

Ten New Records of Mindanao Mosses collected from Camiguin Island, Philippines

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ABSTRACT

Ten new moss records from Camiguin Mountains are reported for Mindanao moss flora, namely: *Fissidens crispulus* Brid. var. *crispulus*, *Fissidens javanicus* Dozy & Molk., *Fissidens hollianus* Dozy & Molk., *Acroporium johannis-winkleri* Broth, *Radulina elegantissima* (Fleisch.) W.R. Buck & B.C. Tan, *Sematophyllum subpinnatum* Fleisch., *Clastrobryum cuculligerum* (Lac.) Tix., *Cyatophorum adiantum* (Griff.) Fleisch., *Cyatophorum spinosa* (C. Mull.) Fleisch., and *Herpetineuron tocecae* (Sull. & Lesq.) Card.

Keywords: new record, Mindanao moss flora, Camiguin

INTRODUCTION

The large and diverse Philippine moss flora has a modern checklist (Tan and Iwatsuki, 1991). Mindanao was cited as an important island, though it is still under-collection of moss taxa in northern Mindanao (Tan et al., 2000). Only a few publications mention the mosses of Camiguin Island (Tan et al., 2017; Lubos, 2016, 2015; Linis, 2010; Tan & Iwatsuki, 1991; Bartram, 1939).

Camiguin is a small and compact volcanic island province about 54 km southeast of Bohol Island and 10 km north of Misamis Oriental province in the island of Mindanao. With a land area measuring 291.87 sq. km, it lies in

the waters of Bohol Sea with geographic coordinates of 124°35' to 124°5' east longitude and 9°5' to 9°20' north latitude (DENR, 1998).

Camiguin has several volcanoes with Mt. Timpoong (1,525 masl) and Mt. Hibok-hibok (1,086 masl) as two of its highest peaks. The latter is classified as an active volcano and is considered a high-risk area (PHILVOCS, 1990). Mt. Timpoong-hibok-hibok natural monument (MTHNM) is the key biodiversity Area (kba) protected area was proclaimed by virtue of presidential proclamation 570 on March 9, 2004 pursuant to republic act 7586 (nipas act).

The number of moss species in the country has increased with each new botanical exploration conducted, especially in places not well collected (Tan et al., 2017; Lubos, 2016, 2015; Tan & Shevock, 2014, 2015; Azuelo et al., 2015; Tan et al., 2015).

OBJECTIVES OF THE STUDY

The objective of the study was to collect and identify the conservation status of the collected species of mosses found on selected mountains in Camiguin, Island.

METHODOLOGY

Survey of mosses was conducted in Mt. Timpoong and Mt. Hibok-hibok, Camiguin Province, Mindanao, Philippines. Entry protocol was observed in the study sites. Representative specimens of mosses were collected at the 10 m on each side of the trail from base to the upper portion of the three selected areas using alpha-taxonomy method. The specimens collected were classified and identified using the taxonomic keys of Bartram (1939) and other related references. Each species identified was described morphologically using different characters of the leaf (leaf arrangement, midrib, base, apex, margin, cells, and shape) and sporophyte (size, shape, texture of capsule and seta, number of teeth). A camera was used for documentation. Stereomicroscope, trinocular microscope and dissecting microscope were also used to identify and classify the species of mosses. The collected specimens of mosses were placed in a plastic bag or ziplock, labelled with the following data: collection number, collected by, altitude, name of the mountain, date of collection, and associated habitats. This was then air-dried and placed in a standard packets and was properly labeled for herbarium vouchers. A New Annotated Checklist of Iwatsuki and Tan (1991), scientific

journals and online journals, were used to determine the status of the collected specimen. Assessments of conservation status of mosses, whether New Record in the Philippines, new in Mindanao, new in terms of locality, rare, endemic, and widespread.

RESULTS AND DISCUSSION

A total of 218 packets of Philippine mosses were collected from Camiguin Island. These specimens were collected mainly from Mt. Hibok-Hibok and Mt. Timpoong. Of the collected packets, ten are found to be new records in Mindanao.

New Mindanao Moss Records

Species Description, Habitat and Distribution

Acroporium johannis-winkleri Broth

Plants are small, greenish brown, densely forming tuft, finely and highly branched. Main stems elongate, initially short creeping; branches erect, slightly curved, 5-7 mm long, densely foliate frequently cuspidate at tips; rhizoid few or absent; central strand absent. Leaves in several ranks, densely, erectopatent, often acicular when dry, slightly horizontal spreading, narrowly triangular to lanceolate, being broadest toward the base, 2.08-2.4 x 0.2-0.32 mm, margins plane, gradually tapered, tubulose and stiff, bristly apex; ecostate; laminal cells elongate, 50-87.5 x 5-7.5 μm , smooth, thick-walled, without papilla, at base middle such cells are smooth and seem a radiate towards margins; alar cells consisting of one row of 3-4 inflated hyaline to yellowish brown cells hyaline, incrassate, lowest row large, rectangular, 75-87.5 x 25-42.5 μm , supra-alar cells 1 to 2 rows of small and irregular hyaline cells above. Autoicous. Sporophytes on main stem, smaller and irregular shaped above. Perichaetial leaves erect, lanceolate, abruptly narrowed, long, slightly entire acumen. Seta erect, red, smooth below and pustulose distally above, 1.5 to 3 cm long; capsule inclined to horizontal, ovate, 1.2-1.4 x 0.6 mm; exothecial cells collenchymatous; operculum shortrostrate; peristome normal, double; exostome teeth 250-270 x 65-75 μm at abse, bordered, horizontally striped below; endostome basal membrane high, segments hyaline, as long as exostome, not split. Spores 18-24 μm in diameter. Illustration. — Tan (1994). Thailand. — PENINSULA. Nakornsrihammarat.

Discussion.—The species was unjustly reduced to a synonym of *A. longicuspis*

by Dixon (1935). The latter has a different leaf outline and possesses papillose leaf cells. Leaves of *A. johannis-winkleri* are 1.5 to 3 mm long and pustulose distally. In many ways, *A. johannis-winkleri* looks like large individuals of *A. diminutum* forming a loose tuft. The only other species that may be confused with it is *A. rigens*, which is a much bigger plant. Occasionally, atypical specimens of *A. sigmatodontium* with small and slightly falcate leaves may come close to *A. johannis-winkleri*. But the former is synoecious and has shorter setae, less than 1.5 cm long. Pollawatn, R. (2008). Systematic treatment of Sematophyllaceae (Musci) in Thailand. Retrieved from <http://hss.ulb.uni-bonn.de/2008/1449/1449.pdf>.

Distribution. — Borneo, Malaysia, and the Philippines.

Habitat. — The species is widespread in an evergreen forest along the stream on branches with a broad altitudinal range from 700 to more than 2000 m.

Specimen studied: on bark of tree trunk, Mt.Hibok-hibok, collected by Lubos, Lesley C. (2008,2010,2014).

***Clastrobryum cuculligerum* (Lac.) Tix**

Plants are in mats, frequently epiphytic on tree branches. Main stems prostrate, 1–2 cm long, with erect branches, ca. 1 cm long. Leaves strongly 3-ranked, ovate-lanceolate, 1.0–1.5 mm long, cybiform, strongly concave in upper half of lamina, acuminate at apex; leaf margins serrulate in the upper portion, serrate below; leaf cells linear, 60–80 mm long, smooth, sometimes prorate due to projection of the cell ends, slightly pitted, gradually becoming shorter toward margins; alar cells oval, thick-walled, colored. Propagula present on the upper branches. Autoicous. Inner perichaetial leaves, ovate-lanceolate, margins strongly toothed. Setae erect, 1–2 mm long, smooth; capsules ovoid to cylindrical, ca. 2 mm long; opercula shortly rostrate. On a fallen branch, 1150 m, HA-Cr 180 (Moss Flora of China (2009). Retrieved from <http://www.tropicos.org/Name/35186868?projectid=22>.)

Habitat: epiphytic on trees; alt. 2000–2200 m.

Distribution: China, Japan, Indonesia, and the Philippines.

Specimen studied: on the bark of tree trunk, Mt.Timpoong, collected by Lubos, Lesley C. ((2008,2010,2014).

***Cyatophorum adiantum* (Griff.)**

Plants are terrestrial, rhizomatous; stems creeping, 4 - 6 cm long, tomentose; branches erect, loosely caespitose, 3 - 5 cm high. Leaves lax, wide-spreading, slightly asymmetric, oblong-ovate, acuminate, 1-2.1 X 0.4 - 0.8 mm, serrate-spinose at apical margin; costa short, forked; apical cells rhomboid, 28 - 52 x 12 - 20 μ m; median cells elongate-hexagonal, 76-128 X 20 - 28 μ m, pitted; basal cells elongate-hexagonal, 62 - 158 X 28 - 46 μ m, pitted. Underleaves 1-rowed, symmetric, ovate-acuminate. Sporophyte not seen. Brijithlal, N.D., Mabel, J.L., & Daniels A.E.D. (2008). Additions To The Moss Flora Of Peninsular India From The Neyyar Wildlife Sanctuary, Kerala, India. Retrieved from http://shodhganga.inflibnet.ac.in/bitstream/10603/134005/16/16_publications.pdf.

Habitat: Terricolous, in evergreen forests, ca 950 m.

Distribution: Bhutan, Nepal, Philippines and India [West Bengal (Darjeeling), Meghalaya (Khasia Hills), Nagaland (Lushai Hills), Sikkim, W. Himalaya and Kerala]. N.D.Brijithlal, and Daniels

Specimen studied: on soil or on the ground, Mt.Timpoong, collected by Lubos, Lesley C. (2008,2010,2014).

***Cyatophorum spinosa* (C. Mull.) Fleisch**

Plants are robust, dull green; secondary stems to 5 cm long, tips caudate, to 1 cm wide with leaves, frequently with conspicuous clusters of orange-red brood filaments among leaves; leaves widely spreading, asymmetrical, broadly ovate, short acuminate with an arista to 200 μ m long, 4.5-6.0 mm long, 2.4-2.8 mm wide, widest below midleaf; margin spinose-serrate in upper third with long multicellular teeth; border not or weakly differentiated; costae short, single or forked; cells oval-hexagonal, 77-95 μ m long, 25-36 μ m wide, thin-walled; amphigastria broad, rounded ovate with an apiculus to 250 μ m. long, distantly spinose above; costae short, unequally forked; perichaetial leaves smaller than lateral leaves; ovate with a long arista. Dioicous. Sporophytes not seen.

REMARKS.-This species is recognized by the spinose-serrate margins in the upper part of the leaves. Closest relationship is to two other species with spinose-serrate margins which are found in adjacent regions, *C. adiantum* (Griffith) Fleischer (Himalayas, Assam, Thailand, Philippines, and Borneo) and *C. tonkinensis* (Brotherus & Paris) Brotherus (Japan, Ryukyus, Taiwan, Vietnam, Thailand, and Borneo). *Cyathophorella tonkinensis* is distinct in having more

densely foliate stems, mostly unicellular marginal teeth, and smaller amphigastria. *Cyathophorella adiantum* differs from *C. spinosa* in the less robust plants, the narrowly ovate leaves with longer acuminate apices, and the less toothed ovate amphigastria. Mohamed, H., Robinson, H. (1991). A Taxonomic Revision of the Moss Families Hookeriaceae and Hypopterygiaceae in Malaya. Retrieved from <https://repository.si.edu/bitstream/handle/10088/6990/scb-0080.pdf>.

Habitat: on soil and rock

Distribution: Thailand, Malaya, Java, Borneo, Moluccas, Philippines, Vanatua, and New Guinea.

Specimen studied: on soil or on the ground, Mt. Timpoong, collected by Lubos, Lesley C. (2008,2010,2014).

Fissidens crispulus* Brid. var. *crispulus

Plants are small, gregarious. Leafy stems simple or branched, 5.5–12.0 mm long, 2.0–2.5 mm wide, with leaf tips curled when dry; axillary hyaline nodules well differentiated; central strand not differentiated. Leaves in 10–24 pairs, often more or less densely arranged, but sometimes rather loosely arranged; middle to upper leaves lanceolate to narrowly lanceolate, 1.5–1.8 mm × 0.3–0.4 mm, broadly acute at apex; base of dorsal laminae rounded to wedge-shaped; vaginant laminae 1/2 –3/5 the leaf length; costa percurrent or ending a few cells below leaf apex; margins finely serrulate to crenulate above, entire below; cells of apical and dorsal laminae rounded-quadrate to rounded- hexagonal, 7–11 µm long, mammillose, obscure; cells of the vaginant laminae similar to those of apical and dorsal laminae, but larger and less mammillose, with thicker wall toward the base. Dioicous. Female inflorescences terminal. Perichaetial leaves differentiated, narrower and longer than stem leaves. Archegonia ca. 280 µm long. Setae 3.4–4.3 mm long, smooth; capsules often erect, symmetrical; urns shortly cylindrical, 0.5–0.6 mm long; exothecial cells shortly rectangular to rectangular-hexagonal, thin-walled; opercula long rostrate, 0.5–0.6 mm long; peristome teeth 0.2–0.3 mm long. Calyptrae campanulate, ca. 0.7 mm long. Spores not seen.

Fissidens crispulus is very common in southern China. It is well characterized by its lanceolate to narrowly lanceolate leaves with mammillose laminal cells, acute, tightly curled tips, and its remarkably differentiated hyaline nodules. Moss flora of China (2001). Retrieved from http://www.efloras.org/florataxon.aspx?flora_id=4&taxon_id=240002050).

Habitat: on soil or rocks;

Distribution: widespread in the Palaeotropics.

Specimen studied: on soil or on the ground, Mt. Timpoong and Mt. Hibokhibok, collected by Lubos, Lesley (2008,2010,2014).

***Fissidens javanicus* Dozy & Molk**

Plants are green, yellowish green to brownish. Leafy stems simple, but usually with innovations from the axils of upper leaves, 8–18 mm long, 2.3–4.0 mm wide; axillary hyaline nodules well developed; central strand only slightly differentiated. Leaves in 18–38 pairs, densely arranged; middle to upper leaves linear-lanceolate to lanceolate, 2.0–2.7 mm × 0.30–45 mm, acuminate at apex, the upper half of leaves usually more or less rugose; base of dorsal laminae often rounded; vaginant laminae ca. 1/2 the leaf length, upper part equal to somewhat unequal; costa stout, slightly excurrent; margins crenulate; margins of apical and dorsal laminae forming a thick band 2–3 cells wide and 2–3 cells thick; margins of vaginant laminae forming a thinner band 2–3 cells wide and 1 cell thick; cells of apical and dorsal laminae subisodiametric, 7–9 µm wide, thick-walled, mammillose; cells of vaginant laminae similar to those of apical and dorsal laminae, but slightly larger and well demarcated with thicker cell walls. Sporophytes not seen. Type. Indonesia: Java, Teysmann s.n. Moss flora of China (2001). Retrieved from http://www.efloras.org/florataxon.aspx?flora_id=4&taxon_id=240002064.

Habitat: on moist soil and rocks;

Distribution: China, Japan, Nepal, India, Sri Lanka, Myanmar, Thailand, Malaysia, Indonesia, the Philippines, and New Guinea.

Specimen studied: on soil or on the ground, Mt. Timpoong and Mt. Hibokhibok, collected by Lubos, Lesley (2008,2010,2014).

***Fissidens hollianus* Dozy & Molk.**

Plants are small, green to yellowish green. Leafy stems usually simple, 2.4–4.3 mm long, 0.8–1.7 mm wide; axillary hyaline nodules not developed; central strand not differentiated. Leaves in 6–12 pairs, densely arranged, the lowest leaves much smaller, middle and upper leaves almost equal in size, lanceolate to oblong-lanceolate, 0.8–1.0 mm × 0.2–0.3 mm, acute at apex; base of dorsal laminae rounded; vaginant laminae 1/2–3/5 the leaf length; costa light yellowish brown, percurrent to excurrent margins nearly entire; cells of apical and dorsal laminae quadrate to irregularly hexagonal, 5–6 µm long, thin-walled, dark and

obscure, pluripapillose; cells of vaginant laminae similar to those of apical and dorsal laminae, but longer, with thicker walls and fewer papillae toward the base near costa; limbidia usually found only on lower one-half of perichaetial leaves, composed of 2–5 rows of cells. Autoicous. Archegonia terminal, 210–235 µm long. Perichaetial leaves larger than stem leaves, ca. 1.3 mm long; base of dorsal laminae wedge-shaped, ending above the base. Sporophytes not seen. Type. Indonesia: Java, Holle 13 (holotype L). Moss flora of China. (2001). Retrieved from http://www.efloras.org/florataxon.aspx?flora_id=4&taxon_id=240002060).

Habitat: on rocks or tree trunks in shade;

Distribution: China, Japan, Thailand, Myanmar, Vietnam, Malay Peninsula, Indonesia, the Philippines, and New Guinea.

Specimen studied: on rocks, branches, and tree trunk, Mt. Timpoong, collected by Lubos, Lesley (2008,2010,2014).

***Herpetineuron toccoae* (Sull. & Lesq.) Cardot**

Plants are medium-sized, yellowish green to green above, dark green at base, caespitose in large loose mats. Stems irregularly branched; branches circinnate when dry. Moss flora of China, (2009). Retrieved from <http://www.tropicos.org/Name/35148630?projectid=22>).

Habitat: frequently on shady calcareous rocks, sometimes growing on tree trunks in deciduous forests; alt. 200–1000 m.

Distribution: China, Japan, Korea, India, Sri Lanka, Thailand, Indonesia, the Philippines, New Caledonia, South and North America.

Specimen studied: on rocks, branches, and tree trunk, Mt. Timpoong, collected by Lubos, Lesley (2008,2010,2014).

***Radulina elegantissima* (M. Fleisch.) W.R. Buck & B.C. Tan**

Plant habitat and leaf areolation are similar to *radulina hamata* var. *hamata*, except that the plant size is half as large, and the leaves are somewhat erect-spreading, but not strongly falcate-secund at the tip of the branches. Autoicous. Perichaetial leaves narrowly lanceolate, gradually long acuminate. Setae short to long, mostly 6–10 mm long, rarely reaching 15 mm long. Capsule small, less than 1 mm long. Spores 8–10 µm, slightly papillose. Tan, B.C., Koponen, T., & Norris, D.H. (2007). Bryophyte flora of the Huon Peninsula, Papua New

Guinea. LXX. Sematophyllaceae (Musci) 1. Acanthorrhynchium, Acroporium, Clastobryophilum, Pseudopiloecium, Radulina and Trichosteium. Retrieved from <http://www.sekj.org/PDF/anbf44/anbf44-supplA-035-078.pdf>.

Habitat: Grows both in lowland rainforests and in montane forests, including moss forests at 500-2400 m. Most of the habitats were taken also in disturbed and in badly logged areas as well. It is both epiphytic and epiphyllic, but grows preferably on rotten wood in diffusely lit or shaded conditions. The substrate information includes log, bark of tree, nodes of bamboo, and moist shaded leaf.

Distribution: Huon Peninsula, the Philippines.

Specimen studied: on rocks, branches, and tree trunk, Mt. Timpoong, collected by Lubos, Lesley (2008,2010,2014).

***Sematophyllum subpinnatum* Fleisch**

Plants are small to medium-sized, green or yellowish, dull. Stems 0.3-0.6 cm, branches reclining. Leaves homomallous, ovate to oblong-lanceolate, tapering abruptly to apex, 0.5-1.1 mm; margins reflexed; apex short-acuminate; alar cells somewhat enlarged, not inflated, light brown, in 1 row, supra-alar cells in several rows, quadrate; laminal cells rhomboidal to elliptic. Specialized asexual reproduction absent. Seta 0.5-1 cm. Capsule suberect, 1-1.5 mm. Capsules mature winter. *Sematophyllum subpinnatum* sometimes persists briefly in greenhouses. Flora of North America (1993). Retrieved from http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250099383).

Habitat: Logs, bark of trees, humid forests, soil; low elevations;

Distribution: Fla., La.; Mexico; West Indies; Central America; South America; Asia; Africa; Pacific Islands (Hawaii); Australia., the Philippines.

Specimen studied: on branches and tree trunk, Mt. Timpoong, collected by Lubos, Lesley (2008,2010,2014).

CONCLUSION

The study was able to collect and identify Ten new Mindanao mosses in Mt. Timpoong and Mt. Hibok-hibok. This will be another additional data in Camiguin Island as regards to the moss diversity and taxonomy.

ACKNOWLEDGMENTS

The researcher would like to thank the late Dr. Benito C. Tan and Singapore Botanic Gardens for the joint botanical expeditions to Camiguin Island. Also, to Local Government Unit and community of Camiguin Island for the assistance in the conduct of the study. To Liceo de Cagayan University and Bukidnon State University which inspired me to finish this paper.

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