

MOSSES NEW TO VIETNAM

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ABSTRACT

Nine moss species are reported new to Vietnam as well as new localities and information on *Gammiella rugosa* and *Yakushimabryum subintegrum* from the country.

Keywords: Bidoup-Nui Ba, bryophyte, Lam Dong, mosses, Tam Dao, Vinh Phuc

INTRODUCTION

The first list of mosses of Vietnam was published by PÓCS (1965). TAN & IWATSUKI (1993) compiled a checklist of mosses of Vietnam, Laos, Cambodia, Myanmar and Thailand based on literature. According to them, 595 species in 180 genera of mosses were reported from Vietnam. Recently HE & NGUYEN (2012) revised the list of Vietnamese mosses by adding their own collections and reported a total of 719 species in 213 genera and 59 families. Later, HO *ET AL.* (2015) added 15 new moss records and ZHANG *ET AL.* (2016) added 61 new species records for the country. A detailed history of the moss flora of the country was summarized by HE & NGUYEN (2012).

The senior author, who has been studying the taxonomy of epiphytic mosses in East Asia for years, especially of the family Pylaisiadelphaceae, had a chance to conduct field works in Vietnam from November 9th to 20th in 2014, with the other two authors of this report. We carried out co-operative bryological surveys in two national parks (Figs. 1–3) and collected ca. 300 specimens. Among these, nine moss species were confirmed as new records for Vietnam. In addition, we found new localities of *Yakushimabryum subintegrum* (P. Tixier) H. Akiyama and *Gammiella rugosa* P. Tixier from the country.

The places we visited and their corresponding collection numbers are enumerated as follows:

- (1) Bidoup–Nui Ba National Park, Lam Dong Province

HA23927–23981: in the vicinity of Giang Ly Forest Station (12°11'28"N, 108°40'20"E, 1430 m msl) in subtropical evergreen mountain forest.

HA 23982–24026: in the vicinity of Hon Giao Forest Station (12°11'02"N, 108°42'09"E, 1560 m msl) in subtropical evergreen mountain forest.

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HA 24027–24045: in the vicinity of a fish farm (between Giang Ly and Hon Giao stations, 1500 m msl) in subtropical evergreen mountain forest.

HA 24046–24070: in the vicinity of Dung K'si Village (12°08'08"N, 108°40'25"E, 1400 m msl) along a riparian forest.

(2) Tam Dao National Park, Vinh Phuc Province

HA 24071–24115: in the vicinity of a lodge house at the end of road to Tam Dao 1 (21°28'23"N, 105°38'22"E, ca. 1000 m msl) in a warm-temperate evergreen forest partially mixed with bamboo thickets.

HA 24116–24148: Tam Dao 1 (21°29'N, 105°38'E, 1000–1365 m msl) in warm-temperate evergreen elfin forest along a mountain ridge to the summit.

HA 24149–24190: Tam Dao town and Television Tower Mountain (21°27'N, 105°39'E, 990–1275 m msl) in a town area and along a trail to the summit in warm-temperate forest.

LIST OF MOSSES NEWLY FOUND IN VIETNAM

All voucher specimens are deposited at Museum of Nature and Human Activities, Hyogo (HYO), with duplicates at the Faculty of Biology, University of Sciences (PHH). Collector's name (*H. Akiyama*) is abbreviated as *HA*. *Yakushimabryum subintegrum* and *Y. brevigemmium*, which had been reported from Vietnam in AKIYAMA (2017), are also cited.

Orientobryum oligonema (Cardot & P. de la Varde) H. Akiyama [Pylaisiadelphaceae]—Fig. 4.

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Basionym: *Clastobryum oligonema* Cardot & P. de la Varde, *Rev. Bryol.* 50: 74 (1923).
Type: India, Maduré, Kodaikanal, 1911, *Rev. Foreau* 74 (holotype, PC!).

Specimens examined: Bidoup-Nui Ba N. P.: *HA23983* and *24006*; Tam Dao N. P.: *HA24086*, *24087*, *24109*, *24133*, *24151*, *24153*, *24154* and *24183*.

Note 1: This species was originally described based on the specimen collected from Kodaikanal in Western Ghāts, northwest of Madurai in South India (POTIER DE LA VARDE, 1923). Like the genus *Indopotia* A. E. D. Daniels, Raja & P. Daniel of the Pottiaceae (DANIELS ET AL., 2010; AKIYAMA & GOFFINET, 2011), our discovery of *Orientobryum oligonema* in Vietnam suggests a close phytogeographical relationship between the Indochinese Peninsula and South India.

Note 2: TIXIER (1977) treated *Clastobryum oligonema*, basionym of *Orientobryum oligonema*, as a synonym of *Stereodon tenuiramea* Mitt. [= *Aptychella tenuiramea* (Mitt.) P. Tixier] without providing a reason. Comparing the species with *Gammiella tonkinensis* (Broth.) B. C. Tan & W. R. Buck, TAN (1991: Table 1) suggested a close affinity of *S. tenuiramea* to the genus *Brotherella* Loeske ex M. Fleisch., a taxonomic opinion which we follow here tentatively.

Furthermore, *Clastobryum oligonema* has quadrate alar cells at both corners of leaf base arranged in a scalariform manner and this feature suggests a distant affinity to the genus *Clastobryum s. str.* (e.g. TAN & IWATSUKI, 1992). Our recent analysis of the systematic position of the species using molecular markers suggests that it represents a separate genus in the Pylaisiadelphaceae (AKIYAMA, 2017).

Note 3: HE & NGUYEN (2012) cited three specimens of *Gammiella tonkinensis* from Vietnam. We confirmed that the following one is *Orientobryum oligonema*.

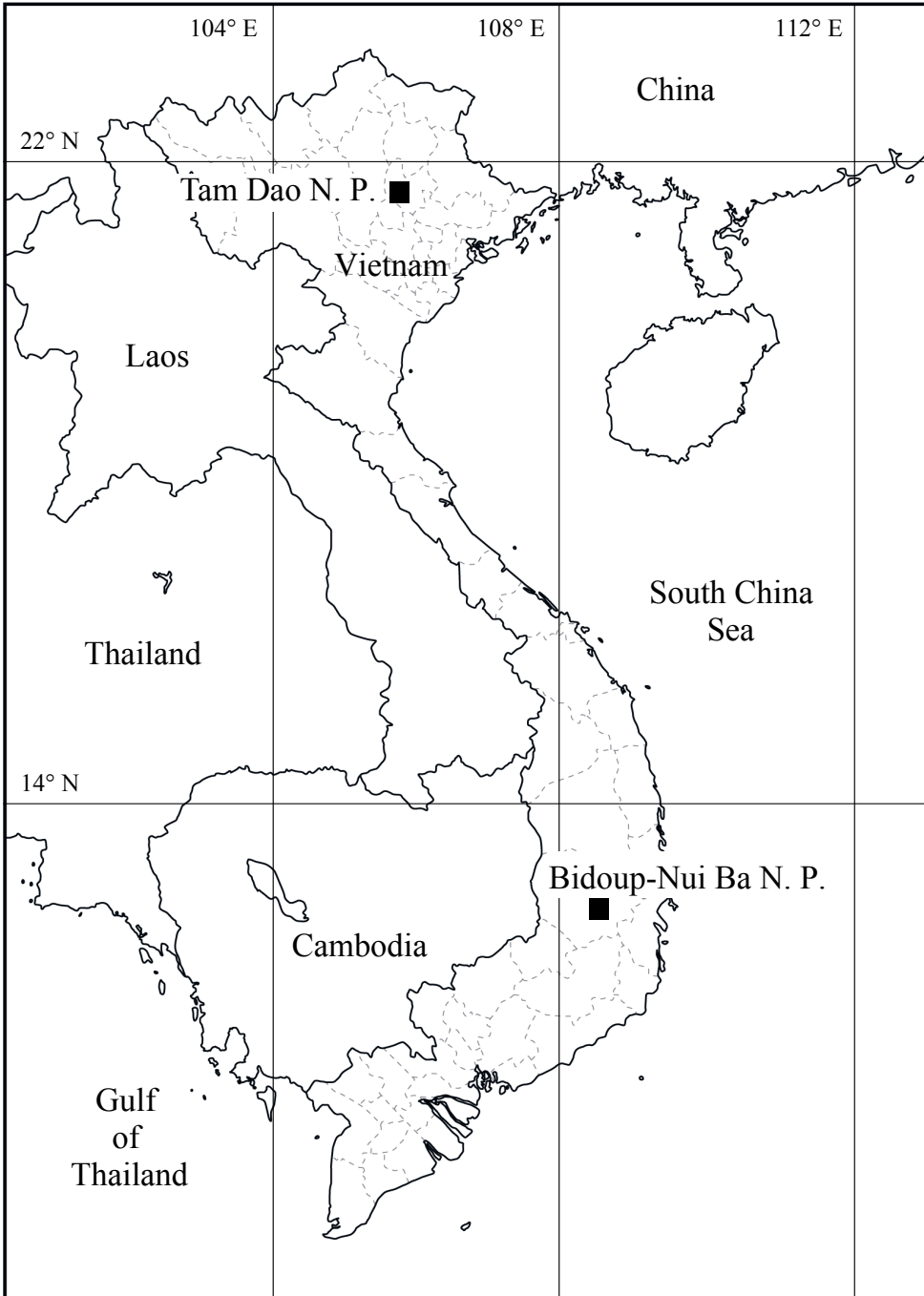


Figure 1. A map showing the locations of two collection sites (solid squares).



Figures 2–9. 2: Bidoup–Nui Ba National Park, in the vicinity of Giang Ly Forest Station. 3: Tam Dao National Park showing the three peaks (namely Tam Dao 1, 2 and 3). 4: *Clastobryum oligonema*. 5: *Holomitrium vaginatum*. 6: *Microdus brasiliensis*. 7: *Symphiodon scabrissetus*. 8: *Trismegistia calderensis* var. *rigida* (condensed type as in Akiyama 2010). 9: *Yakushimabryum subintegrum*. All photographs were taken by Hiroyuki Akiyama.

Specimen examined: Central Vietnam, Da Nang, *He & Nguyen 42611* (MO, as *Gammiella tonkinensis*).

Note 4: Another species of the genus *Orientobryum*, *O. ovalifolium* H. Akiyama, had also been reported from Vietnam by AKIYAMA (2017). It differs from *O. oligonema* in being pendulous, having more or less concave, ovate leaves, much shorter filamentous gemmae (0.1–0.3 mm long), only weakly or almost entire basal leaf margins, and caducous branchlets.

***Clastobryum papillosum* R. S. Williams [Sematophyllaceae]**

Bull. New York Bot. Gard. 8 (31): 360 (1914).

Type: Philippines, Luzon, Baguiol, *R. S. Williams 3159* (holotype, NY!).

Specimen examined: Bidoup–Nui Ba N. P.: *HA 23937*. For other specimens showing the variation of morphological features, see Note 2 below.

Note 1: The specimen (*HA23937*) listed above agrees well with the typical *C. papillosum*, because it has a distinct papilla on each laminal cell lumen. TAN (1991: p. 93) treated this species as a synonym of *Clastobryum epiphyllum* (Renauld & Cardot) B. C. Tan & Touw. TIXIER (1970) reported it as *Clastobryella epiphyllum* (Renauld & Cardot) M. Fleisch. from Lam Dong, Central Vietnam.

Note 2: At Bidoup–Nui Ba N. P., we collected seven specimens of *Clastobryum* that have papillose laminal cells. Among these specimens, there is variation in the development of papillae on laminal cells:

Papillae weak or almost absent: *HA 23975*.

Papillae conspicuous: *HA23935, 23999, 24045, 24052* and *24060*.

As TIXIER (1977) pointed out, when papillae on laminal cells are indistinct, it is difficult to distinguish *Clastobryum papillosum* from *C. cuculligerum* (Sande Lac.) P. Tixier. The latter was reported from Vietnam (TIXIER, 1962; HE & KHANG, 2012). On the other hand, if cellular papillae are conspicuous, it becomes difficult to separate *C. papillosum* from *C. epiphyllum*.

It is true that these three species share several features, such as linear-lanceolate leaf shape, strong serration at upper leaf margins, linear and moderately thick-walled laminal cells, and filamentous propagules composed of short-rectangular and papillose cells. TAN & BUCK (1989: 314) presented morphological features which can be used to distinguish *C. cuculligerum* and *C. papillosum*, but TAN (1991: 93) only discussed the morphological differences between *C. epiphyllum* and *C. cuculligerum*. We treat them here as three separate species.

***Clastobryum serrulatum* Cardot & P. de la Varde [Sematophyllaceae]**

Rev. Bryol. 50: 75 (1923).

Type: à Kodaikanal, en Maduré (Indes Orientales), dans les Gathes, à 7000 p. et plus d'altitude, Mai 1909, *R. F. G. André 103* (holotype, PC!).

Specimens examined: Bidoup–Nui Ba N. P.: *HA24031, 23928, 23998, 24030, 24040-b, 24041* and *24065*.

Note 1: *Clastobryum serrulatum* was described based on a specimen collected at Kodaikanal, northwest of Madurai in South India (POTIER DE LA VARDE, 1923). TIXIER (1977) treated it as a synonym of *Aptychella speciosa* (Mitt.) Tixier (= *Stereodon speciosus* Mitt.) without stating the supporting rationales. *Aptychella speciosa* is now treated as *Pylaisiopsis speciosa* (Broth.) Broth. in the Sematophyllaceae (GANGULEE, 1980; ARIKAWA, 2004) or as *Pylaisia speciosa* (Mitt.) Wilson ex A. Jaeger in the Hypnaceae (ARIKAWA ET AL., 2006). We do not follow TIXIER (1977) and treat *C. serrulatum* here as a separate species.

Clastobryum serrulatum is an epiphyte with small plants (e.g. secondary stems less than 10 mm long). It has more or less teretely foliated stems and branches, thus resembles *Gammiella ceylonensis* (Broth.) B. C. Tan & W. R. Buck. These two species are also similar in having acuminate leaves with distinct serration at margins, and scalariform alar cell arrangement. The former, however, is longer in leaf length, always reaching more than 1.6 mm (less than 1.3 mm in *G. ceylonensis*).

Note 2: Based on examination of the type and other specimens, we found that *C. serrulatum* has a few small and quadrate alar cells arranged in a scalariform manner. A similar alar formation was also found in species of *Aptychella* and *Gammiella*. This distinctive feature in *C. serrulatum* is very different from all other species of *Clastobryum* s. str. that have inflated, colored and thick-walled alar cells arranged in a single row (TAN & IWATSUKI, 1992). However, our preliminary analysis using molecular markers does suggest a close relationship between *C. serrulatum* and the members of *Clastobryum* (e.g. *C. spiculiferum* [Dixon] B. C. Tan, Z. Iwats. & D. H. Norris and *C. glabrescens* [Z. Iwats.] B. C. Tan, Z. Iwats. & D. H. Norris) (Akiyama, in prep.)

Holomitrium vaginatum (Hook.) Brid. [Dicranaceae]—Fig. 5.

Bryologia Universa 1: 227 (1826).

Specimen examined: Tam Dao N. P.: HA24164.

Note: The elongate perichaetial leaves tightly embracing and covering the lower-half of setae are very characteristic of this species. We found this species growing on a fallen, thick branch.

Leucomium strumosum (Hornsch.) Mitt. [Leucomiaceae]

J. Linn. Soc., Bot. 12: 502 (1869).

Specimen examined: Tam Dao N. P.: HA24166.

Note: *Leucomium strumosum* is one of the pantropical mosses. Comparing with the descriptions provided by FLEISCHER (1923), BARTRAM (1939), and JIA & LI (2002), plants in our collection have more filiform leaf apices and shorter, narrower laminal cells (12–18 μm \times 50–65 μm). ALLEN (1987) indicated that this species is very variable in morphological features including leaf shape and lamina cell size.

Microdus brasiliensis (Duby) Thér. [Dicranaceae]—Fig. 6.

Bull. Herb. Boissier, sér. 2, 7: 278 (1907).

Specimen examined: Tam Dao N. P.: HA24114.

Note: This is a small moss growing on bare soil at roadside and it can be distinguished from the closely related genus *Dicranella* (Müll. Hal.) Schimp. by its papillose peristome teeth.

Symphyodon erraticus (Mitt.) A. Jaeger [Symphyodontaceae]

Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876–77: 296 (1878).

Specimens examined: Tam Dao N. P.: HA24157, 24138 and 24180.

Note 1: *Symphyodon erraticus* has similar morphological features as *S. copelandii* Broth., which was originally described based on Philippines plants. According to HE & SNIDER (2000), the former can be distinguished from the latter by the acuminate stem leaves and wider median

laminal cells. Our examination of numerous specimens shows that both features are not stable, even within the same species; therefore, their relationship needs to be re-examined critically.

Note 2: *Symphiodon erraticus* has been reported from Bhutan, Nepal, India (Darjeeling, Kurseong, Sikkim), Myanmar (Moulmein), northern Thailand (Chiang Mai), Indonesia (Java), and Sri Lanka (HE & SNIDER, 2000). Our specimens show differences in stem and branch laminal cells; they are almost smooth or only slightly prorate, whereas the leaf cells of those specimens from Sri Lanka, Nepal, and northern India all have distinctly prorate cells with some spinose projections here and there. Therefore, we consider our identifications as tentative placement.

Note 3: The plants we collected have very soft texture, thus, they are always hanging from shrubby branches or stretching downward on the surface of tree trunks. No upward stems and branches were found.

Symphiodon scabrisetus Dixon [Symphyodontaceae]—Fig. 7.

Rec. Bot. Surv. India 6 (3): 66. 1, f. 3 (1914).

Specimens examined: Bidoup-Nui Ba N. P.: HA24004, 24005, 24008, 24009, 24010, 24042, 24043 and 24059.

Note: Our collections well match with the species description provided by HE & SNIDER (2000). The plants grow on the base of tree trunks in rather dry riparian forest. Secondary stems are pinnately branched and spread horizontally or slightly upward. Unfortunately, none of the specimens bore sporophytes.

Trismegistia calderensis (Sull.) Broth. var. *rigida* (Mitt.) H. Akiyama—Fig. 8.

Humans & Nature 21: 12 (2010).

Specimens examined: Bidoup–Nui Ba N. P.: HA23933 and 23963.

Note 1: Ho et al. (2015) reported *Trismegistia calderensis* var. *subintegrifolia* (Broth.) H. Akiyama from Bidoup–Nui Ba N. P. Our specimen listed above shows similar plant size with var. *subintegrifolia*, but judging from the shape of stipe leaves, we consider it belongs to var. *rigida*. Although there is a different opinion for the scientific name of this variety (as *T. calderensis* var. *convolutum* [Bosch & Sande Lac.] K. T. Yong, B. C. Tan & B. C. Ho in YONG ET AL. [2013]), we here follow AKIYAMA (2010).

Note 2: One of our specimens (HA23963) agrees well to the “condensed type” previously reported from Cameron Highland in Malaysia (AKIYAMA, 2010).

Note 3: According to our field observation made around Bidoup–Nui Ba National Park, the most common *Trismegistia* plants show the following features: stipes hardly developed and secondary stems mostly prostrate on substrata, with leaves arranged in a more or less complanate manner. At first glance, the plants resemble *T. lancifolia* (Harv.) Broth. Close examination, especially of stem and branch leaves, however, suggests a relationship with the *T. calderensis* group, judging from their deeply curved leaf bases and alar cell formation. These plants probably represent a new variety of the species and need further examination.

Trismegistia calderensis var.?

Specimens examined: Bidoup–Nui Ba N. P.: HA23950, 23964, 23965, 23972, 24024, 24055 and 24059.

In addition to the above new reports from Vietnam, the following two rare species were found from our collection with additional localities in Vietnam.

Gammiella rugosa P. Tixier [Pylaisiadelphaceae]

Rev. Bryol. Lichénol. 43: 443 (1977).

Type: Vietnam. Tuyen Duc, Mt. Lang Bian, 1900 m msl, 26 11 1958, *Tixier 211* (holotype, PC!).

Specimens examined: Tam Dao N. P.: *HA24125* and *24126*.

Note: This species was described based on the specimens collected in Vietnam and Thailand. Plants are very small, with shortly ovate-lanceolate leaves (less than 0.8 mm long) and alar cells arranged in a scalariform manner. The teretely-foliated stems in both wet and dry conditions give this species a julaceous appearance. In addition, the filamentous propagules are composed of smooth or slightly mammillose cells. These features suggest its close affinity to *Gammiella merrillii* Broth. When describing *G. rugosa*, TIXIER (1977) distinguished it by the scabrous laminal cells from *G. merrillii* with smooth ones.

Gammiella rugosa also resembles *G. ceylonensis* (Broth.) B. C. Tan & W. R. Buck. As far as we know, however, stems of *G. ceylonensis* are more or less foliated in a flat manner and the filamentous gemmae are composed of strongly mammillose cells. We also found *G. ceylonensis* (Bidoup—Nui Ba N. P.: *HA24007*, *24040* and *24152*) among our collections from Vietnam. The inter-relationships among *G. ceylonensis*, *G. merrillii* and *G. rugosa*, however, need further study.

Yakushimabryum subintegrum (P. Tixier) H. Akiyama [Pylaisiadelphaceae]—Fig. 9.

Acta Phytotax. Geobot. 68 (3): 162 (2017).

Basionym: *Aptychella subintegra* P. Tixier, Rev. Bryol. Lichénol. 34: 160 (1966). Type: Vietnam, Tam Dao, 950 m msl, 7 Juin 1926, *V. Demange 280* (holotype, Herb. R. Henry in PC!).

Important synonym: *Yakushimabryum longissimum* H. Akiyama, Y. Chang, T. Yamag. & B. C. Tan, J. Bryol. 33 (1): 42 (2011). Type: Japan, Kagoshima Pref.: Yakushima Island, en route from Yakusugi-land to Hananoego moor, 1070 m msl, on shrub branches, *H. Akiyama 20318* (holotype, HYO!; isotypes, HIRO!, NY!, SING!).

Specimens examined: Bidoup—Nui Ba N. P.: *HA23938*. Tam Dao N. P.: *HA24071*, *24084*, *24106*, *24128*, *24132*, *24134*, *24140*, *24143*, *24144*, *24149*, *24184*, *24187*, *24189* and *24190*.

Note 1: The occurrence of this species in Vietnam was confirmed by Akiyama (2014) based on specimens named as *Gammiella tonkinensis* (Tam Dao, *Câmara 1675* and *1772*, both in MO!) by HE & NGUYEN (2012). It is now reported to have a wider distribution in mountain areas in the southern part of Vietnam. The species is very common on shrubby branches and tree trunks in Tam Dao N. P., as evidenced by the number of specimens we have collected. The plants from this locality are somewhat different from those collected in other localities, especially in the lower-most margin of leaves with minor serration.

Note 2: This species was usually found growing together with *Orientobryum oligonema* in Tam Dao National Park. The difference in papillosity found in propagule cells is a useful distinguishing feature to separate the two species; i.e. they are smooth in *Y. longissimum* and strongly and densely mammillose in *C. oligonema*.

Note 3: *Aptychella subintegra* P. Tixier was originally described by TIXIER (1966) based on his collection from Tam Dao, but latter TIXIER (1977) reduced it to a synonym of *A. tenui-*

ramea. However, we do not agree with his treatment after checking both types, and consider *A. subintegra* more aligned with *Y. longissimum* due to the similarity in overall morphology. A critical comparison is presented by AKIYAMA (2017).

Aptychella tamdaoensis P. Tixier, originally described from Tam Dao (TIXIER, 1966) was reduced to be a synonym of *A. tenuiramea* by TIXIER (1977) without explanation. Although we did not examine the type specimen of this species, it appears to be very similar to *Yakushimabryum subintegra* when comparing it with their original descriptions.

Note 4: SUZUKI *ET AL.* (2013) reduced *Yakushimabryum longissimum* (= *Y. subintegra* here) to a synonym of *Aptychella tonkinensis* (Broth. & Paris) Broth. (= *Gammiella tonkinensis*). As pointed out by AKIYAMA (2014, 2017), both species have their own distinctive morphological features. The reason why these two species could be confused each other is that they had been often misidentified. As shown above some specimens of *Y. subintegra* and *Orientobryum oligonema* might have been mistaken for *G. tonkinensis*.

Gammiella tonkinensis was originally described based on a specimen collected in Vietnam (Type: Tonkin, Vinh Yen Pro., Tam Dao, 950–1000 m msl, *Eberhardt s.n.*, holotype, H!). We have found this species among our collections (Tam Dao N. P.: HA23985, 24161 and 24177-b.). Based on our field experience in Japan, *G. tonkinensis* was often found growing tightly attached to fallen, thick branches around the crowns of tall trees.

Note 5: *Yakushimabryum brevigemmium* H. Akiyama had been reported from Vinh Phuc Co., Tam Dao National Park in Vietnam by AKIYAMA (2017). The aggregated, short fusiform, blackish-green, well-septate gemmae in the leaf axils are the most distinguishing feature of *Y. brevigemmium*. For full description and its relationship to the other congeneric species, see AKIYAMA (2017).

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