NEW RECORDS FOR THE LIVERWORT AND HORNWORT FLORA OF VIETNAM, 1

T. Pócs1*, N.-K.-T. Tram2, Q. He3, T. Katagiri4, T.-T. Luong2,5

1Botany Department, Institute of Biology, Eszterházy Károly University
H-3301 Eger, Pf. 43, Hungary; E-mail: *colura@upcmail.hu; corresponding author
2Department of Ecology-Evolutionary Biology, University of Science, Vietnam National University, Ho Chi Minh City, Vietnam; E-mail: nguyenkhanhtrinhtram@gmail.com
3State Key Laboratory of Systematic and Evolutionary Botany, Institute of Botany
Chinese Academy of Sciences, Beijing, China; E-mail: heqiang@ibcas.ac.cn
4Hattori Botanical Laboratory, Obi 6-1-26, Nichinan, Miyazaki 889-2535, Japan
E-mail: tomoyuki-katagiri@hattorilab.org
5Herbarium, Biodiversity Unit, University of Turku, Turku, FI-20014, Finland
E-mail: thien-tam.luong@utu.fi

(Received: 21 May, 2019; Accepted: 16 August, 2019)

After the examination of the Cryptogam collection in the Herbarium of the University of Science, Vietnam National University Ho Chi Minh City (PHH), 25 species proved to be new to Vietnam, including one hornwort and 24 liverworts. Among them, four genera: De-notarisia Grolle, Gongylanthus Nees, Leiomitra Lindb. and Lepicolea Dumort. are new records for the country. Diagnostic characters and illustrations are given for some taxa, as well as locality notes and habitat descriptions are provided for each collecting area.

Key words: GBIF, hornwort, liverwort, new record, PHH Herbarium, Vietnam

INTRODUCTION

The first checklist of bryophytes, also the first checklist of Vietnam liverworts was published by T. Pócs in 1965, including 394 species of mosses and 162 species of liverworts and hornworts (Pócs 1965). Tixier (1966a) gave a detailed account on the epiphytic vegetation (including the bryophytes) of the Central Highlands of southern Vietnam, without floristical novelties. Fifty years later, Bakalin and Nguyen (2016) published the second checklist of 301 Vietnam liverwort and hornwort species (five species of hornworts) based on 45 literature sources. Recently, Bakalin et al. (2018) added 79 new records for Vietnam liverworts, in which 43 species are new to Indochina. The authors concluded that Vietnam liverwort flora currently has 379 species and infraspecific taxa and predicted that the total number of liverworts in Vietnam should be close to 500 species and infraspecific taxa. In the same year, Shu et al. (2017) revised Bakalin and Nguyen’s (2016) checklist and added 100 new records, raising the total number of Vietnam liverwort and hornwort species...
to 430 (except for 23 infraspecific taxa). There are differences in these author’s opinions about the status of some species, which causes some discrepancies in the precise number of liverwort and hornwort taxa of Vietnam.

There has been a gap in liverwort studies in Vietnam for about 20 years since the late 1970s and the majority of publications on Vietnam liverworts and hornworts concentrated on floristical records. Studies on Vietnam liverworts began again in 1999, when Zhu and So reported a new Cololejeunea for Vietnam: C. pseudoplagiophylla P. C. Wu et J. X. Luo (Zhu and So 1999), which was not included in the Bakalin and Nguyen’s (2016) checklist. Floristical studies with the participation of local bryologists have been restarted during the 21st century. In 2005, Pócs and Tran published 41 liverwort taxa in Vu Quang Nature Reserve (now it is a national park), of which Cheilolejeunea streimannii Pócs and Cololejeunea vuquangensis Pócs et Ninh were new to science, eight taxa were new to Indochina or Asia, while a further four were new to Vietnam (Pócs and Tran 2005). For the south of Vietnam, Pócs and Tran (2012) reported 21 epiphyllous species in Cat Tien National Park, in which Colura ornata K. I. Goebel were new to Vietnam. In 2013, Pócs, Luong and Ho described a new liverwort, Drepanolejeunea bidoupensis Pócs, among 54 epiphyllous species from 125 samples collected in Bidoup-Núi Ba National Park (Pócs et al. 2013). Three of them are also new to Vietnam. Bakalin and Vilnet (2018) announced a new Mylia to science: Mylia vietnamica Bakalin et Vilnet, which was also the first record of this genus for Southeast Asia. Recently, in 2019, Borovichev, Bakalin and Nguyen published a paper on the genus Cyathodium, which is poorly known in Vietnam. The authors provided morphological descriptions, ecology and distribution for three Cyathodium species present in the country (Borovichev et al. 2019).

In summary, the liverwort and hornwort floras of Vietnam have been studied for a long time but still insufficiently understood due to many disruptions. This paper belongs to a series of reports of new and noteworthy bryophytes of Vietnam, whereas specimen information is published and available on the Global Biodiversity Information Facility (GBIF) (www.gbif.org) database.

MATERIALS AND METHODS

The samples treated in this article were collected from 2011 to 2018 in 11 locations (1–11) of seven main localities (A–G) (Fig. 1), which are all described below. An overview on habitat and vegetation for each location is provided. Most of the specimens are from the Central Highlands of southern Vietnam and dominated by those in Bidoup-Núi Bà National Park.

The specimens were identified in connection with the project by the University of Science, VNUHCM, which aims to digitise and publish observations.
of Vietnamese bryophyte and lichen specimens being held in the Herbarium of the University of Science, Vietnam National University Ho Chi Minh City (PHH) in the GBIF database. Until now, the dataset includes 851 records of which three species are hornworts and 154 species of liverworts (Luong et al. 2019). Identifications of specimens were done or confirmed by Tamás Pócs (EGR), Tomoyuki Katagiri (NICH) and Qiang He (PE). All specimens listed below are stored in PHH, with duplicates in EGR, NICH and PE.

**Study locations**

A). Bidoup-Núi Bà National Park located at the end of the Central Highlands, Lâm Đồng province. The Park has an average elevation of 1,500–1,700 m with the highest peaks at Bidoup 2,287 m, and Núi Bà (Lang Bian) 2,167 m.
   - Loc. 3: the vicinity of Hòn Giao station, in mixed forest (Fagaceae, Clusiaceae, Illiciaceae, Theaceae). 12° 11’ 22.0” N, 108° 42’ 48.5” E. Alt.: 1,500–1,800 m. Date: 2010, 2011 and 2015.
   - Loc. 4: the vicinity of Cổng Trời station, in mixed forest (*Pinus kesiya*, Fagaceae). 12° 05’ 55.0” N, 108° 22’ 27.0” E. Alt.: 1,500–1,800 m. Date: 16 and 18 Nov. 2015.

B). Chư Yang Sin National Park, Đắk Lắk province, NW to Bidoup-Núi Bà National Park. Elevation: 800–2,442 m. The highest peak of the park and also of the province is Chư Yang Sin peak (2,442 m).
   - Loc. 5: the forest along a stream in Subarea 1359 of the park, in mixed pine (*Pinus krempfii*, *P. dalatensis*, *Calocedrus macrolepis*, and *Fokienia hodginsii*) and evergreen forest (Fagaceae, Lauraceae, Meliaceae, Illiciaceae). 12° 05’ 55.0” N, 108° 26’ 49.5” E. Alt.: 1,600 m. Date: 29 Nov. 2015.

   - Loc. 6: the trail from Dr Yersin’s heritage house to Hòn Bà summit, in mixed coniferous and broadleaved forest (*Pinus krempfii*, *Fokienia hodginsii*, Fagaceae, Magnoliaceae, Rubiaceae and Lauraceae). 12° 07’ 49.5” N, 108° 57’ 37.7” E. Alt.: 1,550–1,560 m. Date: 23 Oct. 2015.

D). Đà Lạt city, a famous city for tourism in Lâm Đồng province, Central Highlands.
– Loc. 7: the Lâm Đồng Museum, liverworts on ornamental tree trunks. 11° 56’ 26.9” N, 108° 27’ 35.9” E. Alt.: 1,500 m. Date: 24 Nov. 2018.

E). Nam Ban Protected Forest, Lâm Đồng province, SW of Đà Lạt city.
– Loc. 8: a tropical montane forest along a shallow stream, next to a banana and coffee farm, including Euphorbiaceae, Lauraceae, Moraceae, Malvaceae with the understory dominated by Gesneriaceae. With the moisture from the stream, there are many Gesneriaceae leaves covered by epiphyllous liverworts. 11° 54’ 59.5” N, 108° 10’ 28.8” E. Alt.: 1,219 m. Date: 2 Dec. 2018.

F). Tân Phú Protected Forest, Đồng Nai Province, 40 km NW of Ho Chi Minh City.
– Loc. 9: along Mai Waterfall, characterised by tropical lowland forest vegetation, such as Dipterocarpus, Ficus, Fabaceae and Rubiaceae. It was shaded and semi-moist at the time we conducted the survey. 11° 06’ 38.0” N, 107° 27’ 10.0” E. Alt.: 76 m. Date: 25 Nov. 2018.

Fig. 1. The seven study locations in Vietnam. The letters refer to their description in the text.
– Loc. 10: the trail to Rùng Rình peak, bamboo mixed forest, which possesses 30% cover of canopy. 21° 28’ 06.3” N, 105° 37’ 09.8” E. Alt.: 950–1,300 m. Date: 18 Nov. 2014.
– Loc. 11: a car road from a stilt house to the town, which runs through an evergreen forest, opened 70–100%. 21° 28’ 27.6” N, 105° 38’ 53.0” E. Alt.: 955 m. Date: 19 Nov. 2014.

RESULTS

A total of 25 species are newly recorded for the flora of Vietnam: one hornwort and 24 liverworts, in which four genera are new for the country: Denotarisia Grolle, Gongylanthus Nees, Leiomitra Lindb. and Lepicolea Dumort.

Acrolejeunea arcuata (Nees) Grolle et Gradst. (Figs 8–9). – Specimen examined: location 1, on bark, Tram LBT-L-18003 p.p. (PHH, EGR). – Distribution: a Malesian species, new to Vietnam; Java, Sumatra, Borneo (Sabah), Philippines, New Guinea. – Taxonomic notes: it can be distinguished by the lobule (more than 2.5 times long than wide with 1–2 teeth at its apex and by the suborbicular underleaves not wider than long (Gradstein et al. 2002).

Acromastigum herzogii Grolle (Figs 10–12). – Specimens examined: location 1, on bark, Póc 1827/J (PHH, EGR); location 2, on decaying log, Luong & Ho BD-511-056 (PHH); location 3, on bark, Luong & Ho BD-810-052-b (PHH). – Distribution: hitherto known only from Borneo (Sarawak); new to Vietnam. A plant published and illustrated by Kitagawa (1978, fig. 2) from Thailand under the name of Acromastigum curtilobum A. Evans, may be the same species (A. curtilobum has truncate leaf lobe apices). – Taxonomic notes: the species is related to A. filum (Steph.) A. Evans and to A. capillare (Steph.) A. Evans. It differs from A. filum by its J shaped (not square) leaf insertion, and from A. capillare by its more elongated leaves and underleaves (Grolle 1964).


Asterella mussuriensis (Kashyap) Verd. – Specimens examined: location 11, on rock, Luong & Dinh 14622 (PHH, PE) and 14623 (PHH, PE). – Distribution: a Sino-Himalayan species, new to Vietnam; N India, Nepal, Bhutan, China and Pakistan (Jia and He 2013, Singh et al. 2016). – Taxonomic notes: the species is characterised by 1) sexual condition ventral-autoicous, both androecia and archegoniophores on very small ventral branches; 2) spores dark
red-brown, 80–110 µm diam.; 3) elaters 130–195 × 12.5–20 µm, mostly bisprial (Long 2006).

**Bazzania serrulatoides** Horik. – Specimen examined: location 3, on bark, Luong BD-0111-027 (PHH). – Distribution: a Malesian species, new to Vietnam, known from Sumatra, China (Hainan), Taiwan and Thailand. – Taxonomic notes: the combination of the serrulate leaf apex and narrow underleaves with hyaline margins distinguishes it from all other Vietnamese and South Chinese species (Zhou et al. 2012).

![Figs 2–7](image)

Figs 2–7. Fig. 2. *Schiffneria yunnanensis* C. Gao et W. Li, part of plant with perianth, dorsal view (from Luong & Duong 15760). – Figs 3–4. *Riccardia latifrons* (Lindb.) Lindb.: 3 = part of plant with calyptrae; 4 = cross section of thallus (from Luong & Dinh 14646). – Fig. 5. *Asterella mussurienis* (Kashyap) Verd., part of plant with ventral branches, dorsal view (from Luong & Dinh 14623). – Figs 6–7. *Riccardia nagasakiensis* (Steph.) S. Hatt.: 6 = part of plant; 7 = cross section of thallus (from Luong BD0111-005)
**Cheilolejeunea intertexta** (Lindenb.) Steph. – Specimen examined: location 9, on rock, Pócs 1829/A (PHH, EGR). – Distribution: widespread in the Palaeotropics, new to Vietnam (Zhu et al. 2002). – Taxonomic notes: the species is distinguished from the related *C. rigidula* (Nees ex Mont.) R. M. Schust. by its autoicy, pycnolejeuneoid innovation and by its very small trigones (Grolle 1979).

**Cheilolejeunea khasiana** (Mitt.) N. Kitag. – Specimen examined: location 1, on bark, Pócs 1827/T p.p. (PHH, EGR). – Distribution: a Southeast Asian species, new to Vietnam; S China, Japan, India (Assam), Nepal, Philippines. – Taxonomic notes: it is distinguished by its subacute leaves with short lobule and relatively large underleaves with rounded segments, and by its obovate perianth with weakly-developed keels (Zhu et al. 2002).

**Colura speciosa** Jovet-Ast (Fig. 29). – Specimen examined: location 5, epiphyllous, Luong & Duong 15949-b (PHH). – Distribution: known only from Indonesian Borneo and from Papua New Guinea, new to Vietnam (Pócs 2013). – Taxonomic notes: the characteristic feature of species is the entire lobe margin, the rare occurrence of lobulated leaves and the sharply apiculate lobule sac (Jovet-Ast 1954).

**Denotarisia linguifolia** (De Not.) Grolle – Specimen examined: location 1, on *Pinus kesiya* bark, Pócs 1828/B (PHH, EGR). – Distribution: Malesian-Pacific, genus and species new to Vietnam; known from Ceylon to Fiji and to the Society Islands. – Taxonomic notes: apart from its subfalcate leaves with incurved margins, the best character of the genus and species are the star-like marks in the largely nodulose trigones of the cell walls (Grolle 1971).

**Drepanolejeunea levicornua** Steph. (Figs 28 and 30). – Specimens examined: all specimens epiphyllous: location 2, 15055-a (PHH), 15057-c (PHH) and 15061-c (PHH); location 3, Luong 15032-c (PHH); location 5, Luong & Duong 15948-b (PHH) and 15949-a (PHH). – Distribution: a Malesian species, new to Vietnam; known from Borneo, Java, Peninsular Malaysia and Sarawak, Seram and New Guinea (Lee et al. 2018). – Taxonomic notes: within the *D. thwaitesi-ana* group the species is characterised by the lack of median leaf ocelli and by the highly mamillose perianth wall (Mizutani 1990).

**Gongylanthus himalayensis** Grolle (Figs 16–17). – Specimen examined: location 8, on soil, Tram NBT-L-1813 p.p. (PHH, EGR). – Distribution: a Sino-Himalayan species, genus is new to Vietnam; known from India: Nilgiri Hills, Sikkim and Assam; Nepal; Bhutan; China: Sichuan and Yunnan, in an altitude range of 1710 to 5070 m (Váňa et al. 2012). – Taxonomic notes: similar to *G. ericetorum* (Raddi) Nees, but clearly differs from the latter by 1) the smooth cuticle of leaf cells; 2) the rather concave leaves with upper margin recurved (Grolle 1966).

Leiomitra merrillana (Steph.) T. Katag. (Figs 31–33). – Specimens examined: location 3, on bark, Luong & Ho BD-511-041 (PHH, NICH) and BD-810-037 (PHH, NICH). – Distribution: widely distributed in SE Asia (Thailand, Malaysia, Philippines, Indonesia, Papua New Guinea); new genus to Vietnam. – Taxonomic notes: Leiomitra Lindb. is distinguished from Trichocolea Dumort. by the lack of regularly pinnate branching and from Eotrichocolea R. M. Schust. by succubous leaves. Leiomitra merrillana is characterised by irregularly pinnate branching, leaf cilia with (3–)6–10(–12) cells long and thick-walled cells with dilated septa. More distinguishing characters are discussed in Katagiri and Deguchi (2012).

Lejeunea cf. dipterota (Eifrig) G. E. Lee – Specimen examined: location 7, on bark, Pócs 1824/C (EGR). – Distribution: a Malesian species known from Java, Borneo (Sabah), new to Vietnam (Lee 2013). – Taxonomic notes: the vegetative characters are the well-developed cell wall trigones and intermediate thickenings of lobe, the fully incurved margin and large disc cell below the apical tooth of lobule and the large, reniform underleaves (Lee 2013). Sterile, perianth not seen.

Lejeunea compressiuscula (Steph.) G. E. Lee et Heinrichs (Figs 18–19). – Specimens examined: both epiphyllous, location 2, Luong 15061-b (PHH), location 4, Luong & Duong 15429 (PHH). – Distribution: a Malesian species known from Sri Lanka and Java, new to Vietnam (Lee et al. 2018). – Taxonomic notes: the distinguishing characters are the ovate-oblong leaves with rounded apices, the straight ventral margin of keel, the leaf cells with trigones, the small leaf lobules and the distant, small, suborbicular underleaves (Lee et al. 2018). Eifrig (1937) described it as Taxilejeunea compressiuscula Lindenb. ex Steph. nom. nudum, but did not separate it well from specimens of the later described L. micholitzii Mizut.

Lepicolea yakusimensis (S. Hatt.) S. Hatt. (Fig. 20). – Specimen examined: location 3, on bark, Luong BD-0111-021 (PHH). – Distribution: a Southeast-Asian species, the genus is new to Vietnam; known from Japan, Taiwan, Malaysia: Cameroon Highlands, Sabah (Kitagawa and Kodama 1973, Wang et al. 2011). – Taxonomic notes: characters of the species are the absence of stem paraphyllia and the leaf segments ending in a long, hyaline, uniseriate tip (Piippo 1988).


**Metahygrobiella acuminata** (Herzog) R. M. Schust. (Figs 25–26). – Specimen examined: location 3, on soil, Luong BD-410-091-b (PHH). – Distribution: hitherto known from Borneo: Sarawak, Sabah and from the Philippines, new to Vietnam (Váňa 1993, Schuster 2002). – Taxonomic notes: the main features of the species are the nearly lanceolate, long acuminate leaf lobes with 2–6 cells long uniseriate tips (Váňa 1993). The species is well illustrated by Herzog (1950, fig. 10) under the name of *Hygrobiella acuminata* Herzog.

**Radula amentulosa** Mitt. (Fig. 27). – Specimen examined: location 3, epiphyllous, Luong 15031-b (PHH). – Distribution: a widespread Malesian-Pacific species distributed from Ceylon to Tahiti (So 2006), new to Vietnam. – Taxonomic notes: as a member of section Amentulosa, differs from all species previously known from Vietnam, by the amentulose branches shorter than a normal leaf, composed of reduced, fusiform lobes. *R. amentulosa* has ca 2 mm wide shoots and leaves with obovate lobules ca 2/3 of lobe length (Yamada 1979).


**Riccardia latifrons** (Lindb.) Lindb. (Figs 3–4). – Specimen examined: location 11, on concrete, Luong & Dinh 14646 (PHH, PE). – Distribution: Wide distribution in the Northern Hemisphere (Furuki 1991), new to Vietnam. – Taxonomic notes: the species is characterised by 1) medium size (0.7–1.0 × 20 mm), fresh green thallus when alive; 2) crystalline structures secreted on the surface of thallus; 3) Massula-type oil bodies (drop-like oil bodies, 1–2.5 µm in diameter and numerous in each cell); 4) paraphyses of female branches long and hair-like.

**Riccardia nagasakiensis** (Steph.) S. Hatt. (Figs 6–7). – Specimen examined: location 2, on rock, Luong BD-0111-005 (PHH). – Distribution: Japan (Furuki 1991), China (Piippo 1990 as *R. jackii* Schiffn.), new to Vietnam. – Taxonomic notes: the species is characterised by 1) blackish and brown thallus when dried; 2) small epidermal cells of median part of thallus; 3) epidermal cells of median part of thallus lacking oil bodies; 4) narrow lobes of ultimate pinnales; 5) dioicous plants (Furuki 1991).
**Schiffneria yunnanensis** C. Gao et W. Li (Fig. 2). – Specimen examined: location 6, on decaying log, Luong & Duong 15760 (PHH, PE). – Distribution: China (Li et al. 2006), new to Vietnam. – Taxonomic notes: the species is characterised by 1) archegoniophores at the apex of the dorsal sides of thallus; 2) bracts dense, 2–4 pairs; 3) lobe of bracts with rounded apex.

Trichocolea mollissima (Hook. f. et Taylor) Gottsche (Figs 34–36). – Specimens examined: both on bark, location 3, Luong 15013 (PHH) and location 10, Luong & Dinh 14618 (PHH, NICH). – Distribution: Oceania (Australia, New Zealand) to SE Asia (Philippines, Malaysia, Indonesia), new to Vietnam, also new for continental Asia. – Taxonomic notes: T. mollissima can be diagnosed by 2–3 pinnate branching, lack of superficial cilia on leaf disc, and the curved terminal cells of cilia. SE Asian specimens of this species have been often kept in herbaria under the name of T. tomentella var. javanica (Reinw., Blume et Nees) Gottsche, Lindenb. et Nees, but it is just an extreme variation of T. pluma (Reinw., Blume et Nees) Mont. (Katagiri et al. 2013).

DISCUSSION

The greater part of the above species was collected in the Bidoup-Nui Ba National Park in the Lang Bian Mountains, Central Highlands of southern Vietnam. As the area, both in altitudinal regions and in its variable substrates, provides a high diversity of habitats along favourable climatic conditions, it is no wonder that its bryoflora is so rich. Here an important substrate is the acidic bark of Pinus kesiya, occurring both in pure stands or mixed among broadleaved trees. Pine bark is especially rich in members of Lepidoziaceae family. Epiphylls are more common in the broadleaved forests of the area.

As far as the phytogeographical composition of the bryoflora is concerned, the number of Indo-Malesian and Malesian-Pacific elements increases going southward in Vietnam, as was previously shown by Tixier (1966a, b). At the same time the ratio of Sino-Himalayan elements decreases southwards. Belonging to the former group, in our collection, they are for example Acrolejeunea arcuata, Acromastigum herzogii, Bazzania serrulatoides, Colura speciosa, De-notarisia linguifolia, Lepidozia borneensis, Metahygrobiella acuminata and Radula formosa, while to the later group are Asterella mussuriensis and Gongylanthus himalayensis. Southeast Asian species add a special feature to the bryoflora, like Lepicolea yakusimensis and Riccardia nagasakiensis. The rest of species are more widespread Palaeotropical or northern temperate elements.

To gain a more complete knowledge of the flora a more detailed phytogeographical analysis should be done. But currently based on our collection of 103 species, 24 proved to be new to Vietnam and much more species of the area yet to be investigated, we can conclude that the very rich liverwort flora of the country is still very imperfectly known. We can also confirm the statements of Bakalin and Nguyen (2016) and of Shu et al. (2017) in this respect, that to obtain a fairly complete knowledge of the bryoflora of Vietnam further thorough researches are needed.
Acknowledgements – We would like to express our gratitude to managers, staff and forest guards of Bidoup-Núi Bà National Park, Chu Yang Sin National Park, Tam Đảo National Park, Hòn Bà Nature Reserve and Nam Ban Protected Forest for their kindest helps in our fieldtrips. We are also very grateful to Ministry of the Environment, Government of Japan for funding us under the project BIFA3_32. Thanks are due to Ms Judit Havasi assisting of collecting and preserving specimens from locations 1 and 9; Mr Cheng-Wei Chen for inviting us to join the botanical fieldtrip in Nam Ban. This work was partly supported by JSPS KAKENHI Grant Number JP16K18604 and Grant-in-Aid for Scientific Research (Specially Designated Research Promotion) of Japan Society for the Promotion of Science (JSPS). We are grateful to Dr Christine Cargill (CANBR) for the very careful review of our manuscript.

REFERENCES


Katagiri, T., Sadamitsu, A., Miyauchi, H., Tsubota, H. and Deguchi, H. (2013): Taxonomic studies of the Trichocoleaceae in Southeast Asia. III. The genus Trichocolea Dumort. – *Hattoria* **4**: 1–42. https://doi.org/10.18968/hattoria.4.0_1


Unauthenticated | Downloaded 09/14/23 12:31 PM UTC
NEW RECORDS FOR THE LIVERWORT AND HORNWORT FLORA OF VIETNAM, 1


Open Access statement. This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited, a link to the CC License is provided, and changes – if any – are indicated. (SID_1)