

## New moss records for Taiwan

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### Abstract

Fifteen mosses are reported as new for Taiwan with eight species representing the first record for all of China. Four species previously reported for Taiwan but not cited with a specimen in the Moss Flora of China are also provided. References to illustration of all the taxa reported are provided.

### Introduction

Although Taiwan has a long history of bryological exploration since the Japanese period during the early 20<sup>th</sup> century, species new to Taiwan and even new to science are still being discovered among its high-quality forests (He 2008; He et al. 2009; Higuchi and Lin 2005). Much of mountainous Taiwan is steep in rugged terrain with limited trail and road access. Taiwan has 268 mountain peaks over 3000 m, and Yushan at 3952 m is the tallest point in southeast Asia. For its size at only 36,193 km<sup>2</sup>, Taiwan should clearly be one of the bryological ‘hot spots’ in Asia. Moreover, the protection of forests through land-use policies and practices is among the most effective in all of Asia with many established forest reserves and national parks. It is likely to be one of the few land areas in Asia that is not losing forest cover due to exploitation of its forest resources. Taiwan has protected its forests to reduce impacts of flooding and landslides caused by heavy rains during the monsoon season and from intense typhoons.

Moss, liverwort and hornwort checklists have been produced for China (Redfearn et al. 1996; Piippo 2000; Jia and He 2013), and more specifically for Taiwan (Chiang and Kuo 1989; Chiang et al. 2001; Kuo and Chiang 1987; 1988; Lin 1988). Over the years with ongoing collection and inventory, new distribution records were incorporated into the recently completed 8 volume set of the *Moss Flora of China English version* (MFC 1999–2011) and its Chinese companion, the projected 12 volume *Flora Bryophytarum Sinicorum* (FBS 1994–2011) that also contains liverworts and hornworts. Nonetheless, even with these recent floristic works, much inventory work remains in mainland China and Taiwan. In this work, we rely primarily on the species distribution range for China as reported in MFC and FBS as the most recent monographic treatments and assessments based on review of specimens in herbaria. However, many mosses that have been previously documented as occurring in Taiwan are omitted in the cited specimens section and distribution maps in MFC. In these cases, we have added new records below for taxa that we have examined to validate the distribution of these species for Taiwan. In a few cases, taxa reported for Taiwan in earlier literature proved to be based on misidentified specimens, and therefore, they were excluded in MFC and FBS. Subsequently, a Taiwan specimen has now been

confirmed and these taxa are re-instated and listed below. Since species and generic circumscriptions change as new information becomes available, all species checklists should be based on cited voucher specimens so that source information and documents can be re-evaluated in the future.

In summary, many of the new records reported in this work are members of the Sematophyllaceae, a family well studied by the third author. This family has many species that colonize small twigs and branches in the forest canopy, and therefore, they are less frequently encountered. Most often these canopy dwellers are collected only when recently fallen branches become available on the forest floor. The Taiwan specimens obtained by the first author have recently been collected this way, and many of these new records reported here are based on these epiphytic specimens growing on branches and twigs.

### New moss records for Taiwan

#### *Acroporium downii* (Dixon) Brotherus [Sematophyllaceae]

Illustrations: Tan (1994, p. 266).

Notes: This is a widespread Malesian species (see Tan 1994). Taiwan is most likely its northernmost range. Its presence in Taiwan is also viewed as a new record for China.

**Specimens examined: Taiwan: Taitung County:** Along Jinshueiying National Trail near trail junction to Mt. Guzailun, 1420 m, 14 Jun 2006, *Shevock & Yang 28825* (CAS, MO, TAIE).

#### *Acroporium joannis-winkleri* Brotherus [Sematophyllaceae]

Illustrations: Tan (1994, p. 266).

Notes: The small plant size of less than 10 mm tall coupled with erect spreading and tubulous leaves identify this species. As a new Taiwan record, it is also a new record for China.

**Specimens examined: Taiwan: Pingtung County:** Along Jinshueiying National Trail toward Mt. Guzailun, on hardwood trunk, 1450 m, 14 Jun 2006, *Shevock & Yang 28790* (CAS, MO, TAIE).

#### *Acroporium strepsiphylum* (Montagne) B.C.Tan in Touw [Sematophyllaceae]

Illustrations: MFC 8, p. 12; FBS 8, p. 71; Tan (1994, p. 287).

Notes: This is a widely scattered species in Malesia (Tan 1994) and subtropical region of mainland China (MFC 8, p. 11 & 12) and newly found in Taiwan is expected.

**Specimens examined: Taiwan: Nantou County:** Sitou Forest Recreation Area, north slope of Alisan Range along road beyond University Pond on *Cryptomeria japonica* trunk in filtered light, 1225 m, 30 Sep 2008, *Shevock & Yao 31988* (CAS, KUN, MO, TAIE).

#### *Calypothecium phyllogonioides* A.Noguchi & Li Xing-jiang [Pterobryaceae]

Illustrations: MFC 5, p. 221; FBS 5, p. 252.

Notes: Among its congeners in China, it is the only species that has a distinctive, distichously arranged foliation. It is known from Hainan and subtropical part of Yunnan and is a new record for Taiwan.

**Specimens examined: Taiwan: Hsinchu County:** Siakaluo National Trail at the 15.5 km trail marker, Baishih River watershed. On hardwood liana in filtered light, 1330 m, 3 Nov 2012, *Shevock, Yao, Chu & Tsai 41389* (CAS, MO, TAIE).

#### *Fissidens gedehensis* Fleischer [Fissidentaceae]

Illustrations: Suzuki and Iwatsuki (2011, p. 33).

Notes: According to Suzuki and Iwatsuki (2011), *F. gedehensis* is known from Sri Lanka, Malaysia, Indonesia and New Guinea. It is new for Taiwan and also China.

**Specimens examined: Taiwan: Hsinchu County:** Along Siakaluo National Trail between km markers 19.5 & 20, 1400 m, 3 Nov 2012, *Shevock, Yao, Chu & Tsai 41403* (CAS, TAIE), along a 5 km long trail from Smangus Resort to grove of large *Chamaecyparis* trees, 1575 m, 4 Nov 2012, *Shevock, Yao & Chu 41421* (CAS, MO, TAIE). Determined by Ronald A. Pursell.

***Gammiella panchienii*** B.C.Tan & Yu Jia ex B.C.Tan [Sematophyllaceae]

Illustrations: MFC 8, p. 31; FBS 8, p. 15.

Notes: Known formerly as a mainland Chinese endemic (MFC 8, p. 30 & 31), it was recently reported for the Philippines (Linis and Tan 2010). It is now found also in Taiwan.

**Specimens examined: Taiwan: Nantou County:** Sun-Link-Sea Forest Recreation Area along trail to Blue Dragon Waterfall along Jia-Jou-Liao Stream, on *Cryptomeria japonica* branch, 1655 m, 1 Oct 2008, *Shevock & Yang 32051* (CAS, MO, TAIE, UC).

***Hymenodon sericeus*** (Dozy & Molkenboer) C.Müller Hal. [Orthodontaceae]

Illustrations: Tessler (2012, p. 513).

Notes: Genus and species new for China. The Taiwan occurrence is the northernmost extension of the genus *Hymenodon*. Here it is growing on trunks of *Cyathea* tree ferns associated with *Spiridens reinwardtii*, also the northernmost occurrence for this genus and species in China.

**Specimens examined: Taiwan: Taitung County:** Along Jinshueiyang National Trail near junction of Mt. Guzailan, 1420 m, 14 Jun 2006, *Shevock & Yang 28818* (CAS, MO, TAIE).

***Meiothecium macrocarpum*** (W.J.Hooker) Mitten [Sematophyllaceae]

Illustrations: Fleischer (1923, p. 1232).

Notes: The history of the Chinese reports of *Meiothecium* was reviewed by Tan and Jia (1999) who considered the genus doubtfully present in China and Taiwan without a correctly identified specimen. Here we report a confirmed specimen of *M. macrocarpum* from Taiwan, and as a new record also for China.

**Specimens examined: Taiwan: Nantou County:** Huisun Forest Recreation Area between Fording and Frog Rock trails off of highway 80, on hardwood trunk, 650 m, 27 Oct 2011, *Shevock, Yang & Yao 39083* (CAS, KUN, MO, TAIE, UC).

***Papillidiopsis stissophylla*** (Hampe & C.Müller Hal.) B.C.Tan & Yu Jia [Sematophyllaceae]

Illustrations: Fleischer (1923, p. 1317, as *Trichosteleum stisophyllum* (Hampe) A. Jaeger)

Notes: This is mainly a Malesian species. Although this species was reported for Taiwan by Redfearn et al. (1996) as *Trichosteleum stissophyllum* and listed by Chiang and Kuo (1989) as *Rhaphidostichum stissophyllum*, and repeated again in Chiang et al. (2001), this species reference was based on misidentified material (Tan and Jia 1999). This species is, however, not reported in MFC or FBS. With this confirmed specimen listed below we now re-instate this species as new for Taiwan and China.

**Specimens examined: Taiwan: Taipei City:** Lalashan National Forest Reserve along Ba-Fu Cross Ridge National Trail near km marker 13 below junction with trail to Lalashan Peak, 1500 m, 12 Sep 2007, *Shevock & Yang 30553* (CAS, MO, TAIE, UC).

***Sematophyllum phoeniceum*** (C.Müller Hal.) Fleischer [Sematophyllaceae]

Illustrations: Gangulee (1978, p. 1882).

Notes: New for Taiwan. This formerly known Southeast Asian species (see Gangulee 1978) has now been shown to be widely distributed across insular Malesia to New Caledonia (Thouvenot & Bardat 2013).

**Specimens examined: Taiwan: Keelung City:** Hai Hsing Trail, on *Machilus* trunk, 100 m, 4 Nov 2009, *Shevock, Yang & Yao 33880* (CAS, MO, TAIE); **Taichung City:** Guguan Scenic Area at hot springs resort of Guguan adjacent to Dijia River. On hardwood trunk, 600 m, 9 Nov 2009, *Shevock & Yao 33980* (CAS, MO, TAIE); Basianshan National Forest Recreation Area. Along trail to Basianshan about 1 km above the Jinghai Temple, on rotten hardwood log, 1360 m, 10 Nov 2009, *Shevock & Yao 34015* (CAS, MO, TAIE).

***Taxithelium lindbergii*** (A.Jaeger) Renaud & Cardot [Pylaisiadelphaceae]

Illustrations: Câmara (2011, p. 14).

Notes: The treatment in MFC and FBS differs markedly from the recent monograph by Câmara (2011) where several Asian and Chinese taxa are relegated into synonymy of this species.

**Specimens examined: Taiwan: Taitung County:** Along Jinshueiyang National Trail between Mt. Guzailun and Mt. Kulibabao, 1100 m, 14 Jun 2006, *Shevock & Yang 28828* (CAS, MO, TAIE, UC).

***Trichosteleum pseudomammosum*** Fleischer [Sematophyllaceae]

Illustrations: Fleischer (1923, p. 1320).

Notes: This species is often confused with *Trichosteleum boschii* (Dozy & Molkenboer) A. Jaeger (see Tan et al. 2007). Its earlier reports from China in Redfearn et al. (1996) had been corrected by Tan and Jia (1999) to other species. Here we report the first confirmed record of this species from Taiwan, which is also a new record for China.

**Specimens examined: Taiwan: Nantou County:** Taiwan Forestry Research Institute, Lienhuachih Branch Station, along path to weir 5, tributary to Huopeikeng Stream, on base of hardwood trunk and soil, 750 m, 10 Nov 2012, *Shevock & Yang* 41634 & 41635 (CAS, TAIE, UC).

***Trichosteleum stigmatosum*** Mitten [Sematophyllaceae]

Illustrations: MFC 8, p. 70; FBS 8, p. 78.

Notes: New for Taiwan.

**Specimens examined: Taiwan: Nantou County:** North slope of Alisan Range, Sun-Link-Sea Forest Recreation Area, trail to Blue Dragon Falls above Jia-Jou-Liao Stream, 1655 m, 1 Oct 2008, *Shevock & Yang* 32064 (CAS, MO, TAIE).

***Vesicularia hainanensis*** Chen Pan-chieh [Hypnaceae]

Illustrations: MFC 8, p. 256; FBS 8, p. 246.

Notes: *Vesicularia hainanensis* is close in leaf morphology to the widespread *V. reticulata* (Dozy & Molkenboer) Brotherus. The two species may prove to be synonymous in future study. It is here reported as a new record for Taiwan.

**Specimens examined: Taiwan: Keelung City, Nuannuan District:** trail along East Fork Song Shi Stream, Nuandong Valley Recreation Area, 165 m, 4 Nov 2009, *Shevock, Yang & Yao* 33859 (CAS, MO, TAIE).

***Warburgiella breviseta*** (Brotherus) Brotherus [Sematophyllaceae]

Illustrations: Bartram (1939, p. 340).

Notes: This species was treated as a member of *Trichosteleum* by Bartram (1939) because of its unipapillose leaf cells. But the overall leaf morphology and sporophyte characters ally it closer to *Warburgiella*. It is a new record for Taiwan and also a new record for China.

**Specimens examined: Taiwan: Taipei City:** Lalashan National Forest Reserve, along Ba-Fu Cross Ridge National Trail between km markers 12 & 13, on *Chamaecyparis* branch in filtered light, 1450 m, 12 Sep 2007, *Shevock & Yang* 30563 (CAS, KUN, MO, TAIE).

### Species previously reported for Taiwan not cited in text or distribution map in *Moss Flora of China* (MFC)

***Chionostomum rostratum*** (Griffith) C.Müller Hal. [Sematophyllaceae]

Illustrations: Tan and Jia (1999, p. 35).

Notes: This wide-ranging species also occurs in Southeast Asia including the Philippines, so the Taiwan record is within the species range. However, nearly all of the past reports of this species occurring in China (Redfearn et al. 1996) were based on misidentifications (see Tan and Jia 1999).

**Specimens examined: Taiwan: Miaoli County:** Xuejian Recreation Area, Shei-Pa National Park near km road marker 21.5 about 4.5 km below Visitor Center, on rotten log, 1725 m, 9 Oct 2013, *Shevock, Higuchi & Akiyama* 43816 (CAS, TAIE); **Nantou County:** Sun-Link-Sea Forest Recreation Area, along the 10 km contour trail to Lucynshan to Shueiyang Forest, 1940 m, 8 Nov 2012, *Shevock, Yao & Chu* 41526 (CAS, TAIE).

***Fissidens jungermannioides*** Griffith [Fissidentaceae]

Illustrations: MFC 2, p. 43.

Notes: Reported for Taiwan (Redfearn et al. 1996) but apparently based on a mis-identified specimen since it is not listed in volume 3 of MFC.

**Specimens examined: Taiwan: Nantou County:** along path to Weir 2, Taiwan Forestry Research Institute, Lienhuachih Branch Station, 710 m, 10 Nov 2012, *Shevock & Yang 41662* (CAS, MO, TAIE). Determined by Ronald A. Pursell.

***Gammiella ceylonensis*** (Brotherus) B.C.Tan & W.R.Buck [Sematophyllaceae]

Illustrations: Tan and Buck (1989, p. 313).

Notes: Reported for Taiwan by Redfearn et al. (1996) but not confirmed by Chiang et al. (2001).

**Specimens examined: Taiwan: Nantou County:** Sun-Link-Sea Forest Recreation Area along ridge trail to Jinganshu Mountain, 2040 m, 7 Nov 2012, *Shevock & Yao 41499* (CAS, KUN, MO, TAIE, UC) and along trail to Blue Dragon Waterfall above Jia-Jou-Liao Stream, 1655 m, 1 Oct 2008, *Shevock & Yang 32065* (CAS, MO, TAIE).

***Oedocladium serricuspe*** (Brotherus) A.Noguchi & Z.Iwatsuki [Myuriaceae]

Illustrations: MFC 5, p. 210; Noguchi (1994, p. 1073).

Notes: This species was reported from Taiwan in Noguchi (1994), but the Taiwan record is not mentioned in MFC 5. Here we report a confirmed specimen of the species from Taiwan.

**Specimens examined: Taiwan: Nantou County:** Taiwan Forestry Research Institute, Lienhuachih Branch Station, along path to Weir 4, tributary of Huopeikeng Stream, 835 m, 10 Nov 2012, *Shevock & Yang 41642* (CAS, KUN, MO, TAIE, UC).

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