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Further additions to the macrolichen mycota of Vietnam

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ABSTRACT — Seven new records of foliose lichens are reported from Chu Yang Sin National Park of Dak Lak province in Vietnam. Morphological, anatomical and chemical characteristics are described for *Heterodermia obscurata*, *Hypotrachyna flavida*, *Leptogium ulvaceum*, *Parmotrema sancti-angelii*, *Parmeliella brisbanensis*, *Physma byrsaeum*, and *Sticta marginifera*.

KEY WORDS — tropical, macrolichens, *Parmeliaceae*, Da Lat Plateau

Introduction

Although larger organisms are well known in the tropics, the fungi and their lichenized counterparts in tropical forests are less known (Coppins & Wolseley 2002). Aptroot & Sipman (1997) observed that the tropical forest lichens represent about one-third to one-half of the world's lichen diversity. Vietnam, being a moderately large country with the monsoon tropical climate (VARCC 2009), provides a range of conditions to support lichen growth (Nguyen et al. 2010, 2011).

Although the lichen mycota of Vietnam is underworked, recently many species have been reported or described. Aptroot & Sparrius (2006) provided the first checklist of Vietnam lichens, which has been followed by new records of macrolichens by Gao (2009), some findings on foliicolous lichens by Nguyen et al. (2010, 2011), and reports of some *Graphidaceae* species by Joshi et al. (2012).

The Korean Lichen Research Institute (KoLRI) has initiated collaboration with Tay Nguyen University in Vietnam, which has resulted in the collection of many lichen specimens, which have been deposited in the herbarium of the KoLRI. This paper reports seven taxa (in five lichen families) from Chu Yang Sin National Park, Vietnam.

Materials & methods

Chu Yang Sin National Park is located in the central highlands of Vietnam in Krong Bong and Lak Districts of Dak Lak Province. This park is situated within the elevations ranging from less than 600 m to 2442 m at the summit of Mount Chu Yang Sin with the area of 58,947 ha. The Park is the largest protected area on the Da Lat Plateau, in the central highlands (Hughes 2010).

The dominant vegetation type in the Park is broadleaved evergreen forest, covering over 65% of the area. This forest is dominated by the vascular plant families *Fagaceae*, *Lauraceae*, *Meliaceae*, and *Illiciaceae* with a canopy height often in excess of 35 m. The high altitudinal range and varied topography gives rise to high vascular plant diversity in different forest types. Montane and submontane forests are at >900 m and lowland semi evergreen forests at <900 m (Hughes 2010).

Morphological and anatomical investigations were performed under a binocular dissecting (NIKON SMZ645) and light microscope (Zeiss Scope. A1). Measurements of all the microscopic features were made on hand-cut thallus and apothecial sections. The sections were examined by mounting in water, 10% KOH, and Lugol's iodine solutions. Ascospore measurements were determined in water. Chemical constituents were identified by spot tests and thin layer chromatography performed in solvent systems A (toluene:dioxin:acetic acid 180:45:5) and C (toluene:acetic acid 85:15) (Orange et al. 2010).

Taxonomic descriptions

Heterodermia obscurata (Nyl.) Trevis., Nuovo Gior. Bot. Ital. 1: 114 (1869) FIG. 1A

Thallus foliose, suborbicular, adnate, 2–6 cm across; lobes narrow, up to 1–2 mm wide, flat; upper surface whitish gray, shiny, epruinose, sorediate; soredia granular, labriiform to capitate on lateral and terminal lobes; lower cortex absent; lower surface (medulla) felted with yellowish-brown pigment, K+ purple, marginally rhizinate; rhizines black, simple to squarrosely branched; apothecia not seen.

CHEMISTRY — Cortex K+ (yellow), C–, KC–, P+ (pale yellow); medulla K–, C–, KC–, P–. TLC: atranorin, chloroatranorin, zeorin.

ECOLOGY & DISTRIBUTION — Found on sandy rock in broad-leaved evergreen forest in Chu Yang Sin National Park. According to Moberg & Nash (2001), this species is growing on tree trunk and mossy rocks in open humid conditions. Mostly cosmopolitan and has been reported from many countries in Africa, Asia, Europe, North America, South America, and Oceania (Aptroot & Feijen 2002, Calvelo & Liberatore 2002, Egea 1996, Eliasaro & Adler 1997, Elix & McCarthy 1998, Fryday et al. 2001, Gowan & Brodo 1988, Hafellner & Türk 2001, Knezevic & Mayrhofer 2009, Kurokawa 1960, Llimona & Hladun 2001, López-Figueiras 1986, Osorio 1992, Singh & Sinha 2010, Sipman 1993, Streimann 1986, Tenorio et al. 2002, Wei 1991).

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, on rock, 12°27'57.0"N 108°20'34.9"E, elev. c. 780 m, 20.04.2012, S.O. Oh, J.S. Hur VN120185 (KoLRI).

REMARKS — *Heterodermia obscurata* (*Physciaceae*) is characterized by its robust appearance, labiate soredia, lack of lower cortex, and the rusty-brown pigmented (K+ purple) lower surface or medulla. According to Moberg & Nash (2001), this species is closely related to *H. speciosa* (Wulfen) Trevis., which differs in having a lower cortex and in lacking yellowish pigmentation. It is also easily confused with *H. japonica* (M. Satô) Swinscow & Krog, which has no lower cortex and which is white to violet.

Hypotrachyna flavida (Zahlbr.) Hale, *Smithson. Contr. Bot.* 25: 37 (1975) FIG. 1B

Thallus adnate to loosely attached, coriaceous, green, 4–6 cm across; lobes sublinear, separate, 2–4 mm wide, margins eciliate; upper surface greenish grey, emaculate, plane to convex, continuous or irregularly cracked on older lobes; medulla white; lower surface moderately rhizinate; rhizines long, sparsely dichotomously branched, often projecting beyond the lobe margins; apothecia adnate, 1–3 mm in diameter, disc brown, flat to concave; Asci clavate, 8 spored, spores colourless, 6–8 µm; pycnidia not seen.

CHEMISTRY — Cortex K–, C–, KC–, P–; medulla K+ (pale yellowish to brown), C–, KC–, P+ (orange-red). TLC: usnic acid, protocetraric acid.

ECOLOGY & DISTRIBUTION — Found on a sandy rock in broad-leaved evergreen forest in Chu Yang Sin National Park. Reported as saxicolous species at somewhat higher elevations by Hale (1975). This species has previously been reported from Central and South America (Calvelo & Liberatore 2002, Eliasaro & Adler 1997, Hale 1975, Riddle 1920, Tenorio et al. 2002).

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, on rock, 12°28'12.3"N 108°20'59.9"E, elev. c. 763 m, 20.04.2012, S.O. Oh, J.S. Hur VN120120 (KoLRI).

REMARKS — *Hypotrachyna flavida* (*Parmeliaceae*) is characterized by a saxicolous habit and a medulla containing usnic acid and protocetraric acid. According to Hale (1975), *H. flavida* is fairly restricted to northern South America. Externally, this species very closely resembles *H. protoboliviana* (Hale) Hale, which differs in its corticolous habitat and medulla containing barbatic acid.

Leptogium ulvaceum (Pers.) Vain., *Ann. Acad. Sci. Fenn.*, Ser. A, 15(6): 38 (1921) FIG. 1C

Thallus foliose, loosely adnate, 4–8 cm across, bluish gray; lobes rotund, 2–8 mm wide, homiomorous, margins entire, surface smooth to somewhat rough; isidia, phyllidia absent; lower surface smooth, etomentose, pale bluish with sparse tufted rhizines; apothecia laminal, shortly pedicellate, 0.5–2 mm diam., disc flat to concave, red brown, exciple smooth to wrinkled, cells paraplectenchymatous and continuous to below the hypothecium; ascospores

ellipsoid, muriform, 30–40 × 12–18 µm, apices acute to elongate; pycnidia submarginal; conidia 2–3 µm long.

CHEMISTRY — No chemical detected.

ECOLOGY & DISTRIBUTION — Found on a sandy rock in a shady place in broad-leaved evergreen forest in Chu Yang Sin National Park. This species has previously been reported from Asia, Europe, South America, and Oceania (Awasthi 1988, Elix & McCarthy 1998, Hafellner 1995, Marcelli 1991).

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, on rock, 12°26'51.9"N 108°20'18.1"E, elev. c. 816 m, 21.04.2012, S.O. Oh, J.S. Hur VN120170 (KoLRI).

REMARKS — *Leptogium ulvaceum* (*Collemataceae*) is characterized by smooth upper surface lacking vegetative propagules. This species is morphologically similar to *L. cochleatum* (Dicks.) P.M. Jørg. & P. James, which differs in its periclinally wrinkled thalline exciple.

Parmeliella brisbanensis (C. Knight) P.M. Jørg. & D.J. Galloway, Flora of Australia, 54: 314 (1992) FIG. 1D

Thallus rosette-forming, orbicular, 5–7 cm across, on a thick, black prothallus projecting 1–2 mm beyond lobe apices, closely appressed to substratum; lobes narrow, 0.6–1 mm wide, discrete at margins, flat; margins entire, somewhat thickened, occasionally ascending; upper surface, slightly maculate, smooth, occasionally striate, grayish when wet, whitish gray when dry, isidiate; isidia delicate, simple to finger-like, to 0.5 mm tall and 0.1 mm thick, laminal and marginal; medulla white to blackish, photobiont *Nostoc*; apothecia, 0.5–2 mm wide, rounded to contorted; exciples thick, thalline, persistent, crenulate-striate, concolorous with thallus; disc flat to concave, red-brown; ascospores simple, ellipsoidal, 10–15 × 8–10 µm; pycnidia not seen

CHEMISTRY — No chemical detected.

ECOLOGY & DISTRIBUTION — Found on a sandy rock in a shady place in broad-leaved evergreen forest in Chu Yang Sin National Park. According to Jørgensen and Galloway (1992), *Parmeliella brisbanensis* also occurs on tree bark in tropical to subtropical rain forests. This species has been recorded from many countries in the tropics, in Asia, Australia, and Oceania (Elix & McCarthy 1998, Jørgensen & Galloway 1992, Singh & Sinha 2010, Sipman 1993, Wolseley et al. 2002).

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, on rock, 12°28'04.4"N 108°20'39.0"E, elev. c. 622 m, 20.04.2012, S. O. Oh, J. S. Hur VN120046 (KoLRI).

REMARKS: *Parmeliella brisbanensis* (*Pannariaceae*) is characterized by its rosette form, black hypothallus, and finger-like isidiate upper surface. According to Jørgensen & Galloway (1992), this species is the isidiate counterpart of the *P. mariana* (Fr.) P.M. Jørg. & D.J. Galloway complex.

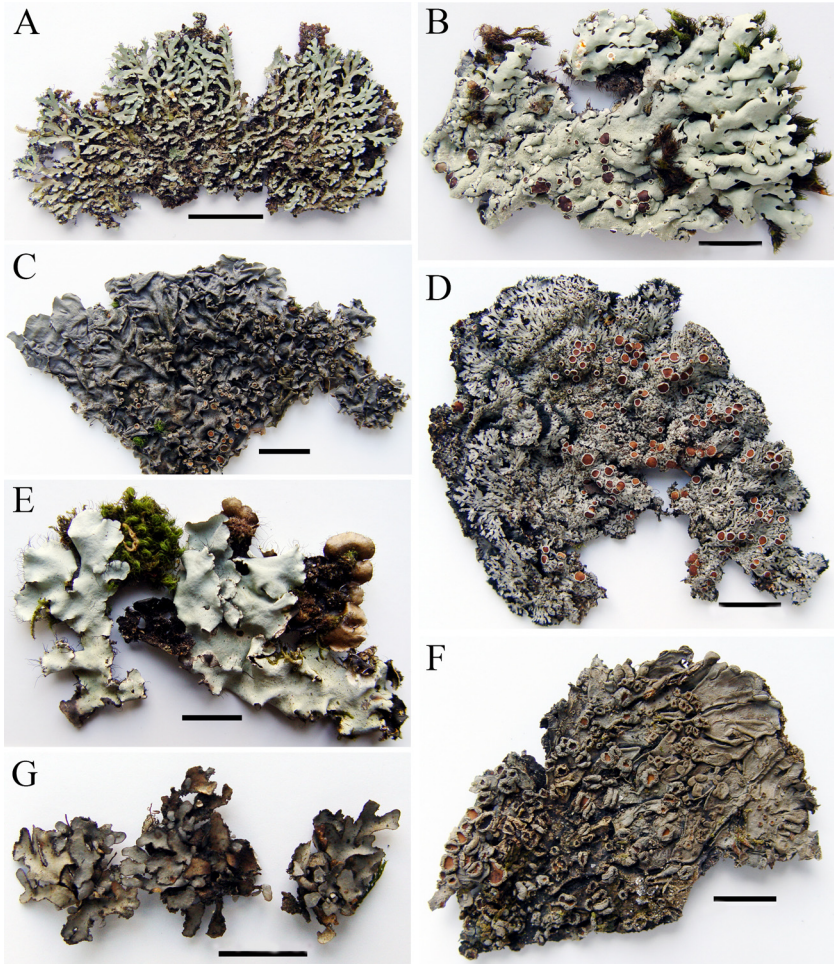


FIGURE 1: External morphology of Vietnamese lichen specimens (Scale bars = 1 cm). A. *Heterodermia obscurata* VN120185 (KoLRI); B. *Hypotrachyna flavida* VN120120 (KoLRI); C. *Leptogium ulvaceum* VN120170 (KoLRI); D. *Parmeliella brisbanensis* VN120046 (KoLRI); E. *Parmotrema sancti-angelii* VN120288 (KoLRI); F. *Physma byrsaeum* VN120107 (KoLRI); G. *Sticta marginifera* VN120053 (KoLRI).

Parmotrema sancti-angelii (Lynge) Hale, Phytologia 28: 339 (1974)

FIG. 1E

Thallus loosely attached to the substratum, up to 6 cm across; lobes rotund, 4–10 mm wide; margins crenate, ciliate; cilia numerous, simple, 2–4 mm long; upper surface pale grey, emaculate, smooth, sorediate; soralia marginal, soredia granular; medulla white, yellowish brown pigments below; lower surface, with

relatively narrow, smooth, erhizinate marginal zone; rhizines sparse, simple; apothecia and pycnidia not seen.

CHEMISTRY — Cortex K+ (yellow), C-, KC-, P-; medulla K- C+ (rose), KC+ (red), P-. TLC: atranorin, chloroatranorin, gyrophoric acid and unknown compound.

ECOLOGY & DISTRIBUTION — Found on a sandy rock in an open place in broad-leaved evergreen forest in Chu Yang Sin National Park. A common and widespread species in the pantropical region (Elix 1994), it has been reported from Asia, Australia, South America, and Oceania (Calvelo & Liberatore 2002, Divakar & Upreti 2005, Elix 1994, Elix & McCarthy 1998, Elix & Schumm 2001, Hale 1974, Kurokawa 1993, Wei 1991, Wolseley et al 2002).

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, on rock, 12°28'04.4"N 108°20'39.0"E, elev. c. 622 m, 20.04.2012, S.O. Oh, J.S. Hur-VN120288 (KoLRI).

REMARKS — *Parmotrema sancti-angelii* (*Parmeliaceae*) is characterized by an emaculate upper surface, sorediate margins, yellowish lower medulla, and brown to black lower surface. This species is very close to *P. indicum* Hale, which differs in having norlobaridone and in lacking pigmentation on the lower medulla.

Physma byrsaeum (Ach.) Tuck., Syn. N. Amer. Lich. 1: 115 (1882) FIG. 1F

Thallus foliose, rosulate, adnate, 6–8 cm across, 200–350 µm thick; lobes radiating, oblong 1–5 mm wide; margins entire, thickened, re-curved at the lobes end; upper surface ridged, somewhat wrinkled, brownish black, lacking isidia; cortex thin, photobiont *Nostoc*; lower surface pale brown, rhizinate; rhizines of interwoven hyphae forming a cushion-like indumentum, whitish to black; ascomata apothecial, abundant, laminal, sessile, 1–4 mm wide; disc concave to plane, reddish brown; thalline exciple thick, wrinkled, lobed, concolorous with thallus; ascospores simple, ellipsoidal, 12–15 × 10–12 µm; episporium, 2–3 µm thick; pycnidia laminal, conidia 2–3 µm long.

CHEMISTRY — No chemicals detected.

ECOLOGY & DISTRIBUTION — Found on sandy rock in a shady place in broad-leaved evergreen forest in Chu Yang Sin National Park. *Physma byrsaeum* has been reported from many countries in the paleotropics, including Asia, Australia, Central America, and Oceania (Aptroot & Seaward 1999, Aptroot & Sipman 1991, Elix & McCarthy 1998, Sipman 1993, Tenorio et al. 2002, Verdon 1992, Wolseley et al. 2002).

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, on rock, 12°28'12.3"N 108°20'59.9"E, elev. c. 763 m, 20.04.2012, S.O. Oh, J.S. Hur-VN120107 (KoLRI).

REMARKS — *Physma byrsaeum* (*Collemataceae*) is characterized by a well-developed cortical layer and wrinkled thalline apothecial exciple. This species

is morphologically similar to *P. pseudoisidiatum* Aptroot & Sipman, which is isidiate.

Sticta marginifera Mont., Anns Sci. Nat., Bot., Sér. 2 18: 265 (1842) FIG. 1G

Thallus palmate to irregularly branched in clumps, 1–2 cm across, arising from a rooted holdfast; lobes flabellate to irregularly dichotomously branching, 1–3 mm wide, proliferating round to oblong lobules attached to primary lobes by thin terete stalks; margins entire or irregularly notched, thickened below; upper surface grayish glaucous when dry, dark blue-black when wet, thin, papery, smooth, rather fragile, isidiate, phyllidiate and minutely maculate; isidia marginal, sometimes on the upper surface, styliform to coralloid, to 0.5 mm tall; phyllidia marginal, developing from isidia, to 1 mm tall, irregularly lobed; photobiont *Nostoc*; lower surface white to pale at margins, brown centrally, minutely pubescent; cyphellae scattered, round, to 0.5 mm diam.; pit membrane white; apothecia not seen.

CHEMISTRY — No chemicals detected.

ECOLOGY & DISTRIBUTION — Found on sandy rock in a shady place in broad-leaved evergreen forest in Chu Yang Sin National Park. According to Galloway (2001), *Sticta marginifera* prefers humid, deeply shaded habitats in montane rain forests on different substrates. This species has been recorded from Asia, Australia, South America, and Oceania (Awasthi 2007, Calvelo & Liberatore 2002, Elix & McCarthy 1998, Galloway 2001, Streimann 1986).

SPECIMEN EXAMINED: VIETNAM. DAK LAK PROVINCE: Chu Yang Sin National Park, on rock, 12°28'04.4"N 108°20'39.0"E, elev. c. 622 m, 20.04.2012, S.O. Oh, J.S. Hur VN120053 (KoLRI).

REMARKS — *Sticta marginifera* (*Lobariaceae*) is characterized by the presence of secondary lobules and the coralloid isidia. According to Galloway (2001), the similar *S. brevipes* (Müll. Arg.) Zahlbr. also has similar flabellate lobes with thickened and revolute apices but does not produce secondary lobules.

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Literature cited

- Aptroot A, Feijen FJ. 2002. Annotated checklist of the lichens and lichenicolous fungi of Bhutan. *Fungal Diversity* 11: 21–48.
- Aptroot A, Seward MRD. 1999. Annotated checklist of Hong Kong lichens. *Tropical Bryology* 17: 57–101.
- Aptroot A, Sipman H. 1991. New lichens and lichen records from New Guinea. *Willdenowia* 20: 221–256.

- Aptroot A, Sipman HJM. 1997. Diversity of lichenized fungi in the tropics. 93–106, in KD Hyde (ed.), Biodiversity of Tropical Microfungi. Hong Kong, Hong Kong University Press.
- Aptroot A, Sparrius LB. 2006. Addition to the lichen flora of Vietnam, with an annotated checklist and bibliography. *Bryologist* 109(3): 358–371.
[http://dx.doi.org/10.1639/0007-2745\(2006\)109\[358:ATTLFO\]2.0.CO;2](http://dx.doi.org/10.1639/0007-2745(2006)109[358:ATTLFO]2.0.CO;2)
- Awasthi DD. 1988. A key to the macrolichens of India and Nepal. *Journ. of Hattori Bot. Lab.* 65: 239–242.
- Awasthi DD. 2007. A compendium of the macrolichens from India, Nepal and Sri Lanka. 580 p.
- Calvelo S, Liberatore S. 2002. Catalogo de los liquenes de la Argentina. *Kurtziana* 29(2): 7–170.
- Coppins BJ, Wolseley P. 2002. Lichens of tropical forests. 113–131, in: R Watling et al. (eds). *Tropical Mycology, Micromycetes*. CAB International, Oxon, UK.
- Divakar PK, Upreti DK. 2005. Parmelinoid lichens in India (a revisionary study). Bishen Singh Mahendra Pal Singh, India. 488 p.
- Egea JM. 1996. Catalogue of lichenized and lichenicolous fungi of Morocco. *Bocconea* 6: 19–114.
- Eliasaro S, Adler MT. 1997. Two new species and new reports in the *Parmeliaceae* sensu stricto (Lichenized *Ascomycotina*) from Brazil. *Mycotaxon* 63: 49–55.
- Elix JA. 1994. *Parmotrema*. *Flora of Australia* 55: 140–162.
- Elix JA, McCarthy P. 1998. Catalogue of the lichens of the smaller Pacific Islands. *Bibliotheca Lichenologica* 70: 5–361.
- Elix JA, Schumm F. 2001. A new species and new records in the lichen family *Parmeliaceae* (*Ascomycotina*) from the Philippines. *Mycotaxon* 79: 253–260.
- Fryday AM, Fair JB, Googe MS, Johnson AJ, Bunting EA, Prather LA. 2001. Checklist of lichens and allied fungi of Michigan. *Contributions to the University of Michigan Herbarium* 23: 145–223.
- Galloway DJ. 2001. *Sticta*. *Flora of Australia* 58A: 78–97.
- Giao VTP. 2009. New records of lichens from Vietnam. *Science & Technology Development*, 12(09): 54–60.
- Gowan SP, Brodo IM. 1988. The lichens of Fundy National Park, New Brunswick, Canada. *Bryologist* 91(4): 255–325.
- Hafellner J. 1995. A new checklist of lichens and lichenicolous fungi of insular Laurimacaronesia including a lichenological bibliography for the area. *Fritschiana* 5: 1–132.
- Hafellner J, Türk R. 2001. Die lichenisierten Pilze Österreichs eine Checkliste der bisher nachgewiesenen Arten mit Verbreitungsangaben. *Stafia* 76: 1–167.
- Hale ME. 1974. *Bulbothrix*, *Parmelina*, *Relicina* and *Xanthoparmelia*, four new genera in the *Parmeliaceae*. *Phytologia* 28: 479–490.
- Hale ME. 1975. A revision of lichen genus *Hypotrachyna* (*Parmeliaceae*) in tropical America. *Smithson. Cont. Bot.* 25: 1–73.
- Hughes R. 2010. The biodiversity of Chu Yang Sin National Park, Dak Lak Province, Vietnam. *Bird Life International in Indochina*. Hanoi, Vietnam. 173 p.
- Jørgensen P, Galloway DJ. 1992. *Pannariaceae*. *Flora of Australia* 54: 272–273.
- Joshi S, Jayalal U, Oh SO, Nguyen TT, Dzung NA, Hur JS. 2012. Lichen genus *Fissurina* Fée (*Graphidaceae*) from Vietnam. 173, in: Proceedings of the International Meeting of the Federation of Korean Microbiological Societies.
- Knezevic B, Mayrhofer H. 2009. Catalogue of the lichenized and lichenicolous fungi of Montenegro. *Phyton* 48(2): 283–328.
- Kurokawa S. 1960. *Anaptychia* (lichens) and their allies of Japan (3). *Jpn. Bot.* 35: 91–94.

- Kurokawa S. 1993. Nepalese genera and species of the *Parmeliaceae* with notes on three additional and rare species. *Ann. Tsukuba Bot. Gard.* 12: 75–81.
- Llimona X, Hladun NL. 2001. Checklist of the lichens and lichenicolous fungi of the Iberian Peninsula and Balearic Islands. *Bocconea* 14: 1–581.
- López-Figueiras M. 1986. Censo de macrolíquenes de los estados Falcón, Lara, Mérida, Táchiray Trujillo (Venezuela). Facultad de Farmacia, Universidad de Los Andes, Mérida.
- Marcelli MP. 1991. Aspects of the foliose lichen flora of the southern-central coast of Sao Paulo State, Brazil. 151–170, in DJ Galloway (ed.), *Tropical lichens: their systematics, conservation, and ecology*. Oxford University Press.
- Moberg R, Nash III TH. 2001. *Heterodermia*. 215, in TH Nash III et al. (eds.), *Lichen Flora of the Greater Sonoran Desert Region*.
- Nguyen TT, Joshi Y, Lücking R, Wang XY, Nguyen AD, Koh YJ, Hur JS. 2010. Notes on some new records of foliicolous lichens from Vietnam. *Taiwania* 55(4): 402–406.
- Nguyen TT, Joshi Y, Lücking R, Wang XY, Nguyen AD, Koh YJ, Hur JS. 2011. Seven new records of foliicolous lichens from Vietnam. *Mycotaxon* 117: 93–99. <http://dx.doi.org/10.5248/117.93>
- Orange A, James PW, White FJ. 2010. Microchemical methods for the identification of lichens. *British Lichen Society*. 101 p.
- Osorio HS. 1992. Contribucion a la flora liquénica del Uruguay. XXV. Lichenes publicados entre 1972 a 1991. *Anales del Museo Nacional de Historia Natural de Montevideo* 2(8): 43–70.
- Riddle LW. 1920. Lichens. 522–553, in CF Millspaugh (ed.), *The Bahama Flora*. NL Britton.
- Singh KP, Sinha GP. 2010. Indian lichens an annotated checklist. *Botanical Survey of India*. Kolkata.
- Sipman HJM. 1993. Lichens from Mount Kinabalu. *Tropical Bryology* 8: 281–314.
- Streimann H. 1986. Catalogue of the lichens of Papua New Guinea and Irian Jaya. *Biblioth. Lichenol.* 22: 1–145.
- Tenorio LU, Sipman HJM, Lücking R. 2002. Preliminary checklist of lichens from Costa Rica. Version 1.2 <http://archive.fieldmuseum.org/ticolichen/checklist.html>. [Accessed Nov. 2012].
- VARCC. 2009. Vietnam assessment report on climate change. Institute of Strategy and Policy on Natural Resources and Environment, Vietnam (ISPONRE).
- Verdon D. 1992. *Physma*. *Flora of Australia* 54: 193–196.
- Wei JC. 1991. An enumeration of lichens in China. International Academic Publishers, Beijing.
- Wolseley PA, Aguirre-Hudson B, McCarthy PM. 2002. Catalogue of the lichens of Thailand. *Bull. Nat. Hist. Mus. Lond. (Bot.)* 32(1): 13–59.