



***Porella longifolia* (Steph.) S.Hatt. and *Porella densifolia* var. *robusta* (Steph.) S.Hatt. (Porellaceae, Marchantiophyta) excluded from the liverwort flora of China**

KAI QIAN¹, XING-FENG BI¹, LEI SHU^{1,2,*} & RUI-LIANG ZHU^{1,2}

¹Bryology Laboratory, School of Life Sciences, East China Normal University, 500 Dongchuan Road, Shanghai 200241, China

²Tiantong National Station of Forest Ecosystem, Shanghai Key Lab for Urban Ecological Processes and Eco-Restoration, East China Normal University, Shanghai 200241, China

*Author for correspondence: lshu@bio.ecnu.edu.cn

Abstract

Porella is a large genus with 86 currently accepted species. China is its center of diversity. Two narrowly distributed taxa, *Porella densifolia* var. *robusta* and *P. longifolia* are excluded from the liverwort flora of China because vouchered specimens are assignable to other species. The illustrations of *Porella densifolia* var. *densifolia* and *P. acutifolia* var. *acutifolia* based on Chinese plants are provided. *Porella longifolia* is thus far known only from Sumatra, Indonesia.

Keywords: China, Indonesia, liverworts, *Porella acutifolia*, *Porella densifolia*, *Porella japonica*, *Porella longifolia*, *Porella perrottetiana*, *Porella stephaniana*

Introduction

Porella Linnaeus (1753: 1106) is the largest genus in its own family Porellaceae with 86 currently accepted species (Jia & He 2015; Söderström *et al.* 2016; Müller 2017; Qian & Zhu 2017; updated data). China is its center of diversity with 39 species currently listed in Jia & He's (2013) "Species Catalogue of China".

Porella densifolia var. *robusta* (Stephani 1910: 313) Hattori (1969: 343) was originally described from Japan as *Madotheca robusta* (Stephani 1910: 313). Chang (1988) reported its occurrence in Hubei Province of China based on a specimen cited below. This is the only record of this taxon in China. Chang's report, however, was omitted from the checklists of Chinese liverworts and hornworts (Piippo 1990; Jia & He 2013).

Porella longifolia (Stephani 1910: 305) Hattori (1969: 351) was originally described from Sumatra as *Madotheca longifolia* (Stephani 1910: 305). It is characterized by long, flat leaf lobes with a toothed apex and nearly straight lateral margins, flat and narrowly rectangular underleaves, leaf lobules very densely toothed along the margins, oblong leaf lobes almost horizontally spreading and underleaf bases not decurrent (Hattori 1969). *Porella longifolia* is a rare species known only from Sumatra and China (Jia & He 2013). In China this species was first recorded in Yunnan Province by Bai (2000). Since then, it has been reported for Chongqing, Guangdong, Guangxi and Xizang (Wang 1993; Xiong 2007; Jia 2012; Xie *et al.* 2012; Zhu & Cheng 2013; Jia & He 2013; Liu *et al.* 2016).

In the course of a taxonomic revision of *Porella* in China, we tried to examine all vouchered specimens of *Porella densifolia* var. *robusta* and *P. longifolia*. Our studies reveal that *P. densifolia* var. *robusta* and *P. longifolia* have to be excluded from the liverwort flora of China because the previous reports for China were based on erroneous identifications. The only available Chinese specimen previously determined as *P. densifolia* var. *robusta* is assignable to *P. densifolia* (Stephani 1894: 219) Hattori (1944: 109) var. *densifolia*, a very common taxon in China. The Chinese specimens previously reported as *P. longifolia* belong to *Porella acutifolia* (Lehmann 1838: 8) Trevisan (1877: 408) var. *acutifolia*, *Porella japonica* (Sande Lacoste 1856: 105) Mitten (1891: 202) var. *japonica*, *Porella perrottetiana* (Montagne 1842: 15) Trevisan (1877: 408) var. *perrottetiana*, and *Porella stephaniana* (Massalongo 1897: 23) Hattori (1951: 81).

Taxonomy

The representative specimens previously reported as *Porella densifolia* var. *robusta* and *P. longifolia* are enumerated below.

Porella acutifolia (Lehm. et Lindenb.) Trevis. var. *acutifolia*, *Mem. Reale Ist. Lombardo Sci. (Ser. 3), C. Sci. Mat.* 4 (13): 408. 1877.

Specimens examined:—CHINA. Yunnan, Yangbi Co., Meixi Commune (Village), Maluchanghoushan, on tree trunk, 25 May 1963, *W.-M. Zhu* 63525 (HIMC, reported by Bai (2000, p. 364 as *Porella longifolia*)).

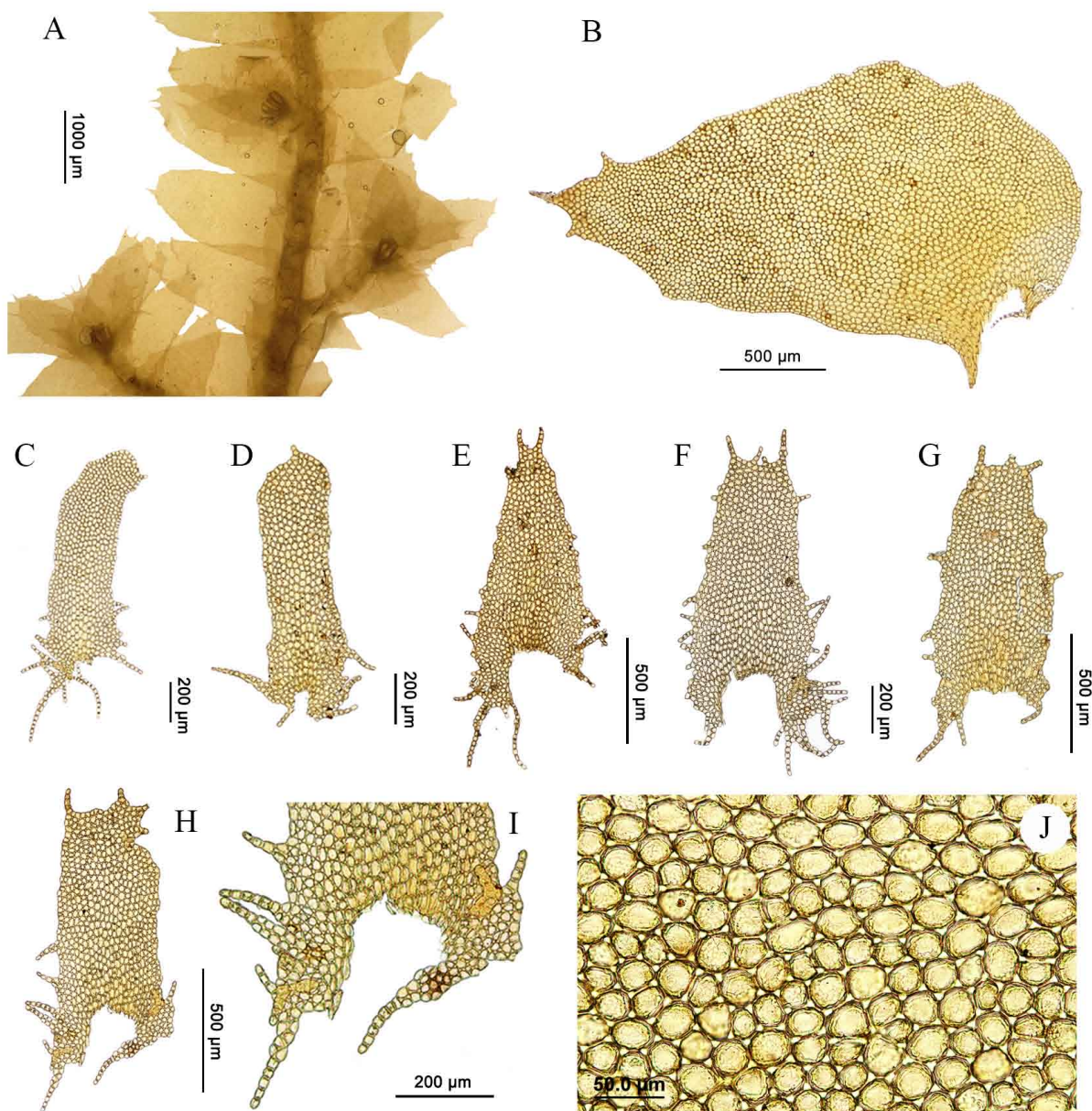


FIGURE 1. *Porella acutifolia* (Lehm. & Lindenb.) Trevis. var. *acutifolia*. A: portion of shoot, ventral view. B: leaf lobe. C, D: leaf lobules. E–H: underleaves. I: long decurrent base of underleaf. J: cells of leaf lobe. All from *W.-M. Zhu* 63525 (HIMC).

Notes:—In China *Porella longifolia* was first described and illustrated by Bai (2000) based on the specimen (*W.-M. Zhu* 63525) cited above. The Yunnan plant, however, has triangular-oblong leaf lobes, strongly decurrent underleaf bases and almost entire lateral lobular margins (Fig. 1), which do not fit *Porella longifolia*. Jia (2012) also reported *P. longifolia* for Xizang and Yunnan. Although the voucher specimens are not available for the present study, we believe

that the record in China by Jia (2012) is also based on the erroneous determination because the description of *P. longifolia* in Jia (2012, p. 206) is same as that from Bai (2002) based on the specimen from Yunnan (*W.-M. Zhu 63525*). With its exclusion in China, *Porella longifolia* is still a rare species thus far known only from Sumatra, Indonesia.

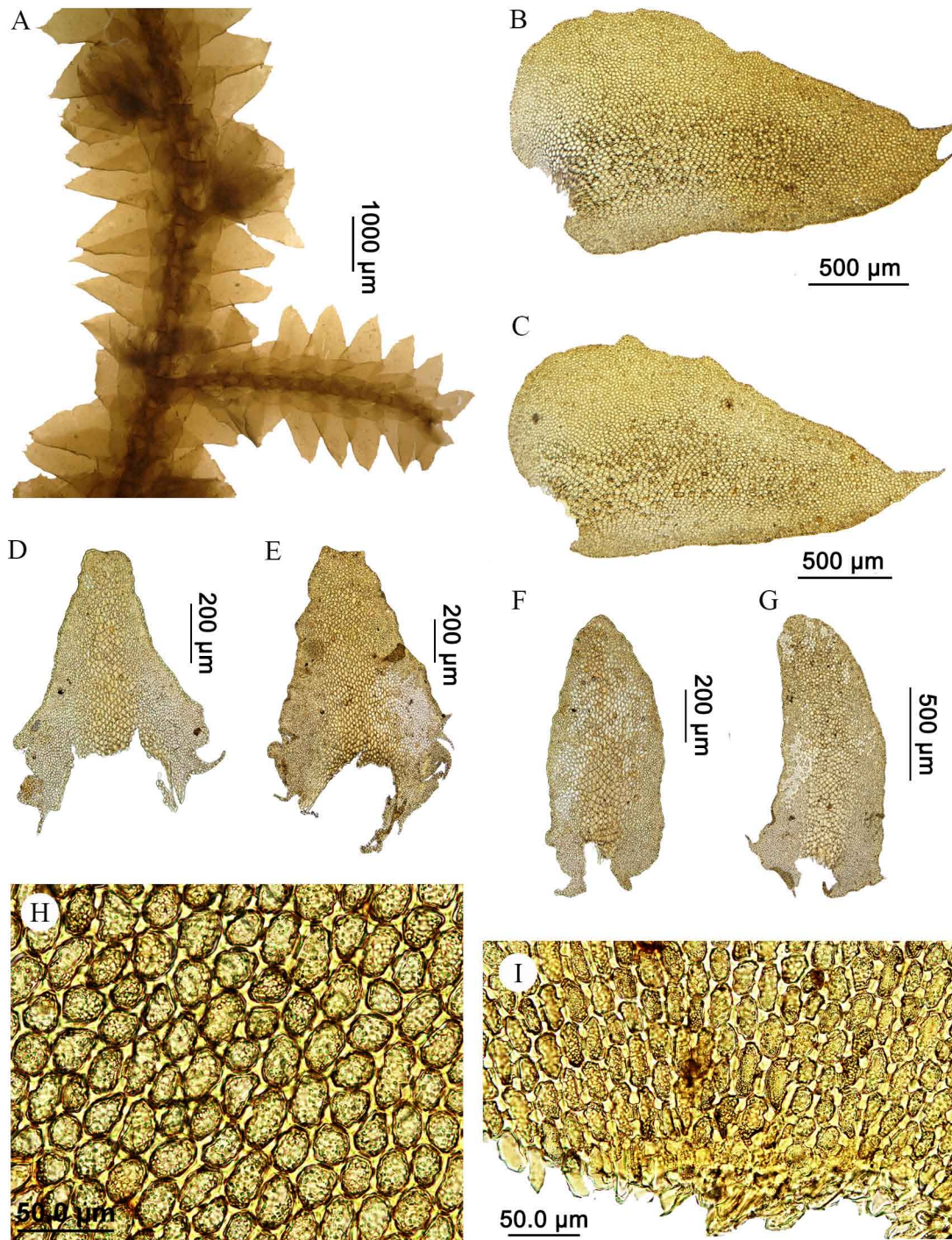


FIGURE 2. *Porella densifolia* (Steph.) S.Hatt. var. *densifolia*. A: portion of shoot, ventral view. B, C: leaf lobes. D, E: underleaves. F, G: leaf lobules. H: median cells of leaf lobe. I: basal cells of leaf lobe. All from *K.C. Chang & E.Z. Bai 34386* (IFP).

Porella densifolia (Steph.) S.Hatt. var. *densifolia*, *J. Jap. Bot.* 20: 109. 1944.

Specimens examined:—CHINA. Hubei, Shennongjia Nature Reserve, 29 Aug. 1983, *K.C. Chang & E.Z. Bai* [*K.C.Y. Chang*] 34386 (IFP, reported by Chang (1988 as *P. densifolia* var. *robusta*)).

Notes:—*Porella densifolia* var. *robusta* was originally described based on U. Faurie's collection from Japan by Stephani (1910) as *Madotheca robusta*. It is separated from *P. densifolia* var. *densifolia* by the obtuse apex of the leaf lobe usually with 3–4 teeth, and leaf lobule apex often with 1–2 teeth as shown in Hattori (1969). The Hubei plants,

previously reported as *Porella densifolia* var. *robusta* by Chang (1988), have subacute to acute apex of the leaf lobe strongly 1–2-toothed, and obtuse apex of the leaf lobule without any teeth (Fig. 2), which fits well with *P. densifolia* var. *densifolia*. *Porella densifolia* var. *densifolia* is one of the most common *Porella* taxa in China, and also known from Japan, Korea and Vietnam (Pócs 1968; Hattori 1978). With its exclusion in China, *Porella densifolia* var. *robusta* is thus far known only from Japan.

Porella japonica (Sande Lac.) Mitt. var. ***japonica***, *Trans. Linn. Soc. London, Bot.* 3 (3): 202. 1891.

Representative specimens examined:—CHINA. Guangxi, Jingxi Co., Renzhuang Town, Bangliang Village, Bangliang National Nature Reserve, 650–750 m, on rock, 19 Aug. 2008, *Y.-M. Wei 8-626A* (IBK, reported by Xie *et al.* (2012 as *P. longifolia*)); *ibid.*, 22°54.927' N, 106°29.164' E, 650–750 m, on rock, *Y.-M. Wei 8-632* (IBK, reported by Xie *et al.* (2012 as *P. longifolia*)). Guangxi, Napo Co., Baisheng Town, Nonglong Village, Laohutiao Nature Reserve, 23°14.25' N, 105°33.25' E, 1160–1200 m, on rock, 19 Oct. 2008, *Y.-M. Wei 10-596* (IBK, reported by Xie *et al.* (2012 as *P. longifolia*)); *ibid.*, 23°14.25' N, 105°33.25' E, 1160–1200 m, on rock, 19 Oct. 2008, *Y.-M. Wei 10-640A* (IBK, reported by Xie *et al.* (2012 as *P. longifolia*)).

Notes:—*Porella japonica* var. *japonica* is known from Bhutan, China, India, Indonesia, Japan, Korea, the Marianas, Myanmar, Sri Lanka, the Philippines, and Vietnam (Inoue 1959; Miller *et al.* 1983; Long & Grolle 1990; Long & Rubasinghe 2014; Shu *et al.* 2017). *Porella japonica* is divided into one subspecies and two varieties (Söderström *et al.* 2016). The voucher specimens reported by Xie *et al.* (2012) as *P. longifolia* belong to *Porella japonica* var. *japonica*.

Porella perrottetiana (Mont.) Trevis. var. ***perrottetiana***, *Mem. Reale Ist. Lombardo Sci. (Ser. 3), C. Sci. Mat.* 4 (13): 408. 1877.

Specimens examined:—CHINA. Guangdong, Ruyuan Co., Ruyuan Forestry Bureau, Longxidong, on valley in dense forest, 21 Jun. 1973, *B.-J. Lin 1131* (HSNU, IBSC reported by Zhu & Cheng (2013 as *P. longifolia*)).

Notes:—*Porella perrottetiana* comprises four varieties (Söderström *et al.* 2016). The voucher specimen reported by Zhu & Cheng (2013 as *P. longifolia*) is assignable to *Porella perrottetiana* var. *perrottetiana*.

Porella stephaniana (C.Massal.) S.Hatt., *J. Hattori Bot. Lab.* 5: 81. 1951.

Specimens examined:—CHINA. Chongqing, Chengkou Co., Dong'an Town, Xingtian Village, 31°43'36.01" N, 109°08'29.82" E, 1430–1440 m, on rock, Aug. 2012, *Y. Liu 1904* (CTC, reported by Liu *et al.* (2016 as *P. longifolia*)).

Acknowledgements

We are grateful to the curators of CTC, G, GACP, HBNU, HIMC, HKBU, HSNU, IBK, IBSC, IFP, KUN, NICH, PE, and SDNU for making specimens available for study through loans or visits, and to X.-L. Bai, Y. Jia, Q. Li, Y.-M. Wei, Y.-X. Xiong, J.-C. Zhao and Z.-T. Zhao for help in loan of specimens. This research is supported by the National Natural Science Foundation of China (NSFC) (nos. 31570206 & 31770224).

References

- Bai, X.-L. (2000) Porellaceae. In: Gao, C. & Cao, T. (Eds.) *Flora Yunnanica*, Tomus 17 (Bryophyta: Hepaticae, Anthocerotae). Science Press, Beijing, pp. 352–379.
- Chang, K.C. (1988) Notes on the Porellaceae of China. *Bulletin of Botanical Research, Harbin* 8 (2): 43–47.
- Hattori, S. (1944) Notulae de Hepaticis Japonicis (VII). *Journal of Japanese Botany* 20: 103–112.
- Hattori, S. (1951) Oil bodies of Japanese Hepaticae (1). *Journal of the Hattori Botanical Laboratory* 5: 69–97.
- Hattori, S. (1969) Studies of the Asiatic species of the genus *Porella* (Hepaticae). II. *Journal of the Hattori Botanical Laboratory* 32: 319–359.
- Hattori, S. (1978) Studies of the Asiatic species of the genus *Porella* (Hepaticae). VII. A synopsis of Asiatic Porellaceae. *Journal of the Hattori Botanical Laboratory* 44: 91–120.

- Inoue, H. (1959) Miscellaneous notes on hepatics of Japan. 2. *Journal of Japanese Botany* 34: 209–210.
- Jia, Y. (2012) Porellaceae. In: Wu, P.C., Jia, Y. & Zhang, L. (Eds.) *Higher Plants of China*, Volume 1. Qingdao Publishing House, Qingdao, pp. 202–211.
- Jia, Y. & He, S. (2013) *Species Catalogue of China 1 (Plants)*. Science Press, Beijing, 525 pp.
- Jia, Y. & He, Q. (2015) A new species and a new variety of *Porella* (Porellaceae, Marchantiophyta) from China. *Plant Diversity and Resources* 37 (6): 741–745.
- Lehmann, J.G.C. (1838) *Novarum et minus cognitarum stirpium pugillus septimus*. Meissner, Hamburg, 41 pp.
<https://doi.org/10.5962/bhl.title.45011>
- Linnaeus, C. (1753) *Species Plantarum*, ed. 1. Laurentii Salvii, Holmiae [Stockholm], 1200 pp.
- Liu, Y., Pi, C.-Y. & Tian, S. (2016) Bryophyte biodiversity of the Dabashan National Nature Reserve in Chongqing. *Biodiversity Science* 24 (2): 244–247.
<https://doi.org/10.17520/biods.2015236>
- Long, D.G. & Grolle, R. (1990) Hepaticae of Bhutan II. *Journal of the Hattori Botanical Laboratory* 68: 381–440.
- Long, D.G. & Rubasinghe, S.C.K. (2014) Liverworts and hornworts of Sri Lanka: a revised checklist. *Ceylon Journal of Science, Biological Sciences* 43 (1): 1–36.
<https://doi.org/10.4038/cjsbs.v43i1.7280>
- Massalongo, C. (1897) *Hepaticae in provincia Schen-si*. G. Franchini, Verona, pp. 3–63.
- Miller, H.A., Whittier, H.O. & Whittier, B.A. (1983) Prodrum Flora Hepaticarum Polynesiae with key to genera. *Bryophytorum Bibliotheca* 25: 1–423.
- Mitten, W. (1891) An enumeration of all species of Musci and Hepaticae recorded from Japan. *Transactions of the Linnean Society of London. Botany* 3(3): 153–206.
- Montagne, J.F.C. (1842) Cryptogamae nilgheriensis. *Annales des Sciences Naturelles; Botanique* (sér. 2) 18: 12–23.
- Müller, F. (2017) *Porella biedermannii* sp. nov. (Marchantiophyta, Porellaceae) and other new records of liverworts and hornworts from central Chile. *Cryptogamie, Bryologie* 38 (4): 349–363.
<https://doi.org/10.7872/cryb/v38.iss4.2017.349>
- Piippo, S. (1990) Annotated catalogue of Chinese Hepaticae and Anthocerotae. *Journal of the Hattori Botanical Laboratory* 68: 1–192.
- Pócs, T. (1968) The genus *Porella* in Vietnam. *Journal of the Hattori Botanical Laboratory* 31: 65–93.
- Qian, K. & Zhu, R.-L. (2017) The status of *Porella subparaphyllina* J.S.Lou (Marchantiophyta, Porellaceae), a poorly known species endemic to Yunnan, China. *Phytotaxa* 319 (3): 299–300.
<https://doi.org/10.11646/phytotaxa.319.3.11>
- Sande Lacoste, C.M. (1856) *Synopsis Hepaticarum Javanicarum*. C. G. van der Post, Amsterdam, pp. 1–112.
- Shu, L., Xiang, Y.-L., Cheng, X.-F., Wei, Y.-M., Wang, J., Zhang, L.-N., Li, W., Yin, X.-B., Zhang, W.-P., Zhao, C.-X., Peng, T., Do, T.V., Lu, T.N. & Zhu, R.-L. (2017) New liverwort and hornwort records for Vietnam. *Cryptogamie, Bryologie* 38 (4): 411–445.
<https://doi.org/10.7872/cryb/v38.iss4.2017.411>
- Söderström, L., Hagborg, A., von Konrat, M., Bartholomew-Began, S., Bell, D., Briscoe, L., Brown, E., Cargill, D.C., Cooper, E.D., Costa, D.P., Crandall-Stotler, B.J., Dauphin, G., Engel, J.J., Feldberg, K., Glenney, D., Gradstein, S.R., He, X., Ilkiu-Borges, A.L., Heinrichs, J., Hentschel, J., Katagiri, T., Konstantinova, N.A., Larrain, J., Long, D.G., Nebel, M., Pócs, T., Puche, F., Reiner-Drehwald, E., Renner, M.A.M., Sass-Gyarmati, A., Schäfer-Verwimp, A., Segarra Moragues, J.G., Stotler, R.E., Sukkharak, P., Thiers, B.M., Uribe, J., Vána, J., Villarreal, J.C., Wigginton, M., Zhang, L. & Zhu, R.-L. (2016) World Checklist of Hornworts and Liverworts. *PhytoKeys* 59 (1): 1–828.
<https://doi.org/10.3897/phytokeys.59.6261>
- Stephani, F. (1894) Hepaticae Chinenses. *Mémoires de la Société des Sciences Naturelles de Cherbourg* 29: 207–228.
- Stephani, F. (1910) *Species Hepaticarum* 4. George & Cie, Genève & Bale, pp. 97–448.
<https://doi.org/10.5962/bhl.title.95494>
- Trevisan, V.B.A. (1877) Schema di una nuova classificazione delle Epatiche. *Memorie del Reale Istituto Lombardo de Scienze e Lettere (Serie 3), Classe di Scienze Matematiche e Naturali* 4 (13): 383–451.
- Wang, M.-Z. (1993) A preliminary study of Hepaticae from Mt. Jiuwan of Guangxi, south China. *Chenia* 1: 125–131.
- Xie, Q., Wei, Y.-M. & Xie, Y.-J. (2012) Bryoflora of limestone areas in Sino-Vietnamese border areas of Southwest Guangxi (the title translated from the Chinese). *Zoological and Botanical Ecology Studies of Guangxi* [the title translated from the Chinese] 1: 3–17.
- Xiong, Y.-X. (Ed.) (2007) *Research on bryophyte diversity of the intersection converge of Guizhou, Chongqing, Hulan [sic], Hubei*. Science and Technology Publishing House of Guizhou, Guiyang, 281 pp.
- Zhu, R.-L. & Cheng, X.-F. (2013) Porellaceae. In: Wu, D.-L. & Zhang, L. (Eds.) *Bryophyte Flora of Guangdong*. Guangdong Science and Technology Press, Guangzhou, pp. 88–94.