benguet, 16° 19' 13.47"N, 120° 48' 9.04"E, 2112 m, *J. Maslang* & *M. Racoma* SLU-L00586; Mt. Apo, Cotabato 1823 m, *A. Azuelo* 170 (CMU, Bukidnon), 1820 m, *A. Azuelo* 242 (CMU, Bukidnon).

Diagnosis: Thallus loosely adnate, coriaceous, lobes crowded, convoluted, lobulate lacinate at the margins, with cilia (Fig. 2E); upper surface weakly maculate lacking isidia or soredia; medulla white, red-orange near the lower cortex; medulla K-, C-, KC+ red, P; major acid alectoronic, with skyrin.

Parmotrema tinctorum (Despr. ex Nyl.) Hale, *Phytologia* 28 (4): 339 (1974) [MB#343140] = *Parmelia tinctoria* Despr. Ex Nyl. (1872) [MB#273861]; *Parmelia tinctorum* Despr. Ex Nyl. (1872) [MB#542088]; *Parmotrema tinctorium* (Despr. Ex Nyl.) Hale, *Phytologia* 28 (4): 339 (1974) [MB#531735]

Specimens examined: Mt. Sto. Tomas, Tuba, Benguet, 16° 20' 6"N, 120° 33' 38.99"E, 1996 m, *C. Fomaneg* & *G. Negritto* SLU-L00026; Bana-ao, Tadian, Mt. Province, 16° 55.684"N, 120° 49.477"E, 1144 m, *P. Bawingan* SLU-L00104; Bontoc, Mt. Province, 17° 05' 14"N, 120° 58' 32"E, 1087 m, *P. Bawingan*, *Y. Flores* & *M. Lardizaval* SLU-L00131; PMA Compound, Baguio City, 16° 21' 42"N, 120° 37' 14"E, 1540 m, *C. Fomaneg* & *D. Lucas* SLU-L00261; Virac, Itogon, Benguet, 16° 21' 55.387"N, 120° 39' 11.031"E, 992 m, *V. Valdez* & *G. Sepulchre* SLU-L00321, *A. Cuevas* & *V. Tabor* SLU-L00370; Tadian Poblacion 16° 45' N, 120° 5' E, 1340 m, *P. Bawingan* SLU-L00324; Mt. Lusod, Benguet, 16° 31' N, 120° 46' E, 1625 m, *P. Bawingan* & *T. Colallad* SLU-L00570; Acop, Tublay, Benguet 16° 21' N, 120° 37' E, 1400 m *P. Bawingan* & *M. Lardizaval* SLU-L00907; Burnham Park, Baguio City, 16° 24' 35"N, 120° 35'

41"E, 1504.88 m *S. Tamayo* & *G. Racca* SLU-L00947; Botanical Garden and Centennial Park, Baguio City, 16° 56.197"N, 121° 08.190"E, 1460 m, *W. Leyson*, *R. Amoncio* & *K. Dumlao*, SLU-L01073; Sitio Sayet, Caliking, Atok, Benguet, 16° 35' N, 120° 42' E, 1450 m, *M. Lardizaval* SLU-L01252, SLU-L01253; Asipulo, Ifugao, 16° 41.4' 28"N, 120° 4.9' 23"E, 798 m, *C. Oy-yeng* & *M. Balabag* SLU-L02796, SLU-L02800; Yamashita Shrine, Kiangan, Ifugao 16.779299°N, 121.081443°E, 700-800 m, *A. Kiaki* SLU-L02797; Kumyas, La Trinidad, 16° 30' 28"N, 120° 38' 10"E, 1207 m, *F. Bengwayan* SLU-L02806.

Diagnosis: Thallus large, loosely adnate, lobes irregular, margins linear or crenate, no cilia (Fig. 2H); isidia sparse to abundant, mostly laminal, confluent to scattered, some marginal; medulla white; lower surface black with wide brown erhizinate marginal zone; rhizines short, simple, black; medulla K-, C+ red, KC+ red, P-; major acid, lecanoric.

Parmotrema ultralucens (Krog) Hale, *Mycotaxon* 1 (2): 108 (1974) [MB#342939]

= *Parmelia ultralucens* Krog (1974) [MB#342939]; *Canomaculina ultralucens* (Krog) Elix & J.B. (2003) [MB#372302]

Specimens examined: Bontoc, Mt. Province, 17° 5' N, 120° 59' E, 1196 m, *P. Bawingan*, *P. Rosuman*, & *E. Singson* SLU-L00131.

Diagnosis: Thallus loosely attached, lobes rounded to subirregular, margins crenate, ciliated; isidia laminal, simple to coralloid, often ciliated (Fig. 2G); medulla white; lower surface black with brown, erhizinate zone, rhizines, simple, black, varied in length; medulla UV+ yellow, K+ yellow to red, C-; major acids, salazinic and lichexanthone.

Parmotrema vartakii Hale, *Mycotaxon* 5 (2): 441 (1977) [MB#343144]

Specimen examined: Madongo, Sagada, Mt. Province, 17° 15' N, 120° 54' E, 1996 m, *P. Bawingan*, *P. Rosuman* & *E. Singson* SLU-L00139.

Diagnosis: Thallus adnate, membranaceous to coriaceous, lobes subirregular to linear, rugose, margins ciliated, cilia sparse to numerous, slender; sorediate, soredia farinose, scattered in the lamina (Fig. 2K); medulla white; lower surface black with brown erhizinate zone; rhizines simple, sparse, black; medulla K+ pale orange, C+ pale orange, KC+ red orange, P-; major acid, gyrophoric.

KEY TO THE *PARMOTREMA* SPECIES

1a Thallus without wide erhizinate marginal zone in the lower surface 2
1b Thallus with wide erhizinate marginal zone in the lower surface 5
2a Soredia present 3
2b Soredia absent 4
3a Soredia pustulate, marginal to submarginal, maculae forming areoles then flaking off *P. neopustulatum*
3b Soredia not pustulate, marginal, labriform to linear, maculae not forming areoles or flaking off *P. reticulatum*
4a Maculae forming areoles, then flaking off *P. austrocetratum*
4b Maculae not forming areoles or flaking off *P. cetratum*
5a Thallus lacking isidia and soredia 6
5b Thallus with isidia or soredia 10
6a Medulla entirely white 7
6b Medulla partly orange-pigmented near lower cortex, pigmented part K⁺ purple 9
7a Medulla KC⁻, P⁺ deep orange; protocetraric acid present 8
7b Medulla KC⁺ purple, P⁺ red; alectoronic acid present *P. maclayanum*
8a Cilia present, prominent; conidia bacilliform *P. elacinulatum*
8b Cilia present or absent; conidia sublageniform *P. overeemii*
9a Thallus lobulate-laciniate; conidia bacilliform *P. subrugatum*
9b Thallus not lobulate-laciniate, conidia filiform *P. corniculans*
10a Thallus with isidia 11
10b Thallus with soredia 15
11a Eciliate or sparingly ciliate 12
11b Lobes conspicuously ciliate. 13
12a Medulla C⁺ red, P⁻; lecanoric acid present *P. tinctorum*
12b Medulla C⁻, P⁺ brick-red; protocetraric acid present *P. saccatilobum*
13a Medulla K⁻, KC⁺ red; alectoronic and α -collatolic acids present *P. mellissii*
13b Medulla K⁺ yellow or red, KC⁻ 14
14a Medulla K⁺ yellow; stictic acid present *P. crinitum*
14b Medulla K⁺ yellow to red; salazinic acid present *P. ultralucens*
15a Lobes eciliate or sparsely ciliate 16
15b Lobes conspicuously ciliate 19
16a Medulla K⁻ *P. praesorediosum*
16b Medulla K⁺ yellow or yellow then red 17
17a Medulla K⁺ yellow then red; salazinic acid present *P. cristiferum*
17b Medulla K⁺ dull yellow to yellow-brown; protocetraric acid present 18
18a Upper surface grey; usnic acid and echinocarpic acid absent *P. gardneri*
18b Upper surface pale yellowish-grey; usnic acid and echinocarpic acids present *P. dilatatum*
19a Medulla K⁺ yellow then red, P⁺ orange; norstictic and salazinic acids present *P. parahypotropum*

19b Medulla K-	20
20a Medulla C+ red	21
20b Medulla C-	23
21a Lower medulla pigmented, medulla C+ pink; gyrophoric acid present	<i>P. permutatum</i>
21b Medulla entirely white	22
22a Medulla C+ intense red; lecanoric acid present	<i>P. cooperi</i>
22b Medulla C+ pink or pale red; gyrophoric acid present	<i>P. sancti-angelli</i>
23a Medulla entirely white	23
23b Medulla with pigmented areas	26
24a Medulla KC-; fatty acids present	<i>P. grayanum</i>
24b Medulla KC+ red; alectoronic acid ± α -collatolic acid present	25
25a Upper surface maculate; secondary lobules often present	<i>P. lobulascens</i>
25b Upper surface emaculate; secondary lobules absent	<i>P. poolii</i>
26a Medulla P+ orange; protocetraric acid present	<i>P. subarnoldii</i>
26b Medulla P-; alectoronic acid ± α -collatolic acid present	27
27a Thallus coriaceous; upper surface distinctly maculate	<i>P. negrosorientalum</i>
27b Thallus membranaceous; emaculate upper surface	<i>P. rampoddense</i>

ACKNOWLEDGMENT

The authors gratefully acknowledge the funding support given by Vlaamse Interuniversitaire Raad (VLIR) through the SLU-BSU-VLIR inter-university cooperation (2000-2005), the Saint Louis University Research Grant (SLU-URG) from 2010-2013, and the Sunchon National University, Sunchon, Korea from 2014-2016.

REFERENCES

APTROOT A, SIPMAN H. 1989. New lichen records from the Philippines. *Acta Bryolichologica Asiatica* 1(1, 2): 31-41.

ANING J. 2014. SC stops activities in Mt. Santo Tomas forest. Retrieved from <http://newsinfo.inquirer.net> on 31 January 2017.

ASIAN DEVELOPMENT BANK. 2009. Country environmental analysis 2008: Philippines. Mandaluyong City: Asian Development Bank. p. 16-20.

BENATTI MN, GERNERT M, SCHMITT I. 2013. *Parmotrema hydrium*, a new species of Parmeliaceae

in southeastern Brazil. *Acta Botanica Brasilica* 27(4): 810-814.

BLANCO O, CRESPO A, DIVAKAR PK, ELIX JA, LUMBSCH HT. 2005. Molecular phylogeny of parmotrema lichens (Ascomycota, Parmeliaceae). *Mycologia* 97: 150-159.

BOTANISCHER GARTEN UND BOTANISCHES MUSEUM BERLIN. Not dated. Lichen determination keys. Retrieved from <http://www.bgbm.org/de/lichen-determination-keys>.

BRODO IM, SHARNOFF SD, SHARNOFF S. 2001. *Lichens of North America*. New

Haven and London: Yale University Press. 795p.

CRESPO A, KAUFF F, DIVAKAR P, PRADO R, ORTEGAS P, DE PAZ GA, FERENCOVAZ, BLANCO O, ROCA-VALIENTE B, NUNEZ-ZAPATA, et al. 2010. Phylogenetic generic classification of parmelioid lichens (Parmeliaceae, Ascomycota) based on molecular, morphological and chemical evidence. *Taxon* 59 (6): 1735-1753.

- CYBERLIBER. Not dated. Cyberliber: An electronic library for mycology. Retrieved from <http://www.cybertruffle.org.uk/cyberliber>.
- ELIX JA. 1994. *Parmotrema*, Flora of Australia 55: 140-146.
- ELIX JA. 1997. The lichen genera *Canomaculina* and *Rimeliella* (Ascomycotina, Parmeliaceae). Mycotaxon 65: 475-479.
- ELIX JA, BAWINGAN PA, FLORES YG. 2002. A new species and further new records in the lichen family Parmeliaceae (Ascomycotina) from the Philippines. Mycotaxon 81: 251-256.
- ELIX JA, ERNST-RUSSEL KD. 1993. A catalogue of standardized thin layer chromatographic data and biosynthetic relationships for lichen substances, 2nd ed. Canberra: Australian National University.
- ELIX JA, HALE ME. 1987. *Canomaculina*, *Myelochroa*, *Parmelinella*, *Parmelinopsis* and *Parmotremopsis*, five new genera in the Parmeliaceae (lichenized Ascomycotina). Mycotaxon 29: 223-244.
- ELIX JA, JOHNSTON J. 1988. New species in the lichen family Parmeliaceae (Ascomycotina) from the southern hemisphere. Mycotaxon 31: 491-510.
- ELIX JA, SCHUMM F. 2001. A new species and new records in the lichen family Parmeliaceae (Ascomycotina) from the Philippines. Mycotaxon 79: 253-260.
- FEIGE GB. 1998. Etymologie der Wissenschaftlichen Gattungsnamen der Flechten. 1. Auflage. Essen: Published by the author. 91p.
- HALE ME. 1965. Monograph of *Parmelia* subgenus *Amphigymnia*. Contributions from the U.S. National Herbarium 36(5): 193-358.
- HALE ME. 1974a. New combinations in the lichen genus *Parmotrema* Massalongo. Phytologia 28: 334-339.
- HALE ME. 1974b. Notes on species of *Parmotrema* (Lichenes; Parmeliaceae) containing yellow pigments. Mycotaxon 1(2): 105-106.
- HALE ME. 1977. New species in the lichen genus *Parmotrema* Mass. Mycotaxon 5: 432-448.
- HALE ME, FLETCHER A. 1990. *Rimelia* Hale & Fletcher, a new lichen genus (Ascomycotina: Parmeliaceae). Bryologist 93: 23-29.
- KUROKAWA S. 1991. *Rimeliella*, a new lichen genus related to *Rimelia* of the Parmeliaceae. Annals of the Tsukuba Botanical Garden 10: 1-14.
- KROG H, SWINSCOW TDV. 1981. *Parmelia* subgenus *Amphigymnia* (lichens) in East Africa. Bulletin of the British Museum (Natural History) 9(3):159-200.
- KROG H, SWINSCOW TDV. 1983. New species and new combinations in *Parmotrema* (Parmeliaceae). Lichenologist 15: 127-130.
- LOUWHOFF SHJJ, ELIX JA. 1999. *Parmotrema* and allied lichen genera in Papua New Guinea. Bibliotheca Lichenologica 73:1-152.
- LOUWHOFF SHJJ, ELIX JA. 2000. Five new species in the lichen family Parmeliaceae (Ascomycotina) from Grande Terre, New Caledonia. Mycotaxon 75: 195-203.
- MAGBANUA W. 2016. Massive forest fire rages on Mt. Apo; hikers flee inferno. Retrieved from <http://newsinfo.inquirer.net> on 31 January 2017.
- MYCOBANK. Not dated. Data: Fungal databases, nomenclature & species banks. Retrieved from <http://www.mycobank.org>.
- NASH TH III, ELIX JA. 2002. *Parmotrema*. In: Nash III TH, Ryan BD, Diederich P, Gries C, Bungartz F, eds. Lichen flora of the greater Sonoran Desert Region Vol. 2. Lichens. Tempe: Lichens Unlimited, Arizona State University. p. 318-329.
- ORANGE A, JAMES PW, WHITE FJ. 2001. Microchemical methods for the identification of lichens. British Lichen Society. 101p.
- SIPMAN HJM, DIEDERICH P, APTROOT A. 2013. New lichen records and a catalogue of lichens from Palawan Island, The Philippines. Philippine Journal of Science 142(3): 199-210.
- SPIELMANN A, MARCELLI MP. 2009. *Parmotrema* s.l. (Parmeliaceae, lichenized Ascomycota) from Serra Geral slopes in central Rio Grande do Sul State, Brazil. Hoehnea 36(4): 551-595.
- VAINIO EA. 1909. Lichenes Insularum Philippinarum I. Philippine Journal of Science 4(5): 651-662.