
New or little known epiphyllous liverworts, XXVI. Records of last century Vietnam collections.

*Dedicated to the 80th birthday
of the first Vietnamese bryologist,
Prof. Dr. Trần Ninh,
my former postgraduate
student and companion.*

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Abstract: Pócs T. (2023): New or little known epiphyllous liverworts, XXVI. Records of last century Vietnam collections. *Frahmia* 34:1-10.¹

62 epiphyllous species were identified from the collections made at the end of last century by Erzsébet Fráter (VBI), Gabriella Kis (EGR) and Trần Ninh (VNU). 56 of them were liverworts and 6 mosses. The material contained 2 species: *Cololejeunea pacifica* Pócs and *Cololejeunea pseudoserrata* Tixier new to Vietnam, and a number new to different provinces or recorded before only from one Vietnamese locality. The species identity of *Cololejeunea serrulata* Steph. is re-established. The distribution of some species was analysed, mapped or illustrated.

1. Introduction

I visited the Democratic Republic of Vietnam first in August 1963, within the frame of the scientific exchange of the academies of our countries. With the help of Vietnamese colleagues, among others with Tran Ninh, who was that time 20 years old, I made successful collection of vascular and cryptogamic plants and Arthropoda, resulting in a large number of specimens identified and deposited in Hungarian and Vietnamese museums and herbaria. I revisited the country during the war in 1965-66 and afterwards three more times, already in the reunited Vietnam, continuing collecting work.

In 1976, at the International Botanical Congress in Leningrad, the Vietnamese delegate, Prof. Dr. Thai van Trung has asked me to educate a bryologist for the country, in the person of Trần Ninh, whom I already knew. He came to Hungary and spent several years with his language and scientific studies, completing and successfully defending his thesis on the Indochinese species of genus *Homaliodendron* (Ninh 1984). Within this framework the separation of a new genus (*Noguchiodendron*, Ninh & Pócs 1981) and other publications were also made (Ninh 1980, 1981). Returning to Vietnam, he started his teaching and scientific career as a professor at the Vietnam National University (VNU, Hanoi) and became the curator of the Cryptogamic Herbarium and did

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active collecting and publication work (Ninh 1993, 1998, Tan & Ninh 2003). Later he also became an expert of the vascular genus *Camellia* (Theaceae), describing several species new to science (Ninh 2005; Ninh & Lieu 2022; Ninh et al. 1998a, 1998b, 2007, 2010).

We kept in contact during the past 60 years, meeting several times and publishing joint papers. Trần Ninh once organized a successful collecting trip to the bryologically unknown Vu Quang reserve, which resulted in the Asian discovery of the genus *Myriocoleopsis* (Tan & Ninh 2003; Pócs & Ninh 2005; Pócs 2010). From time to time he gave or sent me epiphyllous bryophyte collections for identification (Pócs & Ninh 2012). His second collections made after our joint works in Vietnam is now published in this paper, together with the field results of Hungarian botanists, Gabriella Kis (EGR) and Erzsébet Fráter (VBI), accompanied by Vietnamese colleagues, almost made at the same time in 1999, but from other parts of the country. There are still more unidentified materials in our herbarium (EGR) collected by Trần Ninh.

2. Material and methods

I investigated all leaves covered by epiphylls, collected by the three botanists. In most cases the quantity of leaves was not enough to make phytosociological relevés, but good enough to have an impression of the epiphyllous flora of the different areas. Epiphyllous diversity is depending on many, mostly macro- and microclimatic factors (Marline et al. 2020, Graham et al. 2023). Among these factors the combination of continually high air moisture, relatively good light conditions and temperature mostly above the freezing point seem to be most important. Generally the alpha diversity increases with elevation to a certain level with altitude, up to the belt(s) of regular cloud formation, then usually decreases (van Reenen & Grasdstein 1984, Pócs 1994). According to my earlier investigation 20–30 leaves collected from various shrubs and herbs (including thin leaved ferns and hard leaved woody plants) reflects basically the epiphyllous diversity of an area (Pócs 1978). The good state or the level of degradation of a rain forest is well expressed by the average number of species per leaf (Pócs & Tóthmérész 1997). Later R. & A. Lücking (1996) has found, that collecting the data of maximum 250 leaves gives a rather complete records of an area, while in extra high diversity conditions the survey of even 360 leaf might be necessary to obtain a full inventory.

The localities according to the collector's numbers

In addition to the description of localities from the different collectors I gave the number of species that were collected there. Except the last locality of Ninh, all specimens were epiphyllous, collected from leaves.

E. Fráter 99251: CAO BO Prov. : HA-GIANG Mts. SW of HA-GIANG town, on the ridge leading to N. TAY CON LINH. Montane rainforest at 1500 m elevation, with giant trees, *Camellia* spp., *Lauraceae*, *Fagaceae*, on siliciferous bedrock. Date: 17. Dec. 1999. 23 species.

G. Kis 99240: HA-GIANG Prov. : SONG-LO Valley north of HA-GIANG town. Degraded forest bush with *Aglaonema* cf. *siamense*, *Caryota mitis*, *Sterculia hypochrea*, *Zanthoxylon* sp., *Amorphophallus konjac*, at 165-280 m elevation. 22°52, 63'N, 105°00. 05'E. . Date: 12. Dec. 1999. 2 species:

G. Kis 99241: CAO-BO Prov. : HA-GIANG Mountains SW of HA-GIANG town. In SONG NAM NO Valley. Remnants of laurel forest with *Cinnamomum cambodianum*, *Castanopsis tessalata*, *Garcinia multiflora*, *Lithocarpus bonnettii*, *Livistona saribus*. 22°44, 84'N, 104°54, 56'E. Date: 13. December 1999. 2 species:

- G. Kis 99243:** PHU-LINH Prov. : 20 km SE of HA-GIANG town. On the N slope of NLOONG Valley. Lowland rainforest on carstic area with sharp edged limestone rocks at 135—420 m elevation. Giant trees: *Diospyros* sp. *Vatica tonkinensis*, *Szygium aromaticum*, *Pometia pinnata*. In the lower layers *Pandanus* sp., *Arenga pinnata*, *Bauhinia*, *Entada*, *Wendlandia*, *Uvaria* spp. 22°41, 02'–41, 76'N, 105°00, 01'–02'E. Date: 14. December 1999. 6 species.
- G. Kis 9945:** CAO BO Prov. : HA-GIANG Mts. : N slope of SONG NAM NO Valley. Bamboo thicket along a creek, with remnant forest trees, ferns, on slate bedrock. At 485—500 m, 22°45, 99'N, 104°56, 92'E. Date: 15. December 1999. 4 species.
- G. Kis 9947:** CAO BO Prov. : HA-GIANG Mts. WSW of HA-GIANG town, upper part of SONG NAM NO Valley. Bamboo thicket replacing forest with remnant *Quercus*, *Paulownia*, *Dillenia*, *Betula alnoides* and *Magnoliaceae* trees at 980–1000 m elevation. 22°44, 85 N, 104°51, 19 E. Date: 16. Dec. 1999. 27 species.
- G. Kis 9948:** CAO BO Prov. : HA-GIANG Mts. WSW of HA-GIANG town, upper part of SONG NAM NO Valley. Bamboo thicket replacing forest with remnant *Quercus*, *Paulownia*, *Dillenia*, *Betula alnoides* and *Magnoliaceae* trees at 980–1000 m elevation. . 22°44, 85 N, 104°51, 19 E Epiphyllous. . Date: 16. Dec. 1999. 8 species.
- G. Kis 99249:** CAO BO Prov. : HA-GIANG Mts. SW of HA-GIANG town, in the valley leading to N. TAY CON LINH. Cultivated and forest remnant trees above rice fields, at 980–1100 m elev. 22°46, 19 N, 104°50, 03 E. Date: 17. December 1999. 9 species.
- G. Kis 99250:** CAO BO Prov. : HA-GIANG Mts. SW of HA-GIANG town, in the valley leading to N. TAY CON LINH. Secondary bushes replacing montane rainforest with remnant trees, at 1250–1300 m elev. 22°46, 19 N, 104°50, 03 E. Date: 17. December 1999. 5 species.
- G. Kis 99252:** VINH-PHUC Prov. : Foothills of TAM-ĐAO Mts above KHUON BOONG village, at ME LINH Biodiversity Station. Lowland rainforest at 70–100 m elevation with *Castanopsis*, *Ficus*, *Liquidambar formosana*, *Calamus salicifolius*, *Dendrocalamus lancifimbriatus* and *Mallotus*. 21°22, 75'–24, 37'N, 105°42, 82–86'E. Date: 21. December 1999. 18 species.
- Trần Ninh 9865 –9890:** Tuyên Quang Prov., Na Hang Distr. Tropical forest, 300–350 m elev. Date: October 1998. 12 species.
- Trần Ninh 9864 and 9984–99123:** Hà Tĩnh Prov., Hương Sơn Distr., Sơn Kim village. Tropical forest at 230–350 m elev. Date: 26–27 November 1999. 14 species.
- Trần Ninh 70255:** Hà Tĩnh Province, Vũ Quang District, Vũ Quang National Park, lower montane rain forest at 1100 m elevation. Date: 20 July 2002., 6 species.
- Trần Ninh 702162:** Hà Tĩnh Province, Vũ Quang District, Vũ Quang National Park, montane rain forest at 1700 m elevation. Collected from bark. 21 July 2002. 1 species.

3. Annotated enumeration of the collected species

3.1 Hepaticae

Caudalejeunea reniloba (Gottsche) Steph. — Kis 99252 (EGR)

Cheilolejeunea trapezia (Nees) Kachroo & R. M. Schust. — Kis 99249 (VNU), Ninh 9865 (EGR, VNU); 9986 (VNU); 9987; 9988 (EGR, VNU); 99119 (EGR, VNU).

Cololejeunea appressa (A. Evans) Benedix — Fráter 99251 (EGR); Kis 99249 (EGR)

Cololejeunea bachmaensis Tixier — Fráter 99251 (EGR, VNU). Hitherto known only from its type locality in Thua Thien Province near Hué in Bach Ma National Park. It differs from the related *C. ocelloides* (Horik.) Mizut. (Syn. : *C. leonidens* Benedix) by its saccate lobule and 2–3 celled stylus.

Cololejeunea ceatocarpa Ångstr.) Steph. — Kis 99247 (EGR)

Cololejeunea cordiflora Steph. Pócs — Kis 99245 (EGR), Kis 99247 (EGR, VNU), 99250 (EGR, VNU); 99252 (EGR); Ninh 1864a (EGR, VNU). *C. cordiflora* even though treated as a subsp. of *C. trichomanis* (Gottsche) Steph. (Pócs & Piippo 2011: 104) in the past, was later reestablished as distinct species. (Pócs 2016).

Cololejeunea desciscens (Steph.) Mizut. — Kis 99252 (EGR, VNU)

Cololejeunea diaphana A. Evans — Fráter 99251 (EGR); Kis 99247 (EGR, VNU)

Cololejeunea floccosa Schiffn. — Fráter 99251 (EGR)

Cololejeunea gottschei (Steph.) Mizut. — Kis 99247 (EGR)

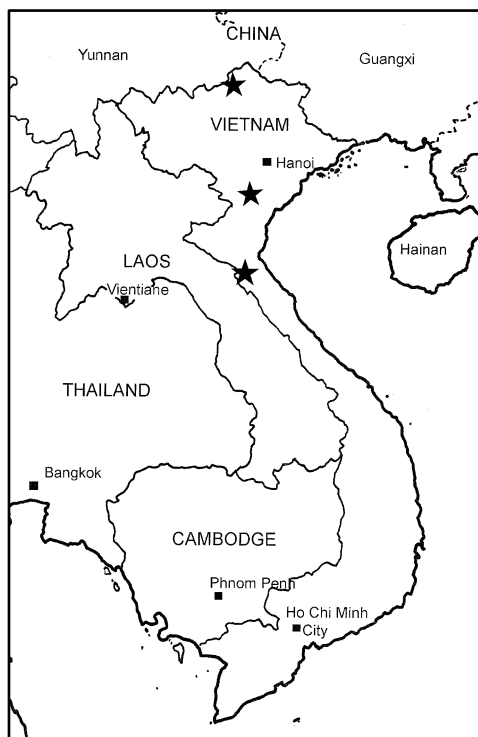
Cololejeunea grushvitzkiana Pócs (Map 1. and Figs 1 A–D) — Ninh 9986 (VNU); 9987 (EGR, VNU); 9988 (EGR, VNU). The species was described from the collection of Grushvitzki made in the low altitude of Ha Giang Mountains, near the collecting locality 99247 of Kis (Pócs 1971). Later Tixier (1985) synonymised it with *C. balansae* (Steph.) Mizut., but Zhu & So (2000) restored its identity, based on the good distinguishing characters (see their fig 1), like the very elongated first lobule tooth, the symmetric lobe with parallel margins and other characters used also by Pócs (1971). Zhu & So (2000) reported it also from the Cuc Phuong National Park in Ninh Binh Province and it was now collected by Ninh in the Ha Tinh Province of central Vietnam. This Vietnamese endemic is a nice looking, shiny, relatively large species of *Cololejeunea*, with shoot width reaching sometimes 2 mm.

Cololejeunea haskarliana (Lehm & Lindenb.) Schiffn. — Fráter 99251 (EGR); Kis 99243 (EGR, VNU), Kis 99247 (EGR, VNU), Kis 99248 (VNU) 99252 (EGR)

Cololejeunea hoabinhiana Tixier — Kis 99252 (EGR). A Vietnamese endemic hitherto known only from Hoa Binh Province near Tu Ly (Tixier 1974).

Cololejeunea inflata Steph. — Kis 99247 (EGR)

Cololejeunea lanciloba Steph. — Kis 99240 (EGR), Kis 99241 (EGR), Kis 99243 (EGR), Kis 99247 (EGR, VNU)



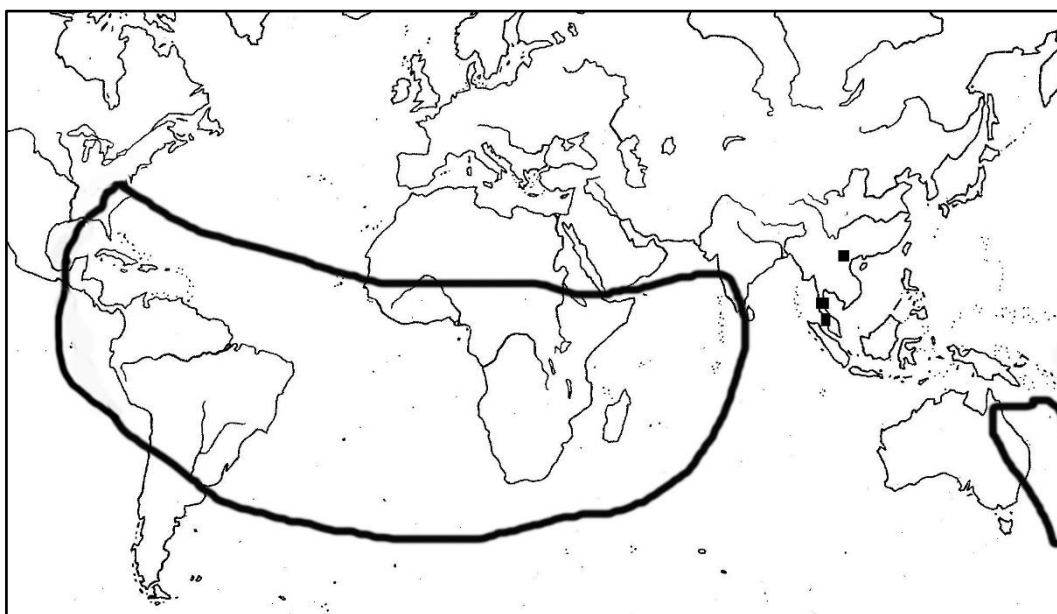
Map. 1: The known localities of *Cololejeunea grushvitzkiana* Pócs marked by asterisks.

Cololejeunea latilobula (Herzog) Tixier — Kis 99252 (EGR)

Cololejeunea longifolia (Mitt.) Mizut. — Kis 99247 (EGR)

Cololejeunea ocellata (Horik.) Benedix — Ninh 9895 (VNU).

Cololejeunea pacifica Pócs — Kis 99240 (EGR). As I wrote (Pócs 2012, 2014), this species is an interesting allopatric vicariant of *Colejeunea cardiocapa* (Mont.) A. Evans. (see map 2). Though they are related, they can be distinguished by well separating characters (Pócs 2012) and they never occur together in the same geographic area (Chantanaorrapint & Pócs 2014). *Cololejeunea pacifica* occurs only in Vietnam, Thailand, on the Malay Peninsula and in the Pacific islands, while *Colejeunea cardiocapa* is widespread from the Americas through Africa to southern India. It does not occur in the Malayan Archipelago and in Southeast Asia, but has a smaller distribution area from eastern Australia through New Caledonia to the Hongiora Island in the Alderman island group, near the northernmost part of New Zealand (Braggins 1999).



Map 2. The known distribution of *Colejeunea cardiocapa* (Mont.) A. Evans. (continuous line, including the northernmost part of New Zealand) and of *Cololejeunea pacifica* Pócs (squares + Fiji, Tonga and Tahiti islands).

Cololejeunea planissima (Mitt.) Abeyw. — Fráter 99251 (EGR); Kis 99247 (EGR), 99252 (VNU)

Cololejeunea peraffinis (Schiffn.) Benedix — Fráter 99251 (EGR)

Cololejeunea pseudoserrata Tixier (Fig. 1 E) — Kis 99247 (EGR, microslide). New to Vietnam, described from New Caledonia (Tixier 1979). It has been reported from New Guinea and the Solomon Islands (Pócs & Piippo 2011), the Fiji islands (Pócs 2012) and finally from Thailand (Pócs & Podani 2015). It differs from *C. serrulata* by its apiculate, slightly falcate

lobes with teeth consisting of more than one cell, by the leaf shoulders not crossing the stem (crossing in *C. serrulata*) and the one cell wide ventral merophyte (two in *C. serrulata*).

Cololejeunea pseudofloccosa (Hook.) Benedix. — Fráter 99251 (EGR); Ninh 9890 (EGR, VNU)

Cololejeunea pseudostephani Tixier — Fráter 99251 (EGR).

Cololejeunea raduliloba Steph. — Kis 99252 (EGR, VNU)

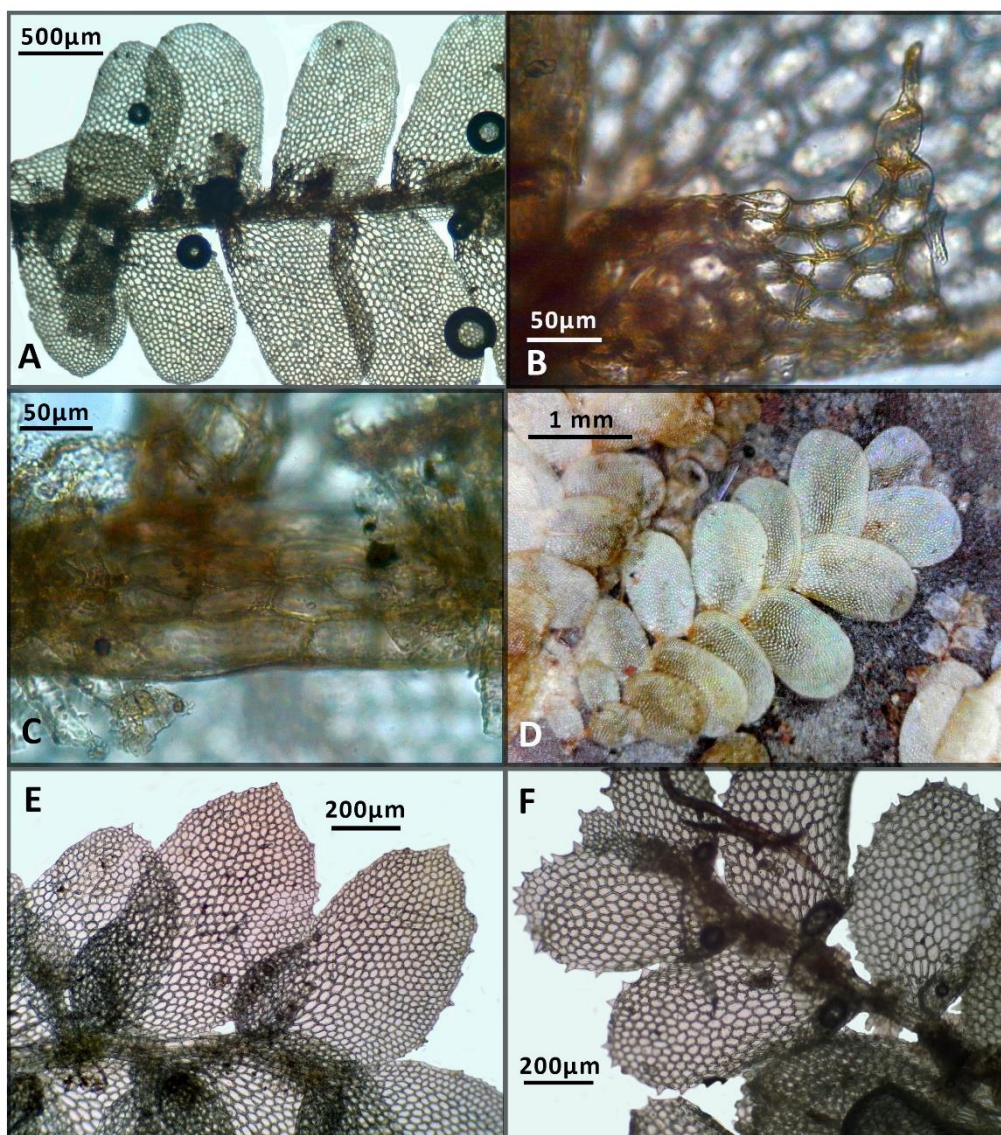


Fig. 1: A–D *Cololejeunea grushvitzkiana* Pócs (Ninh 9987b, EGR, VNU). A: habit, ventral view; B: lobule; C: stem with 2 ventral merophytes; D: habit, dorsal view. **E:** *Cololejeunea pseudoserrata* Tixier, habit, ventral view (Kis 99247, EGR); **F:** *Cololejeunea serrulata* Steph. habit, ventral view (Zanten, Papua New Guinea, Wau, 741263C (H, microslide in EGR).

- Cololejeunea serrulata* Steph. — Ninh 9984 (EGR, VNU). Although we synonymised it with *Cololejeunea trichomanis* (Gottsche) Steph. subsp. *cordiflora* (Steph.) Pócs (in Pócs & Piippo 2011: 104), it seems to be useful to restore its species identity due to its morphological differences. There is larger and more regular, serrulate dentition both, of the lobe and perianth margins, manifested more on the Australasian specimens than on the type.
- Cololejeunea sigmoidea* Ast & Tixier — . Fráter 99251 (EGR, VNU); Kis 99247 (EGR), 99251 (VNU), 99252 (EGR, VNU); Ninh 9883 (VNU)
- Cololejeunea spathulifolia* (Steph.) H. A. Mill. — Ninh 9895 (VNU). A rare (but poorly defined) species with very scattered known distribution: Hawaii, Solomon Islands, Vietnam, Malaysia, Thailand, Réunion. (Chantanaorrapint & Pócs 2014, Pócs & Lee 2016).
- Cololejeunea stylilobula* Tixier ex R. L. Zhu — Kis 99252 (EGR, VNU). A rare species distributed from Indochina to West Irian.
- Cololejeunea tenella* Benedix — Kis 99247 (EGR)
- Cololejeunea trichomanis* (Gottsche) Steph. s. str. — Kis 99245 (EGR, VNU), 99252 (EGR, VNU).
- Cololejeunea verrucosa* Steph. — Fráter 99251 (EGR); Kis 99247 (EGR)
- Colura ari* Steph. — Ninh 9985 (VNU); 9988 (VNU).
- Colura tenuicornis* (A. Evans) Steph. — Kis 99247 (EGR), 99249 (EGR, VNU), 99250 (EGR)
- Drepanolejeunea pentadactyla* (Mitt.) Steph. — Kis 99247 (EGR, VNU)
- Drepanolejeunea foliicola* Horik. — Kis 99247 (EGR, VNU); Ninh 9886 (EGR, VNU); 9887 (VNU).
- Drepanolejeunea spicata* (Steph.) Grolle & R. L. Zhu — Ninh 1864a (EGR, VNU); 9880 (EGR, VNU); 9890 (EGR, VNU); 9884 (EGR, VNU); 9987 (EGR, VNU).
- Drepanolejeunea yunnanensis* (P. C. Chen) Grolle & R. L. Zhu — Kis 99247 (EGR, VNU)
- Jubula hutchinsiae* subsp. *javanica* (Steph.) Verd. — Kis 99248 (EGR)
- Lejeunea anisophylla* Mont. — Kis 99249 (EGR), 99252 (EGR, VNU); Ninh 9880 (EGR, VNU).
- Lejeunea flava* (Sw.) Nees — Kis 99249 (EGR, VNU)
- Lejeunea micholitzii* Mizut. — Kis 99245 (EGR, VNU), 99247 (EGR), 99248 (EGR), 99252 (EGR)
- Lejeunea* cf. *papilionacea* Steph. — Kis 99249 (EGR); Ninh 70255 (EGR, VNU)
- Leptolejeunea elliptica* (Lehm. & Lindenb.) Schiffn. — Fráter 99251 (EGR); Kis 99240 (EGR, VNU), Kis 99247 (EGR), Kis 99248 (VNU), 99252 (EGR); Ninh 9883 (VNU); 9890 (EGR, VNU); 9895 (VNU); 9886 (EGR, VNU); 9887 (VNU).
- Leptolejeunea epiphylla* (Mitt.) Steph. — Kis 99240 (EGR)
- Leptolejeunea maculata* (Mitt.) Schiffn. — Kis 99243 (EGR, VNU), Kis 99247 (EGR, VNU)
- Leptolejeunea subdentata* Schiffn. ex Herzog — Kis 99247 (EGR, VNU)
- Leptolejeunea* cf. *truncatifolia* (Steph.) Grolle — Ninh 9884 (EGR, VNU).

- Lopholejeunea nigricans* (Lindenb.) Schiffn. — Ninh 9865 (VNU) — Common pantropical species.
- Metzgeria consanguinea* Schiffn. — Fráter 99251 (VNU); Kis 99252 (EGR)
- Microlejeunea punctiformis* (Taylor) Steph. — Kis 99245 (EGR), Kis 99247 (EGR), 99250 (EGR); Ninh 9890 (EGR, VNU), 9887 (VNU).
- Plagiochila sciophila* Nees & Lindenb. — Fráter 99251 (EGR, VNU); Kis 99248 (EGR).
- Ptychanthus striatus* (Lehm. & Lindenb.) Nees — Ninh 70255 (EGR, VNU)
- Radula acuminata* Steph. — Kis 99243 (EGR, VNU), 99251(EGR), 99251 (VNU)99252 (EGR; Ninh 99119, 120, 121, 122, 123 (all VNU),
- Radula assamica* Steph. — Ninh 9985 (VNU)

3.2 Musci

- Aerobryopsis longissima* (Dozy & Molk.) M. Fleisch. — Ninh70255 (VNU).
- Cyatophorum hookerianum* (Griff.) Mitt. Syn. : *Cyatophorella hookeriana* (Griff.) M. Fleischer. — Ninh 9865 (VNU).
- Daltonia sp. n.* — Ninh 9865 (BM, EGR, SING, VNU); 9880 (EGR, VNU). An undescribed species, which needs further study.
- Ephemeropsis tjibodensis* K. I. Goebel Ninh 9865 (EGR, VNU). Widespread obligate epiphyllous Indomalesian-Pacific moss species. Distribution map in Pócs (2007), discussed in Pócs et al. 2013.
- Meteoriopsis reclinata* (Müll. Hal.) M. Fleisch. — Kis 99247 (EGR, VNU)
- Taiwanobryum mucronatum* (Bosch & Sande Lac.) S. Olsson et al. Syn. : *Pinnatella mucronata* (Bosch & Sande Lac.) M. Fleisch. — Ninh 702162 (VNU).

4. Conclusions

In this small account a great part of the epiphyllous bryophytes originated from different elevations of Ha-Giang Mountains in northernmost Vietnam. The observed altitudinal range of diversity also supports the opinion of Tixier (1975) that in Vietnam the elevation between 1000-1200 m is the richest of epiphyllous species. Even though we have already some knowledge about the liverworts flora of this area (Pócs 1971), the mountains still hold many novelties, like *Cololejeunea pacifica* and *C. pseudoserrata*, both of Australasian-Pacific connections, indicating, that further research is needed.

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