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NEW RECORDS FOR THE LIVERWORT AND HORNWORT FLORA OF VIETNAM, 4. – COLLECTIONS OF TRẦN NINH IN TAM ĐẢO MOUNTAINS, VIETNAM

Tamás Pócs

Institute of Biology, Eszterházy Károly Catholic University, H–3301 Eger, Pf. 43, Hungary; E-mail: pocs.tamas33@gmail.com

Abstract: Professor Trần Ninh in 1967 started to deal with the bryoflora of the Tam Đảo Mountains and published two papers in 1980 and 1981 and a checklist of its mosses in 1993. He collected also liverworts. After the long time elapsed I identified these and wish to publish the results. The material consists of hundred specimens, divided among 35 taxa. It contained *Schiffneriolejeunea pulopenangensis* as new to Vietnam and also *Plagiochila cuspidata*, if we consider it as an independent species. Further six became known from Tam Đảo, which were only recently discovered by others in Vietnam (*Chiastocaulon dendroides, Frullania motoyana, Lepidozia fauriana, Plagiochila assamica, P. javanica, Radula retroflexa*).

Keywords: *Bazzania*, endemics, Lejeuneaceae, *Plagiochila,* Southeast-Asia

INTRODUCTION

Tam Đảo Mountains are a 80 km long crystalline range 85 km north of Hanoi, with its slopes covered by wet rainforests. The highest summit has 1592 m elevation. For their rich flora and fauna the area was declared to Conservation Forest in 1977 and was given National Park status in 1996. Its bryoflora since 1967 was studied by Trần Ninh, presently retired professor at the Hanoi University of Science. He published from here many records new to the Vietnam moss flora (Ninh 1980, 1981, 1984), some species even new to science (*Calymperopsis vietnamensis*; *Calyptrochaeta pocsii,* now syn. with *Calyptrochaeta ramosa* subsp*. spinosa* (Nog.) P.J. Lin & B.C. Tan; *Distichophyllum duongii*, now syn. of *Distichophyllum maibarae* Besch.). Finally he published the moss checklist of the area, containing 178 species (Ninh 1993), based on his own collection supplemented by literature data. In this publication he gave a description (with map) of the mountain range and outlined the

history of bryological investigations and the environmental conditions of the area. Between 1967 and 1971 he collected also liverworts and handed me over for identification, which are, after a long elapse, published in the present paper. This liverwort collection contained about hundred specimens, of which 81 were identified (the rest being mostly sterile *Frullania* and *Lejeunea* species). They proved to belong to 35 taxa, of which at least *Schiffneriolejeunea pulopenangensis* (Gottsche) Gradstein is new to the country and other six were only recently published (Shu *et al.* 2017) from other parts of Vietnam. In the November of 1998 we made a joint collecting trip together with professor Trần Ninh in Tam Đảo Mountains, supported by our academies of sciences. We expect to publish its records later.

MATERIAL AND METHODS

The nomenclature follows mostly Söderström *et al.* (2016), except for the species of *Porella,* where I use the names of my revision of Vietnamese species (Pócs 1986). In the enumeration below the same abbreviations mark the different localities, which were used by Trần Ninh (1993) in his moss checklist: **B –** Binh Dân, 950 m; **D –** Dong Dieng, 600 m; **K** – Ký Phú, 950–1420 m; **Q** – Quân Chu, 950 m and **Y** – Ỳên Mỹ, 1100–1300 m. The collected specimens are deposited in the herbaria of VNU and EGR. After the abbreviation of the localities I give Trần Ninh's original collecting numbers, some annotations and distributional data.

RESULTS

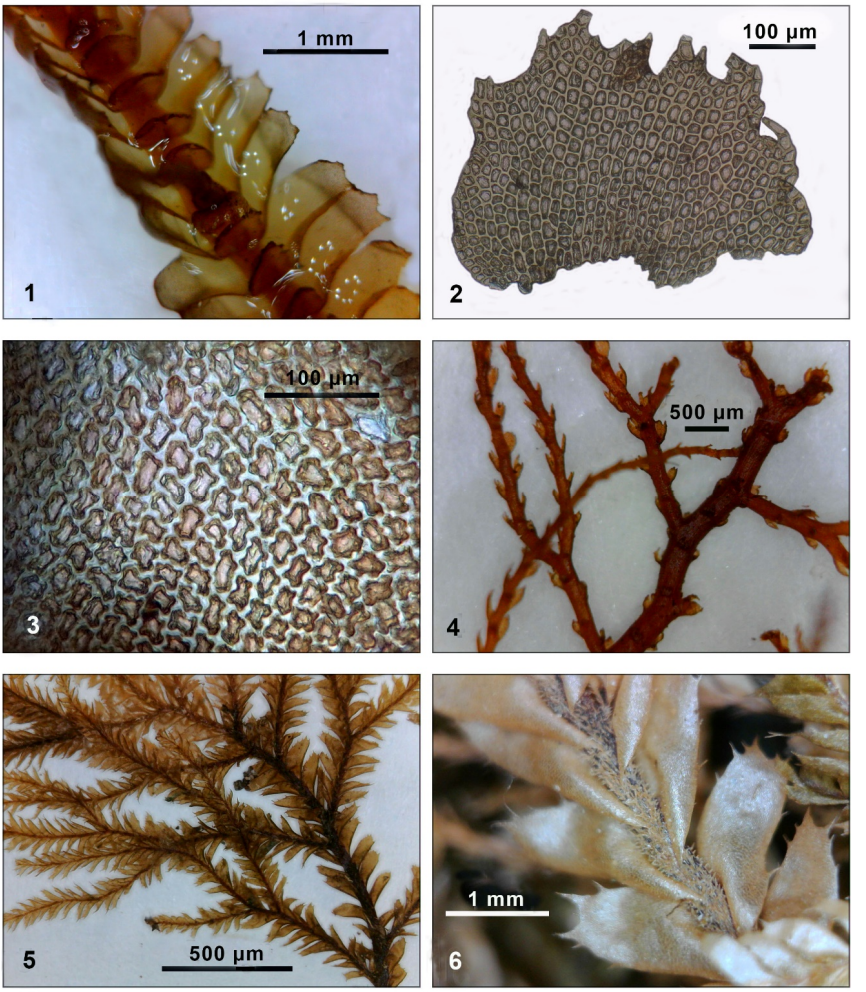
Enumeration of species

Bazzania japonica (Sande Lac.) Lindb. (*Figures 1–2*) **Y**: 68134. Rare in Vietnam, Southeast Asian species.

Bazzania praerupta (Reinw *et al.*) Trev. **Y**: 68224, 68239, 68241. Widespread Palaeotropic species.

Bazzania tridens (Reinw. *et al.*) Trev. **Y**: 68183, 68190, 68240C; **B**: 68217, 68236, 68248, 69186; **Q**: 69141; **K**: 69189. The most widespread species in Vietnam and possible also in the whole tropical Asia (Pócs 1969).

Bazzania tridens (Reinw. *et al.*) Trev. var. ***cornistipula*** (Steph.) Pócs **K**: 69102; B: 69188. Relatively rare from Japan to Vietnam.



Figures 1–2. *Bazzania japonica* (Sande Lac.) Lindb. Part of shoot, ventral view and underleaf (from 68112). **Figure 3.** *Frullania motoyana* Steph. Lobe cells (from 68192). **Figure 4.** *Lepidozia fauriana* Steph. Habit, ventral view (from 68187). **Figures. 5–6.** *Plagiochila assamica* Steph. Habit, ventral view and part of shoot with paraphyllia, dorsal view (from 67164).

Bazzania vietnamica Pócs **Y**: 68232. Vietnamese – South Chinese endemic. Closely related to the Neotropical *Bazzania aurescens* Spruce. Pócs (2020) synonymized with it, but probably a different species, being much larger in size, having broader underleaves.

Cheilolejeunea trapezia (Nees) R.M.Schust. & Kachroo **Y**: 68240D. Widespread Palaeotropical species.

Cheilolejeunea trifaria (Reinw. et al.) Mizut. **B**: 69277A. Widespread Pantropical species (Zhu and So 2001).

Cheilolejeunea ventricosa (Schiffn. *ex* P.Syd.) Xiao L.He **B**: 69170E. Uncommon Malesian species occurring from Mauritius to Australia (Pócs and Streimann 2006).

Chiastocaulon dendroides (Nees) Carl. **Y**: 68211, 68240A. It is known also under the name of *Plagiochila dendroides* (Nees) Lindenb. It was recently found in other parts of Vietnam (Shu *et al.* 2017). Malesian-Pacific species widespread from Japan and Indonesia to Fiji (Inoue 1970).

Cololejeunea appressa (A.Evans) Benedix **K**: 69169C. Widespread Pantropical species.

Cololejeunea ceatocarpa (Aongstr.) Steph. **B**: 69231A. Indomalesian-Pacific species occurring from Réunion to Hawaii (Tixier 1985).

Cololejeunea sigmoidea Ast & Tixier **K**: 69169A Indomalesian species (Zhu and So 2001). Main characteristics are the sigmoid marginal cells gradually passing into normal lobe cells and its strongly reduced lobules, which distinguish it from *Cololejeunea rotundilobula* (P.C.Wu & P.J.Lin) Piippo, with almost always well developed, ovate-orbicular, inflate lobules (Zhu and So 2001).

Frullania ericoides (Nees) Mont. **B**: 69250; **Q**: 69303A, 69312, 69316, 69401A, 69406; **Y**: 69318. Widespread light demanding Pantropical species.

Frullania hamatiloba Steph. **B**: 69278, 69307; **Y**: 68150. Southeast Asian species.

Frullania motoyana Steph. (*Figure 3*) **Y**: 68192, 68213. Dioicous, with flexuose lobe cell walls and entire perichaetial leaves. Southeast Asian species known from Japan and China. recently found in northern Vietnam (Shu *et al.* 2017).

Heteroscyphus argutus (Reinw. et al.) Schiffn. **Y**: 68204. Widely distributed Indomalesian-Pacific species.

Jubula hutchinsiae (Hook.) Dum. ssp. ***javanica*** (Steph.) Verd. **Y**: 68246A. Indomalesian-Pacific species penetrating in the northern warm temperate zone and occurring also in Madagascar and Transcaucasus (Guerke 1978).

Lejeunea adpressa Nees **Y**: 68122. Widespread Pantropical species (Gradstein 2021).

Lejeunea parva (S.Hatt.) Mizut. **Y**: 68240B. It is known only from Tam Đảo in Vietnam. Southeast Asian species distributed in India and from Japan through southern China, Korea and Thailand to Singapore (Shu *et al.* 2017).

Lepidozia fauriana Steph. **Y**: 68187. It was recently found in other parts of Vietnam. Southeast Asian species (Shu *et al.* 2017).

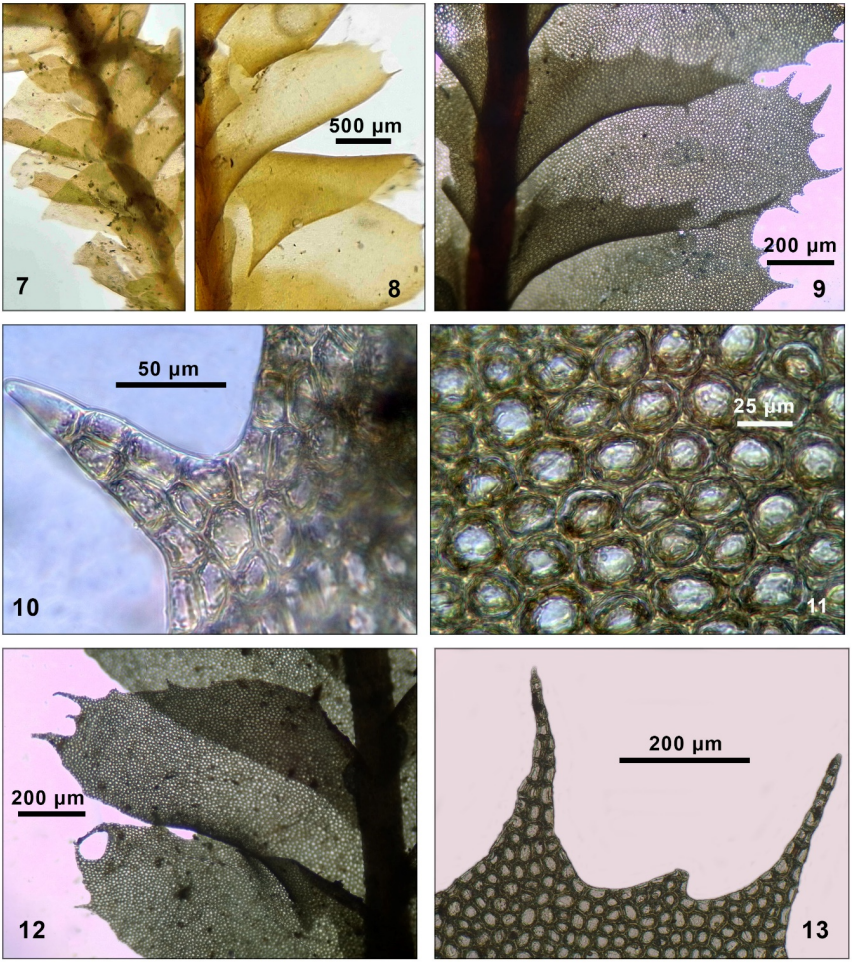
Leptolejeunea subacuta A. Evans **B**: 69231B, 69274; **K**: 69169D. According to the molecular studies of Shu *et al.* (2021) true *Leptolejeunea elliptica* (Lehm. & Lindenb.) Schiffn. is not Pantropical species but occurs only in the Neotropics. In Tropical Asia the related *Leptolejeunea subacuta* and *L. dapitana* (Spruce) Steph. thrive, and our specimens match the former.

Lopholejeunea nigricans (Lindenb.) Schiffn. **B**: 69277B. Common Pantropical species.

Mastigolejeunea humilis (Gottsche) Schiffn. **Q**: 69401B., According to Sukkharak and Gradstein (2017, as *Thysananthus humilis* (Gottsche) Sukkharak & Gradst., is a species of Palaeotropic distribution).

Plagiochila assamica Steph. (*Figures 5–6*) **K**: 67164, 67165, 67166, 68385; **Y**: 68305. Characteristics of the species are the abundant setose paraphyllia only on the dorsal side of the stem. It was recently found in other parts of Vietnam too (Shu *et al.* 2017). General distribution: Continental tropical Asia from India to Thailand (So 2001).

Plagiochila cuspidata Steph. (*Figures 7–8*) **Y**: 68021. According to So (2001) it is an independent species, then is new to Vietnam. According to Rawat and Sriwastava (2007) is a synonym of *Plagiochila parvifolia* Lindenb. As another species is described from the same relationship, as a southern China endemic, *Plagiochila kunmingensis* Piippo (1997), which also differ in size and leaf shape from *P. parvifolia*, I should prefer to keep these species apart, until molecular proofs are available for their synonymy. *Plagiochila cuspidata* is known from India: Darjeeling, Nepal, Bhutan, Myanmar and Thailand (So 2001).



Figures 7–8. *Plagiochila cuspidata* Steph. Shoot, ventral and dorsal views (from 68021). **Figures 9–11.** *Plagiochila javanica* Sande Lac. Part of shoot, dorsal view, apical tooth and lobe cells (from 68288). **Figures 12–13.** *Plagiochila junghuhniana* Sande Lac. Part of shoot, ventral view and apical teeth (from 69051).

Plagiochila javanica (Sw.) Nees & Mont. **Y**: 68315. **K**: 69147 and **Y**: 68288 are forms, which were described before as *Plagiochila infirma* Sande Lac., unknown from Vietnam (*Figures 9–11*). Syn. by So and Grolle (2000). A Malesian-Pacific species (Inoue 1984; Söderström *et al.* 2011).

Plagiochila junghuhniana Sande Lac. (*Figures 12–13*) **K**: 69017, 69051, 69109. A Malesian-Pacific species (So 2001).

Plicanthus birmensis (Steph.) R.M.Schust. **K**: 67133; **Y**: 68225. Widespread Palaeotropic taxon, maybe only a variety of *Plicanthus hirtellus* (F.Weber) R.M.Schust. Sukkharak (2023) discusses their relationship in details.

Porella acutifolia Hampe ex Gottsche & al. (*Figure 14*) **Y**: 68024. Indomalesian species (Pócs 1968a).

Porella piligera (Steph.) Pócs (*Figure 15*). **B**: 69022; **K**: 69010, 69022, 69024, 69157; **Q**: 69347, 69348; **Văn Yên** 1000 m: 74230. Syn.: *Porella caespitans* (Steph.) Hatt. var. *setigera* (Steph.) Hatt. according to Hattori (1978). Vietnam endemic species (Pócs 1968b).

Porella piligera (Steph.) Pócs var. ***grossidentata*** Pócs **B**: 69262; **K**: 67131. Syn.: *Porella caespitans* (Steph.) Hatt. var. *reflexigastria* (Pócs) Hatt. (Hattori 1978). Endemic.

Ptychanthus striatus (Lehm. & Lindenb.) Nees **B**: 69357; **K**: 69036, 69059, 69092; **Y**: 68225A, 68230. Widespread Indomalesian-Pacific species. In Africa replaced by *Ptychanthus africanus* Steph. (Ahonen *et al.* 2005).

Radula acuminata Steph. **K**: 69169B. Widespread Indomalesian-Pacific species. (Yamada 1979).

Radula retroflexa Taylor (*Figures 16–17*) **B**: 69270. Lobules turning away from the stem. Only recently found in Vietnam (Shu *et al.* 2017). Malesian-Pacific species (Yamada 1979).

Schiffneriolejeunea pulopenangensis (Gottsche) Gradstein **Q**: 69303B, 69401C. Characterized by the plane, free lobe margin with 2-4 lobule teeth and by the toothed perichaetial leaves. Widespread Indomalesian species (Wang *et al.* 2016), new to Vietnam.

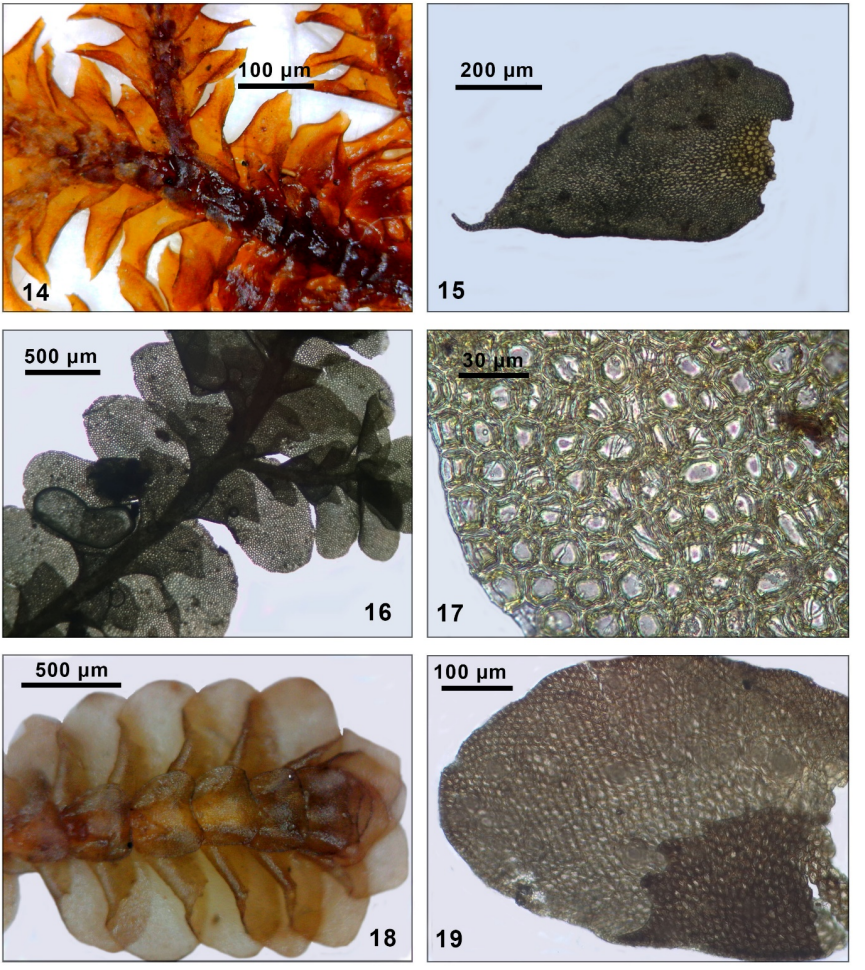


Figure 14. *Porella acutifolia* (Lehm. & Lindenb.) Trev. Part of shoot, ventral view (from 68024). **Figure 15.** *Porella piligera* (Steph.) Pócs. Leaf (from 69022). **Figure 16–17.** *Radula retroflexa* Taylor. Part of shoot, ventral view and lobe cells (from 69270). **Figure 18–19.** *Schiffneriolejeunea pulopenangensis* (Gottsche) Gradstein. Part of shoot, ventral view and leaf, ventral view (from 69303).

DISCUSSION

With these records the known number of liverworts in Tam Đảo National Park, based on Pócs (1969, 2023), Pócs *et al.* (1967), Bakalin and Sinh (2016), Shu *et al.* (2017) and Zhu and Lai (2003) is raised from 56 to 84. As it was already seen (Pócs 1969, 2023), in

the northernmost part of Vietnam the number of Indomalesian distribution elements is moderate, only about 25% of the bryoflora, along the Sino-Himalayan, Southeast-Asian, Palaeotropic and a few endemic species. Going southwards, the ratio of Indo-Malesian and Malesian-Pacific elements increases and that of the Sino-Himalayan and Southeast Asian decreases (Pócs *et al.* 2019).

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