

A SMALL COLLECTION OF THAI MOSSES MADE BY J. F. MAXWELL AT THE HERBARIUM OF CALIFORNIA ACADEMY OF SCIENCES IN UNITED STATES

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ABSTRACT

A small collection of unidentified Thai mosses made by J. F. Maxwell deposited at the herbarium of California Academy of Science (CAS) was studied and identified. The collection consists of 16 species in 14 genera and 12 families, with one taxon, *Brachymenium longidens*, representing a new moss record of Thailand.

Keywords: *Brachymenium*, CMU moss database, moss, new species record, Thailand

INTRODUCTION

James F. Maxwell, one of the better known and respected vascular plant taxonomists in Thailand, passed away on May 12, 2015. His many contributions to the Thai flora, both in the field study and herbarium documentation of plant diversity, are reported in the two obituaries prepared by BROCKELMAN (2015) and WEBB *ET AL.* (2016). His vast knowledge of the Thai vascular flora and types of vegetation can be read from his two important publications, namely, MAXWELL & ELLIOT (2001) and MAXWELL (2004).

Little do people know that Maxwell also had an interest in bryophytes. At his resident herbarium (the Herbarium of the Pharmacy Faculty [CMU]) at Chiang Mai University, he not only encouraged students to study the regional bryophyte diversity, but he also collected and deposited a good number of bryophyte specimens obtained from his survey of the many ecological plots conducted around Thailand (see PRINTARAKUL *ET AL.*, 2009).

Outside Thailand, the herbarium of the California Academy of Sciences (CAS) in San Francisco received a small set of 30 unidentified Thai bryophyte specimens. Many of these collections have duplicates deposited at CMU.

The bryophyte specimens collected by J. F. Maxwell, like his vascular plant specimens, were neatly pressed flat in between a pair of plant pressers. Each of the heat-dried specimens bears a large label containing the locality information, and additionally, a description of the plant habit and color of the fresh plant observed in the field. While the field notes of the specimens help to visualize the moss plant in its living state, the flattened and crispy dried specimen becomes a problem for accurate species identification. To identify a bryophyte

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specimen, it is customary to soak the air-dried (not heat dried) plant in water to regain the original plant habit and the shape of the leaves and leaf cells for observation of characters. In the case of the bryophyte specimens processed by Maxwell, such a revival of the original form and shape of the dry plant in water is no longer possible. Nevertheless, we managed to identify this set of dried moss specimens kept at CAS, albeit with difficulty, to 16 species belonging to 14 genera and 12 families. A few collections with ample material were further divided to provide a duplicate for the UC (University of California) herbarium.

Below we report, with comments where relevant, the species identification and locality information of the Thai moss collections of Maxwell sent to CAS. Of the 16 moss species identified, *Brachymenium longidens* is new to the Thai moss flora. The new moss species record has been checked against the electronic moss checklist of Thailand hosted by the MO (Missouri Botanical Garden) website (<http://www.mobot.org/MOBOT/moss/Thailand/thai-t.shtml>) and also the recently published moss database of the herbarium of Chiang Mai University (Biology) (see PRINTARAKUL *ET AL.*, 2009). In localities of specimens examined, we retain the original spelling of localities in Maxwell's notes, although it frequently differs from the official spelling on Thai maps.

LIST OF MOSS TAXA

Brachymenium longidens Renauld & Cardot [Bryaceae]

Specimen examined: **Chiang Mai Province**. Muang District, Doi Sutep, southeast side below the King's Palace, 1300 m msl (above mean sea level), on tree trunk in deciduous forest, 5 Sep. 1987, *J. F. Maxwell B-49* (CAS, CMU, UC).

Note: This is a new species record for the moss flora of Thailand. The same collection number at CMU was determined as *B. nepalense* Hook. (PRINTARAKUL *ET AL.*, 2009). *Brachymenium longidens* differs from *B. nepalense* in having a broader leaf border consisting of 3–6 rows of elongate to linear cells. The latter has a narrow leaf border with 1–3 rows of elongate to linear cells (ZHANG *ET AL.*, 2007).

Brachymenium nepalense Hook. [Bryaceae]

Specimen examined: **Lamphun Province**. Mae Tah District, Doi Kuhn Dahn National Park, on large granite boulder in open area in mixed pine and primary evergreen hardwood forest along summit ridge of and slightly below the summit of Doi Kuhn Dahn, 1350 m msl, 26 Sep. 1993, *J. F. Maxwell B-94* (CAS, CMU).

Bryum coronatum Schwägr. [Bryaceae]

Specimens examined: **Chiang Mai Province**. Muang District, Doi Sutep, east side, above Pah Ngeub, 550 m msl, on broken tree trunk in partly shaded and partly moist place in dipterocarp-oak forest, 28 Apr. 1988, *J. F. Maxwell B-56* (CAS, CMU); Chiang Dao District, Doi Chiang Dao Animal Sanctuary, northwest side between Bah Giah station and Huay Mae Gawk station, 1325 m msl, on rotten log in open, disturbed fire damaged area in seasonal, mixed evergreen hardwood pine forest, 9 Sep. 1995, *J. F. Maxwell B-102* (CAS, CMU). **Phrae Province**. Song District, Mae Yom National Park, northern part, west side of Yom River, 225 m msl, on charred tree stump in open place in disturbed dipterocarp forest. 14 Nov. 1991, *J. F. Maxwell B-82* (CAS, CMU).

Rhodobryum giganteum (Schwägr.) Paris [Bryaceae]

Specimen examined: **Chiang Mai Province**. Muang District, Doi Sutep-Doi Pui National Park, 1685 m msl, on tree trunk in plantation of *Cupressus tortulosa* D. Don ex Lamb., 15 Oct. 1988, *J. F. Maxwell B-65* (CAS, CMU).

Cyathophorum adiantum (Griff.) Mitt. [Daltoniaceae]

[syn. *Cyathophorella tonkinense* (Broth. & Paris) Broth.]

Specimen examined. **Chiang Mai Province**. Muang District, Doi Suthep-Pui National Park, summit of Doi Pui, 1685 m msl, on shaded tree trunk in plantation of *Cupressus tortulosa*, 15 Oct. 1988, *J. F. Maxwell B-67A* (CAS, CMU).

Erythrodontium julaceum (Hook. ex Schwägr.) Paris [Entodontaceae]

Specimen examined: **Chiang Mai Province**. Mae Rim District, Doi Sutep-Doi Pui National Park, north side, Mae Sa Botanical Garden, along Mae Sa Noi stream, 750 m msl, on moist, shaded tree trunk in disturbed, fire prone area in mixed forest with many bamboo, 2 Oct. 1990, *J. F. Maxwell B-77* (CAS, CMU).

Funaria hygrometrica Hedw. [Funariaceae]

Specimens examined: **Chiang Mai Province**. Muang District, Doi Sutep-Pui National Park, east slope of Doi Pui, 1500 m msl, on gravelly soil in partly open, fire disturbed area of primary evergreen forest, 15 Oct 1988, *J. F. Maxwell B-70* (CAS, CMU); Muang District, Doi Sutep, below Pu Ping Palace, 1300 m msl, on slightly shaded and damped ground in deciduous forest, 31 Oct 1987, *J. F. Maxwell B-51* (CAS, CMU); *ibid.*, above Pu Ping Palace, 1450 m msl, on shaded soil embankment in deciduous forest, 21 Nov. 1987, *J. F. Maxwell B-54* (CAS, CMU). **Lamphun Province**. Mae Tah District, Doi Kuhn Dahn National Park, on soil in open burned area in mixed pine and primary evergreen hardwood forest along summit ridge of and slightly below the summit of Doi Kuhn Dahn, 1350 m msl, 26 Sep. 1993, *J. F. Maxwell B-93* (CAS, CMU).

Macrothamnium macrocarpum (Reinw. & Hornsch.) M. Fleisch. [Hylocomiaceae]

Specimen examined: **Chiang Mai Province**. Muang District, Doi Sutep-Doi Pui National Park, 1685 m msl, on trunk of *Cupressus tortulosa* in plantation, 15 Oct. 1988, *J. F. Maxwell B-66* (CAS).

Foreauella orthothecia (Schwägr.) Dixon & P. de la Varde [Hypnaceae]

Specimen examined: **Chiang Mai Province**. Muang District, Doi Sutep, east side, CMU Observatory area, 850 m msl, on tree trunk in deciduous forest, 8 Oct. 1988, *J. F. Maxwell B-64* (CAS, CMU).

Note: This species is diagnostic in having tumid branches all curled at tip or falcately oriented in one direction. It is a moss species distributed from the northern part of the Indian subcontinent to Indochina with disjunct populations in the northern Luzon highland of the Philippines (BARTRAM, 1939; GANGULEE, 1978). The duplicate of this collection kept at CMU was misidentified as *Heterophyllum affine* (Hook.) M. Fleisch. (see PRINTARAKUL *ET AL.*, 2009).

Leucobryum aduncum Dozy & Molk. var. *scalare*

(Müll. Hal. ex M. Fleisch.) A. Eddy [Leucobryaceae]

Specimens examined: **Chiang Mai Province**. Muang District, Doi Sutep-Pui National Park, southeast side below the King's Palace, 1300 m msl, on tree trunk in deciduous forest, 5 Sep. 1987, *J. F. Maxwell B-48* (CAS, CMU); *ibid*, Doi Sutep, Paping Palace, 1500 m msl, on tree trunk in shaded place in single-storied evergreen forest, 4 Aug 1988, *J. F. Maxwell B-60* (CAS, CMU); *ibid*, Doi Sutep, east side, on hill opposite to and south of Doi Sutep Temple, 950 m msl, on tree trunk in shaded place in dipterocarp-oak forest, 7 Jul. 1988, *J. F. Maxwell B-58* (CAS, CMU).

Macromitrium sulcatum (Hook.) Brid. [Orthotrichaceae]

Specimens examined: **Chiang Mai Province**. Muang District, Doi Sutep-Pui National Park, 1620 m msl, on shaded tree trunk in moist and disturbed primary evergreen forest, 22 Sep. 1991, *J. F. Maxwell B-80* (CAS); *ibid*, just below the summit of Doi Pui, 1675 m msl, on hardwood stump in open burnt area of mixed evergreen hardwood pine forest, 29 May 1992, *J. F. Maxwell B-27* (CAS).

Macromitrium ferriei Cardot & Thér. [Orthotrichaceae]

Specimen examined: **Lamphun Province**. Mae Tah District, Doi Kuhn Dahn National Park, on large granite boulder in mixed pine and primary evergreen hardwood forest along summit ridge of and slightly below the summit of Doi Kuhn Dahn, 1350 m msl, 26 Sep. 1993, *J. F. Maxwell B-92* (CAS, CMU).

Note: The duplicate of this moss collection at CMU herbarium database is reported only as "*Macromitrium* sp." (see PRINTARAKUL *ET AL.*, 2009).

Racopilum orthocarpum Wilson ex Mitt. [Racopilaceae]

Specimen examined: **Chiang Mai Province**. Muang District, Doi Suthep-Pui National Park, summit of Doi Pui, 1685 m msl, on trunk of *Cupressus* plantation, 15 Oct. 1988, *J. F. Maxwell B-68* (CAS, CMU).

Rhachithecium perpusillum (Thwaites & Mitt.) Broth. [Rhachithecaceae]

Specimen examined: **Chiang Mai Province**. Muang District, Doi Sutep-Pui National Park, 1650 m msl, on tree trunk in exposed place in evergreen scrub forest on summit ridge of Doi Pui, 15 Oct. 1988, *J. F. Maxwell B-71* (CAS, CMU).

Note: PRINTARAKUL *ET AL.* (2009) made the first report of *Rhachithecium perpusillum* from the country based on the same Maxwell collection listed above. Yet, the species and the genus are not included in the current electronic moss checklist of Thailand hosted at MO website. According to IWATSUKI & SHARP (1976), *Rachithecium perpusillum* has a disjunctive distribution in tropical regions of Africa, Asia and South America.

Mastopoma robinsonii (Broth.) E.B. Bartram [Sematophyllaceae]

Specimens examined: **Chiang Mai Province**. Muang District, Doi Sutep-Pui National Park, east side, Ru-see Cave, 1125 m msl, on moist rotten log in shaded, fire-disturbed area in the primary evergreen hardwood forest, 3 Sep. 1992, *J. F. Maxwell B-84* (CAS, CMU); *ibid*, Jawm Tong District, Doi Inthanon National Park, off the main road to Mae Jam, 1700 m msl, on tree stump in shaded understory of moist primary evergreen forest, 23 Sep. 1991, *J. F. Maxwell B-81* (CAS).

Note: POLLAWATN (2008) reported *Mastopoma robinsonii* from a collection from Surat Thani Province as a new species record for Thailand. The Chiang Mai collection of Maxwell 84 matches well the photo illustrations of the type specimen of this species shown in POLLAWATN (2008). Duplicate collection of Maxwell 84 was identified as “*Isopterygium* sp.” in the CMU moss database (see PRINTARAKUL *ET AL.*, 2009).

***Pelekium gratum* (P. Beauv.) A. Touw [Thuidiaceae]**

Specimen examined: **Chiang Mai Province.** Mae Rim District, Doi Sutep-Pui National Park, north side, Mae Sa Botanical Garden, along Mae Sa Noi stream, 650 m msl, on rotten long in moist, shaded place along stream in mixed evergreen, deciduous forest, 8 Aug. 1989, J. F. Maxwell B-75 (CAS, CMU).

Note: The collection was reported inaccurately as *Thuidium plumulosum* (Dozy & Molk.) Dozy & Molk. in the CMU moss database (see PRINTARAKUL *ET AL.*, 2009). Although the two taxa have been confused in several specimens seen in herbaria, *Thuidium plumulosum* is a much larger plant than *Pelekium gratum*. The paraphyllia of *Thuidium plumulosum* are strongly forked, while those of the latter are short and unbranched (TOUW, 2001). *Pelekium gratum* is a widespread species in tropical parts of Africa, Continental Asia (including Thailand), Malesia, Melanesia and Oceania, reaching Queensland of Australia (TOUW, 2001; HO *ET AL.*, 2015). It is not listed in the electronic moss checklist of Thailand hosted at MO website.

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