

Endemic Species of Bryophytes in Japan

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(Received 30 May 2011; accepted 22 June 2011)

Abstract The endemic species of bryophytes in Japan are reviewed. A total of 165 taxa of bryophytes are endemic to Japan, which is ca. 8.4% of the Japanese bryoflora. The endemism of mosses and liverworts from Japan revealed ca. 7.7% and ca. 10.1%, respectively. There is no endemic species of hornwort in Japan. Four genera, *Taxiphyloopsis* and *Yakushimabyum* of mosses, and *Cavicularia* and *Hattoria* of liverworts, are endemic to Japan and monospecific. There is no endemic family of bryophytes in Japan. The low endemism rate of bryophytes in Japan might be a result of the close relationship of the flora between Japan and the Asian continent. Two taxa are proposed to be synonyms of other taxa.

Key words: bryophytes, endemic species, Japan.

An endemic species is defined as one limited to a single county or floristic area (cf. Magill, 1990). The endemism rate of bryophytes in Japan has been reported as ca. 10% in mosses, ca. 28% in liverworts and ca. 25% in hornworts (Environment Agency of Japan, 2000). Subsequently Higuchi and Fife (2006) noted that the endemism rate of mosses in Japan was 9% at the species level. Recently a first list of the endemic species of bryophytes in Japan was published by Higuchi (2011). Endemism in bryophytes of Japan appears not to have been discussed previously. This paper aims to provide an overview of the endemic species of bryophytes in Japan. Although the number of the endemic species of bryophytes in Japan will change by the progress of taxonomic and floristic studies, the endemic species give important hints as to the origin and diversity of the bryophyte flora in Japan and the conservation of endangered and/or rare species.

Materials and Methods

The list of endemic species of bryophytes in Japan was mainly based on the checklists of

Japan (Noguchi, 1987, 1988, 1989, 1991, 1994; Iwatsuki, 2001, 2004; Furuki and Mizutani, 2004; Yamada and Iwatsuki, 2006) unless otherwise stated. The following bryophyte floras of the adjacent regions are referred; Korea (Yamada and Choe, 1997; Choe, 1980; Park and Choi, 2007), China (Piippo, 1990; Redfearn *et al.*, 1996; Gao and Crosby, 1999, 2003; Li and Crosby, 2001, 2007; Wu and Crosby, 2002, 2005; Hu *et al.*, 2008), Taiwan (Lin, 2000; Chiang *et al.*, 2001) and Russia (Ignatov *et al.*, 2006; Konstantinova and Bakalin, 2009). Doubtful taxa and records are excluded from the list.

Results and Discussion

At present there are 1,145 species (1,303 taxa) of mosses, 620 species (633 taxa) of liverworts and 17 species (17 taxa) of hornworts reported from Japan. The number of endemic taxa is shown in Tables 1 and 2. A total of 165 taxa of bryophytes are endemic to Japan, which is ca. 8.4% of the total Japanese bryophyte flora. There is no endemic species of hornwort in Japan. The endemism rate is ca. 7.7% in mosses and ca.

Table 1. Number of the endemic taxa of mosses in Japan

Family	Genera	Species	Subspecies	Variety	Taxa
Amblystegiaceae	4	4		2	6
Brachytheciaceae	4	10			10
Bryaceae	2	3			3
Calymperaceae	2	3			3
Daltoniaceae	1	1			1
Dicranaceae	4	7		3	10
Diphysciaceae	1	2			2
Ditrichaceae	2	3			3
Fissidentaceae	1	5			5
Fontinalaceae	1	1			1
Grimmiaceae	3	3		2	5
Hypnaceae	7	8			8
Lembophyllaceae	2	2		1	3
Leskeaceae	2	3			3
Leucodontaceae	1	3			3
Meteoriaceae	2			2	2
Mniaceae	2	2			2
Myuriaceae	1			1	1
Neckeraceae	1	1		1	2
Orthotrichaceae	3	3			3
Polytrichaceae	1	1			1
Pottiaceae	8	10		1	11
Pylaisiadelphaceae	4	4			4
Rhachithecaceae	2	2			2
Seligeriaceae	1	2			2
Sematophyllaceae	1	2			2
Sphagnaceae	1	1			1
Thamnobryaceae	1	1			1
Thuidiaceae	1	1			1

Table 2. Number of the endemic taxa of liverworts in Japan

Family	Genera	Species	Subspecies	Variety	Taxa
Acrobolbaceae	1	1			1
Aneuraceae	3	8			8
Aytoniaceae	1			1	1
Blasiaceae	1	1			1
Calypogeiaceae	1	4	1		5
Cephaloziellaceae	1	1			1
Cleveaceae	1	1			1
Frullaniaceae	1	7		1	8
Gymnomitriaceae	2	3			3
Jungermanniaceae	6	14	1		15
Lejeuneaceae	7	9		1	10
Lepidoziaceae	1	1			1
Pallaviciniaceae	1	1			1
Porellaceae	1			2	2
Radulaceae	1	2	1		3
Ricciaceae	1	3			3

10.1% in liverworts. As compared with the former report (Environment Agency of Japan, 2000), the endemism rate is distinctly lower, which was mainly caused by the progress of taxonomic and

floristic studies of Japan and its neighboring countries. Recently Akiyama *et al.* (2011) described a new genus, *Yakushimabryum*, from Yakushima Island, Kyushu, Japan. At present

four genera, *Taxiphyllopsis* Higuchi & Deguchi and *Yakushimabryum* H. Akiyama, Ying Chang, Yamaguchi & B. C. Tan of mosses, *Cavicularia* Steph. and *Hattoria* R. M. Schust. of liverworts, are endemic to Japan; all are monospecific. There are seven and 23 endemic genera of bryophytes in China (Wu, 1992) and North America (Schofield, 2004), respectively. When compared phytogeographically, Japan and China should be united together with Korea and the Russian Far East as East Asian region, where there are about 20 endemic genera of bryophytes (cf. Deguchi and Iwatsuki, 1984). There is no endemic family of bryophytes in Japan. In mosses, the Pottiaceae (11 taxa), Brachytheciaceae (10 taxa), Dicranaceae (10 taxa) and Hypnaceae (8 taxa) are rather rich in endemic taxa (Table 1). While, in liverworts, the Jungermanniaceae (15 taxa), Lejeuneaceae (10 taxa), Aneuraceae (8 taxa) and Frullaniaceae (8 taxa) are rich in endemic taxa (Table 2).

Higuchi and Fife (2006) compared the moss flora of Japan with that of New Zealand. The two countries have comparatively rich and unique moss floras for their land areas. A comparison of the mosses recorded from Japan and New Zealand revealed that the Japanese moss flora was richer than that of New Zealand, but that the endemism rate at the species level in New Zealand was higher than that of Japan (Higuchi and Fife, 2006). The reason why the endemism rate is so high in New Zealand was not clear, but it is certain that the longer isolation of New Zealand from other land masses caused such high endemism rate. The low endemism rate of bryophytes in Japan might be derived from the close relationship of the flora between Japan and the Asian continent.

Taxonomic Treatments

In the course of the study, the following taxonomic treatments were found to be needed.

1. *Isotheciadelphus sasaokae* Dixon & Thér.

My examination of the type indicates that this

species is identical with *Dolichomitriopsis diversiformis* (Mitt.) Nog.

Dolichomitriopsis diversiformis (Mitt.) Nog., J. Hattori Bot. Lab. 4: 44 (1950).

Isotheciadelphus sasaokae Dixon & Thér., J. Bot. 74: 4 (1936), syn. nov. ≡ *Dolichomitriopsis sasaokae* (Dixon & Thér.) Nog., J. Jap. Bot. 22: 83 (1948). Type: Mt. Kimpo, Prov. Sinano, Japan, 25 May, 1929, *Sasaoka 5343* (isotype in TNS!).

2. *Dichodontium pellucidum* (Hedw.) Schimp. var. *japonicum* Sakurai

My examination of the type indicates that this variety is identical with the type variety.

Dichodontium pellucidum (Hedw.) Schimp., Coroll. 12 (1856).

Dichodontium pellucidum (Hedw.) Schimp. var. *japonicum* Sakurai, Bot. Mag. Tokyo 65: 91 (1952), syn. nov. Type: Prov. Ise, Naigu, *T. Mago-fuku 1985*, 17 Dec., 1949 (isotype in TNS!).

Acknowledgments

This study was carried out under a research program, "Studies on the Geography and Evolution of Biodiversity in Japan" of the National Museum of Nature and Science. Travel support to visit other herbaria in Japan was provided by National Museum of Nature and Science, Tokyo, and is acknowledged. I wish to thank Dr. W. R. Buck of The New York Botanical Garden for reviewing the manuscript and giving valuable comments.

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Appendix

The endemic species of bryophytes in Japan are listed with distribution data. The parentheses after the species show the distribution in Japan:

Hk (Hokkaido), H (Honshu), S (Shikoku), K (Kyushu), R (Ryukyu Islands) and B (Bonin Islands). The familial position follows Goffinet *et al.* (2009) with minor changes. The number of genera and species in the world is from Frey and Stech (2009), and those in Japan is based on Iwatsuki (2004) and Yamada and Iwatsuki (2006) with subsequent publications.

Marchantiophyta

Acrobolbaceae

Seven genera and ca. 60 species are recorded from the world, and three genera and three species from Japan. One species is endemic to Japan.

Lethocolea naruto-toganensis Furuki (H)

Aneuraceae

Four genera and ca. 210 species are recorded from the world, and three genera and 27 species from Japan. Eight species are endemic to Japan.

Aneura gemmifera Furuki (H)

A. hirsuta Furuki (R)

Lobatiriccardia yakusimensis (S.Hatt.) Furuki (K, R)

Riccardia aeruginosa Furuki (K, R, B)

R. arcuata Furuki (H, K)

R. glauca Furuki (H, K)

R. subalpina Furuki (Hk, H)

R. vitrea Furuki (H, S, K)

Aytoniaceae

Five genera and ca. 90 species are recorded from the world, and four genera and 11 species from Japan. One variety is endemic to Japan.

Asterella mussuriensis (Kashyap) Kashyap var. *crassa* (Shimizu & S.Hatt.) D.G.Long (H)

Blasiaceae

Two genera and two species are recorded from the world and Japan. One genus, *Cavicularia*, and one species are endemic to Japan.

Cavicularia densa Steph. (Hk, H, S, K)

Calypogeiaceae

Four genera and ca. 50 species are recorded from the world, and three genera and 18 species from Japan. Four species and one subspecies are endemic to Japan.

Calypogeia angusta Steph. (Hk, H)

C. asakawana Inoue (H)

C. contracta Inoue (H)

C. fujisana Inoue (H)

C. neesiana (C.Massal. & Carestia) Müll.Frib. subsp. *subalpina* (Inoue) Inoue (Hk, H, S, K)

Cephaloziellaceae

Ten genera and ca. 140 species are recorded from the world, and two genera and 10 species from Japan. One species is endemic to Japan.

Cephaloziella acanthophora (S.Hatt.) Horik. (K)

Cleveaceae

Three genera and ca. 20 species are recorded from the world, and three genera and six species from Japan. One species is endemic to Japan.

Sauteria yatsuensis S.Hatt. (H)

Frullaniaceae

One genus and ca. 350 species are recorded from the world, and one genus and 46 species from Japan. Seven species and one variety are endemic to Japan.

Frullania amamiensis Kamim. (R)

F. cristata S.Hatt. (Hk, H)

F. iriomotensis S.Hatt. (R)

F. iwatsukii S.Hatt. (H)

F. okinawensis Kamim. (R)

F. pseudoalstonii Tsudo & J.Haseg. (K)

F. schensiana C.Massal. var. *punctata* (S.Hatt.) Kamim. (H, S, K)

F. zennoskeana S.Hatt. (B)

Gymnomitriaceae

Twelve genera and ca. 80 species are recorded from the world, and three genera and 20 species from Japan. Three species are endemic to Japan.

Gymnomitrium mucronulatum (N.Kitag.) N.Kitag. (H)

G. noguchianum S.Hatt. (H, K)

Marsupella alata S.Hatt. & N.Kitag. (Hk, H)

Jungermanniaceae

Twenty-eight genera and ca. 340 species are recorded from the world, and 17 genera and 91 species from Japan. One genus, *Hattoria*, fourteen species and one subspecies are endemic to Japan.

Anastrophyllum ellipticum Inoue (H)

Hattoria yakushimensis (Horik.) R.M.Schust. (H, K)

Jungermannia cephalozoides Amakawa (Hk, H)

J. hattoriana (Amakawa) Amakawa (Hk, H, S)

J. hattorii Amakawa (K)

J. hiugaensis (Amakawa) Amakawa (H)

J. hokkaidensis Vána (Hk)

J. japonica Amakawa (Hk, H, S, K)

J. kyushuensis Amakawa (K, R)

J. shimizuana Vána (H)

J. unispiris (Amakawa) Amakawa (H)

Leiocolea mayebarae (S.Hatt.) Furuki & Mizut. (Hk, H, S, K)

Lophozia silvicoloides N.Kitag. (Hk, H)

Nardia minutifolia Furuki (H, K)

N. scalaris Gray subsp. *harae* (Amakawa) Amakawa (Hk, H, S)

Lejeuneaceae

Ninety genera and ca. 1370 species are recorded from the world, and 25 genera and 134 species from Japan. Nine species and one variety are endemic to Japan.

Cheilolejeunea boninensis Mizut. (B)

Cololejeunea inoueana Mizut. (B)

C. nakajimae S.Hatt. (H)

C. uchimae Amakawa (R)

Drepanolejeunea obtusifolia T.Yamag. (R)

Lejeunea aquatica Horik. var. *apiculata* S.Hatt. (K)

L. syoshii Inoue (R)

Leucolejeunea japonica (Horik.) Verd. (H, K)

Pycnolejeunea minutilobula (Amakawa) Amakawa (R)

Stictolejeunea iwatsukii Mizut. (R)

Lepidoziaceae

Twenty-nine genera and ca. 900 species are recorded from the world, and five genera and 26 species from Japan. One species is endemic to Japan.

Telaranea iriomotensis T.Yamag. & Mizut. (R)

Pallaviciniaceae

Ten genera and ca. 60 species are recorded from the world, and three genera and seven species from Japan. One species is endemic to Japan.

Moerckia japonica Inoue (H)

Porellaceae

Three genera and ca. 80 species are recorded from the world, and two genera and fifteen species from Japan. Two varieties are endemic to Japan.

Porella densifolia (Steph.) S.Hatt. var. *oviloba* (Steph.) N.Kitag. (S)

P. densifolia var. *robusta* (Steph.) S.Hatt. (H, S, K)

Radulaceae

One genus and ca. 200 species are recorded from the world, and one genus and 23 species from Japan. Two species and one subspecies are endemic to Japan.

Radula campanigera Mont. subsp. *obiensis* (S.Hatt.) K.Yamada (K)

R. boninensis Furuki & K.Yamada (B)

R. fujitae Furuki (R)

Ricciaceae

Two genera and ca. 160 species are recorded from the world, and two genera and nine species from Japan. Three species are endemic to Japan.

Riccia miyakeana Schiffn. (H, S, K)

R. nipponica S.Hatt. (H, S, K)

R. pubescens S.Hatt. (H)

Bryophyta

Amblystegiaceae

Forty genera and ca. 190 species are recorded

from the world, and 21 genera and 51 species from Japan. Four species and two varieties are endemic to Japan.

Amblystegium calcareum (Kanda) Nog. (H, K)

Hygrohypnum alpinum (Lindb.) Broth. var. *tsurugizanicum* (Cardot) Nog. & Z.Iwats. (Hk, H, S)

H. subeugyrium (Lindb.) Loesk. var. *japonicum* Cardot (H, K)

Leptodictyum mizushimae (Sakurai) Kanda (Hk, H)

Platdictya fauriei (Cadot) Z.Iwats. & Nog. (Hk, H)

P. hattorii Kanda (Hk, H)

Brachytheciaceae

Forty-three genera and ca. 540 species are recorded from the world, and 12 genera and 78 species from Japan. Ten species are endemic to Japan.

Brachythecium camptothecioides Takaki (Hk, H)

B. hastile Broth. & Paris (H)

B. nitidulum (Broth.) Nog. (H)

B. otaruense Cardot (Hk, H)

B. pseudo-uematsui Nog. (Hk, H)

B. uyematsui Broth. ex Cardot (Hk, H, K)

Bryhnia tenerrima Broth. & M.Yasuda (Hk, H, S, K)

B. tokubuchii (Broth.) Paris (Hk, H, K)

Eurhynchium yezoanum S.Okamura (Hk, H)

Helicodontium kiusianum (Sakurai) Taoda (H, S, K)

Bryaceae

Seventeen genera and ca. 870 species are recorded from the world, and 10 genera and 73 species from Japan. Three species are endemic to Japan.

Plagiobryum hultenii (Ochi & H.Perss.) Hederson (Hk, H)

Pohlia otaruensis (Cardot) Iisiba (Hk, H, K)

P. pseudo-defecta Ochi (H)

Calymperaceae

Eight genera and ca. 210 species are recorded

from the world, and four genera and 14 species from Japan. Three species are endemic to Japan.

Calymperes boninense Z.Iwats. (B)

Syrrhopodon kiensis Z.Iwats. (H, K)

S. yakushimensis Takaki & Z.Iwats. (K)

Daltoniaceae

Fourteen genera and ca. 240 species are recorded from the world, and two genera and 11 species from Japan. One species is endemic to Japan.

Distichophyllum yakumontanum H.Akiyama & Matsui (K)

Dicranaceae

Fifty-six genera and ca. 990 species are recorded from the world, and 24 genera and ca. 87 species from Japan. Seven species and three varieties are endemic to Japan.

Dicranella dilatatinervis Dixon (H)

D. ditrichoides Broth. (H, S)

D. globuligera Cardot (Hk)

D. mayebarae (Sakurai) Matsui & Z.Iwats. (K)

D. subsecunda Besch. (H, K)

D. yezoana Cardot (Hk)

Dicranoloma cylindrothecium (Mitt.) Sakurai var. *brachycarpum* (Broth.) Takaki (H)

D. cylindrothecium var. *maedae* (Sakurai) Takaki (H, K)

Oncophorus wahlenbergii Brid. var. *perbrevipis* Deguchi & H.Suzuki (H)

Trematodon mayebarae Takaki (H, K)

Diphysciaceae

One genus and 15 species are recorded from the world, and one genus and 10 species from Japan. Two species are endemic to Japan.

Diphyscium perminutum Takaki (H, S, K, R)

D. suzukii Z.Iwats. (H)

Ditrichaceae

Twenty-six genera and ca. 190 species are recorded from the world, and nine genera and 20 species from Japan. Three species are endemic to Japan.

Ditrichum brevisetum H.Kiguchi, Tad.Suzuki

& Z.Iwats. (H)

D. sekii Ando & Deguchi ex Matsui & Z.Iwats. (H, K)

Pleuridium japonicum Deguchi, Matsui & Z.Iwats. (Hk, H, S, K)

Fissidentaceae

One genus and ca. 440 species are recorded from the world, and one genus and 50 species from Japan. Five species are endemic to Japan.

Fissidens bonienseis Z.Iwats. (B)

F. fujienseis Tad.Suzuki & Z.Iwats. (H)

F. neomagofukui Z.Iwats. & Tad.Suzuki (H)

F. pseudoadelphinus Z.Iwats. & Tad.Suzuki (H)

F. pseudohollianus Z.Iwats. (B)

Fontinalaceae

Three genera and ca. 130 species are recorded from the world, and two genera and three species from Japan. One species is endemic to Japan.

Dichelyma japonicum Cardot (Hk, H)

Grimmiaceae

Eleven genera and ca. 380 species are recorded from the world, and six genera and 51 species from Japan. Three species and two varieties are endemic to Japan.

Grimmia brachydietyon (Cardot) Deguchi (Hk, H, S)

G. percarinata (Dixon & Sakurai) Nog. ex Deguchi (K)

Ptychomitrium gardneri Lesq. var. *angustifolium* (Nog.) T.Cao (H)

Racomitrium fasciculare (Hedw.) Brid. var. *hayachinense* Nog. (H)

R. vulcanicola Frisvoll & Deguchi (Hk, H)

Hypnaceae

Sixty-six genera and ca. 870 species are recorded from the world, and 23 genera and ca. 86 species from Japan. One genus, *Taxiphyllopsis*, and eight species are endemic to Japan.

Ctenidium percrassum Sakurai (H, S, K)

C. pulchellum Cardot (Hk, H)

Ectropothecium andoi N.Nishim. (H, K, R)

Glossadelphus yakoushimae (Cardot) Nog. (K, R)

Gollania splendens (Iisiba) Nog. (H)

Pseudotaxiphyllum maebarae (Sakurai) Z.Iwats. (H, K)

Pylaisia nana Mitt. (H, K)

Taxiphyllopsis iwatsukii Higuchi & Deguchi (H, S)

Lembophyllaceae

Thirteen genera and ca. 100 species are recorded from the world, and four genera and ca. 8 species from Japan. Two species and one variety are endemic to Japan.

Dolichomitra cymbifolia (Lindb.) Broth. var. *subintegerrima* S.Okamura (H, S, K)

Dolichomitriopsis crenulata S.Okamura (Hk, H, S, K)

D. obtusifolia (Dixon) Nog. (Hk, H)

Leskeaceae

Twenty-two genera and ca. 160 species are recorded from the world, and 12 genera and 24 species from Japan. Three species are endemic to Japan.

Okamuraea brevipes Broth. ex S.Okamura (Hk, H)

O. plicata Cardot (H, S, K)

Rigodiadelphus arcuatus (Nog.) Nog. (H)

Leucodontaceae

Seven genera and ca. 50 species are recorded from the world, and three genera and 14 species from Japan. Three species are endemic to Japan.

Leucodon alpinus H.Akiyama (Hk, H)

L. giganteus (Nog.) Nog. (S)

L. sohayakiensis H.Akiyama (H, S, K)

Meteoriaceae

Twenty-four genera and ca. 190 species are recorded from the world, and 12 genera and 20 species from Japan. Two varieties are endemic to Japan.

Aerobryum speciosum (Dozy & Molk.) Dozy & Molk. var. *nipponicum* Nog. (H, R)

Meteorium buchananii (Broth.) Broth. subsp.

helminthocladulum (Cardot) Nog. var. *cuspidatum* (S.Okamura) Nog. (H, S, K)

Mniaceae

Fourteen genera and ca. 270 species are recorded from the world, and seven genera and 32 species from Japan. Two species are endemic to Japan.

Mnium orientale R.E.Wyatt (Hk, H, S)

Pseudobryum speciosum (Mitt.) T.J.Kop. (Hk, H, S)

Myuriaceae

Four genera and ca. 20 species are recorded from the world, and three genera and six species from Japan. One variety is endemic to Japan.

Oedycladium refescens (Reinw. & Hornsch.) Mitt. var. *yakushimense* (Sakurai) Z.Iwats. (H, K)

Neckeraceae

Twenty-seven genera and ca. 240 species are recorded from the world, and eight genera and 28 species from Japan. One species and one variety are endemic to Japan.

Neckera nakazimae (Iisiba) Nog. (H, S, K)

N. pusilla Mitt. var. *pendula* Nog. (H)

Orthotrichaceae

Twenty-one genera and ca. 860 species are recorded from the world, and eight genera and 31 species from Japan. Three species are endemic to Japan.

Macromitrium tosae Besch. (H, S, K)

Orthotrichum ibukiense Toyama (H)

Ulota yakushimensis Z.Iwats. (S, K)

Polytrichaceae

Twenty-three genera and ca. 220 species are recorded from the world, and five genera and 29 species from Japan. One species is endemic to Japan.

Pogonatum otaruense Besch. (Hk, H, S, K)

Pottiaceae

Eighty genera and ca. 1460 species are recorded from the world, and 30 genera and 103 species

from Japan. Ten species and one variety are endemic to Japan.

Barbula hiroshii K.Saito (H, S, K)

B. horrinervis K.Saito (H, K)

Bryoerythrophyllum linearifolium K.Saito (K)

B. rubrum (Jur. ex Geh.) Chen var. *minus* K.Saito (H)

Didymodon leskeoides K.Saito (H)

Hyophila acutifolia K.Saito (H)

Pachyneurosis miyagii T.Yamag. (R)

Tortella japonica (Besch.) Broth. (H, S, K)

Uleobryum naganoi H.Kiguchi (H)

Weissia atrocaulis K.Saito (H)

W. deciduaefolia K.Saito (H, K)

Pylaisiadelphaceae

Sixteen genera and ca. 425 species are recorded from the world, and 12 genera and 29 species from Japan. One genus, *Yakushimabryum*, and four species are endemic to Japan.

Brotherella complanata Reimers & Sakurai (H, S, K)

Taxithelium liukiense Sakurai (R)

Wijkia concavifolia (Cardot) H.A.Crum (H, K)

Yakushimabryum longissimum H.Akiyama, Ying Chang, Yamaguchi & B.C.Tan (K)

Rhachithecaceae

Seven genera and 20 species are recorded from the world, and two genera and three species from Japan. Two species are endemic to Japan.

Hypnodontopsis apiculata Z.Iwats. & Nog. (H, K)

Rhachithecium nipponicum (Toyama) Wijk & Margad. (H)

Seligeriaceae

Five genera and ca. 50 species are recorded from the world, and three genera and 16 species from Japan. Two species are endemic to Japan.

Brachydontium noguchii Z.Iwats., Tad.Suzuki & H.Kiguchi (H)

Brachydontium pseudodonnianum (Tad.Suzuki & Z.Iwats.) Tad.Suzuki & Z.Iwats. (H)

Sematophyllaceae

Twenty-eight genera and ca. 510 species are recorded from the world, and seven genera and 12 species from Japan. Two species are endemic to Japan.

Rhaphidorrhynchium chichibuense Seki (H)

R. hyoji-suzukii Seki (H)

Sphagnaceae

One genus and ca. 300 species are recorded from the world, and one genus and 44 species from Japan. One species is endemic to Japan.

Sphagnum calymmatophyllum Warnst. & Cardot (H)

Thamnobryaceae

One genus and ca. 50 species are recorded from the world, and one genus and six species from Japan. One species is endemic to Japan.

Thamnobryum planifrons (Broth. & M.Yasuda) Nog. & Z.Iwats. (Hk, H, K)

Thuidiaceae

Twenty-one genera and ca. 190 species are recorded from the world, and 18 genera and 54 species from Japan. One species is endemic to Japan.

Heterocladium tenerum Deguchi & H.Suzuki (H, S)