

Prologue

Biodiversity is deteriorating worldwide. According to the United Nations Environment Programme, biodiversity loss, alongside climate change and pollution, represents one of three major global crises. The 15th meeting of the Conference of the Parties to the Convention on Biological Diversity adopted the Kunming-Montreal Global Biodiversity Framework, which sets goals and targets for the next decade and 2050 to ensure that biodiversity loss is reversed. Understanding biodiversity is the first prerequisite for biodiversity research and conservation. The advancement of biodiversity informatics, biodiversity distribution data provides a robust support for biodiversity research and conservation. It notably facilitates the study of large-scale biodiversity patterns, conservation planning, biodiversity response to global change, and the prediction of invasive alien species dispersal. Creating a species checklist is the primary task in understanding biodiversity spatial-temporal patterns and a critical first step in the field of biodiversity informatics. It is essential for biodiversity conservation, research, management, monitoring and sustainable use. Additionally, the number of native and exotic species serves as a crucial statistical indicator of a country's biodiversity.

Asia is one of the richest continents in terms of biodiversity. With its myriad ecosystems and climatic zones, Asia stands as a global hotspot for plant diversity. The continent boasts an awe-inspiring array of flora, encompassing a wide spectrum of life forms, from the smallest mosses to the towering trees, and from delicate wildflowers to robust grasses. The variety of plant species in Asia reflects the continent's geographic expanse and the complex interplay of ecological, geological, and climatic factors.

However, plant cataloguing and the availability of occurrence data in Asia remain inadequate. In response to this, Mapping Asia Plants (MAP) was initiated at the Working Group Meeting of the Asia Biodiversity Conservation and Database Network (ABCDNet) in November 2015, organized by the Biodiversity Committee, Chinese Academy of Sciences (CAS). MAP aims to establish an online data platform for Asian botanical information, providing comprehensive foundational knowledge and an interdisciplinary data mining environment for the conservation and research of Asian plant diversity. The first step of MAP is to establish a database on the inventory and distribution of plant species in Asia and to develop an online platform for data management and mining. The plant species checklists and their distribution database are the cores of MAP at its current stage. The main sources include:

1. Floras, plant checklists and related publications;
2. Plant distribution maps;
3. Plant specimens, including photographs of plants with reliable identification;
4. Vegetation survey plots;
5. Plant investigation data;
6. Plant observation data, including data published by plant enthusiasts and parataxonomists;
7. Digitized online datasets.

Through cooperation with experts from many Asian countries and beyond, MAP overcame multiple language barriers, compiled research progress on plant diversity in Asia, integrated the floras and checklists, and established a database of Asian plant species. A series of plant species checklists have been completed and will be gradually released. According to our current research progress, there are 435 families, 6,838 genera and about 119,000 species (excluding subspecies) in Asia. Based on the plant species

checklists, a comprehensive data platform will be further developed to support research on plant ecology, evolutionary botany, plant geography, conservation biology and global change biology. It is also planned to create a data clearing and mining kit and an analysis platform for plant species distribution maps, plant diversity distribution maps, the revision of plant names and species distribution models.

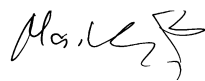
For a plant species checklist developed based on multiple sources, it is essential to perform taxonomic cleaning against a standard global plant checklist. Several global species checklists created by taxonomists are available for this purpose, such as Leipzig Catalogue of Vascular Plants, the World Checklist of Vascular Plants, World Flora Online (successor of The Plant List, TPL), World Plants and Catalogue of Life (CoL).

In this series of checklists, we present a meticulous compilation of plant species, organized taxonomically into families, genera, and species, with additional details on subspecies and varieties where applicable. The aim is to provide researchers, botanists, conservationists, and enthusiasts with a valuable resource for understanding and appreciating the remarkable flora of the Asian continent.

The MAP series presents the first-ever Asian catalogue for liverworts (Marchantiophyta), hornworts (Anthocerotophyta) and mosses (Bryophyta). It includes 2,777 species in 246 genera, representing 74 families from the two phyla of liverworts and hornworts. For mosses, the catalogue includes 4,039 species in 597 genera, representing 99 families. In the checklist of North Asia, there are 162 families, 1,151 genera, 6,459 species of vascular plants. Central Asia's checklist includes 139 families, 1,198 genera and 9,643 species of vascular plants. Related research has advanced in Southeast, South and West Asia, where plant biodiversity research is more complex, making it more challenging and time-consuming to complete the species checklist. To complete the MAP series, we conducted extensive data collection, and taxonomic literature review. Several review papers have been published for South Asia, West Asia, Central Asia, Northeast Asia and Russia respectively.

China, as one of the megadiversity countries in the world, plays an extremely important role in biodiversity conservation. China accounts for 21.5% of Asia's land area and 35% of Asia's plant species, and has published the world's largest flora. Meanwhile, China has established several platforms such as the BioONE (An Integrated Big BioData Infrastructure for CASEarth) and the National Specimen Information Infrastructure (NSII), which covers plant distribution data in China and many nearby countries. Based on these achievements, we have gained a comprehensive understanding of plant diversity in Asian countries, laying the foundation for biodiversity conservation and research at the regional level in Asia. Our work was supported by the Bureau of International Cooperation, CAS, the Alliance of International Science Organizations (ANSO) (ANSO-PA-2020-10), the Strategic Priority Research Program of CAS (No. XDA19050404) and the Southeast Asia Biodiversity Research Institute of CAS.

However, due to factors such as language barriers and the discovery and publication of new plant species or revisions of certain taxa, the MAP series may not be perfect publications at the moment. Suggestions and comments from all colleagues and experts are sincerely welcome to keep the checklists updated.



Keping MA

Editor in Chief

November 10th, 2023

Preface

1. Background

Asia is the largest and most populous continent, covering 8.7% of the Earth's total area (or 29.4% of the total land area). It is home to over 4 billion people, accounting for approximately 60.5% of the world's total population.

The vast majority of Asia is located in both the northern and eastern hemispheres. The boundary between Asia and Africa is the Suez Canal, with Asia lying to the east. The dividing lines between Asia and Europe are the Urals, the Caspian Sea, the Greater Caucasus, the Turkish Straits, and the Black Sea. Asia extends east to Cape Dezhnev (66°4'45"N, 169°39'7"W), south to Cape Piai (Tanjung Piai) (1°16'N, 103°31'E), west to Cape Baba (39°27'N, 26°3'E), and north to 77°43'N, 104°18'E, with the highest peak being Everest. The extensive latitudinal and longitudinal span results in a time difference of up to approximately 9 hours between the eastern and western extremes of Asia. Asia is connected to Europe in the west, forming the largest continent of Eurasia.

Asia is typically divided into six regions on the basis of geographical location: East Asia, Southeast Asia, South Asia, West Asia, Central Asia, and North Asia. Each of these regions has a distinctive natural environment.

- East Asia includes China, the Democratic People's Republic of Korea, the Republic of Korea, Mongolia, and Japan.

- Southeast Asia encompasses Vietnam, Laos, Cambodia, Myanmar, Thailand, Malaysia, Singapore, Indonesia, the Philippines, Brunei, East Timor, and other countries.

- South Asia includes Sri Lanka, the Maldives, Pakistan, India, Bangladesh, Nepal, and Bhutan.

- West Asia, also called Southwest Asia, includes Iran, Türkiye, Cyprus, Syria, Lebanon, Palestine, Israel, Jordan, Iraq, Kuwait, Saudi Arabia, Yemen, Oman, the United Arab Emirates, Qatar, Bahrain, Georgia, Armenia, Azerbaijan, and Afghanistan.

- Central Asia comprises Turkmenistan, Uzbekistan, Kyrgyzstan, Tajikistan, and Kazakhstan.

- North Asia refers to Siberia, part of Russia.

Asia's terrain is varied and undulating, with high elevations in the center and lower elevations elsewhere. The eastern part features a longitudinal chain of island arcs. Excluding Antarctica, Asia is the world's highest continent, with an average elevation of about 950 meters.

The Asian continent spans cold, warm, and hot climate zones. The climate is complex and diverse, featuring a typical monsoon climate and notable continental characteristics. The eastern part of Asia has a humid temperate and subtropical monsoon climate, while Southeast and South Asia have humid tropical monsoon climates. Central Asia, West Asia, and parts of East Asia are arid regions. Between these humid monsoon areas and the inland arid areas, part of North Asia is sub-humid and semi-arid.

Anthoceros punctatus L. was listed in Linnaeus's *Species Plantarum*. The type specimen of this species was collected from Japan, so Asian hornworts were reported as early as 1753. *Radula reflexa* was described by Nees and Montagne in 1843. This is probably the earliest description of Asian liverworts. In 2016, Söderström et al. published the "World checklist of hornworts and liverworts", including 7,486 species of liverworts and hornworts. This is currently the most authoritative number on the diversity of

liverworts and hornworts in the world. But so far, the number of liverworts and hornworts on each continent has not been reported. No one can yet answer any questions about how many liverworts and hornworts are distributed in Asia. Although a large number of papers and works have been published on the taxonomic, floristic, and systematic studies of liverworts and hornworts in Asia, we still do not know the diversity of liverworts and hornworts in Asia or even the estimated number. Therefore, this book is the first comprehensive report on the number, distribution and diversity of liverworts and hornworts in Asia, which will fill the gap in diversity research in this region, play a positive role in promoting the study of liverworts and hornworts diversity in Asia, and contribute to the study of liverworts and hornworts diversity in the world.

2. Structure and format of the Catalogue

The systematic arrangement used in this book follows the “Syllabus of Plant Families (Part 3 Bryophytes and Seedless Vascular Plants)”, published in 2009, while incorporating the latest research findings. Families are arranged systematically, with genera and species ordered alphabetically.

Each accepted species includes a Latin scientific name, basionyms, and other synonyms. Distribution information within the Asian region is recorded according to national units. The type specimens’ information, including type localities of species names in Asia, is listed for both accepted names and synonyms.

3. Brief outline of liverworts and hornworts in Asia

According to the literature, the author here presents the first-ever Asian catalogue for liverworts (Marchantiophyta) and hornworts (Anthocerotophyta) that include 2,777 species in 246 genera representing 74 families from the two phyla. There are 2,664 species, representing 237 genera and 70 families in liverworts, and 113 species representing 9 genera and 4 families in hornworts. In Asia, there are 5 families which include more than or equal to 10 genera, and 23 genera including more than or equal to 30 species (see Tables 1 and 2). There are 30 genera which are endemic to Asia, they are *Aitchisoniella* Kashyap, *Aphanotropis* Herzog, *Asterellopsis* R.L. Zhu & You L. Xiang, *Bucegia* Radian, *Cavicularia* Steph., *Cephalolejeunea* Mizut., *Cryptocoleopsis* Amakawa, *Dactylophorella* R.M. Schust., *Delavayella* Steph., *Diplocolea* Amakawa, *Eocalypogeia* (R.M. Schust.) R.M. Schust., *Gradsteinianthus* R.L. Zhu & Jian Wang bis, *Hamatostrepta* Vána & D.G. Long, *Hattoria* R.M. Schust., *Hattoriolejeunea* M. Mizut., *Macvicaria* W.E. Nicholson, *Mastigopelma* Mitt., *Mizutania* Furuki & Iwatsuki, *Neotrichocolea* S. Hatt., *Nipponolejeunea* S. Hatt., *Poeltia* Grolle, *Pseudomoerckia* Vilnet, Konstant., D.G. Long, N.D. Lockh. & Mamontov, *Scaphophyllum* Inoue, *Sewardiella* Kashyap., *Soella* R.L. Zhu, L. Shu, Qiong He & Y.M. Wei, *Stephensoniella* Kashyap, *Thiersianthus* R.L. Zhu & L. Shu, *Tuzibeanthus* S. Hatt., *Vietnamiella* Bakalin & Vilnet and *Xenochila* R.M. Schust.

Table 1 Families including more than or equal to 10 genera in Asia

Families	Number of genera in the world	Number of genera in Asia
Lejeuneaceae	74	52
Anastrophyllaceae	22	15

Families	Continued	
	Number of genera in the world	Number of genera in Asia
Lepidoziaceae	31	11
Jungermanniaceae	31	10
Cephaloziaceae	15	10

Table 2 Genera including more than or equal to 30 species in Asia

Genera	Number of species in the world	Number of species in Asia
<i>Frullania</i>	350	200
<i>Plagiochila</i>	401	179
<i>Cololejeunea</i>	204	186
<i>Bazzania</i>	150	121
<i>Lejeunea</i>	200	104
<i>Solenostoma</i>	99	92
<i>Riccia</i>	157	87
<i>Radula</i>	431	79
<i>Scapania</i>	91	84
<i>Riccardia</i>	175	68
<i>Cheilolejeunea</i>	90	65
<i>Porella</i>	80	63
<i>Drepanolejeunea</i>	102	49
<i>Lepidozia</i>	60	46
<i>Chiloscyphus</i>	96	45
<i>Metzgeria</i>	104	38
<i>Cephaloziella</i>	99	39
<i>Jungermannia</i>	58	37
<i>Colura</i>	70	40
<i>Calypogeia</i>	43	34
<i>Heteroscyphus</i>	60	34
<i>Lophozia</i>	77	30
<i>Marchantia</i>	37	30

Some genera have been treated as synonyms of other genera, but few species are still used under old names of genera. Those names represent taxa that have not been studied recently and have not been recognized in any recent treatment, they are *Fimbriaria gollania* Steph., *Fimbriaria maculate* Steph., *Fimbriaria papulosa* Steph., *Fimbriaria parvipora* Steph., *Fimbriaria pathankotensis* Kashyap., *Aspiromitus crenatifrons* Steph., *Hygrolejeunea harpaphylla* Steph., *Hygrolejeunea pacifica* Steph. and *Physocolea hamata* (Steph.) Steph.

Asia is a vast region, spanning many climatic zones and supporting rich bryophytes. However, there are still many countries with weak surveys. We believe that there will be more data as the survey scope expands. So far, China has the largest number of species in Asia (see Table 3).

Table 3 Top ten countries of number of species in Asia

Country	Number of species
China	1,178
India	981
Indonesia	867
Malaysia	818
Japan	745
the Philippines	584
Thailand	502
Vietnam	448
Russia (Asian part)	429
Nepal	425

This work is supported by the Alliance of International Science Organizations (Grant No. ANSO-PA-2020-10) and the Strategic Priority Research Program of the Chinese Academy of Sciences (Grant No. XDA19050404).

Due to the age of many original and cited papers, it remains difficult to obtain some documents despite our efforts to provide comprehensive references. To assist readers in locating the literature, the original format has been preserved at the back of the book, and any errors have not been corrected. This book includes a large number of known liverworts and hornworts worldwide. Some references contain old place names, administrative divisions, and other historical information that have not been updated. We lack the time and resources to investigate these historical changes. We hope that interested political scientists and geographers will pursue further research in this area.

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I.

Marchantiophyta

Stotler & Crand.-Stotl.

Treubiopsida M. Stech, J.-P. Frahm, Hilger & W. Frey

Treubiales Schljakov

Treubiaceae Verd.

This family consists of 2 genera in the world, 2 genera in Asia.

Apotreubia S. Hatt. & Mizut

Bryologist 69: 491. 1966.

Type: *A. nana* (S. Hatt. & Inoue) S. Hatt. & Mizut.

This genus consists of 3 species in the world, 2 species in Asia.

Apotreubia nana (S. Hatt. & Inoue) S. Hatt. & Mizut., Bryologist 69: 492. 1966.

Treubia nana S. Hatt. & Inoue, J. Hattori Bot. Lab. 11: 99. f. a-o. 1954. **Type:** Japan, the Kansaka pass in Mts. Chichibu, Saitama Co., July 9. 1953, *H. Inoue s.n.* (holotype: NICH).

Apotreubia hortoniae R.M. Schust. & Konstant. ex Konstant., Phytotaxa 76(3): 33. 2013.

Distribution: China (Jia & He, 2013), India (Hattori et al., 1966), Japan (Hattori & Inoue, 1954, as *Treubia nana*; Yamada & Iwatsuki, 2006), N. America.

Apotreubia yunnanensis Higuchi, Cryptog. Bryol., Lichénol. 19: 321 f. 1-3. 1998. **Type:** China, Yunnan, Zhongdian Co., 3840m, *Higuchi 25186* (holotype: KUN; isotype: TNS).

Distribution: China (Higuchi, 1998).

Treubia K.I. Goebel

Ann. Jard. Bot. Buitenzorg 9: 1. 1890.

Type: *T. insignis* K.I. Goebel

This genus consists of 7 species in the world, 1 species in Asia.

Treubia insignis K.I. Goebel, Ann. Jard. Bot. Buitenzorg 9: 1. 1891.

Distribution: China (Horikawa, 1951), Indonesia (Horikawa, 1951), Malaysia (Chuah-Petiot, 2011), Philippines (Tan & Engel, 1986).

Haplomitriopsida Stotler & Crand.-Stotl.

Haplomitriales H. Buch ex Schljakov

Haplomitriaceae Dědeček

This family consists of 1 genus in the world.

Haplomitrium Nees

Naturgesch. Eur. Leberm. 1: 109. 1833.

Type: *H. hookeri* (Sm.) Nees

This genus consists of 9 species in the world, 7 species in Asia.

Haplomitrium blumii (Nees) R.M. Schust., J. Hattori Bot. Lab. 26: 225. 1963.

Calobryum blumii (Nees) Gottsche, Syn. Hepat. 507. 1846.

Monoclea blumii Nees, Enum. Pl. Crypt. Jav. 1 (Hep.): 2. 1830.

Thusananthus integerrimus Steph., Sp. Hepat. 6: 569. 1924.

Distribution: China (Jia & He, 2013), India (Bapna & Kachroo, 2000, as *Calobryum blumii*), Indonesia (Bartholomew-Began, 1991), Japan (Jia & He, 2013), Malaysia (Chuah-Petiot, 2011), Philippines (Bartholomew-Began, 1991), Papua New Guinea (Bartholomew-Began, 1991), S. America.

Haplomitrium gibbsiae (Steph.) R.M. Schust., J. Hattori Bot. Lab. 26: 225. 1963.

Calobryum gibbsiae Steph., Sp. Hepat. 6: 76. 1917.

Haplomitrium dentatum (D. Kumar & Udar) J.J. Engel, Ann. Missouri Bot. Gard. 68: 668. 1981[1982].

Calobryum dentatum D. Kumar & Udar, J. Indian Bot. Soc. 55: 23. f. 1-34. 1976.

Haplomitrium kashyapii Udar & D. Kumar, J. Indian Bot. Soc. 61: 73. f. 1-41. 1982.

Distribution: India (Bartholomew-Began, 1991), New Zealand (Bartholomew-Began, 1991), Australia (Bartholomew-Began, 1991), Chile (Bartholomew-Began, 1991).

Haplomitrium giganteum (Steph.) Grolle, Oesterr. Bot. Z. 111: 190. 1964.

Tylimanthus giganteus Steph., Sp. Hepat. 6: 247. 1922.

Distribution: Philippines (Tan & Engel, 1986).

Haplomitrium grollei D. Kumar & Udar, Geophytology 7: 260. f. 1-15, pl. 1: f. 1-4. 1977.

Distribution: India (Kumar & Udar, 1977).

Haplomitrium hookeri (Sm.) Nees, Naturgesch. Eur. Leberm. 1: 111. 1833.

Jungermannia hookeri Sm., Eng. Bot. 36: plate 2555. 1814.

Distribution: China (Higuchi et al., 2000), India (Udar & Singh, 1977a; Long, 2005), Japan (Yamada & Iwatsuki, 2006), Nepal (Long, 2005), Siberia and Far East of Russia (Konstantinova & Bakalin, 2009), Europe (Bartholomew-Began, 1991).

Haplomitrium indicum (Udar & Chandra) Y. Jia & Qiang He, comb. nov.

Calobryum indicum Udar & Chandra, Rev. Bryol. Lichenol. 33(3-4): 555. 1964.

Distribution: India (Udar & Chandra, 1964, as *Calobryum indicum*).

Haplomitrium mnioides (Lindb.) R.M. Schust., J. Hattori Bot. Lab. 26: 225. 1963.

Rhopalanthus mnioides Lindb., Hedwigia 14: 130. 1825.

Calobryum mnioides (Lindb.) Steph., Sp. Hepat. 1: 399. 1909.

Calobryum rotundifolium (Mitt.) Schiffn., Oesterr. Bot. Z. 49: 389. 1899.

Haplomitrium mnioides var. *delicatum* C.H. Gao & D.K. Li, Wuyi Sci. J. 5: 234. 1985.

Type: China, Fujian, Mt. Wuyishan, *C. H. Gao 25029* (holotype: SHM).

Distribution: China (Shi & Zhu, 2006), Japan (Yamada & Iwatsuki, 2006), Republic of Korea (Choi et al., 2013), Thailand (Kitagawa, 1979a), Vietnam (Shu et al., 2017).

Blasiopsida M. Stech & W. Frey

Blasiales Stotler & Crand.-Stotl.

Blasiaceae H. Klinggr.

This family consists of 2 genera in the world, 2 genera in Asia.

Blasia L.

Sp. Pl. 1138. 1753.

Type: *B. pusilla* L.

This genus consists of 1 species in the world.

Blasia pusilla L., Sp. Pl. 2: 1138. 1753.

Distribution: Bhutan (Long, 2006), China (Jia & He, 2013), India (Long, 2006), Japan (Yamada & Iwatsuki, 2006), Korea (Jia & He, 2013), Nepal (Long, 2006), Pakistan (Hattori, 1968a), Siberia and Far East of Russia (Konstantinova & Bakalin, 2009), Türkiye (Frey & Kürschner, 1991), Europe, N. America.

Cavicularia Steph.

Bull. Herb. Boissier 5: 87. 1897.

This genus consists of 1 species in the world.

Cavicularia densa Steph., Bull. Herb. Boissier 5: 87. 1897.

Distribution: Japan (Yamada & Iwatsuki, 2006), Republic of Korea (Choi et al., 2013).

Marchantiopsida Cronquist, Takht. & W. Zimm.

Sphaerocarpaceae Cavers

Sphaerocarpaceae Heeg.

This family consists of 2 genus in the world, 1 genus in Asia.

Sphaerocarpos Boehm.

Def. Gen. Pl. (ed. 3) 501. 1760.

This genus consists of 9 species in the world, 4 species in Asia.

Sphaerocarpos michelii Bellardi, App. Fl. Pedem. 52. 1792.

Distribution: Israel (Heyn & Herrnstadt, 2004), Türkiye (Crundwell & Nyholm, 1979).

Sphaerocarpos siguniangensis R.L. Zhu & You L. Xiang, Bryologist 122(4): 591, 2-4. 2019. **Type:** China, Sichuan, Xiaojin Co., Siguniang Mountains Nature Reserve, Haizigou, Huahaizi, 31°02'548"N, 102°55'783"E, 3828m, on soil, 16 Aug. 2016, *R.-L. Zhu 20160816-14A* (holotype: HSNU).

Distribution: China (Xiang & Zhu, 2019).

Sphaerocarpos stipitatus Bisch. ex Lindenb., Ber. Thatigk. St. Gallischen Naturwiss. Ges. 1836.

Distribution: Nepal (Long, 1993), South Africa (Long, 1993).

Sphaerocarpos texanus Austin, Bull. Torrey Bot. Club 6: 158. 1877.

Distribution: Türkiye (Crundwell & Nyholm, 1979).

Riellaceae Engl.

This family consists of 1 genus in the world.

Riella Mont.

Ann. Sci. Nat., Bot., sér. 3 18: 11. 1852.

This genus consists of 18 species in the world, 5 species in Asia.

Riella affinis M. Howe & Underw., Bull. Torrey Bot. Club 30: 221. 1903.

Distribution: Israel (Heyn & Herrnstadt, 2004).

Riella cossoniana Trab., in Batt. & Trab., Atlas Fl. Algérie 6, 1886.

Distribution: Israel (Heyn & Herrnstadt, 2004).

Riella helicophylla (Bory & Mont.) Mont., Ann. Sci. Nat., Bot. 18: 12. 1852.

Duriaea helicophylla Bory & Mont., Compt. Rend. Hebd. Séanc. Acad. Sci (Paris) 16: 1114. 1843.

Distribution: Israel (Heyn & Herrnstadt, 2004), Türkiye (Cetin, 1988).

Riella indica Steph. ex Kashyap, J. Bombay Nat. Hist. Soc. 25: 279. 1917.

Distribution: Pakistan (Kashyap, 1929).

Riella vishwanathai Pandé, Misra & Srivastava, Rev. Bryol. Lichénol. 23(1-2): 166. 1954.

Distribution: India (Pandé et al., 1954a).

Lunulariales D.G. Long

Lunulariaceae H. Klinggr.

This family consists of 1 genus in the world.

Lunularia Adans.

Fam. Pl. 2: 15. 1763.

Type: *L. cruciata* (L.) Dumort. ex Lindb.

This genus consists of 1 species in the world.

Lunularia cruciata (L.) Dumort. ex Lindb., Not. Sällsk. Fauna Fl. Fenn. Förh. 9: 298. 1868.

Marchantia cruciata L., Sp. Pl. 2: 1137. 1753.

Distribution: China (Jia & He, 2013), Cyprus (Frey & Kürschner, 1991), India (Kashyap, 1929), Iran (Jovet-Ast, 1960; Akhiani & Kürschner, 2004), Israel (Heyn & Herrnstadt, 2004), Japan (Yamada & Iwatsuki, 2006), Jordan (El-Oqlah et al., 1988), Lebanon (Frey & Kürschner, 1991), Saudi Arabia (Frey & Kürschner, 1988), Sri Lanka (Onraedt, 1981), Yemen (Frey & Kürschner, 1988), Türkiye (Robinson & Godfrey, 1960), Russia (Konstantinova & Bakalin, 2009), Brazil (Yano, 1995), Bolivia (Gradstein et al., 2003), Australia, Europe.

Marchantiales Limpr. in Cohn

Aytoniaceae Cavers

This family consists of 7 genera in the world, 6 genera in Asia.

Asterella P. Beauv.

Dict. Sci. Nat. 3: 257. 1805.

Type: *Asterella tenella* (L.) P. Beauv.

This genus consists of 49 species in the world, 25 species in Asia.

Asterella angusta (Steph.) Pandé, K.P. Sirvast & Sultan Khan, J. Hattori Bot. Lab. 11: 8. 1954.

Fimbriaria angusta Steph., Sp. Hepat. 1: 104. 1899.

Distribution: China (Jia & He, 2013), India (Bapna & Vyas, 1962; Bir & Chopra, 1972, as *Fimbriaria angusta*; Joshi & Biradar, 1984).

Asterella angusta var. **jamesii**

Distribution: India (Joshi & Biradar, 1984).

Asterella blumeana (Nees) Pandé, K.P. Srivast. & Sultan Khan, J. Hattori Bot. Lab. 11: 8. 1954.

Fimbraria blumeana Nees, Syn. Hepat. 564. 1846.

Distribution: India (Kachroo, 1954; Bapna & Vyas, 1962), Indonesia (Söderström et al., 2010b), Nepal (Hattori, 1975h), Pakistan (Furuki et al., 1993), Thailand (Giesy & Richards, 1959).

Asterella chichibuensis Shimizu & S. Hatt., J. Hattori Bot. Lab. 8: 46. f. 1. 1952.

Distribution: Korea (Yamada & Choe, 1997).

Asterella crassa Shimizu & S. Hatt., J. Hattori Bot. Lab. 8: 48. f. 2. 1952. **Type:** Japan, Saitama Prefecture, Prov. Musashi, Chichibu District, Mt. Buko, 22 Oct. 1951, *D. himizu* (holotype: NICH-19297; isotypes: JE, S).

Distribution: Japan (Yamada & Iwatsuki, 2006).

- Asterella cruciata** (Steph.) Horik., Hikobia 1: 79. 1951.
Fimbraria cruciata Steph., Sp. Hepat. 6: 12. 1917. **Type:** Japan.
Asterella odora S. Hatt., Bot. Mag. (Tokyo) 58: 44. 1944. **Type:** Japan, Iwate Pref., Mt. Hayachine, 20 June 1967, *D. Shimizu s.n.* (holotype: TNS).
Asterella chichibuensis Shimizu & S. Hatt., J. Hattori Bot. Lab. 8: 46. 1952.
Asterella mitsuminenesis Shimizu & S. Hatt., J. Hattori Bot. Lab. 8: 48. 1952.
 Distribution: China (Jia & He, 2013), Japan (Yamada & Iwatsuki, 2006, as *A. odora*), Korea (Yamada & Choe, 1997), Vietnam (Shu et al., 2017).
- Asterella elegans** (Spreng.) Trevis., Reale Ist. Lombardo Sci., Rendiconti 7: 785. 1874.
Fimbraria elegans Spreng., Systema Vegetabilium, Editio decima sexta 4(1): 235. 1827. (before 7 Jan. 1827)
 Distribution: Türkiye (Frey & Kürschner, 1991).
- Asterella gracilis** (F. Weber) Underw, Bot. Gaz. 20: 61. 1895.
Marchantia gracilis F. Weber, Hist. Mus. Hepat. Prodr. 105. 1815.
 Distribution: China (Long, 2008), Iran (Frey et al., 1991; Akhani & Kürschner, 2004), Japan (Yamada & Iwatsuki, 2006), Korea (Yamada & Choe, 1997), Far East of Russia (Konstantinova & Bakalin, 2009), Türkiye (Frey et al., 1991).
- Asterella khasyana** (Griff.) Pandé et al., J. Hattori Bot. Lab. 11: 7. 1954.
Octokepos khasyanum Griff., Not. Plant. Asiat. 2: 343. 1849.
 Distribution: Bhutan (Long & Grolle, 1990; Long, 2001), China (Long & Grolle, 1990), India (Long & Grolle, 1990; Long, 2001, 2006), Indonesia (Long & Grolle, 1990; Long, 2001), Nepal (Long & Grolle, 1990; Long, 2001), Pakistan (Long & Grolle, 1990; Long, 2001), Philippines (Long & Grolle, 1990; Long, 2001), Thailand (Long & Grolle, 1990; Long, 2001), Uganda (Long & Grolle, 1990; Long, 2001).
- Asterella leptophylla** (Mont.) Grolle, Feddes Repert. 87: 246. 1976.
Fimbraria leptophylla Mont., Ann. Sci. Nat., Bot., sér. 2, 18: 19. 1842.
Asterella koreana (Horik.) Horik., Hikobia 1(2): 79. 1951[1952].
Fimbraria koreana Horik., Bot. Mag., Tokyo 50: 201. 1936. **Type:** Korea, Mt. Kongôzan, prov. Kôgen, 5 Aug. 1935, *Y. Horikawa 14916* (lectotype: HIRO).
Asterella sanoana Shimizu & S. Hatt., J. Hattori Bot. Lab. 9: 25. f. 5, 7: e. 1953.
 Distribution: Bhutan (Long & Grolle, 1990), China (Jia & He, 2013), Far East of Russia (Long & Grolle, 1990; Konstantinova & Bakalin, 2009), India (Long & Grolle, 1990; Long, 2006), Japan (Long & Grolle, 1990), Korea (Yamada & Choe, 1997).
- Asterella limbata** D.G. Long & Grolle, J. Bryol. 18: 287. f. 1-2. 1994. **Type:** Indonesia, Sumatra, Mt. Korinchi, Jul. 1956, *W. Meijer B8977* (holotype: JE; isotype: L).
 Distribution: Indonesia (Long, 2001), Malaysia (Long & Grolle, 1994).
- Asterella lindenbergiana** (Corda) Lindb., Musci Scand. 1. 1879.
Fimbraria lindenbergiana Corda ex Nees, Naturgesch. Eur. Leberm. 4: 283-289. 1838.
 Distribution: Far East of Russia (Konstantinova & Bakalin, 2009; Borovichev & Bakalin, 2013a).
- Asterella ludwigii** (Schwägr.) Underw. ex Frye & L. Clark, Univ. Washington Publ. Bot. 6: 73. 1937.
Marchantia ludwigii Schwägr., Hist. Mus. Hepat. Prodr. 33. 1814.
 Distribution: Korea (Yamada & Choe, 1997).
- Asterella mitsuminensis** Shimizu & S. Hatt., J. Hattori Bot. Lab. 8: 48 f. 3. 1952.
 Distribution: China (Jia & He, 2013), Japan (Jia & He, 2013).
- Asterella monospiris** (Horik.) Horik., Hikobia 1: 79. 1951.
Fimbraria monospiris Horik., J. Sci. Hiroshima Univ., Ser. B, Div. 2 (Bot.) 2: 113. f. 3. 1934. **Type:** China, Taiwan, Mt. Chipon, Dec. 1932, *Y. Horikawa 10455*.

- Distribution: China (Horikawa, 1934).
- Asterella multiflora** (Steph.) Pandé, K.P. Sirvastava & Sultan Khan, J. Hattori Bot. Lab. 11: 2. 1954.
Fimbriaria multiflora Steph., Sp. Hepatat. 1: 124. 1899.
 Distribution: China (Long, 2001) India (Pandé et al., 1954b).
- Asterella mussuriensis** (Kashyap) Kashyap, Ann. Bryol. 8: 156. 1935.
Fimbriaria mussuriensis Kashyap, J. Bombay Nat. Hist. Soc. 24: 345. 1916.
 Distribution: Bhutan (Long & Grolle, 1990), China (Jia & He, 2013), India (Kachroo, 1954; Bir & Chopra, 1972, as *Fimbriaria mussuriensis*; Long & Grolle, 1990; Long, 2006), Nepal (Hattori, 1975h; Long & Grolle, 1990).
- Asterella pappii** (Gola) Grolle, Feddes Repert. 87: 246. 1976.
Fimbraria pappii Gola, Ann. Bot. (Rome) 13: 65. 1914.
 Distribution: Yemen (Frey & Kürschner, 1988; Frey et al., 1991; Kürschner, 2003).
- Asterella persica** (Steph.) M. Howe
 Distribution: Iran (Akhani & Kürschner, 2004), Saudi Arabia (Frey et al., 1991), Syria (Frey & Kürschner, 1991), Yemen (Frey et al., 1991).
- Asterella reflexa** (Herzog) P.C. Chen ex (Herzog) P.C. Chen ex Piippo, J. Hattori Bot. Lab. 68: 9. 1990.
Fimbriaria reflexa Herzog, Symb. Sinica. V: 4. 1930. **Type:** China, Sichuan, Yanyuan (Yenyuen) Co., 2500m, 1914. May 15, *Handel-Mazzettii* 2237.
 Distribution: China (Nicholson, 1930, as *Fimbriaria reflexa*).
- Asterella reticulata** (Kashyap) Pandé, K.P. Srivast. & Sultan Khan, J. Hattori Bot. Lab. 11: 9. 1954, *illegitimate, later homonym*.
Fimbraria reticulata Kashyap, J. Bombay Nat. Hist. Soc. 25: 279. 1917.
 Distribution: India (Joshi & Biradar, 1984).
- Asterella saccata** (Wahlenb.) A. Evans, Contr. U. S. Nat. Herb. 20: 276. 1920.
Marchantia saccata Wahlenb., Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeckungen Gesamnten Naturk. 5: 296. 1811.
 Distribution: China (Jia & He, 2013), Far East of Russia (Konstantinova & Bakalin, 2009), N. America.
- Asterella sanguinea** (Lehm. & Lindenb.) Pandé, K.P. Srivastava & Sultan Khan, J. Hattori Bot. Lab. 11: 9. 1954.
Fimbraria sanguinea Lehm. & Lindenb., Nov. Stirp. Pug. 4: 5. 1832.
 Distribution: Bhutan (Long & Grolle, 1990), China (Jia & He, 2013), India (Kachroo, 1954), Nepal (Long & Grolle, 1990).
- Asterella tenella** (L.) P. Beauv., Dict. Sci. Nat. 3: 258. 1805.
Marchantia tenella L., Sp. Pl. 2: 1137. 1753.
 Distribution: China (Yang & Lee, 1964), N. America.
- Asterella wallichiana** (Lehm.) Grolle, Khumbu Himal 1(4): 262. 1966.
Fimbraria wallichiana Lehm., Nov. Stirp. Pug. 4: 4. 1832.
Fimbriaria nepalense Taylor, Linn. Soc. Vol. 17: 387. 1837.
Asterella liukuensis (Horik.) Horik., Hikobia 1: 79. 1951.
Fimbraria liukuensis Horik., J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 1: 55. pl. 7: 1-11. 1931.
Asterella maculata (Steph.) Parihar, Univ. Allahabad Stud., Bot. Sect. 1961-2: 27. 1962.
 Distribution: Bangladesh (Long, 2006), China (Jia & He, 2013), India (Long, 2006; Schwarz & Frahm, 2013), Indonesia (Söderström et al., 2010b), Japan (Yamada & Iwatsuki, 2006, as *Asterella liukuensis*), Nepal (Long, 2006), Thailand (Lai et al.,

2008), Vietnam (Shu et al., 2017; Bakalin et al., 2018), Papua New Guinea (Long, 2001), Solomon Islands (Long, 2001).

Asterella yoshinagana (Horik.) Horik., Hikobia 1951.

Fimbraria yoshinagana Horik., Sci. Rep. Tôhoku Imp. Univ., Ser. 4, Biol. 4: 395. pl. 16. 1929.

Asterella sanoana Shimizu & S. Hatt., J. Hattori Bot. Lab. 9: 25. f. 5, 7: e. 1953.

Distribution: China (Jia & He, 2013), Japan (Yamada & Iwatsuki, 2006).

Asterellopsis R.L. Zhu & Y.L. Xiang

Cladistics 38(6): 659. 2022.

Type: *Asterellopsis grollei* (D.G. Long) R.L. Zhu & Y.L. Xiang

This genus consists of 1 species in the world.

Asterellopsis grollei (D.G. Long) R.L. Zhu & Y.L. Xiang, Cladistics 38(6): 659. 2022.

Asterella grollei D.G. Long, Bryologist 102: 169. f. 1-3. 1999.

Distribution: China (Jia & He, 2013), Nepal (Long, 1999).

Cryptomitrium Austin ex Underw.

Bull. Illinois State Lab. Nat. Hist. 2: 36. 1883.

Type: *C. tenerum* (W.J. Hooker) Underw.

This genus consists of 3 species in the world, 1 species in Asia.

Cryptomitrium himalayense Kashyap, New Phytol. 14: 2. 1915.

Distribution: China (Jia & He, 2013), India (Bir & Chopra, 1972; Long, 2006), Nepal (Long, 2006), Bhutan (Long, 2006).

Mannia Opiz

Naturalientausch 12(Beitr. Naturg. 1): 646. 1829.

Type: *M. raddii* (Corda) Opiz

This genus consists of 16 species in the world, 10 species in Asia.

Mannia androgyna (L.) A. Evans, Chron. Bot. 4: 224. 1938.

Distribution: Afghanistan (Frey & Kürschner, 1991), Far East of Russia (Borovichev & Bakalin, 2013a), Iran (Kürschner, 1996; Akhani & Kürschner, 2004), Israel (Heyn & Herrnstadt, 2004), Jordan (El-Oqlah et al., 1988), Lebanon (Frey & Kürschner, 1991), Oman (Frey & Kürschner, 1988), Saudi Arabia (Frey & Kürschner, 1988), Türkiye (Crundwell & Nyholm, 1979), Yemen (Frey & Kürschner, 1988; Kürschner, 2003).

Mannia foreaui Udar & V. Chandra, Canad. J. Bot. 43: 148. 1965.

Distribution: India (Alam & Srivastava, 2009b).

Mannia fragrans (Balb.) Frye & Clark, Univ. Wash. Publ. Biol. 6: 62. 1937.

Machantia fragrans Balb., Mém. Acad. Sci. Turin, Sci. Phys. 7: 76. 1804.

Fimbraria fragrans (Balb.) Nees, Horae Phys. Berol. 45. 1820.

Grimaldia fragrans (Balb.) Corda ex Nees, Naturgesch. Eur. Leberm. 4: 225. 1838.

Distribution: Afghanistan (Frey & Kürschner, 1991), China (Jia & He, 2013), Israel (Frey & Kürschner, 1991), Japan (Yamada & Iwatsuki, 2006), Mongolia (Grolle et al., 1983; Grolle, 1986), Siberia and Far East of Russia (Konstantinova & Bakalin, 2009), Türkiye (Frey & Kürschner, 1991), Europe, N. America.

Mannia levigata Shimizu & S. Hatt., J. Hattori Bot. Lab. 10: 49. f. 8-9. 1953.

Distribution: Far East of Russia (Borovichev & Bakalin, 2013b), Japan (Yamada & Iwatsuki, 2006).

Mannia perssonii Udar & V. Chandra, Canad. J. Bot. 43(1): 150. 1965.

Distribution: India (Singh & Singh, 2007b).

- Mannia pilosa** (Hornem.) Frye & L. Clark, Univ. Wash. Publ. Biol. 6: 64. 1937.
Marchantia pilosa Hornem., Fl. Dan. 8(24): 7. pl. 1426. 1810.
Fimbraria pilosa (Hornem.) Taylor, Trans. Linn. Soc. London 17: 386. 1837.
Grimaldia pilosa (Hornem.) Lindb., Musci Scand. 1. 1879.
 Distribution: Japan (Katagiri et al., 2010), Siberia and Far East of Russia (Konstantinova & Bakalin, 2009).
- Mannia rupestris** (Nees) Frye & L. Clark, Univ. Washington Publ. Biol. 6: 67. 1937.
Duvalia rupestris Nees, Berlinisches Magazin 8: 271. 1818.
 Distribution: Nepal (Hattori, 1975h).
- Mannia sibirica** (K. Müller) Frye & Clark, Univ. Wash. Publ. Biol. 6: 66. 1937.
Grimaldia pilosa var. *sibirica* K. Müller, Lebermoose 265. 1907.
Arnelliella sibirica (K. Müller) C. Massal., Atti Reale Ist. Veneto Sci., Lett. Art. 16(2): 928. 1914.
Grimaldia sibirica (K. Müller) K. Müller, Lebermoose 2: 721. 1916.
 Distribution: China (Jia & He, 2013), Siberia and Far East of Russia (Konstantinova & Bakalin, 2009), Europe, N. America.
- Mannia subpilosa** (Horik.) Horik., Hikobia 1: 85. 1951.
Grimaldia subpilosa Horik., J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 2: 112. 1934[1934]. **Type:** China, Taiwan, Mt. Morrison, Aug. 1932, *Y. Horikawa* 9251.
 Distribution: China (Horikawa, 1934, as *Grimaldia subpilosa*).
- Mannia triandra** (Scop.) Grolle, J. Bryol. 8: 487. 1975.
Marchantia triandra Scop., Fl. Carniol. (ed. 2): 354. pl. 63. 1772.
 Distribution: China (Jia & He, 2013), Japan (Borovichev & Bakalin, 2016), Korea (Borovichev & Bakalin, 2016), Siberia and Far East of Russia (Konstantinova & Bakalin, 2009), Europe, N. America.
- Plagiochasma** Lehm. & Lindenb.
 Nov. Stirp. Pug. 4: 13. 1832.
Type: *P. cordatum* Lehm. & Lindenb.
 This genus consists of 16 species in the world, 15 species, 1 variety in Asia.
- Plagiochasma appendiculatum** Lehm. & Lindenb., Nov. Stirp. Pug. 4: 14. 1832.
Plagiochasma reboulroides Horik., Bot. Mag. (Tokyo) 49: 672. 1935.
 Distribution: Afghanistan (Frey & Kürschner, 1991), Bangladesh (Long & Grolle, 1990), Bhutan (Long & Grolle, 1990), Myanmar (Long & Grolle, 1990), China (Long & Grolle, 1990), India (Kachroo, 1954; Bapna & Vyas, 1962; Bir & Chopra, 1972; Bischler, 1979; Joshi & Biradar, 1984), Japan (Katagiri & Mizutani, 2014), Nepal (Bischler, 1979), Pakistan (Bischler, 1979), Philippines (Bischler, 1979; Tan & Engel, 1986), Saudi Arabia (Frey & Kürschner, 1988), Sri Lanka, Syria (Frey & Kürschner, 1991), Thailand (Chantanaorrapint & Sridith, 2014), Vietnam (Jovet-Ast & Schmid, 1958, as *P. reboulroides*; Pócs, 1965, as *P. reboulroides*; Bischler, 1979), Yemen (Frey & Kürschner, 1988; Kürschner, 2003), Ethiopia (Bischler, 1979), Kenya (Bischler, 1979).
- Plagiochasma appendiculatum** var. **mahabaleshwarensis**
 Distribution: India (Joshi & Biradar, 1984).
- Plagiochasma articulatum** Kashyap, New Phytol. 13: 320. 1914.
 Distribution: India (Bapna & Vyas, 1962; Bir & Chopra, 1972; Joshi & Biradar, 1984), Nepal (Hattori, 1975h).
- Plagiochasma beccarianum** Steph., Ann. Sci. Nat., Bot., ser. 7.
 Distribution: Syria (Frey & Kürschner, 1991), Yemen (Frey & Kürschner, 1988;