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Mosses of Mt. Yushan, Taiwan

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Abstract. The moss flora of Mt. Yushan, Taiwan, was investigated in 2002 and 2003. The mosses recognized comprise 33 families, 86 genera, and 137 species. Among them 14 species and two varieties are new additions to the moss flora of Taiwan, and most of them are circumboreal species. For each species, substrate, locality, specimen number, and distribution were given.
Key words : bryophytes, mosses, Mt. Yushan, Taiwan.

Introduction

This study deals with the moss flora Mt. Yushan, Taiwan, based on the collections made under a research program, "Natural History Researches of the Island Arcs in the Western Pacific", of the National Science Museum, Tokyo. In 2002 and 2003 we made a field research and collected bryophytes mainly from the summit area of Mt. Yushan.

Taiwan is situated in the northwest region of the Pacific Ocean. Taiwan consists of the main island and many smaller islands occupying 400 km between 21°50′ and 25°20′N in latitude. Mt. Yushan (23°28′N, 120°56′E), also called Mt. Morrison or Mt. Niitakayama, is the highest (3,997 m alt.) in East Asia including Taiwan. Many botanists visited there and studied its flora. As a result, many new taxa have been named after the mountain (Lin, 1985). In bryophytes, several authors reported some taxa from Mt. Yushan (e.g., Nakanishi, 1964; Iwatsuki & Mizutani, 1983; Chiang, 1989; Lin & Chan, 1990, 1991). However, no bryophyte flora of Mt. Yushan has been compiled.

The purpose of this study is to investigate the moss flora of Mt. Yushan and to compile it based on the specimens collected.

Materials and Methods

Field studies were carried out in 2002 and 2003, and a total of ca. 450 specimens were collected. The main sites investigated are summarized as follows (Figs 1, 2).

I: Chiayi Hsien, Mt. Yushan, from Tatakaanbu (2600 m alt.) to Paiyun Lodge (3400 m alt.), along trail in *Abies kawakamii* forest, 14 September 2002, 10 September 2003.

II: Chiayi Hsien, Mt. Yushan, from Paiyun Lodge (3400 m alt.) to Pass of Main Peak (3800 m alt.), along trail in *Abies kawakamii* forest, 6, 9 September 2003.

III: Nantou Hsien, Mt. Yushan, from Pass of Main Peak (3800 m alt.) to Main Peak (3952 m alt.), above tree line, 6 September 2003.

IV: Nantou Hsien, Mt. Yushan, eastern slope from Pass of Main Peak to North Peak, 3380–3600 m alt., along trail in *Abies kawakamii* forest, 7 September 2003.

V: Nantou Hsien, Mt. Yushan, from Pass of Main Peak (3800 m alt.) to North Peak (3858 m alt.), along trail in *Abies kawakamii* forest or *Juniperus squamata* var. *morrisonicola* scrub, 5, 6, 7 September 2003.

VI: Nantou Hsien, Mt. Yushan, from North Peak

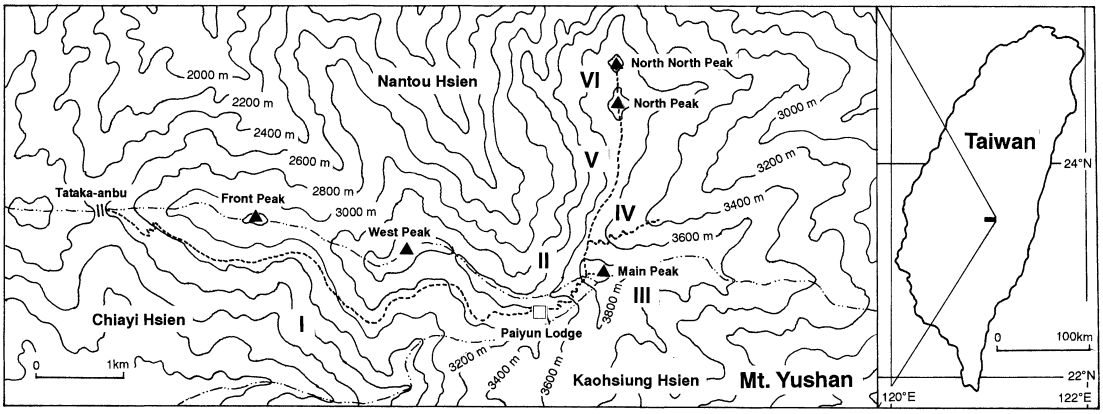

Fig. 1. Map showing the areas investigated.

(3858 m alt.) to North North Peak (3833 m alt.), along trail in *Juniperus squamata* var. *morrisonicola* scrub, 5, 8 September 2003.

References for the moss flora of Taiwan by Chiang *et al.* (2001) and Higuchi & Lin (2004) were used for checking a new record. The data of distribution were from Noguchi (1987, 1988, 1989, 1991, 1994) and recent monographic studies concerned.

Results and Discussion

The mosses recognized in this study comprise 33 families, 86 genera and 137 species. Among them following 14 species and two varieties are new additions to the moss flora of Taiwan: *Dicranum leiodontum*, *D. viride* (as var. *hakkodense*), *Entodon flavescens*, *Grimmia apiculata*, *G. incurva, Herzogiella turfacea*, *Hylocomiastrum pyrenaicum*, *Hypnum cupressiforme* var. *filiforme*, *Isopterygiopsis muelleria*, *Myurella sibirica*, *Pohlia cruda*, *Plagiobryum zieri*, *Symphyodon echinatus*, *Tayloria alpicola*, *Tortella tortuosa*, *Zygodon viridissimus* var. *rupestris*.

Lin and Tsai (1984) studied the floristic relationships of the high mountain mosses of Taiwan to its neighboring regions. Tan (2002) discussed the affinity of moss floras among Japan, Taiwan, and the Philippines. Recently Higuchi and Lin (2004) discussed the relationship between the moss floras of Japan and Taiwan. The moss flora of alpine region in Taiwan appears to be related to those of Japan, southwestern China, and the boreal region. Higuchi and Lin (2004) pointed out that the species lacking in Taiwan were mainly circumboreal species based on the comparison of both moss floras, although floristic studies in Taiwan have been confined to a more limited area than in Japan. Most of the species newly recorded in this study were circumboreal, which show the close relationship between the high mountain moss floras of Taiwan and its neighboring regions.

Enumeration of Species

The families, genera, and species are arranged alphabetically. In the following enumeration an asterisk (*) preceding a species indicates "new to Taiwan". Each species is referred by the substrates, collecting sites (I–VI), and specimen numbers of the first author. The complete set of the specimens are preserved in the herbarium of the Department of Botany, National Science Museum (TNS) and duplicates in the herbarium of the Department of Life Science, Tunghai University, Taichung (TUNG).

AMBLYSTEGIACEAE

Cratoneuron filicinum (Hedw.) Spruce, Cat. Musc. Amaz. And.: 21 (1867).

Fig. 2. Photographs showing the areas investigated. 1, Main Peak of Mt. Yushan (right); 2, North Peak with North Peak Weather Station at the summit; 3, *Juniperus squamata* var. *morrisonicola* scrub at the eastern slope between Main Peak and North Peak; 4. *Abies kawakamii* forest at the eastern slope between Main Peak and North Peak; 5, Tataka-anbu; 6, Paiyun Lodge.

II: on rock-cliff, 42219. IV: on soil, 42071 (+*Mnium lycopodioides*); on rock-cliff, 42072.

Distribution. Europe, Asia, N. and S. America, and New Zealand.

Sanionia uncinata (Hedw.) Loeske, Hedwigia, 46: 309 (1907).

II: on humus, 41833, 41834 (+*Paraleucobryum enerve*). IV: on humus, 42159. V: on tree-trunk of *Abies kawakamii*, 41957, 41965.

Distribution. Europe, northern Asia, Hi-

malayas, Japan, N. and S. America, and Australia.

ANDREAEACEAE

Andreaea morrisonensis Nog., Trans. Nat. Hist. Soc. Formosa, 24: 139 (1936).

III: on rock-crevice, 41887.

Distribution. Endemic to Taiwan.

Andreaea rupestris Hedw. var. ***fauriei*** (Besch.) Takaki, J. Hattori Bot. Lab., 11: 90 (1954).

III: on rock, 41894; on rock-cliff, 41921. V: on rock, 41975. VI: on rock-cliff, 42091, 42104.

Distribution. India, mainland China, Taiwan, Korea, and Japan (cf. Chiang, 1998).

Andreaea wangiana P.C.Chen in Chen & Wan, Acta Phytotax. Sinica, 7: 101 (1958).

III: on rock-cliff, 41908. VI: on rock-cliff, 42113.

Distribution. Mainland China and Taiwan (cf. Chiang, 1998).

BARTRAMIACEAE

Bartramia halleriana Hedw., Spec. Musc.: 164 (1801).

I: on rock-cliff, 40843. V: on soil, 42014 (+*Oncophorus wahlenbergii*). VI: on rock-cliff, 41864; on humus, 42131.

Distribution. Widely distributed in Europe, Africa, Asia, and western region of N. America.

Bartramia ityphylla Brid., Musc. Rec., 2: 132 (1803).

III: on rock-cliff, 41919. IV: on rock-cliff, 42055; on soil, 42084 (+*Oxystegus tenuirostris*).

Distribution. Northern Europe, Himalayas, mainland China, Philippines, Taiwan, Korea, Japan, N. America, and Greenland.

BRACHYTHECIACEAE

Brachythecium buchananii (Hook.) A.Jaeger, Ber. S. Gall. Naturw. Ges., 1876–77: 341 (1878).

II: on basal part of tree-trunk, 42217.

Distribution. Himalayas, Korea, Taiwan, and Japan.

Brachythecium plumosum (Hedw.) Schimp., Bryol. Eur., 6: 8 (1853).

I: on boulder, 42257.

Distribution. Widely distributed in the Northern Hemisphere.

Brachythecium procumbens (Mitt.) A.Jaeger, Ber. S. Gall. Naturw. Ges., 1876–77: 341 (1878).

IV: on soil, 42031.

Distribution. Kashmir, Taiwan, Korea, and Japan (cf. Takaki, 1955).

Cirriphyllum cirrosum (Schwaegr.) Grout, Bull. Torr. Bot. Cl., 25: 223 (1898).

IV: on boulder, 42039. VI: on rock-cliff, 42135.

Distribution. Europe, Caucasus, Pakistan, mailand China, Taiwan, Japan, and N. America.

Eurhynchium angustirete (Broth.) T.J.Kop., Mem. Soc. F. Fl. Fenn., 43: 53 (1967).

I: rock-cliff, 40849.

Distribution. Europe, Turkey, Taiwan, Korea, and Japan.

Rhynchostegium contractum Cardot, Bull. Soc. Bot. Gen., sér. 2, 4: 381 (1912).

I: on boulder, 42266.

Distribution. Taiwan, Korea, and Japan.

Rhynchostegium pallidifolium (Mitt.) A.Jaeger, Ber. S. Gall. Naturw. Ges., 1876–77: 369 (1878).

I: on brach, 42260.

Distribution. Taiwan and Japan.

BRYACEAE

Anomobryum filiforme (Griff.) A.Jaeger, Ber. S. Gall. Naturw. Ges., 1873–74: 142 (1875).

IV: on rock-cliff, 42052.

Distribution. Widely distributed in the Northern Hemisphere.

Bryum argenteum Hedw., Spec. Musc.: 181 (1801).

III: on rock-crevice, 41901. VI: on rock-crevice, 41850 (+*Leptodontium flexifolium*, *Paraleucobryum enerve*); on soil, 41839 (+*Ceratodon purpureus*).

Distribution. Cosmopolitan.

Bryum billardieri Schwaegr., Spec. Musc. suppl., 1: 115 (1816).

II: on humus, 42204; on rock-cliff, 42222 (+*Hookeria acutifolia*).

Distribution. Widely distributed in tropical and warm temperate regions.

Bryum capillare Hedw., Spec. Musc.: 182 (1801).

III: on rock-cliff, 41889. IV: on boulder, 42021, 42028. VI: on dung, 42167.

Distribution. Widely distributed throughout the world.

Bryum handelii Broth., Symb. Sin., 4: 58 (1929).

II: on rock-cliff, 42220.

Distribution. Mainland China, Taiwan, and Japan.

Mielichhoferia japonica Besch., J. Bot., 12: 229 (1893).

III: on boulder, 41899 (+*Coscinodon cribrosus*); on rock-crevice, 41900. V: on rock-cliff, 41961. VI: on rock-cliff, 41841, 42117.

Distribution. Russian Far East, Taiwan, and Japan.

Notes. Plants (42117) have leaves with well recurved margings and capsules with rudimentary endostome.

****Plagiobryum zieri*** (Hedw.) Lindb., Oefv. K. Vet. Ak. Foerh., 19: 606 (1863). (Fig. 3)

VI: on rock-crevice, 42195, 42197.

Distribution. Widely distributed in the Northern Hemisphere.

Notes. Larger sporophytes as compared with gametophytes and asymmetric, elongate capsules with long apophysis are unique to the plants of this genus (Fig. 3-1). *Plagiobryum zieri* is characterized by having acuminate leaves with costa extending to acumen (Fig. 3-2), apophysis of capsule longer than the urn, short-conic opercula (Fig. 3-3), and exostome teeth papillose in the lower half, smooth in the upper half (Fig. 3-5) (Noguchi, 1988).

****Pohlia cruda*** (Hedw.) Lindb., Musci Scand.: 18 (1879).

IV: on dung, 42161.

Distribution. Widely distributed throughout the world.

Notes. This species is characterized by having elongate, cylindric capsules and leaves with costa ending far below the leaf apex.

Pohlia elongata Hedw., Spec. Musc.: 171 (1801).

II: on rock-cliff, 42225.

Distribution. Europe, Pakistan, central and eastern Asia, Philippines, New Guinea, and N. America.

Pohlia longicollis (Hedw.) Lindb., Musci Scand.: 17 (1879).

II: on soil, 41831. IV: on rock-crevice, 42176; on soil, 42086. V: on rock-cliff, 41993; on soil, 41951, 41954.

Distribution. Widely distributed in the Northern Hemisphere.

Pohlia nutans (Hedw.) Lindb., Musci Scand.: 18 (1879).

II: on soil, 42200. III: on rock-crevice, 41891.

Distribution. Widely distributed throughout the world except for the tropical regions.

Pohlia wahlenbergii (F.Weber & Mohr) A.L.Andrews in Grout, Moss Fl. N. Am., 2: 203 (1935).

IV: on soil, 42016 (+*Isopterygiopsis muellerianа*).

Distribution. Widely distributed in the world.

DICRANACEAE

Aongstroemia orientalis Mitt., Trans. Linn. Soc. London Bot. ser. 2, 3: 154 (1891).

I: on rock-cliff, 40839.

Distribution. Himalayas, Myanmar, mainland China, Borneo, Philippines, Taiwan, Japan, and C. America.

Campylopus fragilis (Brid.) Bruch & Schimp., Bryol. Eur., 1: 164 (1847).

I: on rock-cliff, 40830 (+*Rhabdoweisia crispata*), 40838 (+*Dicranodontium denudatum*, *Leptodontium viticulosoides*); on humus, 40860. IV: on rock-cliff, 42063.

Distribution. Europe, Taiwan, Russian Far East, Korea, Japan, and N. America.

Campylopus japonicus Broth., Hedwigia, 38: 207 (1899).

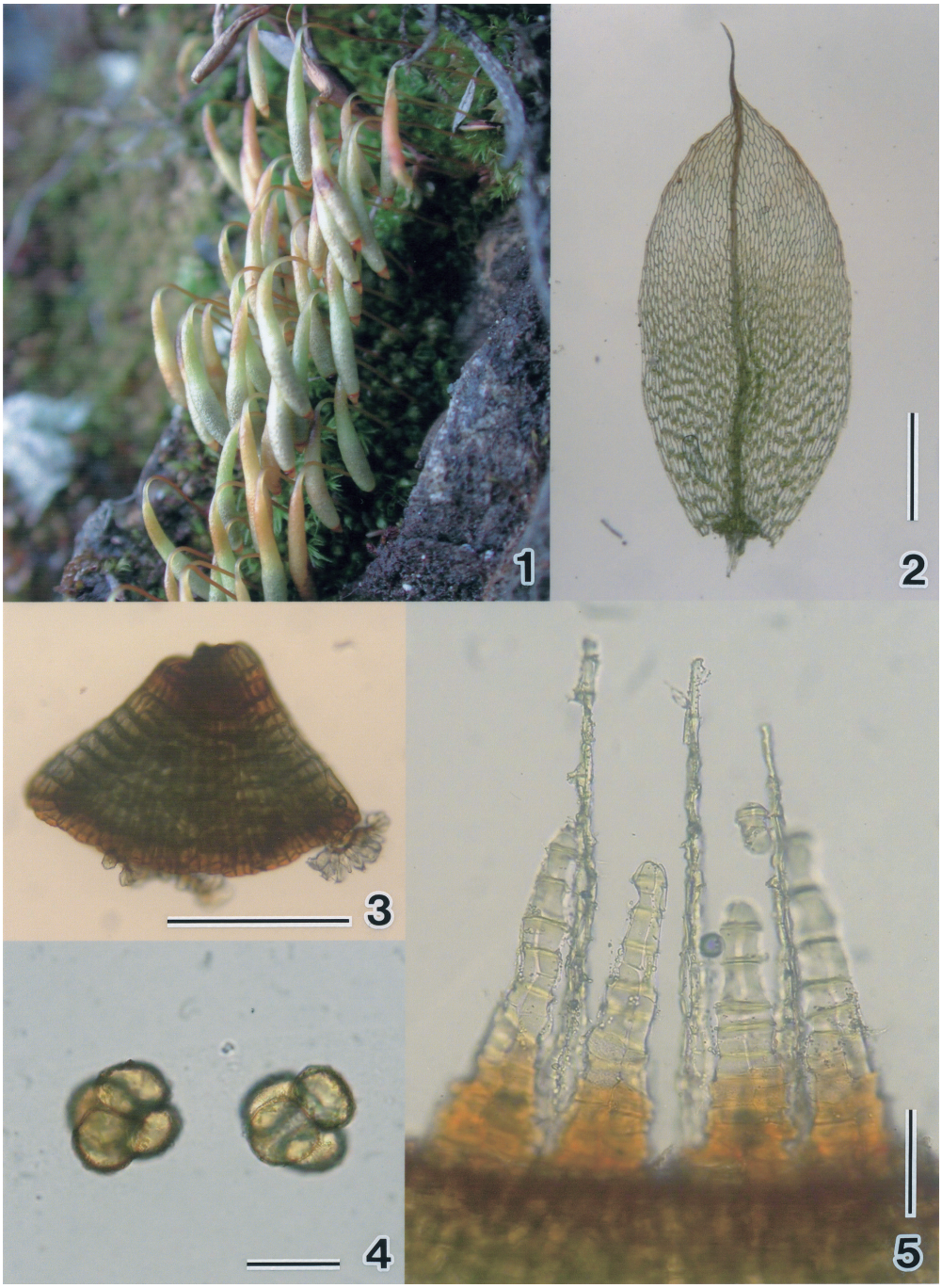

Fig. 3. *Plagiobryum zieri*, 42197. 1, Habit; 2, leaf; 3, operculum; 4, young spores; 5, peristome teeth. Scales: 0.5 mm for 2 and 3; 50 μm for 4; 0.1 mm for 5.

I: on boulder, 42247 (+*Leptodontium flexifolium*, *Plagiothecium cavifolium*). II: on rotten log, 42211. IV: on soil, 42059. VI: on soil, 42149; on humus, 42134.

Distribution. Taiwan, Korea, and Japan.

Cynodontium gracilescens (F.Weber & Mohr) Schimp., Coroll.: 12 (1856).

II: on rock-cliff, 42213 (+*Leptodontium flexifolium*). VI: on soil, 41855; on tree-trunk of *Abies kawakamii*, 41989 (+*Leptodontium flexifolium*).

Distribution. Europe, mainland China, Taiwan, Korea, Japan, and N. America.

Dicranodontium denudatum (Brid.) E.G.Britt., N. Am. Fl., 15: 151 (1913).

I: on rock-cliff, 40838 (+*Campylopus fragilis*, *Leptodontium viticulosoides*). IV: on rotten stump, 42043.

Distribution. Widely distributed in the Northern Hemisphere.

****Dicranum leiodontum*** Cardot, Bull. Herb. Boiss. sér. 2, 7: 714 (1907).

III: on rock-crevice, 41911.

Distribution. Japan and Taiwan.

Dicranum majus Turner, Musc. Hib.: 59 (1804).

IV: on humus, 42012, 42041 (+*Ptilium crista-castrensis*), 42163. VI: on humus, 41856, 41879 (+*Hylocomium splendens*), 42129 (+*Rhytidium rugosum*).

Distribution. Europe, Caucasus, mailand China, Taiwan, Korea, Russian Far East, Japan, N. America, and Greenland.

Dicranum mayrii Broth., Hedwigia, 38: 207 (1899).

V: on humus, 41981.

Distribution. Taiwan, Korea, Japan, and Sakhalin.

Dicranum nipponense Besch., Ann. Sc. Nat. Bot. sér. 7, 17: 332 (1893).

I: on humus, 40841.

Distribution. Taiwan, Korea, and Japan.

****Dicranum viride*** (Sull. & Lesq.) Lindb. var. ***hakkodense*** (Cardot) Takaki, J. Hattori Bot. Lab., 35: 35 (1972).

IV: on boulder, 42042.

Distribution. Japan and Taiwan.

Oncophorus crispifolius (Mitt.) Lindb., Act. Soc. Sc. Fenn., 10: 229 (1872).

IV: on rock-cliff, 42057 (+*Oxystegus tenuirostris*). V: on tree-trunk of *Abies kawakamii*, 41986 (+*Paraleucobryum enerve*), 41991 (+*Leptodontium flexifolium*, *Oreoweisia laxifolia*); on root, 42003.

Distribution. Mainland China, Taiwan, Korea, Russian Far East, and Japan.

Oncophorus wahlenbergii Brid., Bryol. Univ., 1: 400 (1826).

IV: on soil, 42014 (+*Bartramia halleriana*). V: on soil, 42005 (+*Paraleucobryum enerve*).

Distribution. Widely distributed in the Northern Hemisphere.

Oreoweisia laxifolia (Hook.) Kindb., Enum. Bryin. Exot.: 69 (1888).

I: on boulder, 42248. IV: on soil, 42064. V: on tree-trunk of *Abies kawakamii*, 41991 (+*Leptodontium flexifolium*, *Oncophorus crispifolius*).

Distribution. Himalayas, southern India, mainland China, Taiwan, and Japan.

Paraleucobryum enerve (Thed.) Loeske, Hedwigia, 47: 171 (1908).

II: on humus, 41834 (+*Sanionia uncinata*). V: on soil, 42005 (+*Oncophorus wahlenbergii*); on branch, 41984; on tree-trunk, 41986 (+*Oncophorus crispifolius*). VI: on rock-crevice, 41850 (+*Bryum argenteum*, *Leptodontium flexifolium*); on humus, 41861.

Distribution. Widely distributed in the Northern Hemisphere.

Paraleucobryum longifolium (Hedw.) Loeske, Hedwigia, 47: 171 (1908).

IV: on rock-cliff, 42056. V: on tree-trunk of *Abies kawakamii*, 41950 (+*Herzogiella turfacea*).

Distribution. Widely distributed in the Northern Hemisphere.

Rhabdoweisia crispata (With.) Lindb., Acta Soc. Sc. Fenn., 10: 22 (1871).

I: on rock-crevice, 40830 (+*Campylopus fragilis*). II: on soil, 42226. IV: on soil, 42073, 42090. V: on rock-cliff, 42001. VI: on rock-cliff, 42145, 42146; on soil, 42142.

Distribution. Europe, Caucasus, mailand

China, Java, Taiwan, Russian Far East, Japan, Hawaii, and N. and S. America.

Symblepharis reinwardtii (Dozy & Molk.) Sande Lac., Bryologia Javanica, 2: 225 (1870).

I: on boulder, 42249. IV: on root, 42085.

Distribution. Tropical Asia from northern India and Myanmar to Malaysia (cf. Eddy, 1988).

DITRICHACEAE

Ceratodon purpureus (Hedw.) Brid., Bryol. Univ., 1: 480 (1826).

VI: on soil, 41839 (+*Bryum argenteum*), 41840.

Distribution. Cosmopolitan.

Distichium capillaceum (Hedw.) Bruch & Schimp., Bryol. Eur., 2: 156 (1846).

III: on rock-crevice, 41906 (+*Ditrichum crispatissimum*).

Distribution. Widely distributed in the world.

Ditrichum brevidens Nog., J. Jpn. Bot., 20: 255 (1944).

IV: on rock-cliff, 42187, 42198. VI: on rock-cliff, 42096, 42106, 42120.

Distribution. Endemic to Taiwan (cf. Matsui & Iwatsuki, 1990).

Ditrichum crispatissimum (Müll.Hal.) Paris, Ind. Bryol. Suppl.: 131 (1900).

III: on rock-crevice, 41903, 41906 (+*Distichium capillaceum*). IV: on rock-cliff, 42156.

Distribution. Europe, New Guinea, Taiwan, Japan, and N. and C. America (cf. Matsui & Iwatsuki, 1990).

Ditrichum difficile (Dozy) M.Fleisch., Musci Fl. Buitenzorg, 1: 300 (1904).

I: on rock-cliff, 40854.

Distribution. South Africa, Madagascar, India, Indonesia, Taiwan, Japan, eastern Russia, S. America, Australia, and New Zealand (cf. Matsui & Iwatsuki, 1990).

ENCALYPTACEAE

Encalypta ciliata Hedw., Spec. Musc.: 61 (1801).

VI: on rock-cliff, 41851.

Distribution. Europe, Africa, Asia, N. and S. America, and Greenland.

ENTODONTACEAE

****Entodon flavescens*** (Hook.) A.Jaeger, Ber. S. Gall. Naturw. Ges., 1876–77: 293 (1878).

I: on boulder, 40829 (+*Macrothamnium macrocarpum*).

Distribution. Himalayas, southern India, mainland China, Philippines, Taiwan, Korea, Russian Far East, and Japan.

Pterigynandrum filiforme Hedw., Spec. Musc.: 81 (1801).

V: on tree-trunk, 41963 (+*Zygodon viridissimus* var. *rupestris*). VI: on rock-cliff, 42136.

Distribution. Europe, Caucasus, Asia, N. America, and Greenland.

FISSIDENTACEAE

Fissidens dubius P.Beauv., Prodr.: 57 (1805).

IV: on rock-cliff, 42078.

Distribution. Widely distributed in the Northern Hemisphere.

Fissidens geminiflorus Dozy & Molk., Pl. Jungh.: 316 (1854).

II: on rock-cliff, 42221.

Distribution. Tropical region of Asia, mailand China, Taiwan, and Japan.

Fissidens grandifrons Brid., Spec. Musc., 1: 170 (1806).

IV: on rock, 42075.

Distribution. Europe, Pakistan, Nepal, Kashmir, India, mainland China, Taiwan, Korea, Japan, and N. America.

GRIMMIACEAE

Coscinodon cribrosus (Hedw.) Spruce, Ann. Mag. Nat. Hist., ser. 2, 3: 491 (1849).

III: on rock-cliff, 41884, 41897 (+*Grimmia apiculata*); on rock-crevice, 41915; on boulder, 41898, 41899 (+*Mielichhoferia japonica*). VI: on rock-cliff, 41843.

Distribution. Mainly distributed in the Northern Hemisphere (“Eur. As 2, 5. Afr 1. Am 1” in Wijk *et al.*, 1959).

****Grimmia apiculata*** Hornsch., Flora, 2: 85 (1819).

III: on rock-crevice, 41904; on rock-cliff, 41897 (+*Coscinodon cribrosus*), 41914, 41917. VI: on rock-cliff, 41844.

Distribution. Europe, Himalayas, Taiwan, and Japan.

Notes. This species is characterized by having arcuate seta, thin-walled, elongate-rectangular cells at the basal corners of leaves, and autoicous sexuality.

Grimmia elongata Kaulf. in Sturm, Deutschl. Fl., 2: 14 (1816).

III: on rock-cliff, 41913, 41922. IV: on rock-cliff, 42062. VI: on rock-cliff, 42116.

Distribution. Widely distributed in the northern regions of Eurasia and Greenland.

****Grimmia incurva*** Schwägr., Spec. Musc. suppl., 1: 90 (1811).

III: on rock-cliff, 41907, 41916. IV: on boulder, 42151. V: on rock-cliff, 41960. VI: on rock-cliff, 42102, 42105.

Distribution. Europe, Altai, Taiwan, Japan, N. America, Iceland, and Greenland.

Notes. This species is characterized by having thick-walled juxtacostal cells of basal lamina and contorted leaves when dry.

Grimmia longirostris Hook., Musci Exot., 1: 62 (1818). Syn. *G. affinis* Hornsch.

IV: on boulder, 42066. VI: on rock-cliff, 41847; on boulder, 42130.

Distribution. Widely distributed in the Northern Hemisphere.

Ptychomitrium formosicum Broth. & Yasuda, Ann. Bryol., 1: 19 (1928).

I: on boulder, 42236. IV: on boulder, 42067.

Distribution. Taiwan and Japan.

Racomitrium aquaticum (Brid. ex Schrad.) Brid., Mant. Musc.: 80 (1819).

VI: on rock-cliff, 42115.

Distribution. Widely distributed in the Northern Hemisphere, southern S. America, and New Zealand.

Racomitrium barbuloides Cardot, Bull. Herb. Boiss. sér. 2, 8: 336 (1908).

II: on humus, 41832. VI: on rock-cliff, 41845.

Distribution. Mainland China, Taiwan, Korea, and Japan (cf. Deguchi, 1989).

Racomitrium fasciculare (Hedw.) Brid., Mant. Musc.: 80 (1819).

V: on rock, 41974.

Distribution. Europe, Siberia, mainland China, Taiwan, Japan, N. America, southern S. America, and New Zealand.

Racomitrium laetum Besch. & Cardot in Cardot, Bull. Herb. Boiss. sér. 2, 8: 335 (1908).

IV: on rock-cliff, 42058. V: on tree-trunk of *Abies kawakamii*, 41966. VI: on rock-cliff, 42093.

Distribution. Taiwan, Korea, Japan, and N. America.

Racomitrium lanuginosum (Hedw.) Brid., Mant. Musc.: 79 (1819).

III: on rock-crevice, 41910. VI: on rock-cliff, 41859, 42110; on boulder, 42132.

Distribution. Widely distributed throughout the world.

Racomitrium nitidulum Cardot, Bull. Herb. Boiss. sér. 2, 8: 335 (1908).

VI: on rock-cliff, 42109.

Distribution. East Asia ("As 2" in Wijk *et al.*, 1967).

Racomitrium sudeticum (Funck) Bruch & Schimp., Bryol. Eur., 3: 141 (1845).

III: on rock, 41890. IV: on boulder, 42168.

Distribution. Europe, mainland China, Taiwan, Japan, N. America, and Greenland.

HEDWIGIACEAE

Hedwigia ciliata (Hedw.) P.Beauv., Prodr.: 15 (1805).

I: on rock-cliff, 40832.

Distribution. Widely distributed throughout the world.

HOOKERIACEAE

Hookeria acutifolia Hook. & Grev., Edinburgh J. Sc., 2: 225 (1825).

II: on rock-cliff, 42222 (+*Bryum billardieri*). IV: on soil, 42076, 42080 (+*Mnium lycopodioides*, *Plagiomnium maximoviczii*, *Rhizomnium*

tuomikoskii).

Distribution. Taiwan, Japan, Hawaii, and N. and S. America.

HYLOCOMIACEAE

****Hylocomiastrum pyrenaicum*** (Spruce) Broth. in Engler & Prantl, Nat. Pfl. ed. 2, 11: 487 (1925). (Fig. 4)

IV: on humus, 42033; on boulder, 42036 (+*Gollania japonica*).

Distribution. Europe, Caucasus, central Asia, Siberia, Taiwan, Japan, Aleutians, Alaska, British Columbia, Greenland, and Iceland.

Notes. This species is distinguished from *H. himalayanum* (Mitt.) Broth. by the plants not showing distinct annual growth, less branched, thick stems (Fig. 4-1), and lanceolate, less plicate

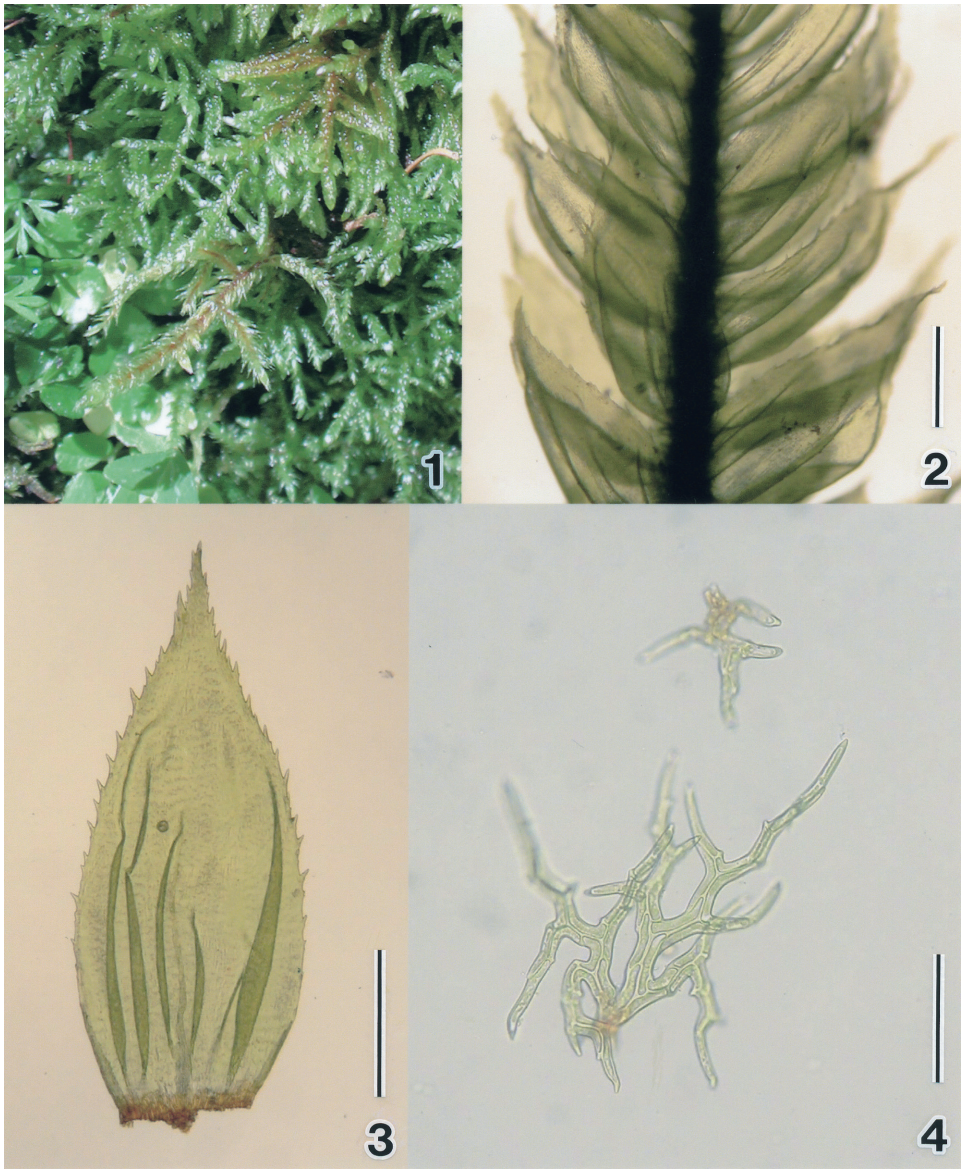

Fig. 4. *Hylocomiastrum pyrenaicum*, 42033. 1, Habit; 2, a part of leafy stem; 3, branch leaf; 4, paraphyllia. Scales: 0.5 mm for 2 and 3; 50 μm for 4.

branch leaves (Fig. 4-3).

Hylocomium splendens (Hedw.) Schimp., Bryol. Eur., 5: 173 (1852).

I: on humus, 40862. IV: on humus, 42060. VI: on humus, 41879 (+*Dicranum majus*).

Distribution. Europe, Asia, Aleutians, Alaska, eastern N. America, and Greenland.

Pleurozium schreberi (Brid.) Mitt., J. Linn. Soc. Bot., 12: 537 (1869).

IV: on rock-cliff, 42166. V: on humus, 41947.

Distribution. Widely distributed in the Northern Hemisphere.

HYPNACEAE

Gollania japonica (Cardot) Ando & Higuchi, Hikobia suppl., 1: 192 (1981).

IV: on boulder, 42032, 42036 (+*Hylocomiastrum pyrenaicum*), 42069.

Distribution. Nepal, mainland China, Taiwan, and Japan.

Gollania philippinensis (Broth.) Nog., Acta Phyt. Geobot., 20: 241 (1962).

I: on rock-cliff, 40824 (+*Chrysocladium retrorsum*), 40826.

Distribution. Mainland China, Taiwan, and Philippines.

Gollania ruginosa (Mitt.) Broth. in Engler & Prantl, Nat. Pfl., 1: 1055 (1908).

I: on boulder, 40827 (+*Hypnum subimponens* subsp. *ulophyllum*). V: on tree-trunk, 41970.

Distribution. N.W. India, Bhutan, mainland China, Taiwan, Korea, Russian Far East, and Japan.

****Herzogiella turfacea*** (Lindb.) Z.Iwats., J. Hattori Bot. Lab., 33: 375 (1970).

II: on basal part of tree-trunk, 42203. VI: on tree-trunk, 41950 (+*Paraleucobryum longifolium*).

Distribution. Europe, northern Asia, Taiwan, Japan, and eastern N. America.

Notes. This species is closely related to *H. perrobusta* (Broth. ex Cardot) Z.Iwats., but is distinguished from it by smaller plants, smaller leaf cells with not pitted cell walls, and conic opercula.

Hypnum cupressiforme Hedw. var. ***cupressiforme***, Spec. Musc.: 291 (1801).

V: on stump, 41987. VI: on rock-cliff, 41866, 42173; on humus, 41876, 41877; on root, 42128.

Distribution. Widely distributed throughout the world.

****Hypnum cupressiforme*** Hedw. var. ***filiforme*** Brid., Musc. Rec., 2: 138 (1801).

I: on rock-cliff, 40861. IV: on boulder, 42037. V: on tree-trunk, 41992; on rock-cliff, 42007. VI: on rock-cliff, 41874; on boulder, 42133.

Distribution. Widely distributed in the Northern Hemisphere and Tasmania.

Notes. The var. *filiforme* differs from var. *cupressiforme* in its slender, less branched plants, smaller leaves, and fewer alar cells. This variety is similar to *Hypnum pallescens* in plant size and well differentiated alar cells; however, *H. pallescens* is distinguished from *H. cupressiforme* var. *filiforme* by having pinnate-branching, strongly falcate leaves, shorer laminal cells, and autoicous sexuality. The var. *filiforme* usually grows on vertical surfaces of tree-trunk or rock-cliff.

Hypnum macrogynum Besch., Ann. Sc. Nat. Bot. sér. 7, 15: 91 (1892).

I: on rock-cliff, 40834. II: on humus, 42206.

Distribution. East and South Africa, Madagascar, Mascarene Is., Nepal, India, Bhutan, Myanmar, Malaysia, mainland China, and Taiwan.

Hypnum pallescens (Hedw.) P.Beauv., Prodr.: 67 (1805).

II: on tree-trunk of *Abies kawakamii*, 41835. IV: on root, 42150. V: on tree-trunk of *Abies kawakamii*, 41969, 42002, 42008. VI: on rock-cliff, 41846.

Distribution. Europe, Caucasus, Pakistan, Kashmir, Nepal, mainland China, Taiwan, Korea, Siberia, Japan, and N. America.

Hypnum subimponens Lesq. subsp. ***ulophyllum*** (Müll.Hal.) Ando, Bot. Mag. Tokyo, 79: 766 (1966).

I: on boulder, 40827 (+*Gollania ruginosa*), 40828. II: on root, 42233.

Distribution. Pakistan, Nepal, Bhutan, Assam, mainland China, Taiwan, Korea, and

Japan.

****Isopterygiopsis muelleriana*** (Schimp.) Z.Iwats., J. Hattori Bot. Lab., 33: 379, f. 1, 3, 21 (1970). (Fig. 5)

IV: on soil, 42016 (+*Pohlia wahlenbergii*).

Distribution. Europe, Pakistan, Kashmir, E. Himalaya, mainland China, Taiwan, Russian Far East, Japan, and N. America.

Notes. In appearance this species is similar to the species of *Isopterygium*. Iwatsuki (1970) established the new genus, *Isopterygiopsis*, for *Plagiothecium muellerianum* Schimp. with large, hyaline cortical cells of stem (Fig. 5-5), lacking of pseudoparaphyllia, not decurrent leaves, linear gemmae (Fig. 5-6), and distinct annulus. The complanate leafy stems (Fig. 5-1) and slightly cuspidate leaves (Fig. 5-3) are also good distinguishing characteristics of this species.

Leptocladiella psilura (Mitt.) M.Fleisch., Musci Fl. Buitenzorg, 4: 1205 (1923).

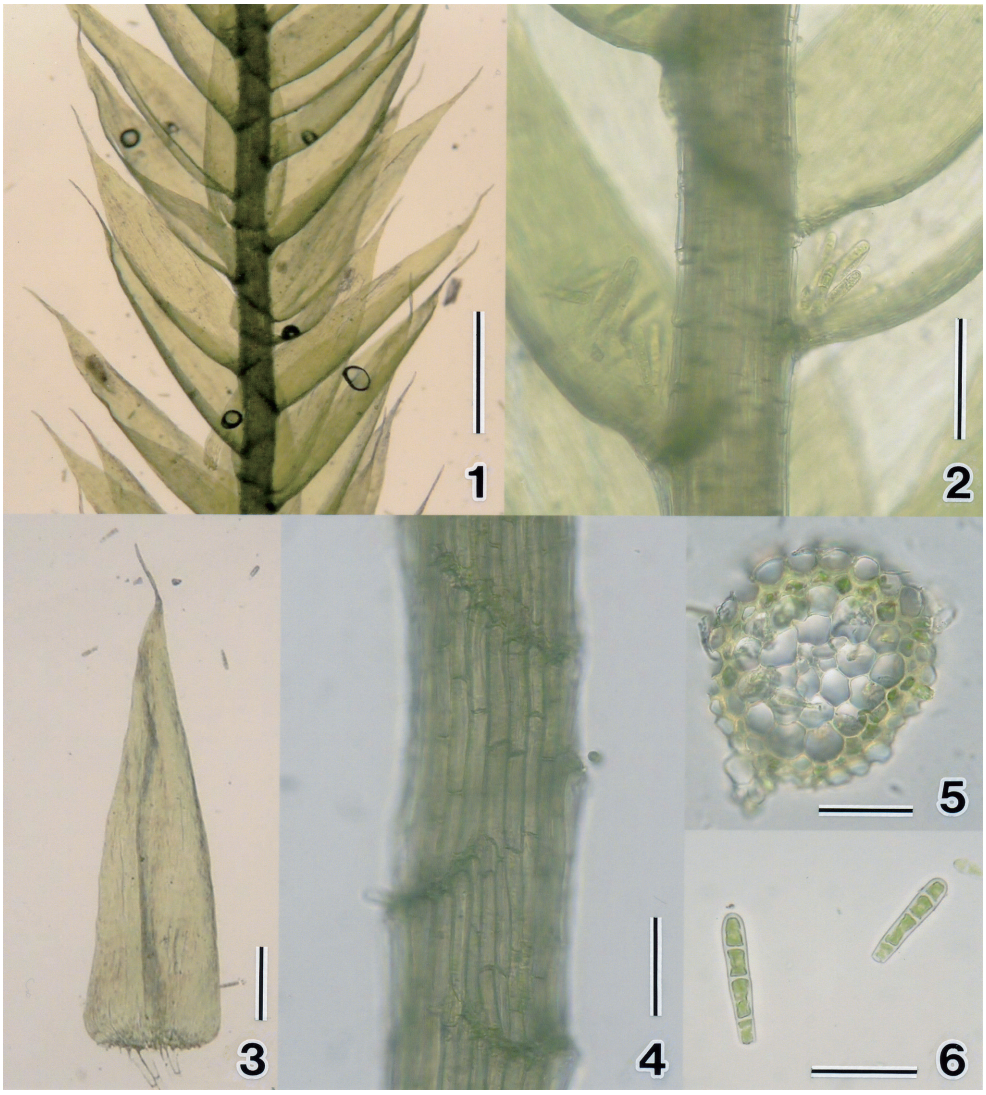

Fig. 5. *Isopterygiopsis muelleriana*, 42016. 1, A part of leafy stem; 2, a bunch of gemmae at axial part of leaf; 3, leaf; 4, a part of stem; 5, a transverse cross section of stem; 6, gemmae. Scales: 0.5 mm for 1; 0.1 mm for 2 and 4; 0.2 mm for 3: 50 μm for 5 and 6.

I: on boulder, 40847, 40848.

Distribution. W. Himalaya, Nepal, Bhutan, Thailand, mainland China, and Taiwan.

Macrothamnium macrocarpum (Reinw. & Hornsch.) M.Fleisch., Hedwigia, 44: 308 (1905).

I: on boulder, 40829 (+*Entodon flavescens*).

Distribution. Nepal, India, Bhutan, Sri Lanka, Thailand, mainland China, Java, Philippines, Taiwan, and Japan.

Pseudotaxiphyllum pohliaecarpum (Sull. & Lesq.) Z.Iwats., J. Hattori Bot. Lab., 63: 449 (1987).

I: on humus, 42263 (+*Leucobryum juniperoideum*).

Distribution. Nepal, S. E. Asia, mainland China, Taiwan, and Japan.

Ptilium crista-castrensis (Hedw.) De Not., Cronac. Briol. Ital., 2: 17 (1867).

IV: on humus, 42010, 42040, 42041 (+*Dicranum majus*). V: on humus, 41949.

Distribution. Europe, Caucasus, Siberia, Nepal, India, Bhutan, Myanmar, mainland China, Taiwan, Korea, Japan, N. America, and Greenland.

Pylaisia levieri (Müll.Hal.) Arikawa, J. Hattori Bot. Lab., 95: 102 (2004). Syn. *Giraldiella levieri* Müll.Hal.

I: on tree-trunk, 40857.

Distribution. Mainland China and Taiwan.

LEMBOPHYLLACEAE

Isothecium subdiversiforme Broth., Hedwigia, 38: 237 (1899).

I: on basal part of tree-trunk, 42241, 42244.

Distribution. Mainland China, Taiwan, and Japan.

LESKEACEAE

Iwatsukiella leucotricha (Mitt.) W.R.Buck & H.A.Crum, J. Hattori Bot. Lab., 44: 352 (1978).

V: on tree-trunk of *Abies kawakamii*, 41958 (+*Ulota crispa*).

Distribution. Taiwan, Japan, and Sakhalin.

Lescuraea incurvata (Hedw.) E.Lawton, Bull. Torr. Bot. Cl., 84: 290 (1957).

IV: on boulder, 42030, 42038; on rock-cliff, 42089.

Distribution. Europe, Pakistan, Taiwan, Korea, Japan, and N. America.

LEUCOBRYACEAE

Leucobryum juniperoideum (Brid.) Müll.Hal., Linnaea, 18: 689 (1845).

I: on humus, 42263 (+*Pseudotaxiphyllum pohliaecarpum*).

Distribution. Europe, Macaronesia, Madagascar, Turkey, Caucasus, Himalayas, India, Sri Lanka, Myanmar, mainland China, Thailand, Sumatra, Java, Borneo, Sulawesi, New Guinea, Philippines, Taiwan, Korea, and Japan (cf. Yamaguchi, 1993).

LEUCODONTACEAE

Antitrichia curtipendula (Hedw.) Brid., Mant. Musc.: 136 (1819).

IV: on tree-trunk, 42088 (+*Leptodontium flexifolium*). V: on rock-cliff, 41867, 41967.

Distribution. Europe, Caucasus, Taiwan, N. America, Greenland, and Iceland (cf. Crum & Anderson, 1981; Lin, 1988).

Leucodon coreensis Cardot, Beih. Bot. Centralbl., 17: 23 (1904).

I: on rock-cliff, 40831.

Distribution. Mainland China, Taiwan, Korea, and Japan (cf. Akiyama, 1988).

Leucodon morrisonensis Nog., Trans. Nat. Hist. Soc. Formosa, 26: 34 (1936).

VI: on rock-cliff, 41863.

Distribution. Mainland China and Taiwan (cf. Akiyama, 1988).

METEORIACEAE

Barbella flagellifera (Cardot) Nog., J. Jpn. Bot., 14, f. 3 (1938).

I: on branch, 42265.

Distribution. India, Sri Lanka, Thailand, Myanmar, Vietnam, Java, Sumatra, Borneo,

Philippines, mainland China, Taiwan, and Japan.

Chrysocladium retrorsum (Mitt.) M.Fleisch., Musci Fl. Buitenz., 3: 829 (1907).

I: on rock-cliff, 40824 (+*Gollania philippinensis*). IV: on tree-trunk, 42019.

Distribution. India, Sri Lanka, Vietnam, Philippines, mainland China, Taiwan, and Japan.

Neodicladiella pendula (Sull.) W.R.Buck, J. Hattori Bot. Lab., 75: 62 (1994).

IV: on tree-trunk, 42034.

Distribution. Mainland China, Taiwan, Japan, N. America, and Mexico.

Sinskea flammea (Mitt.) W.R.Buck, J. Hattori Bot. Lab., 75: 64 (1994).

II: on tree-trunk, 42210.

Distribution. Himalayas, India, Thailand, Mainland China, Philippines, Taiwan, and Japan (cf. Noguchi, 1976 as *Chrysocladium flammeum*).

MNIACEAE

Mnium lycopodioides (Hook.) Schwägr., Spec. Musc. suppl., 12: 24 (1826).

I: on humus, 40852. IV: on soil, 42071 (+*Cratoneuron filicinum*), 42080 (+*Hookeria acutifolia*, *Plagiomnium maximoviczii*, *Rhizomnium tuomikoskii*).

Distribution. Himalayas, mainland China, Philippines, Taiwan, Korea, and Japan.

Plagiomnium maximoviczii (Lindb.) T.J.Kop., Ann. Bot. Fenn., 5: 147 (1968).

IV: on soil, 42074, 42080 (+*Hookeria acutifolia*, *Mnium lycopodioides*, *Rhizomnium tuomikoskii*).

Distribution. East Asia.

Rhizomnium horikawae (Nog.) T.J.Kop., J. Hattori Bot. Lab., 34: 380 (1971).

I: on humus, 40864.

Distribution. India and Taiwan.

Rhizomnium magnifolium (Horik.) T.J.Kop., Ann. Bot. Fenn., 10: 14 (1973).

IV: on boulder, 42009; on soil, 42068.

Distribution. Europe, East Asia, and N. America.

Rhizomnium tuomikoskii T.J.Kop., J. Hattori Bot. Lab., 34: 375 (1971).

IV: on soil, 42080 (+*Hookeria acutifolia*, *Mnium lycopodioides*, *Plagiomnium maximoviczii*).

Distribution. Taiwan and Japan.

Trachycystis ussuriensis (Maack & Regel) T.J.Kop., Ann. Bot. Fenn., 14: 206 (1977).

V: on humus, 41948, 41972.

Distribution. Mainland China, Taiwan, Korea, Russian Far East, and Japan.

ORTHOTRICHACEAE

Macrocoma tenue (Hook. & Grev.) Vitt subsp. ***sullivantii*** (Müll.Hal.) Vitt, Bryologist, 83: 413 (1980).

IV: on tree-trunk, 42087.

Distribution. Himalayas, mainland China, Taiwan, Japan, Hawaii, and N., C., & S. America (cf. Vitt, 1980).

Orthotrichum laevigatum Zett. var. ***japonicum*** (Z.Iwats.) Lewinsky, J. Hattori Bot. Lab., 72: 42 (1992).

V: on tree-trunk, 41988. VI: on tree-trunk, 41852 (+*Ulota crispa*).

Distribution. Northwestern India, Nepal, southeastern Tibet, and Japan (cf. Lewinsky, 1992).

Notes. Plants (41852, 41988) are assigned to the species by having superficial stomata, broad endostome segments, and not furrowed capsules, although they have calyptra without hairs.

Ulota crispa (Hedw.) Brid., Mant. Musc.: 112 (1819).

II: on tree-trunk, 41836. IV: on tree-trunk of *Rhododendron* sp., 42011. V: on tree-trunk of *Abies kawakamii*, 41958 (+*Iwatsukiella leucotricha*), 41964. VI: on tree-trunk, 41852 (+*Orthotrichum laevigatum*), 41862, 42182.

Distribution. Europe, Africa, mainland China, Taiwan, Korea, Siberia, Russian Far East, Japan, N. America, and Tasmania.

****Zygodon viridissimus*** (Dicks.) Brid. var. ***rupestris*** Hartm., Handb. Skand. Fl. ed., 5: 371 (1849).

V: on tree-trunk of *Abies kawakamii*, 41963

(+*Pterigynandrum filiforme*), 41990, 41996.

Distribution. Europe, Taiwan, Japan, and N. America.

Notes. This variety is distinguished from var. *viridissimus*, which has already been reported from Taiwan, by having narrower leaves and gemmae lacking vertical septations.

PLAGIOTHECIACEAE

Plagiothecium cavifolium (Brid.) Z.Iwats., J. Hattori Bot. Lab., 33: 360 (1970).

I: on boulder, 42247 (+*Campylopus japonicus*, *Leptodontium flexifolium*).

Distribution. Europe, Himalayas, Taiwan, Korea, Russian Far East, Japan, and eastern N. America.

Plagiothecium formosicum Broth. & Yasuda, Rev. Bryol., 53: 3 (1926).

II: on root, 42232. IV: on soil, 42027 (+*Plagiothecium neckeroideum* var. *neckeroideum*).

Distribution. Endemic to Taiwan.

Plagiothecium neckeroideum Schimp. var. ***neckeroideum***, Bryol. Eur., 5: 195 (1851).

IV: on soil, 42027 (+*Plagiothecium formosicum*). VI: on soil, 42123.

Distribution. Europe, Himalayas, mainland China, Thailand, Java, Sumatra, Borneo, Philippines, Taiwan, Russian Far East, and Japan.

Plagiothecium neckeroideum Schimp. var. ***niitakayamae*** (Toyama) Z.Iwats., J. Hattori Bot. Lab., 33: 354 (1970).

I: on rock-cliff, 40833, 40836. II: on humus, 42234. IV: on rotten log, 42070; on humus, 42189. VI: on humus, 41873.

Distribution. Endemic to Taiwan.

Plagiothecium nemorale (Mitt.) A.Jaeger, Ber. S. Gall. Naturw. Ges., 1876–77: 451 (1878).

IV: on rock-cliff, 42024.

Distribution. Europe, Africa, Siberia, Himalayas, mainland China, Taiwan, Korea, and Japan.

POLYTRICHACEAE

Oligotrichum obtusatum Broth., Symb. Sin., 4: 133 (1929).

II: on rock-cliff, 42214.

Distribution. Nepal, mainland China, and Taiwan (cf. Hyvönen & Lai, 1991).

Pogonatum alpinum (Hedw.) Röhl., Ann. Wetterau Ges., 3: 226 (1814).

VI: on rock-cliff, 41860, 42148; on rock-crevice, 42114; on soil, 42126.

Distribution. Widely distributed in the Northern Hemisphere and S. America.

Pogonatum fastigiatum Mitt., J. Linn. Soc. Bot. Suppl., 1: 154 (1859).

I: on humus, 42259. IV: on humus, 42045.

Distribution. India, Nepal, Sikkim, Bhutan, Thailand, mainland China, and Taiwan (cf. Hyvönen & Lai, 1991).

Pogonatum microstomum (Schwägr.) Brid., Bryol. Univ., 2: 745 (1827).

I: on rock-cliff, 40858. II: on soil, 42216; on rock-cliff, 42227. IV: on rock-crevice, 42194.

Distribution. India, Nepal, Sikkim, Myanmar, Sri Lanka, Myanmar, Thailand, Vietnam, mainland China, Indonesia, Philippines, and Taiwan (cf. Hyvönen & Lai, 1991).

Pogonatum urnigerum (Hedw.) P.Beauv., Prodr.: 84 (1805).

III: on gravel, 41888. IV: on soil, 42050. VI: on rock-crevice, 41854.

Distribution. Widely distributed in the Northern Hemisphere.

POTTIACEAE

Leptodontium flexifolium (Dicks. ex With.) Hampe, Oefv. K. Vet. Ak. Foerh., 21: 227 (1864).

I: on rock-cliff, 40838 (+*Campylopus fragilis*, *Dicranodontium denudatum*); on soil, 40855; on boulder, 42247 (+*Campylopus japonicus*, *Plagiothecium cavifolium*). II: on rock-cliff, 42213 (+*Cynodontium gracilescens*). IV: on tree-trunk of *Abies kawakamii*, 42088 (+*Antitrichia curtipendula*). V: on soil, 41991 (+*Oncophorus crispifolius*, *Oreoweisia laxifolia*); on rock-crevice, 41995; on tree-trunk of *Abies kawakamii*, 41989 (+*Cynodontium graciles-*

cens). VI: on rock-crevice, 41850 (+*Bryum argenteum*, *Paraleucobryum enerve*); on soil, 41882.

Distribution. Europe, central Africa, Asia, New Guinea, Hawaii, and N. and S. America.

Leptodontium viticulosoides (P.Beauv.) Wijk & Marg., Taxon, 9: 51 (1960).

I: on rock-cliff, 40835; on boulder, 42250. II: on rock-cliff, 42207. IV: on rock-cliff, 42053.

Distribution. Africa, Madagascar, Réunion, Himalayas, S. E. Asia, Taiwan, and C. and S. America (cf. Sharp *et al.*, 1994).

Oxystegus tenuirostris (Hook. & Taylor) A.J.E.Smith, J. Bryol., 9: 393 (1977).

III: on rock-cliff, 41925. IV: on rock-cliff, 42057 (+*Oncophorus crispifolius*); on boulder, 42046; on soil, 42084 (+*Bartramia ithyphylla*). VI: on rock-cliff, 42127.

Distribution. Widely distributed in the Northern Hemisphere.

****Tortella tortuosa*** (Hedw.) Limpr., Laubm. Deutschl., 1: 604 (1888).

VI: on rock-crevice, 41858.

Distribution. Widely distributed in the Northern Hemisphere and southern S. America.

Notes. This species is characterized by stems with hyalodermis, leaves crisped when dry and undulate when moist, costa excurrent, and central strand absent.

PTEROBRYACEAE

Meteoriella soluta (Mitt.) S.Okam., J. Coll. Sc. Imp. Univ. Tokyo, 36: 18 (1915).

VI: on humus, 41869; on rock-cliff, 41871.

Distribution. Himalayas, Malay Peninsula, Taiwan, and Japan.

RHYTIDIACEAE

Rhytidium rugosum (Hedw.) Kindb., Beih. K. Svensk. Vet. Ak. Handl., 7: 15 (1883).

VI: on humus, 41875, 42127, 42129 (+*Dicranum majus*).

Distribution. Widely distributed in the Northern Hemisphere and S. America.

SEMATOPHYLLACEAE

Brotherella fauriei (Cardot) Broth. in Engler & Prantl, Nat. Pfl. ed. 2, 11: 425 (1925).

I: on root, 40863; on rotten log, 42240, 42245. IV: on tree-trunk, 42022; on rotten log, 42044 (+*Dicranodontium denudatum*). V: on basal part of tree-trunk, 41979.

Distribution. Taiwan and Japan.

Brotherella henonii (Duby) M.Fleisch., Nova Guinea, 12: 120 (1914).

I: on boulder, 42242. V: on root, 42004.

Distribution. Mainland China, Taiwan, Korea, and Japan.

Clastobryopsis robusta (Broth.) M.Fleisch., Musci Fl. Buitenz., 4: 1181 (1923).

I: on tree-trunk, 40856; on rotten log, 42239. II: on bamboo shoot, 42205; on tree-trunk of *Abies kawakamii*, 42209.

Distribution. Philippines, Taiwan, Japan, and Hawaii.

Heterophyllium affine (Hook.) M.Fleisch., Musci Fl. Buitenz., 4: 1173 (1923).

I: on tree-trunk, 40845.

Distribution. Europe, Siberia, Himalayas, Japan, N. and S. America, and West Indies.

SPLACHNACEAE

****Tayloria alpicola*** Broth., Symb. Sin. 4: 49 (1929). (Fig. 6)

VI: on rock-crevice, 42175, 42193.

Distribution. Mainland China (Yunnan and Sichuan) and Taiwan.

Notes. In Taiwan, five species of *Tayloria*, *T. hornschuchii*, *T. indica*, *T. recurvi-marginata*, *T. serrata*, and *T. subglabra*, are reported (cf. Chiang *et al.*, 2001). Iwatsuki and Steere (1975) studied the Himalayan Splachnaceae and published detailed description and illustrations of *Tayloria alpicola* Broth. based on the two syntypes collected by Handel-Mazzetti from Yunnan and Sichuan. Plants growing on a ridge between North Peak and North North Peak are identical with *Tayloria alpicola* in having some characteristics, such as round leaf apex (Fig. 6-1), capsules without well developed apophysis (Fig. 6-

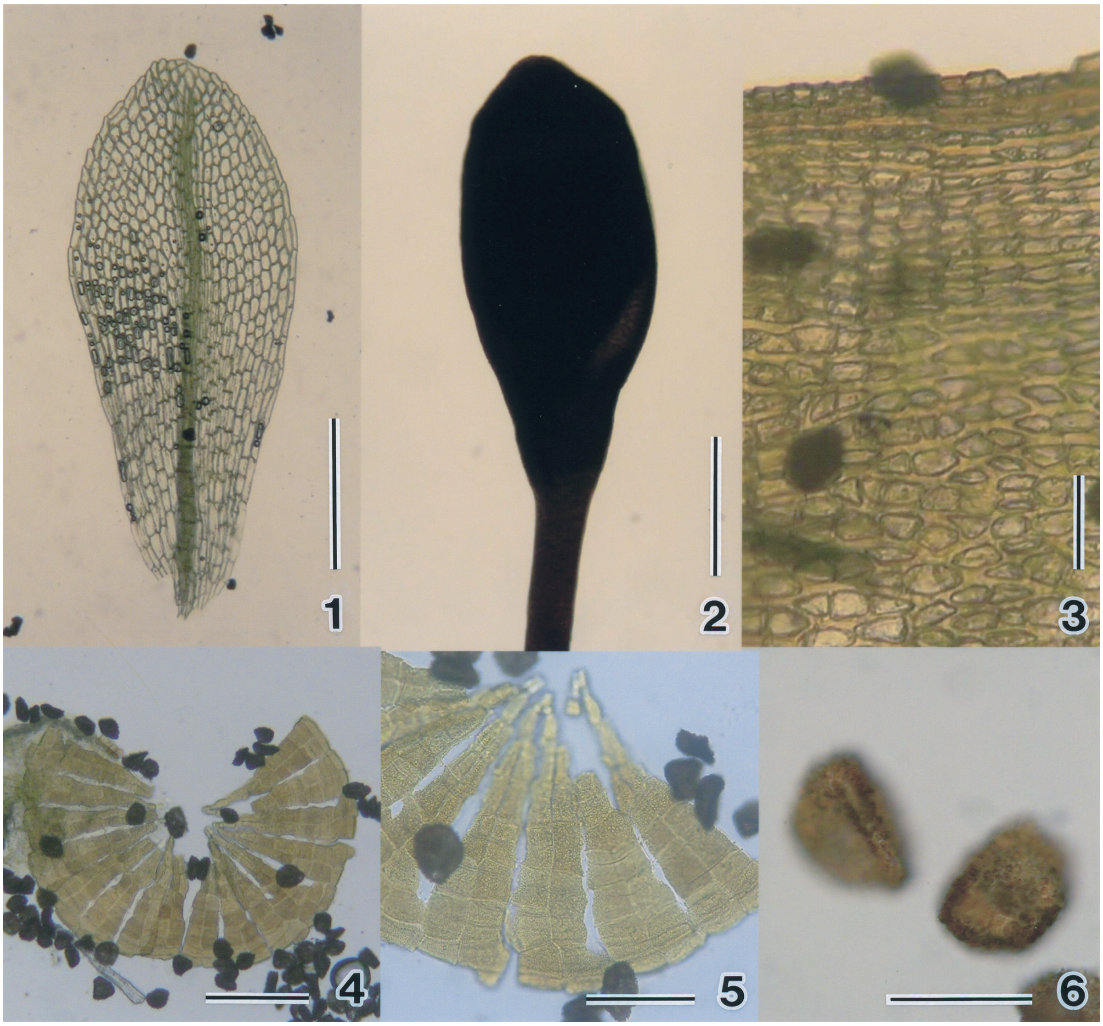

Fig. 6. *Tayloria alpicola*, 42193. 1; Leaf; 2, capsule with operculum; 3, upper part of exothecial cells; 4 & 5, peristome teeth; 6; spores. Scales: 0.5 mm for 1 and 2; 70 μm for 3; 0.2 mm for 4; 0.1 mm for 5; 50 μm for 6.

2), transversely elongated exothecial cells (Fig. 6-3), rectangular to hexagonal upper laminal cells, and roughly papillose, large spores (Fig. 6-6). After falling off of the operculum, complete peristome teeth cannot be observed because they are fragile. In a young capsule examined (42193), well developed peristome teeth were observed (Fig. 6-4, 5). So far as known to us, this is the third record of the species.

Tetraplodon angustatus (Hedw.) Bruch & Schimp., Bryol. Eur., 3: 214 (1844).

V: on humus, 42000. VI: on rock-cliff, 42160.

Distribution. Europe, Siberia, Himalayas, mainland China, Taiwan, Japan, and N. America.

SYMPHYODONTACEAE

****Symphyodon echinatus*** (Mitt.) A.Jaeger, Ber. S. Gall. Naturw. Ges., 1876–77: 296 (1878). (Fig. 7)

I: on boulder, 42251.

Distribution. Nepal, India, Sri Lanka, Thailand, mainland China, and Taiwan.

Notes. In Taiwan, two species of *Symphyo-*

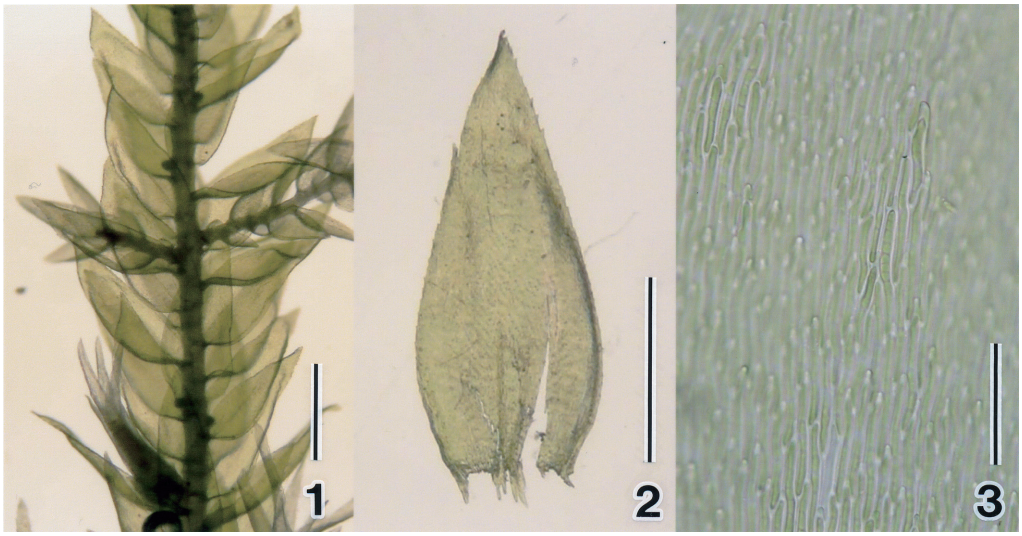

Fig. 7. *Symphyodon echinatus*, 42251. 1, A part of leafy stem; 2, stem leaf; 3, dorsal view of laminal cells of stem leaf. Scales: 0.5 mm for 1 and 2; 50 μm for 3.

don, *S. complanatus* and *S. perottetii*, are reported (cf. Chiang *et al.*, 2001). *Symphyodon echinatus* is distinguished from these species in having long-decurrent stem leaves with shortly acuminate apices, strong costa reaching near midleaf (Fig. 7-2), and shorter, distinctly prorate laminal cells (Fig. 7-3) (cf. He, 2000).

TAKAKIACEAE

Takakia lepidozioides S.Hatt. & Inoue, J. Hattori Bot. Lab., 19: 13 (1958).

VI: on rock-cliff, 42138, 42140, 42190, 42191.

Distribution. Himalayas, mainland China, Borneo, Taiwan, Japan, and western Canada.

Notes. Higuchi and Lin (2005) reported this rare species from Taiwan for the first time based on the specimens collected in 2003. It grew at the base and shelves or crevices of rock-cliffs in outcrop of *Juniperus squamata* var. *mossisonicola* scrub at the northeastern slope between North Peak and North North Peak.

THELIACEAE

****Myurella sibirica*** (Müll.Hal.) Reimers, Hedwigia, 76: 272 (1937).

III: on rock-cliff, 41918. VI: on rock-crevice, 41848.

Distribution. Europe, Caucasus, Siberia, Kashmir, mainland China, Taiwan, Japan, and N. America.

Notes. This species differs from *M. julacea* by its leaves with a long acumen, irregularly dentate leaf margins, and laminal cells with a central papilla on dorsal surface.

THUIDIACEAE

Abietinella abietina (Hedw.) M.Fleisch., Musci Fl. Buitenz., 4: 1497 (1923).

VI: on humus, 41878.

Distribution. Europe, Pakistan, mainland China, Taiwan, Korea, Japan, Sakhalin, N. America, and Greenland.

Thuidium cymbifolium (Dozy & Molk.) Dozy & Molk., Bryol. Jav., 2: 115 (1865).

VI: on humus, 42158.

Distribution. Widely distributed in tropical, subtropical, and temperate regions of Asia.

Thuidium kanedae Sakurai, Bot. Mag. Tokyo, 57: 345 (1943).

I: on humus, 42256.

Distribution. Mainland China, Taiwan, Korea, and Japan.

TRACHYPODACEAE

Trachypus bicolor Reinw. & Hornsch., Nova Act. Ac. Leop. Car., 14: 708 (1829).

II: on rock-cliff, 42208.

Distribution. Himalayas, southern India, Sri Lanka, Java, Borneo, Philippines, mainland China, Taiwan, and Japan.

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References

Akiyama, H., 1988. Studies on *Leucodon* (Leucodontaceae, Musci) and related genera in East Asia. IV. Taxonomic revision of *Leucodon* in East Asia. *Journal of Hattori Botanical Laboratory*, **65**: 1-80.

Chiang, T.-Y., 1989. The Study on the Bryophytic Lifeforms of Mt. Yushan. Master Thesis, 105 pp. National Taiwan University, Graduate Institute of Botany, Taipei.

Chiang, T.-Y., 1998. Taxonomic revision of *Andreaea* (Mosses, Andreaeaceae) of Taiwan. *Botanical Bulletin of Academia Sinica*, New series, **39**: 57–68.

Chiang, T.-Y., T.-W. Hsu, S.-J. Moore & B. C. Tan, 2001. An Updated Checklist of Taiwan Mosses. 36 pp. Botanical Society of China, Taiwan. (In Chinese)

Crum, H. A. & L. E. Anderson, 1981. Mosses of Eastern North America. Vol. 2, pp. 665–1328. Columbia University Press, New York.

Deguchi, H., 1989. Key to the Japanese species of the *Racomitrium canescens* group. *Proceedings of the Bryological Society of Japan*, **5**: 21–24. (In Japanese)

Eddy, A., 1988. A Handbook of Malesian Mosses. Vol. 1. 204 pp. British Museum (Natural History), London.

He, S., 2000. A taxonomic revision of *Symphyodon* (Musci: Symphyodontaceae). *Bryologist*, **103**: 52–81.

Higuchi, M. & S.-H. Lin, 2004. Correlations between the moss floras of Japan and Taiwan. *National Science Museum Monographs*, (24): 227–240.

Higuchi, M. & S.-H. Lin, 2005. *Takakia lepidozioides* S.Hatt. & Inoue (Musci) new to Taiwan. *Bryological Research*, **8**: 349–352.

Hyvönen, J. & M.-J. Lai, 1991. Polytrichaceae (Musci) in Taiwan (China). *Journal of Hattori Botanical Laboratory*, **70**: 119–141.

Iwatsuki, Z., 1970. A revision of *Plagiothecium* and its related genera from Japan and her adjacent areas, I. *Journal of Hattori Botanical Laboratory*, **33**: 331–380.

Iwatsuki, Z. & M. Mizutani, 1983. A small collection of bryophytes from Mt. Yushan, Taiwan. *Miscellanea Bryologica et Lichenologica*, **9**: 194–195.

Iwatsuki, Z. & W. C. Steere, 1975. Notes on the Himalayan Splachnaceae. *Journal of Hattori Botanical Laboratory*, **39**: 345–361.

Lewinsky, J., 1992. The genus *Orthotrichum* Hedw. (Orthotrichaceae, Musci) in Southeast Asia. A taxonomic revision. *Journal of Hattori Botanical Laboratory*, **72**: 1–88.

Lin, S.-H., 1985. Yushan and botanical scientific names. *Yushania*, **2**(1): 13–22. (In Chinese with English summary)

Lin, S.-H., 1988. List of mosses of Taiwan. *Yushania*, **5**(4): 1–39.

Lin, S.-H. & J.-R. Chan, 1990. The bryophyte flora of Yushan National Park, (I). *Yushan National Park Monograph Series*, (1033): 1–108. (In Chinese)

Lin, S.-H. & J.-R. Chan, 1991. The bryophyte flora of Yushan National Park, (II). *Yushan National Park Monograph Series*, (1039). 1–46. (In Chinese)

Lin, S.-H. & C.-C. Tsai, 1984. Notes on a preliminary survey of the high mountain bryophytes and lichens in Taiwan. *Journal of Taiwan Museum*, **37**: 81–100.

Matsui, T. & Z. Iwatsuki, 1990. A taxonomic revision of the family Ditrichaceae (Musci) of Japan, Korea and Taiwan. *Journal of Hattori Botanical Laboratory*, **68**: 317–366.

Nakanishi, S., 1964. Epiphytic communities in the alpine zone of Mt. Yushan (Mt. Niitaka), Taiwan. *Miscellanea Bryologica et Lichenologica*, **3**: 71–72.

Noguchi, A., 1976. A taxonomic revision of the family Meteoriaceae of Asia. *Journal of Hattori Botanical Laboratory*, **41**: 231–357.

Noguchi, A., 1987. Illustrated Moss Flora of Japan. Part 1. Pp. 1–242. Hattori Botanical Laboratory, Nichinan.

Noguchi, A., 1988. Illustrated Moss Flora of Japan. Part 2. Pp. 243–491. Hattori Botanical Laboratory, Nichinan.

Noguchi, A., 1989. Illustrated Moss Flora of Japan. Part 3. Pp. 493–742. Hattori Botanical Laboratory, Nichinan.

Noguchi, A., 1991. Illustrated Moss Flora of Japan. Part 4. Pp. 743–1012. Hattori Botanical Laboratory, Nichinan.

Noguchi, A., 1994. Illustrated Moss Flora of Japan. Part 5. Pp. 1013–1253. Hattori Botanical Laboratory, Nichinan.

Sharp, A. J., H. A. Crum & P. M. Eckel (eds), 1994. The

moss flora of Mexico. Part 1. *Memoirs of the New York Botanical Garden*, **69**: 1–580.

Takaki, N., 1955. Researches on the Brachytheciaceae of Japan and its adjacent areas. II. *Journal of Hattori Botanical Laboratory*, **15**: 1–69.

Tan, B. C., 2002. The affinity of moss floras of Japan, Taiwan and the Philippines revisited: old problems, new insight and more questions. *Acta Phytotaxonomica et Geobotanica* **53**: 77–84.

Vitt, D. H., 1980. The genus *Macrocoma* II. Geographical variation in the *Macrocoma tenue – M. sullivantii* species complex. *Bryologist*, **83**: 437–450.

Wijk, R. van der, W. D. Margadant & P. A. Florschütz, 1959. Index Muscorum (A–C). 548 pp. International Bureau for Plant Taxonomy and Nomenclature, Utrecht.

Wijk, R. van der, W. D. Margadant & P. A. Florschütz, 1967. Index Muscorum (P–S). 604 pp. International Bureau for Plant Taxonomy and Nomenclature, Utrecht.

Yamaguchi, T., 1993. A revision of the genus *Leucobryum* (Musci) in Asia. *Journal of Hattori Botanical Laboratory*, **73**: 1–123.

台湾玉山の蘚類

樋口正信・林　善雄

台湾玉山の蘚類フロラを2002年，2003年にわたり調査した．今回の調査で本地域から33科86属137種の蘚類を確認した．それらのうち，14種と2変種が台湾の蘚類フロラに新たに加わるもので，その多くは北半球に広く見られる種であった．各種について，基物，産地，標本番号，分布域を示した．