

## Vu Quang and other Vietnam Mosses Collected by Tran Ninh, B. C. Tan and T. Pócs in 2002

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**Abstract.** A total of 77 species in 51 genera of mosses are documented for the first time from Vu Quang Nature Reserve near the Vietnam–Laos border and from the karstic area of Bien Son town in Thanh Hoa Province. *Diphyscium tamasii* B. C. Tan & Ninh is described as new to science. *Distichophyllum obtusifolium* var. *vuquangiensis* B. C. Tan & Ninh and *Trichostomum crispulum* var. *pseudocrispulum* B. C. Tan & Ninh are two new varieties described. Four taxa are reported new to Indochina, and 10 are new to Vietnam. *Isocladia* Dix. is a new generic record for Vietnam. The composition of the moss flora of this interior part of Vietnam has been shown to be a mixture of continental Asiatic, Indochinese and Malesian taxa.

### Introduction

The Vu Quang Nature Reserve (VQNR) is situated in north central region of Vietnam at about 350 km south of Hanoi in the Ha Tinh Province (see Map 1). The area of the Reserve is 55,000 hectares, with a core zone of 39,000 hectares. It lies between the latitudes of 18°09' and 18°27' N and longitudes of 105°16' and 105°35' E.

Vu Quang is an important catchment area for the major rivers in the nearby provinces bordering the Vietnam–Laos border. The average annual rainfall is 2,418 mm, while the average annual temperature is around 23 °C in the valley. The entire reserve includes a complex, massif topography of steep slopes and deeply dissected, narrow river valleys, with the highest peak, Rao Co, reaching 2,100 m in elevation. The vegetation zonation starts with seasonally dry lowland evergreen forest and gradually changes into

moist montane forest at 1,400 m, and to upper montane cloud forest above 1,900 m. Most interestingly, the montane vegetation consists of expansive coniferous forest of *Fokienia hodginsii* and *Dacrydium elatum*, as well as *Dacrydium imbricatus* and species of *Amentotaxus* (Kuznetsov and Guigue, 2000).

Today Vu Quang Nature Reserve has obtained global attention because of the recent discovery of *Pseudoryx nghetinhensis*, a new species of large ungulate mammal popularly known as "Saola". Yet, the rich vascular plant resources of Vu Quang are only partly studied (Kuznetsov and Guigue, 2000) and its bryoflora has not been investigated at all.

Our survey of Vu Quang bryophytes was made in May of 2002 with funding provided by the ASEAN-ARCBC Biodiversity Program. The investigation covered mainly the gallery forest along the rivers and streams at low elevation, and on a few occasions, reaching the elevation of 1,200 m. On way to Vu Quang Nature Reserve, we also collected a few mosses from the karstic area near Bien Son town in Thanh Hoa Province. In total, 77 species in 51 genera are documented for this nature reserve and Thanh Hoa Province, with one new species, *Diphyscium tamasii*, and two new varieties, namely *Distichophyllum obtusifolium* var. *vuquangiensis* and *Trichostomum crispulum* var. *pseudocrispulum*. Additionally, 4 taxa are reported new to Indochina and 10 are new to Vietnam. *Isocladiella* Dix. is a new generic record for Vietnam.

Based on the list of mosses presented below, the Vu Quang moss flora represents an equal mixture of continental Asiatic, Indochinese and Malesian taxa. About 28% of the genera and 13% of the species of the Vietnamese moss flora are found in this nature reserve. The fact that there are three moss taxa new to science seems to indicate that the nature reserve has unique environmental conditions promoting local speciation in plants. Since the present survey has concentrated in the valleys at low elevations, further search of bryophytes at high elevations, especially along the jagged and isolated mountain ridges, will surely yield many more taxa, some of which may be new to science.

In the moss checklist below, we have included, under each species and varieties, the information of the collection sites, habitat, elevation, and also provided some taxonomic commentaries. The number inside the parenthesis [ ] indicates the locality inside the nature reserve where the specimen was collected. The citation of synonyms is limited to those found in Tan and Iwatsuki (1993). Species with one asterisk (\*) is new to Vietnam, two asterisks (\*\*), new to Indochina, and three asterisks (\*\*\*), new to science.

### Collection localities in Vu Quang Nature Reserve (VQNR), Ha Tinh Province

[2] Lowland riverine forest and *Homonoia riparia* bushes along Khe Cong River at Ngam Tay Du ford, 110 m, 18 May, 2002.

[3] Degraded lowland rain forest along the trail from Khe Cong River to Tram Sao-la Research Station, between 110–200 m, 19 May 2002.

[4] and [5] Degraded roadside lowland rain forest along Truoi River between Vu Quang village and Kim Quang village, ca 25–180 m, 20 May 2002.

[6] Wet primary lowland rain forest and large boulders near Bac Dau Waterfalls, at 200–270 m, 22 May 2002.

[7] Primary hill forest on the N slope of Man Dai River Valley about 2 km S of Tram Sao-la Research Station, at 200–650 m, 23 May 2003.

### List of Vu Quang and other Vietnamese Mosses

*Aerobryopsis subdivergens* (Broth.) Broth. — [3] *Tan* 02-297, [7] *Tan* 02-275, 02-288, *Pócs* 02102, epiphytic on branches inside forest.

This is the most common member of Meteoriaceae in the study area. The overall plant habit looks like species of *Pseudobarbella*. *Aerobryopsis subdivergens* can be distinguished by its oval to short-oblong leaf cells with a single papilla, whereas the species of *Pseudobarbella* has unipapillose leaf cells that are oblong-linear.

*Callicostella papillata* (Mont.) Mitt. var. *prabaktiana* (C. Muell.) H. Streimann — [3] *Tan* 02-233, on shaded boulders along river bank.

This taxon is common in wet and shaded habitats in Vu Quang Nature Reserve. Interestingly, all the populations examined turned out to be the var. *prabaktiana*, with smooth or very weakly unipapillose leaf cells.

*Calymperes fasciculatum* Dozy & Molk. — [7] *Tan* 02-213, on tree trunk along the trail; *Tran Ninh* 70217, 70223, 70242, 702154, 702157, 702164, on tree base and boulder along stream in Kim Quang Valley, VQNR.

The gradually long acuminate leaf apices and the thickened leaf border with bigeminate teeth are characteristic of this species.

*Campylopus* sp. — [2] *Tan* 02-266, on inundated, shaded river bank.

The specimen is sterile and the species determination can not be made.

*Claopodium assurgens* (Sull. & Lesq.) Card. — [2, 3] *Tan* 02-214, 02-208, on branches and tree trunks inside forest.

\**Claopodium prionophyllum* (C. Muell.) Broth. — [7] Tan 02-285, Pócs 02102, on boulder and shaded stream bank in forest.

The fine and slender plant habit coupled with the strongly unipapillose leaves are characteristic. The species is new to Vietnam.

*Cyathophorum adiantum* (Griff.) Mitt. [syn. *Cyathophorella tonkinensis* (Broth. & Par.) Broth.] — Tran Ninh 2001-102b, 2001-124, on boulders inside forest near Tre stream, VQNR.

The synonymy of taxa of Hypopterygiaceae follows Kruijer (2002).

*Dicranella coarctata* (C. Muell.) Bosch & Lac. — [3] Tan 02-306, on shaded soil bank along trail.

This is a common moss along roadside or trail margin.

*Diphyscium mucronifoium* Mitt. [syn. *Diphyscium involutum* Mitt.] — [7] Tan 02-210, on rock inside forest, locally abundant.

\*\*\**Diphyscium tamasii* B. C. Tan & Ninh, spec. nov. Fig. 1: a–m.

Holotype: Vietnam, Vu Quang Nature Reserve, primary hill forest on the N slope of Man Dai River Valley about 2 km S of Tram Sao-la Research Station, at 200–650 m, on boulder in shaded forest margin near a stream, Tan 02-207 (SINU; isotype, Herbarium of Hanoi University of Science).

*Species insignis planta solitaria foliis vegetativis parvulis paucis distincta.*

Plants dioicous (rhizoautoicous?), solitary, 0.5–10 mm long, including the aristate leaf tip, and 1 mm wide. Stem erect, leaves imbricate; vegetative leaves few and highly reduced, narrowly deltoid to lanceolate, about 0.25 mm wide and 3 mm long, plane, laminal cells polygonal to short rectangular, smooth, unistratose throughout, costa broad, slightly excurrent. Perichaetial leaves numerous, ovate-lanceolate, ca 3–4 mm wide and 7–8 mm long, acute to obtuse, with long excurrent and prorulose costa, the arista distally bent, often longer than the length of the unistratose lamina; inner perichaetial leaves oblong-lanceolate, emarginate or bifurcate apically, but not lacinate, margin entire, distally crenulate, non-ciliated; upper leaf cells polygonal to rectangular, (3–)5–8  $\mu\text{m}$  wide and 13–18  $\mu\text{m}$  long, thick-walled, smooth; basal leaf cells oblong to rectangular, 10–13  $\mu\text{m}$  wide and 25–50  $\mu\text{m}$  long, moderately thick-walled, smooth; marginal rows of cells broadly rectangular, thin-walled, forming a well differentiated, broad, transparent border on both sides of the perichaetial leaf; abaxial cells of costa linear, somewhat prorulose, in cross section made up of 2–3 rows of large, centrally located guide cells, with small and thick-walled cells forming the upper and lower layers. Male plant (or perigonium?) small, less than 0.7 mm tall, attached basally to perichaetial plant, perigonial leaves short, about 0.5 mm

long including the shortly excurrent costa, broadly ovate-lanceolate, with imbricate leaf base. Sporophyte not seen.

The new species is distinctive in being solitary, and with few, highly reduced vegetative leaves. The entire plant nearly consists of perichaetial leaves. The leaf margins are entire, the excurrent costa is smooth to prorulose, the leaf cells are smooth, and the lamina is unistratose. *Diphyscium tamasii* is closely related to *D. involutum* Mitt., which was treated as a synonym of *D. mucronifolium* Mitt. in Eddy (1990), but not in O'Shea (2002).

Among the species of *Diphyscium*, this and *D. satoi* Tuzibe are the two in Asia that produces few, small and inconspicuous vegetative leaves around the base of large perichaetium. However, *D. tamasii* has unistratose lamina while *D. satoi* has bistratose upper leaf cells (Noguchi 1987). Leaf costa of *D. tamasii* is heterogeneous while that of *D. satoi* is homogeneous. From the point of view of evolution, these two species seem to represent the culmination of a trend in the genus to invest more resources in the sporophyte through a decrease in the production of vegetative leaves.

It is a privilege to name this endemic *Disphyscium* from Vu Quang Nature Reserve in honour of our colleague and field companion during the expedition, Prof. Tamás Pócs, for his past and present contributions to our knowledge of Vietnam bryophytes. Interestingly, the honoree has another endemic species of *Diphyscium* from Tanzania in Africa named in his honour, *Diphyscium pócsii* (Bizot) Zander.

\**Distichophyllum nigricaulum* Bosch & Sande Lac. var. *cirratum* (Ren. & Card.) Fleisch. [syn. *Distichophyllum cirratum* Ren. & Card.] — [5] Tan 02-235, on wet boulder in deeply shaded stream bank.

This taxon is reported here as new to Vietnam. It was treated as a species by Mohamed and Robinson (1991). We follow Tan and Robinson (1990) in accepting it as a variety of *D. nigricaulum*. The taxon is identified by its relatively broad leaf border and the presence of several rows of marginal laminal cells that are clearly smaller than the paracostal laminal cells.

\*\**Distichophyllum obtusifolium* Thér. var. *vuquangiensis* B. C. Tan & Ninh, var. nov.

Holotype: Vietnam, Vu Quang Nature Reserve, wet primary lowland rain forest at Bac Dau Waterfalls, at 200–270 m, on fallen log inside forest near a shaded stream, Tan 02-236 (SINU; isotype, Herbarium of Hanoi University of Science).

*Differt a varietatis typica statura multum minore.*

The new variety is distinguished mainly by nearly half the size of the plant specimen of typical variety. The leaves of the new variety measure less than 2 mm long and 0.75 mm at its widest part, whereas the leaves of var.

*obtusifolium* measure 3 mm long and 1.25 at its widest part of the blade. Both perichaetia and antheridia, but not the sporophyte, are seen in the type of this new variety.

*Distichophyllum obtusifolium* is known from China, Japan and Taiwan, and now extended to northern Vietnam. It is new to Indochina. The narrow leaf border forming a tiny mucro and a few small teeth present at the leaf apex is characteristic of the species.

*Duthiella walkichii* (Mitt.) C. Muell. — *Tran Ninh 2001-43*, on rock, along Tre stream, VQNR.

*Ectropothecium* sp. — [7] *Tan 02-284*, on submerged and wet rock in stream.

The specimen is rather similar to the East Asiatic congener, *E. obtusulum* (Card.) Iwats., in having complanate, ovate to oblong leaves with obtuse to broadly acute and slightly toothed apices (see Noguchi 1994). The leaf areolation is also similar except at the leaf base. Their shared preference of wet rock habitat is also noteworthy. However, without the sporophyte, the species identity can not be ascertained.

*Entodon flavescens* (Hook.) Jaeg. — *Tran Ninh 70214*, ca 1,100 m, on log in forest in Kim Quang Valley, VQNR.

*Exostratum blumii* (C. Muell.) Ellis [syn. *Exodictyon blumii* (C. Muell.) Fleisch.] — [7] *Pócs 02103*, p.p., on rotten log.

This species seems rare in the study area. Only a few individual plants were found growing on rotten log among other mosses.

*Fissidens crispulus* Brid. [syn. *Fissidens zippelianus* Dozy & Molk.] — [2, 3, 6, 7] *Tan 02-218, 02-217, 02-221, 02-224*, on rocks in shaded forest, river banks and at waterfall; *Tran Ninh 502159*, on rock by the Soy-lon River, VQNR.

One of the two most common *Fissidens* in the study area, the other one being *F. pellucidus*.

*Fissidens javanicus* Dozy & Molk. — [5, 6] *Tan 02-219, 02-220*, on shaded boulder at waterfall and on wet boulder near stream; *Tran Ninh 50291, 502159, 502192*, on wet rocks along Bac Nuong Stream, Khe Lim Waterfall and Soy-lon River, VQNR.

Surprisingly common in the study area, this species has bi- to tristratose leaf margins that are crenulate to serrulate in outline. The hyaline nodules are also well developed on the stem.

\* *Fissidens kinabaluensis* Iwats. — [7] *Tan 02-201*, on soil bank in forest.

The species is new to Vietnam. It was known before to occur disjunctively in southern China, Thailand and Borneo.

*Fissidens kinabaluensis* is distinctive in having a "opened fan-shaped" foliation on a short stem. The leaves are narrowly elongate to linear, with limbidium present only on the vaginant laminae.

*Fissidens nobilis* Griff. — Tran Ninh 200124b, on shaded rock, Tre stream, VQNR.

*Fissidens pellucidus* Hornsch. [syn. *Fissidens laxus* Sull. & Lesq.] — [3] Tan 02-215, 02-222, on shaded forest soil.

\*\**Gammiella panchienii* B. C. Tan & Jia Yu — Tran Ninh 702188, in forest, in Kim Quang Valley, VQNR.

The collection is a noteworthy extension of range of this recently described Chinese endemic from SE Xizang to Vu Quang Nature Reserve in Vietnam. The peculiar leaf alar of *G. panchienii* which consists of several rows or cluster of coloured, quadrat to short rectangular and thick-walled cells is unmistakable. The leaf margins are serrate. The overall morphology of *G. panchienii* looks like *G. ceylonensis*, but in *G. panchienii*, the plant is twice larger than *G. ceylonensis*, and the population does not develop mat-forming slender branchlets (cf. Tan & Jia, 1999).

Like the type specimen from Xizang Province of China, the collection of *G. panchienii* from Vietnam is also without sporophyte.

cf. *Garovaglia densifolia* Thwaites & Mitt. — Tran Ninh 72011, 1,100 m on tree trunk, Kim Quang valley, VQNR.

A few individual plants were collected from a tree trunk. The specimen has no reproductive structure and its species identity can only be tentatively proposed.

*Homaliodendron exiguum* (Bosch & Sande Lac.) Fleisch. — [3] Tan 02-272, on branch near river crossing point; Tran Ninh 200126, 200141, 200142, 200147, 502181, 70272, on tree trunk in forest and on rock by the stream, Lim Stream and Kim Quang Stream, VQNR.

*Homaliodendron flabellatum* (Sm.) Fleisch. — [6] Tan 02-289, on fallen twig in forest; Tran Ninh 70213, 70236, 70252, on tree trunk and boulder, Kim Quang Valley, VQNR.

*Homaliodendron microdendron* (Mont.) Fleisch. — [6] Tan 02-231, 02-276, on tree trunk inside forest, and on boulder by the river; Tran Ninh 200139, 200156, 200194, 50292, 502178, 502182, 70251, 70258, on rocks, and one specimen found on leaf, vicinity of Bac Nuong Stream, Kim Quang Stream and Leim Quang Stream, VQNR.

*Hypopterygium flavolimbatum* C. Muell. [syn. *H. apiculatum* Thwaites & Mitt., *H. vietnamicum* Pócs] — Tran Ninh 70201, 702126, Kim Quang Valley, VQNR.

The synonym of this species follows Kruijer (2002).

\**Isocradiella surcularis* (Dix.) B. C. Tan & Mohamed — [2] Tan 02-204, on branch in forest above the fast flowing river.

The many flagelliform and caducous branchlets are characteristic of this species that is now known from many places across SE Asia. It is, however, reported here for the first time in Vietnam.

*Isopterygium albescens* (Hook.) Jaeg. — [6] Tan 02-255, on decaying log inside forest.

cf. *Isopterygium annamensis* Broth. & Par. — [3, 6, 7] Tan 02-256a, 02-279, 02-295, on small branches of trees in shaded sites in forest.

This Vietnamese endemic seems common in the nature reserve. The plants are light yellowish green in color, somewhat complanate, and with erect-divergent, oblong- to ovate-lanceolate and long acuminate leaves. It looks like a large version of *Isopterygium minutirameum*. Its relationship with *I. albescens* needs careful comparison. The latter has somewhat broadly ovate-lanceolate leaves and equally long acuminate leaf apices,

*Isopterygium minutirameum* (C. Muell.) Jaeg. — [7] Tan 02-302, Pócs 02103, on fallen twig and branches on forest floor near stream.

*Leucobryum aduncum* Dozy & Molk. var. *scalare* (Fleisch.) Eddy — [7] Tan 02-232, on branches above the stream.

*Leucobryum chlorophyllosum* C. Muell. — [7] Tan 02-230, on log in forest.

*Leucobryum bowringii* Mitt. — Tran Ninh 200162, on rotten wood, Khe Tre valley, VQNR.

*Leucoloma amoene-virens* Mitt. — [6] Tan 02-270, on boulder away from the waterfall.

This species seems uncommon in Vietnam (see Tan and Iwatsuki, 1993).

*Leucoloma molle* (C. Muell.) Mitt. — Tran Ninh 70208, on tree trunk, 1,100 m, Kim Quang Valley, VQNR.

*Leucophanes octoblepharioides* Brid. — Tran Ninh 200189, 200199, on rocks, Khe Tre Valley, VQNR.

*Lopidium struthiopteris* (Brid.) Fleisch. — Tran Ninh 70281, on tree base, Kim Quang Valley, VQNR.



\**Microdus miquelianus* (Mont.) Besch. — [4] Tan 02-296, on roadside soil bank; also collected near one of the Vietnam–Laotian border guard houses.

There are a number of reported endemic species of *Microdus* in Indochina (cf. Tan and Iwatsuki, 1993) which probably are taxonomic synonyms of the present species.

*Neckeropsis moutieri* (Broth. & Par.) Fleisch. — Tran Ninh 200127, on rock near Tre stream, VQNR.

\*\**Papillidiopsis ramulina* (Thwaites & Mitt.) Buck & B. C. Tan — [7] Tan 02-246, on shaded boulder above water in stream.

This is the first report of this species from Vietnam and Indochina.

\**Oxyrrhynchium asperisetum* (C. Muell.) Broth. [syn. *Eurhynchium asperisetum* (C. Muell.) Bartr.] — Pócs 02112, Thanh Hoa Province, karstic area near Bien Son town, in dry evergreen forest, on shaded calcareous rocky wall at cave entrance.

The species, although widespread in SE Asia, is new to Vietnam. Its morphological distinction from the often confused but related species in SE Asia will be clarified in a separate paper.

*Pelekium bonianum* (Besch.) Touw [syn. *Thuidium bonianum* Besch.] — [6] Tan 02-226, on tree trunk base, in forest with bamboo thicket and on boulder near stream; Tran Ninh 50286, on rotten wood in forest, near Bac Nuong stream, VQNR.

The synonymy of this genus follows Touw (2001).

\**Pelekium investe* (Mitt.) Touw [syn. *Thuidium investe* (Mitt.) Jaeg.] — [7] Tan 02-274, on wet rocks near a stream close to a small waterfall.

The small and delicate plant size, ovate-oblong leaves, strongly unipapillose leaf cells, and the nearly lack of paraphyllia in stems and branches identify this species.

*Pelekium vesicolor* (C. Muell.) Touw [syn. *Thuidium sparsifolium* (Mitt.) Jaeg., *T. tamariscellum* (C. Muell.) Bosch & Sande Lac.] — [3] Tan 02-225, on boulder near river.

The taxonomy and synonymy of this taxon follows Touw (2001).

*Philonotis hastata* (Duby) Wijk & Marg. — [6, 7] Tan 02-286, roadside away from waterfall.

For the species treatment of *Philonotis*, we follow the concepts of Noguchi (1989), instead of Koponen and Norris (1996). The latter treatment is applicable to tropical Malesian species but not the continental Asiatic taxa of this genus.

\**Philonotis lancifolia* Mitt. — [6, 7] Tan 02-278, 02-287, on boulder near waterfall.

The specimens have somewhat imbricate to falcate leaves with percurrent costa and the upper leaf cells are rather narrowly rectangular while the leaf margins are only moderately to weakly recurved. The species is a new record for Vietnam.

*Philonotis mollis* (Dozy & Molk.) Mitt. — Tran Ninh 50298, 50248, on rotten wood, ca 210 m, near Du stream, VQNR.

The long excurrent leaf costa is diagnostic of this species.

*Philonotis turneriana* (Schwaegr.) Mitt. — [3] Tan 02-299, on boulder by the stream near the rest house.

This species differs from *P. mollis* in having shorter excurrent leaf costa and also the broadest part of the lamina is at leaf insertion.

*Plagiomnium succulentum* (Mitt.) T. Kop. — Tran Ninh 70210, on rock, Kim Quang Valley, VQNR.

*Pogonatum camusii* (Thér.) Touw [syn. *Racelopus camusii* Ther.] — [7] Tan 02-211, on rock inside hill forest.

*Pogonatum neesii* (C. Muell.) Dozy — [3] Tan 02-300, on eroded trail bank.

*Pseudobarbella attenuata* (Thwaites & Mitt.) Nog. — [7] Tan 02-268, hanging from branches in forest near a stream.

Another common species of Meteoriaceae in the study area.

*Pseudobarbella laosensis* (Broth. & Par.) Nog. — [7] Tan 02-283, on woody vine inside forest.

The Vu Quang specimen has many caducous, flagellate branchlets produced on the branches.

*Pseudoleskiopsis zeppellii* (Dozy & Molk.) Broth. — [2, 6, 7] Tan 02-239, 02-305, 02-238, on submerged boulders or by the river banks.

The species is rather common in the study area in river bed and along stream bank. The illustration of this semi-aquatic species in Fleischer (1904–1923) is excellent.

*Pseudotaxiphyllum pohliaecarpum* (Sull. & Lesq.) Iwats. — [6] Tan 02-240, [7] Tan 02-264, on rock near stream bank; Tran Ninh 502104, on rock, near Con Stream, VQNR.

This species is locally abundant inside forest. Its purplish color of the population is distinctive.

*Pterobryopsis crassicaulis* (C. Muell.) Fleisch. — [2, 7] Tan 02-228, on branch in hill forest.

In the family Pterobryaceae, the erect stem with strongly concave leaves having abruptly constricted leaf apices, coupled with the attenuated stem terminal, is diagnostic for this species.

*Pyrrhobryum spiniforme* (Hedw.) Mitt. — [7] Tan 02-212, on rock in forest.

*Racopilum cuspidigerum* (Schwaegr.) Aoengstr. [syn. *R. schmidii* (C. Muell.) Mitt.] — [7] Tan 02-269, on trunk base inside forest; Tran Ninh 50274, ca 100 m, on wet boulder in stream, Bac Nuong stream, VQNR.

*Radulina hamata* (Dozy & Molk.) Buck & B. C. Tan — [2] Tan 02-257, on tree trunk near base, partly flooded.

This species, with its falcate leaves that have seriatly arranged papillae on the leaf cell, is distinctive in the family Sematophyllaceae.

*Rhynchostegiella menadensis* (Sande Lac.) Bartr. — [6, 7] Tan 02-294, 02-280, on branch inside forest by the stream; Pócs & Tan 02-244, Thanh Hoa Province, karstic area near Bien Son town, in dry evergreen forest, on calcareous substrate and on tree trunk base near the cave entrance.

This is the most common epiphytic species of Brachytheciaceae in the study area.

*Rhynchostegium aciculatum* (Broth.) Broth. — Tran Ninh 200144, on branchlets, in Khe Tre Valley, VQNR.

\**Schlotheimia grevilleana* Mitt. — [7] Tan 02-308, on branches inside forest.

The species is new to Vietnam. It has an earlier report from Thailand (cf. Tan and Iwatsuki, 1993).

*Sematophyllum subpinnatum* [syn. *S. caespitosum* (Hedw.) Mitt., *S. tristiculum* (Mitt.) Fleisch.] — [2, 3] Tan 02-242, 02-243, 02-252, 02-254, 02-248, 02-256b, on shaded tree trunks, branches and boulders along the rivers; Tran Ninh 50227, 50254, on rock and branches along Bac Nuong and Cay Du streams, VQNR.

This is the most common species of Sematophyllaceae found in the study area. Plants vary greatly in size and grow epiphytically on various substrates along the river banks. The synonymy of this species follows Tan and Jia (1999).

*Syrrhopodon armatus* Mitt. [syn. *Syrrhopodon fimbriatulus* C. Muell.] — [7] Tan 02-200, on log inside forest.

Indochina was included in the range of this species by Reese (1987) without reporting a specific Indochinese locality. The species is distinctive in having long cilia at the leaf shoulder region, strong papillae scattered on the abaxial side of the costa, and also the strongly unipapillose leaf cells. We can not see any differences between the Chinese *S. armatus*, and the widespread Malesian *S. fimbriatulus*.

*Syrrhodon japonicus* (Besch.) Broth. — Tran Ninh 702141, on tree trunk of *Fokienia hodginsii*, at 1700 m, Kim Quang Valley, VQNR.

*Taxiphyllum tazirameum* (Mitt.) Flesich. — [6] Tan 02-293, on wet and shaded boulder in stream.

*Taxithelium nepalense* (Schwaegr.) Broth. — [7] Tan 02-298, on shaded rock, stream bank.

*Taxithelium vernieri* (Duby) Besch. — [7] Tan 02-263, on boulder in forest.

This is a widespread species in tropical SE Asia. The ovate lanceolate leaves have both acute and long acuminate leaf apices that are serrated.

*Thuidium assimile* (Mitt.) Jaeg. — Tran Ninh 702184, on rock inside forest, Kim Quang Valley, VQNR.

*Thuidium pristocalyx* (C. Muell.) Jaeg. [syn. *Thuidium glaucinum* (Mitt.) Bosch & Sande Lac.] — [2, 3, 7] Tan 02-205, 02-206, 02-202, on branches above water, but mostly on shaded boulder in forest; Tran Ninh 70273, 702150, 200136, on tree base and boulder in Kim Quang Valley, and on rock, along Tre stream, VQNR.

This is the most common species of *Thuidium* in the study area. For a discussion of its differences from *T. assimile*, see Touw (2001).

*Trichosteleum boschii* (Dozy & Molk.) Jaeg. — [6, 7] Tan 02-249, 02-251, on fallen log and boulder near river bank and inside forest.

This is a common and variable species in Vu Quang Nature Reserve.

\**Trichosteleum mammosum* (C. Muell.) Jaeg. — [2] Tan 02-203, epiphytic on branch inside forest.

The strongly unipapillose cum mammillose exothecial cells of the capsule of this species is very distinctive. The record is new to Vietnam.

\*\**Trichosteleum mindanense* Broth. — [7] Tan 02-277, on rock, trail along the river.

This species has been known hitherto as a Philippine endemic. Bartram (1939) opined that it is close to *T. mammosum* on the basis of its clearly mammillose exothecial cells. In our opinion, the species is more related to

*T. boschii* by virtues of its leaf morphology. Unlike *T. boschii*, *T. mindanense* has gradually acuminate leaf apices. It looks more like a miniature plant of *T. stigmatum* Mitt. Its taxonomic affinity within the genus needs reassessment. We report it here as new to Vietnam and Indochina region.

*Trichosteleum stigmatum* Mitt. — [7] Tan 02-247, on decaying log near stream in forest.

This species differs from the widespread *T. boschii* in having gradually long acuminate leaf apices. Seki (1968) included this species in the synonymy of *T. boschii*, a taxonomic judgment which we disagree.

*Trichostomum crispulum* Bruch var. *pseudocrispulum* B. C. Tan & Tran Ninh, var. nov.

Holotype: Thanh Hoa Province, karstic area near Bien Son town, dry evergreen forest on calcareous substrate, on soil and root mass of *Microsorium* ferns attached to limestone cliff, 26 May 2002, Tan 02-307 (SINU; isotype: Herbarium of Hanoi University of Science).

*Differt a varietatis typica foliis constrictis supra basin.*

The new variety differs from the var. *crispulum* in having a well constricted shoulder above the slightly expanded leaf base. In addition, its incurved leaf margins are more strongly developed in var. *pseudocrispulum*. The other leaf characters and the plant size are comparable with specimens of typical variety. The type of the new variety has no sporophyte.

*Trichostomum platyphyllum* (Broth. ex Ihs.) Chen — [3] Tan 02-229, Tran Ninh 50207, on wet boulder, submerged in stream.

*Vesicularia montagnei* (Bel.) Broth. — [3, 7] Tan 02-267, 02-271, 02-301, on wet boulder and river bank.

This is a common species of mosses in wet, shaded sites in the study area.

*Wijkia deflexifolia* (Ren. & Card.) Crum — Tran Ninh 702152, on rock, in forest in Kim Quang Valley, VQNR.

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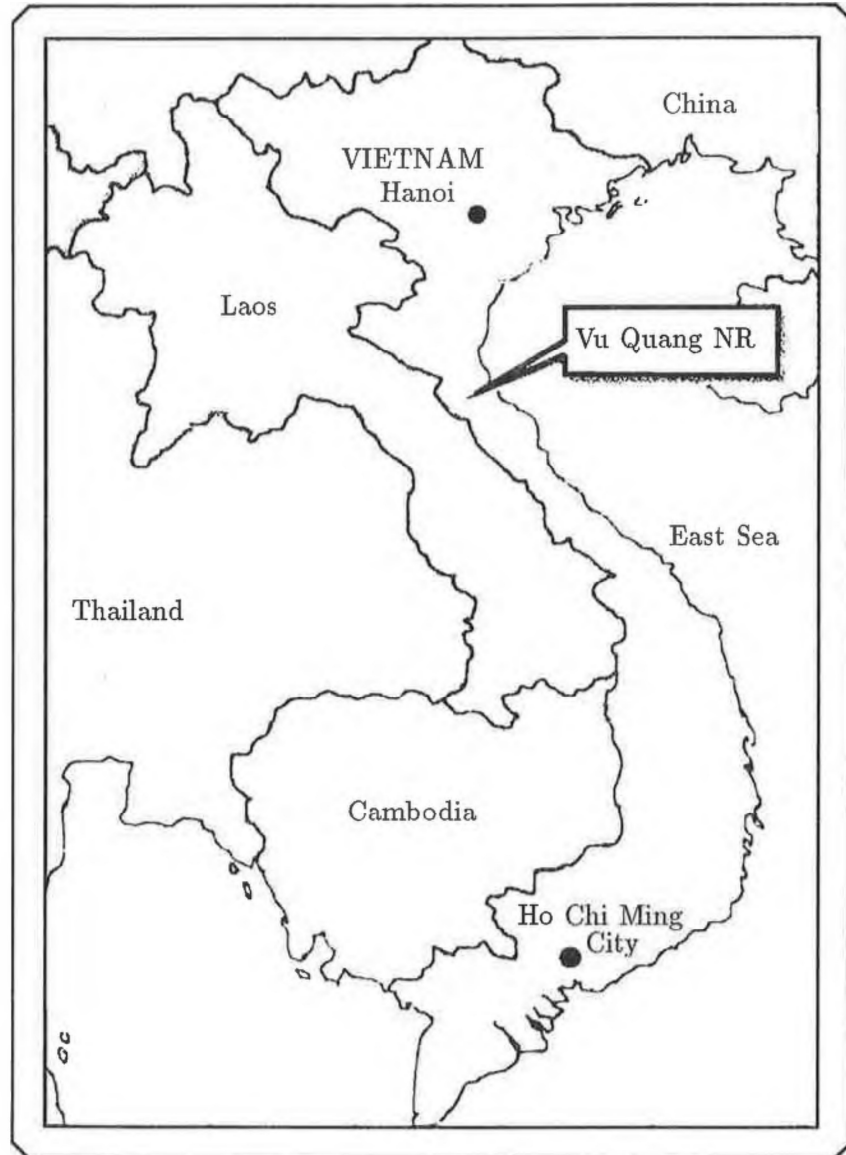
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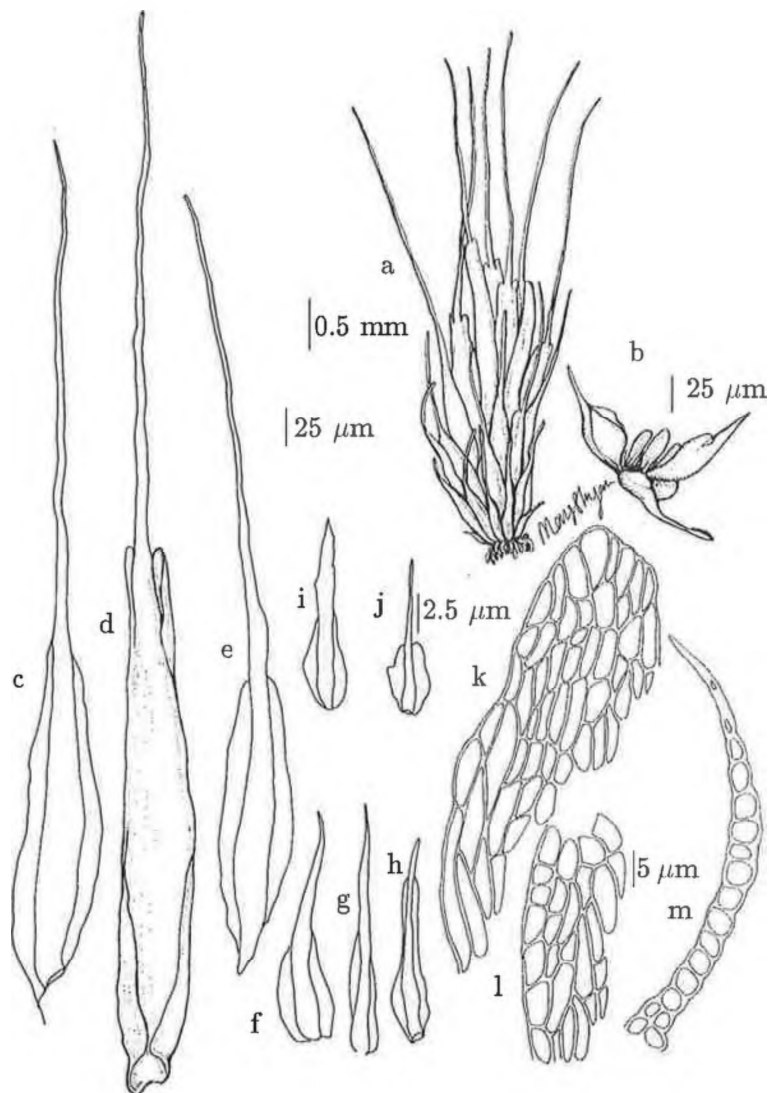
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Map 1. Location of Vu Quang Nature Reserve in Vietnam





**Fig. 1** *Diphyscium tamasii* B. C. Tan & Ninh (based on holotype at SINU) (a) Perichaetial plant; (b) Dissected perigonium; (c-e) Inner perichaetial leaves; (f-j) Outer perichaetial leaves; (k) Apical lobe of perichaetial leaf; (l) Basal margin of perichaetial leaf; (m) Cross-section of perichaetial lamina showing unistratose leaf cells.