

文献探査による日本産蘚類の孢子散布季節情報

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Seasonal data on spore dispersing of mosses in Japan, based on literature survey

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Abstract: Based on a literature survey for spore dispersing season of mosses in Japan, the seasonal data on 340 species of 159 genera in 52 families are presented here.

1. はじめに

コケ植物の繁殖に関する情報の中で、各種における孢子の成熟季節や散布季節は、基礎的情報の一つとして重要である。分類学的研究ではOkamura (1911, 1913)をはじめとして、形態とともに孢子や孢子体の成熟季節が示されていることが多い。Horikawa (1950)は101種の蘚類に関して孢子成熟の月や受精の月などを示し、繁殖季節に関する情報の重要性を指摘しているが、蘚類の繁殖季節が本格的に調べられはじめたのは比較的近年になってからである。Tsujiura (1974), Iwatsuki (1983)やDeguchi & Takeda (1986)などが興味深い報告を行っているが、日本産蘚類全般についてまとめたものはまだないようである。

本資料は、文献探査によって得られた、日本産蘚類における孢子体や孢子の成熟、また孢子散布の季節に関する情報をまとめたものである。分類学的報告や繁殖季節の研究に加え、孢子の形態や発芽に関する研究報告も参考にした。研究材料の孢子がいつ、どこで採集されたかというデータは孢子成熟季節を推察する上で大変参考になるためである。結果として、52科159属340種に関する情報をえることが

できた。

なお、蘚類の群落では、通常、2～3ヶ月に渡って孢子を散布する。これは同一群落内においても孢子体の成熟時期が異なるものがあるため、それは受精の時期が違っているために生じていることと推察される。また、孢子体や孢子の成熟季節は、同種であっても、地域によって、また年によって若干異なるのが普通である。気候や気象の違いによって生じる差異と推察される。そのような違いや差異があるにしても、本報告に取り上げた情報は、各種の孢子散布季節を知るうえで大きな手がかりになると思える。本資料がコケ植物の生態や繁殖に関する研究の進展に役立てば幸いである。

2. 日本産蘚類の孢子散布季節

科の配列順と属の所属はIwatsuki (ed.) (2001)に従い、科内の属と種はアルファベット順に配列した。文献に示されている学名が現在使用されていない場合には、Iwatsuki (ed.) (2001)やIwatsuki (2004)などを参照して変更し、文献中に使用されていた学名を引用文献の後に示した。

孢子体や孢子の成熟時期や孢子散布季節の表示

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はなるべく文献の記載に従うようにした。孢子採集の情報は文献に記載されている月日と場所で示した。

Sphagnaceae

Sphagnum cuspidatum Hoffm.: Spores collected at Apr. 9 at Shimane-ken (Nishida & Saito 1961); spores collected at May 10 in Shimane-ken (Nishida 1970a).

Sphagnum fimbriatum Wilson ex Wilson & Hook. f.: Spores collected at Aug. 23 at Shiga-kohgen, Nagano-ken (Nishida 1978).

Sphagnum junghuhnianum Dozy & Molk. subsp. *pseudomolle* (Warnst.) H. Suzuki: Spores collected at April 28 in Shimane-ken (Nishida 1970a).

Sphagnum girgensohnii Russow: Spores collected at Sept. 23 at Mt. Ontake (Noguchi 1958).

Sphagnum imbricatum Hornsch. ex Russow: Spores collected in Aug. in Hokkaido (Kajita et al. 1987).

Sphagnum palustre L.: Spores collected in mid June in Hiroshima-ken (Suzuki 1949 as *S. cymbifolium*).

Sphagnum squarrosum Crome: Spores collected at Aug. 19 at Mt. Yatsugatake (Noguchi 1958).

Andreaeaceae

Andreaea rupestris Hedw. var. *fauriei* (Besch.) Takaki: Spores collected at Aug. 10 at Ura-hiuchigadake (Miyoshi 1969a); spores collected at Aug. 18 at Mt. Hodaka, Nagano-ken (Nishida 1971a).

Tetraphidaceae

Tetraphis pellucida Hedw.: Spores maturing in May and June (Horikawa 1950 as *Georgia*); spores collected at June 23 at Mt. Daisen, Tottori-ken (Nishida 1970b).

Tetraphis geniculata Girg. ex Milde: Spores maturing in May and June (Horikawa 1950 as *Georgia*).

Buxbaumiaceae

Buxbaumia aphylla Hedw.: Spores maturing in June (Horikawa 1950); spores collected at Apr. 22 in Hiroshima-ken (Miyoshi 1969a); spores collected at Aug. 18 at Mt. Hodaka, Nagano-ken (Nishida 1971b); spores maturing in late Apr. to early May in Chugoku Dist., SW-Honshu (Nishimura & Tateishi 1996).

Buxbaumia minakatae S. Okam.: Spores maturing in June (Horikawa 1950).

Diphyscium fulvifolium Mitt.: Spores maturing in Aug. to Sept. (Horikawa 1950); spores collected in Aug. 13 at Matsue, Shimane-ken (Nishida & Saito 1961); spores dispersing in July to Aug. at Hiruzen, Okayama-ken (Nishimura 1993).

Theriotia lorifolia Card.: Spores maturing in June (Horikawa 1950); spores collected at April 22 at Niimi, Okayama-ken (Nishida 1980a).

Polytrichaceae

Atrichum rhystophyllum (Müll. Hal.) Paris: Spores maturing in Sept. to Oct. (Horikawa 1950 as *Catharinaea angustata*): sporophytes to observe sporogenesis collected at Sept. 27 in Kochi-ken (Deguchi et al. 1993); spores released during Feb. at Miyajima Isl., Hiroshima-ken (Imura 1994).

Atrichum undulatum (Hedw.) P. Beauv.: Spores maturing at Feb. and Mar. (Horikawa 1950 as *Catharinaea*): spores collected in Oct. 15 in Tochigi-ken (Miyoshi 1973); fruiting season in Sept. to Dec. at Okutama, Tokyo-to (Tsujimura 1974); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Atrichum yakushimense (Horik.) Mizush.: Spores maturing at Oct. (Horikawa 1950 as *Catharinaea*).

Bartramiopsis lescurii (James) Kindb.: Sporophytes to observe sporogenesis collected at Apr. 29 at Mt. Iwaguro, Ehime-ken (Deguchi et al. 1993).

Pogonatum alpinum (Hedw.) Röhl.: Spores maturing

- in June to July (Horikawa 1950 as *Polytrichum*): spores maturing in June to July (Horikawa 1972).
- Pogonatum contortum* (Brid.) Lesq.: Spores maturing in Sept. to Oct. (Horikawa 1972); spores collected at June 28 at Mt. Daisen, Tottori-ken (Nishida 1978); fruiting season in Aug. to Nov. at Okutama, Tokyo-to (Tsujimura 1974); spores dispersing in late autumn to early spring at Hiruzen, Okayama -ken (Nishimura 1993).
- Pogonatum inflexum* (Lindb.) Sande Lac.: Spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993); spores released from Feb. to Mar. at Miyajima Isl., Hiroshima-ken (Imura 1994).
- Pogonatum japonicum* Sull. & Lesq.: Spores maturing in Sept. to Oct. (Horikawa 1972).
- Pogonatum neesii* (Müll. Hal.) Dozy: Spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).
- Pogonatum spinulosum* Mitt.: Spores maturing in Oct. to Dec. (Horikawa 1972); fruiting season in Sept. to Mar. at Okutama, Tokyo-to (Tsujimura 1974); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).
- Pogonatum sphaerothecium* Besch.: Spores collected at Aug. 29 at Mts. Yatsugatake (Miyoshi 1969a).
- Pogonatum urnigerum* (Hedw.) P. Beauv.: Spores maturing at Mar. (Horikawa 1950); fruiting season in Aug. to Dec. at Okutama, Tokyo-to (Tsujimura 1974).
- Polytrichum commune* Hedw.: Spores maturing in July to Aug. (Horikawa 1950); Spores collected at Aug. 28 at Mts. Yetsugatake (Miyoshi 1969a).
- Polytrichum formosum* Hedw.: Spores maturing in July to Aug. (Horikawa 1950 as *P. attenuatum*).
- Polytrichum juniperinum* Hedw. subsp. *strictum* (Brid.) Nyl. & Sael.: Spores maturing in June to July (Horikawa 1950 as *P. strictum*).
- Polytrichum longisetum* Sw. ex Brid.: Spores maturing in June (Horikawa 1950 as *P. gracile*).
- Polytrichum piliferum* Hedw.: Spores maturing in June (Horikawa 1950).
- Fissidentaceae**
- Fissidens beckettii* Mitt.: Meiosis at mid-Oct. in Shizuoka, at late Dec. in Okinawa (Iwatsuki 1983).
- Fissidens bogoriensis* M. Fleisch.: Meiosis in late Sept. to mid-Oct. in Shizuoka, at late Dec. in Okinawa (Iwatsuki 1983).
- Fissidens bryoides* Hedw. var. *esquirolii* (Thér.) Z. Iwats. & Tad. Suzuki: Meiosis in early Oct. to early Nov. in Shizuoka, at early Nov. in Miyazaki, in late Dec. to early Jan. at Amami-Oshima, in late Dec. to early Jan. in Okinawa (Iwatsuki 1983).
- Fissidens bryoides* Hedw. var. *lateralis* (Broth.) Z. Iwats. & Tad. Suzuki; Meiosis at late Oct. in Shizuoka, at early Oct. in Miyazaki, at late Dec. in Amami-Oshima (Iwatsuki 1983).
- Fissidens bryoides* Hedw. var. *ramosissimus* Thér.: Meiosis in late Sept. to mid-Oct. in Shizuoka, at late Dec. in Okinawa (Iwatsuki 1983).
- Fissidens closteri* Austin subsp. *kiusiuensis* (Sakurai) Z. Iwats.: Meiosis in early Sept. to mid-Oct. in Shizuoka, in mid-Oct. to early Nov. in Miyazaki, at late Dec. in Okinawa (Iwatsuki 1983).
- Fissidens crassinervis* Sande Lac.: Meiosis at late Dec. in Okinawa (Iwatsuki 1983).
- Fissidens crispulus* Brid.: Meiosis in mid- to late Oct. in Miyazaki (Iwatsuki 1983 as *F. zippelianus*).
- Fissidens dubius* P. Beauv.: Meiosis at early Oct. in Shizuoka (Iwatauki 1983 as *F. cristatus*): spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).
- Fissidens ganguleei* Nork. ex Gangulee: Meiosis at mid-Oct. in Shizuoka (Iwatsuki 1983).
- Fissidens gardneri* Mitt.: Meiosis at mid-May in Shizuoka, at early Jan. in Okinawa (Iwatsuki 1983 as *F. microcladus*).
- Fissidens geminiflorus* Dozy & Molk.: Meiosis at mid-

- Oct. in Shizuoka (Iwatsuki 1983 as *F. geminiflorus* var. *nagasakius*).
- Fissidens geppii* M. Fleisch.: Meiosis in mid-Sept. to mid-Oct. in Shizuoka (Iwatsuki 1983).
- Fissidens gymnogynus* Besch.: Young sporophytes found in mid summer in Kyushu (Iwatsuki & Inoue 1984).
- Fissidens hollianus* Dozy & Molk.: Meiosis at late Dec. in Amami-Oshima, at late Dec. in Okinawa (Iwatsuki 1983).
- Fissidens hyalinus* Hook. & Wilson: Meiosis at mid-Oct. in Shizuoka, in mid- to late Oct. in Miyazaki, at late Dec. in Amami-Oshima (Iwatsuki 1983).
- Fissidens linearis* Brid. var. *obscurirete* (Broth. & Paris) I. G. Stone: Meiosis in late May to mid-June in Shizuoka, at mid-May in Miyazaki, in late Dec. to early Jan. in Amami-Oshima (Iwatsuki 1983 as *F. obscurirete*).
- Fissidens nobilis* Griff.: Meiosis at mid-Oct. in Miyazaki (Iwatsuki 1983).
- Fissidens oblongifolius* Hook. f. & Wilson: Meiosis at early Oct. in Shizuoka, at late Dec. in Amami-Oshima, in late Dec. to early Jan. in Okinawa (Iwatsuki 1983 as *F. mangarevensis*).
- Fissidens pellucidus* Hornsch.: Meiosis in mid-Sept. to mid-Oct. in Shizuoka, at late Dec. in Okinawa (Iwatsuki 1983 as *F. laxus*).
- Fissidens protonemaecola* Sakurai: Meiosis in late Sept. to mid-Oct. in Shizuoka, in mid- to late Oct. in Miyazaki (Iwatsuki 1983).
- Fissidens serratus* Müll. Hal.: Meiosis in late Apr. to mid-May and in mid-Sept. to late Dec. in Shizuoka, at early July and in mid- to late Oct. in Miyazaki, at late Dec. in Amami-Oshima, in late Dec. to early Jan. in Okinawa (Iwatsuki 1983 as *F. papillosus*).
- Fissidens strictulus* Müll. Hal.: Meiosis in late May to mid-June in Shizuoka (Iwatsuki 1983).
- Fissidens subangustus* M. Fleisch.: Meiosis in mid-Oct. to early Nov. in Shizuoka (Iwatsuki 1983).
- Fissidens taxifolius* Hedw.: Meiosis at early Oct. in Shizuoka (Iwatsuki 1983).
- Fissidens tosaensis* Broth.: Meiosis at mid-Oct. in Shizuoka, at mid-Oct. in Miyazaki, at late Dec. in Amami-Oshima, at late Dec. in Okinawa (Iwatsuki 1983).

Archidiaceae

- Archidium ohioense* Schimp. ex Müll. Hal.: Spores maturing in early spring (Okamura 1915 as *A. japonicum*); spores maturing at Oct. (Horikawa 1950 as *A. tokyoense*); mature sporophyte observed in July (Suzuki & Iwatsuki 1997).

Ditrichaceae

- Ceratodon purpureus* (Hedw.) Brid.: Spores maturing in May to June (Horikawa 1950).
- Distichium capillaceum* (Hedw.) Bruch & Schimp.: Spores maturing at July (Horikawa 1950).
- Ditrichum heteromallum* (Hedw.) E. G. Britton: Spores maturing in Oct. to Mar. (Horikawa 1950 as *D. homomallum*).
- Ditrichum pallidum* (Hedw.) Hampe : Spores maturing in May to June (Horikawa 1950); spores collected at June 28 at Mt. Daisen, Tottori-ken (Nishida 1978); spores dispersing in July to Aug. at Hiruzen, Okayama-ken (Nishimura 1993).
- Eccremidium minutum* (Mitt.) I. G. Stone & G. A. M. Scott: Spores collected at Oct. 28 in Aichi-ken (Nishida & Iwatsuki 1981a) spores maturing at late Sept. and also at Mar. (Iwatsuki & Higuchi 1987).
- Pleuridium japonicum* Deguchi, Matsui & Z. Iwats.: Spores maturing in May to Aug. (Horikawa 1950 as *P. subulatum*).
- Pseudephemerum nitidum* (Hedw.) Reimers: Spores collected at Mar. 15 at Fukuejima, Nagasaki-ken (Nishida & Iwatsuki 1981a).

Bryoxiphiaceae

Bryoxiphium norvegicum (Brid.) Mitt. subsp. *japonicum* (Berggr.) A. Löve & D. Löve: Spores collected at June 28 at Mt. Daisen, Tottori-ken (Nishida 1978).

Seligeriaceae

Blindia acuta (Hedw.) Bruch & Schimp.: Spores maturing in June (Horikawa 1950).

Dicranaceae

Bruchia microspora Nog.: Mature sporophyte observed in Aug. (Suzuki & Iwatsuki 1997).

Campylopodium medium (Duby) Giesenh. & J. -P. Frahm: Spores collected at Jan 18 at Mt. Miharayama, Izu-oshima (Nishida 1980b as *C. euphorocladum*).

Cynodontium polycarpum (Hedw.) Schimp.: Spores maturing in June to July (Horikawa 1950).

Dichodontium pellucidum (Hedw.) Schimp.: Spores maturing in Dec. to Mar. (Horikawa 1950).

Dicranella coarctata (Müll. Hal) Bosch & Sande Lac.: Spores maturing at July (Okamura 1911, as *D. salsuginosa*).

Dicranella heteromalla (Hedw.) Schimp.: Spores maturing in Feb. to Mar. (Horikawa 1950); spores collected at June 26 at Mt. Daisen, Tottori-ken (Nishida 1978): fruiting season in July to Dec. in Okutama. Tokyo-to (Tsujimura 1974): spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Dicranum fuscescens Turner: Spores maturing at Aug. (Horikawa 1950).

Dicranum undulatum Schrad. ex Brid.: Spores maturing in Aug. to Sept. (Horikawa 1950 as *D. bergeri*); spores maturing at Oct. (Horikawa 1950).

Dicranum scoparium Hedw.: Spores maturing in Oct. to Nov. (Horikawa 1950); spores collected at Apr. 6 at Oki, Shimane-ken (Nishida 1978).

Oncophorus crispifolius (Mitt.) Lindb.: Sporophytes to observe sporogenesis collected at Mar. 29, at Mt. Yokogura, Kochi-ken (Deguchi et al 1993).

Trematodon longicollis Michx.: Spores collected at July 6 at Hiroshima (Miyoshi 1973); spores collected at Mar. 10 at Matsue, Shimane-ken (Nishida 1978); fertilization in Oct. to Mar., meiosis and spore maturation at May in Kochi (Deguchi & Hidaka 1987); spores dispersing in June and July at Hiruzen, Okayama-ken (Nishimura 1993).

Leucobryaceae

Leucobryum juniperoideum (Brid.) Müll. Hal.: Spores maturing in Oct. to Nov. (Horikawa 1950 as *L. breviceule*): spores collected at Mar. 15 at Matsue, Shimane-ken (Nishida 1978 as *L. neilgherrense*); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Leucobryum scabrum Sande Lac.: Spores maturing in Oct. to Nov. (Horikawa 1972).

Pottiaceae

Anoetangium stracheyanum Mitt.: Sporophyte maturing in late autumn to winter (Saito 1975).

Anoetangium thomsonii Mitt.: Sporophyte maturing in late autumn to winter (Saito 1975).

Barbula arcuate Griff.: Sporophyte maturing in late autumn to winter (Saito 1975).

Barbula convoluta Hedw.: Spores maturing in May to June (Horikawa 1950); sporophyte maturing in autumn (Saito 1975).

Barbula coreensis (Card.) K. Saito; Sporophyte maturing in summer (Saito 1975).

Barbula fallx Hedw.: Spores maturing at Mar. (Horikawa 1950).

Barbula horrinervis K. Saito; Sporophyte maturing in autumn (Saito 1975).

Barbula indica (Hook.) Spreng.: Sporophyte maturing in autumn (Saito 1975).

- Berbula javanica* Dozy & Molk.: Sporophyte maturing in summer to autumn (Saito 1975).
- Barbula subcomosa* Broth.: Sporophyte maturing in summer to autumn (Saito 1975).
- Barbula unguiculata* Hedw.: Spores maturing in Mar. to Apr. (Horikawa 1950); sporophyte maturing in winter to early spring (Saito 1975); spores collected in Apr. at Hiroshima (Takio et al. 1986); spores dispersing in late autumn to early spring at Hiruzen, Okayam-ken (Nishimura 1993).
- Bryoerythrophyllum brachystegium* (Besch.) K. Saito: Sporophyte maturing in summer (Saito 1975).
- Bryoerythrophyllum gymnostomum* (Broth.) P. C. Chen: Sporophyte maturing in summer (Saito 1975).
- Bryoerythrophyllum recurvirostre* (Hedw.) P. C. Chen: Spores maturing in Oct. to Dec. (Horikawa 1950); sporophyte maturing in summer (Saito 1975).
- Bryoerythrophyllum rubrum* (Jur.) P. C. Chen var. *minus* K. Saito: Sporophyte maturing in summer (Saito 1975).
- Desmatodon latifolius* (Hedw.) Brid.: Spores maturing in autumn (Saito 1973).
- Desmatodon laureri* (Schultz) Bruch & Schimp.: Spores maturing in summer (Saito 1973).
- Didymodon acutus* (Brid.) K. Saito: Sporophyte maturing in summer (Saito 1975).
- Didymodon constrictus* (Mitt.) K. Saito: Sporophyte maturing in summer (Saito 1975).
- Didymodon nigrescens* (Mitt.) K. Saito: Sporophyte maturing in summer (Saito 1975).
- Didymodon rigidicaulis* (Müll. Hal.) K. Saito: Sporophyte maturing in late autumn to winter (Saito 1975).
- Didymodon rigidulus* Hedw.: Sporophyte maturing in summer (Saito 1975).
- Gymnostomum aeruginosum* Sm.: Sporophyte maturing in autumn to winter (Saito 1975).
- Gymnostomum aurantiacum* (Mitt.) Paris: Sporophyte maturing in autumn to winter (Saito 1975).
- Gymnostomum recurvirostrum* Hedw.: Sporophyte maturing in autumn (Saito 1975).
- Hyophila acutifolia* K. Saito: Sporophyte maturing in late autumn (Saito 1975).
- Hyophila involuta* (Hook.) Jaeg. & Sauerb.: Sporophyte maturing in late autumn (Saito 1975); sporophytes to observe sporogenesis collected at Sept. 27 and Oct. 11 in Kochi (Deguchi et al. 1991).
- Hyophila propagulifera* Broth.: Sporophyte maturing in late autumn (Saito 1975).
- Oxystegus tenuirostris* (Hook. & Taylor) A. J. E. Smith: Sporophyte maturing in autumn (Saito 1975 as *O. cylindricus*).
- Pottia intermedia* (Turner) Fürnr.: Spores mature in late autumn to winter (Saito 1973).
- Pottia lanceolata* (Hedw.) Müll. Hal.: Spores maturing in Mar. to Apr. (Horikawa 1950).
- Pottia truncata* (Hedw.) Bruch & Schimp.: Spores maturing in Jan. to Feb. (Horikawa 1950); spores maturing in autumn to spring (Saito 1973).
- Paeudosymblypharia angustata* (Mitt.) P. C. Chen: Sporophyte maturing in autumn (Saito 1975).
- Scopelophila ligulata* (Spruce) Spruce: Spores collected in Nov. 26 at Kumamoto-ken (Noguchi & Furuta 1956 as *Merceya*).
- Timmiella anomala* (Bruch & Schimp.) Limpr.: Sporophyte maturing in late autumn (Saito 1975).
- Tortella japonica* (Besch.) Broth.: Sporophyte maturing in autumn (Saito 1975).
- Tortella tortuosa* (Hedw.) Limpr.: Spores maturing in June and July (Horikawa 1950); sporophyte maturing in summer (Saito 1975).
- Tortula muralis* Hedw.: Spores maturing in June to Aug. (Horikawa 1950); spores maturing in spring to early summer (Saito 1973).
- Tortula obtusifolia* (Schwägr.) Mathieu: Spores maturing in spring to early summer (Saito 1973).
- Tortula sinensis* (Müll. Hal.) Broth.: Spores maturing in summer to early autumn (Saito 1973).

Trichostomum brachydontium Bruch: Sporophyte maturing in spring (Saito 1975).

Trichostomum crispulum Bruch: Sporophyte maturing in winter (Saito 1975).

Trichostomum platyphyllum (Broth. ex Iisiba) P. C. Chen: Sporophyte maturing in early spring (Saito 1975).

Tuerckheimia svihlae (Bartr.) R. H. Zander: Spores maturing in Aug. to Oct. (Saito 1972 as *Gymnostomum angustifolium*).

Weissia atrocaulis K. Saito: Sporophyte maturing in summer to autumn (Saito 1975).

Weissia controversa Hedw.: Spores maturing in May to June (Horikawa 1950); sporophyte maturing in spring and autumn (Saito 1975); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Weissia crispa (Hedw.) Mitt.: Spores maturing in Dec. (Okamura 1911 as *Astomum kiiense*); sporophyte maturing in spring (Saito 1975); fertilization in Sept. to Oct., meiosis at Jan., spores dispersing at May, in Kochi (Deguchi & Hidaka 1987 as *Astomum*).

Weissia edentula Mitt.: Sporophyte maturing in spring and autumn (Saito 1975).

Weissia exerta (Broth.) P. C. Chen: Sporophyte maturing in spring (Saito 1975).

Weisia longidens Card.: Sporophyte maturing in spring (Saito 1975).

Weissia newcomeri (E. B. Bartram) K. Saito: Sporophyte maturing in spring (Saito 1975).

Weissia planifolia Dixon: Sporophyte maturing in autumn (Saito 1975).

Weisiopsis anomala (Broth. & Paris) Broth.: Sporophyte maturing in late autumn to winter (Saito 1975).

Encalyptaceae

Encalypta ciliata Hedw.: Spores maturing at July (Horikawa 1950).

Encalypta raptocarpa Schwägr.: Spores collected

Sept. 1 at Mt. Kitadake, Yamanashi-ken (Nishida & Iwatsuki 1980b).

Grimmiaceae

Campylostelium brachycarpum (Nog.) Z. Iwats., Tateishi & Tad. Suzuki: Spores dispersing in Nov. at Hiruzen, Okayama-ken (Nishimura 1993 as *C. saxicola* var. *brachycarpum*).

Coscinodon humilis Nog.: Spores maturing at June (Horikawa 1950 as *C. cribrosus*).

Grimmia doniana Sm.: Spores maturing in Aug. to Oct. (Horikawa 1950).

Grimmia pilifara P. Beauv.: Spores collected at Aug. 8 at Tachikue, Shimane-ken (Nishida 1978).

Ptychomitrium dentatum Mitt.: Fertilization in June to July, spores maturing in Feb. to Mar., at Befu-kyo, Kochi-ken (Deguchi & Takeda 1986).

Ptychomitrium fauriei Besch.: Fertilization in June to July, spores maturing in Feb. to Mar., at Befu-kyo, Kochi-ken (Deguchi & Takeda 1986).

Ptychomitrium gardneri Lesq.: Fertilization in June to July, spores maturing in Feb. to Mar., at Befu-kyo, Kochi-ken (Deguchi & Takeda 1986 as *P. polyphylloids*).

Ptychomitrium linearifolium Reimers & Sakurai: Fertilization in June to July, spores maturing in Feb. to Mar., at Befu-kyo, Kochi-ken (Deguchi & Takeda 1986).

Racomitrium barbuloides Card.: spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Racomitrium heterostichum (Hedw.) Brid.: Spores maturing in Apr. to May (Horikawa 1950).

Racomitrium japonicum (Dozy & Molck.) Dozy & Molck.: Sporophytes to observe sporogenesis collected at Nov. 10 in Tottori-ken (Deguchi et al. 1993).

Racomitrium lanuginosum (Hedw.) Brid.: Spores collected at Mar. 28 at Matsue, Shimane-ken (Nishida 1978).

Schistidium liliputanum (Müll. Hal.) Deguchi: Spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Schistidium strictum (Turner) Loeske: Spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Erpodiaceae

Aulacopilum japonicum Broth. ex Card.: Fertilization in June to July, meiosis at Apr., in Kochi-ken (Deguchi & Hidaka 1987).

Glyphomitrium humillimum (Mitt.) Card.: Juvenile sporophytes observed at early Oct., LCI at Mar., start of spore dispersing in mid Apr., at Kumamoto (Muraoka 1968).

Venturiella sinensis (Vent.) Müll. Hal.: Spores collected in Feb. (Noguchi & Mizuno 1959): fertilization at May, meiosis in Oct. to Jan., spores dispersing in Jan. to Feb., in Kochi (Deguchi & Hidaka 1987); sporophytes to observe sporogenesis collected at Oct. 11 in Kochi (Deguchi et al. 1993).

Ephemeraceae

Ephemerum serratum (Hedw.) Hampe: Mature sporophyte observed in Mar. at Kakegawa, Shizuoka-ken, and observed also in July (Suzuki & Iwatsuki 1997).

Micromitrium tenerum (Bruch & Schimp.) Crosby: Spores maturing at late Sept. and at Mar. (Iwatsuki & Higuchi 1987); mature sporophyte observed in July (Suzuki & Iwatsuki 1997).

Funariaceae

Entosthodon wichurae M. Fleisch.: Spores maturing presumably in late summer to autumn (Ochi 1968 as *E. buseanus*); fruting in Mar. and Apr. (Ochi 1968).

Funaria hygrometrica Hedw.: Spores maturing in July to Oct. (Horikawa 1950); spores dispersing in June and July at Hiruzen, Okayama-ken (Nishimura 1993).

Physcomitrella patens (Hedw.) Bruch & Schimp. subsp. *californica* (H. A. Crum & L. E. Anderson) B. C. Tan: Sporophytes to observe sporogenesis collected at Dec. 6 in Kagawa-ken (Deguchi et al. 1993); sporophytes of operculum-fallen stage observed in Jan. and Feb. in Okayama (Une & Tateishi 1996).

Physcomitrium eurytomum Sendtn.: Spores maturing in Mar. to May (Ochi 1968); spores collected at Mar. 13 at Yatsuka, Shimane-ken (Nishida 1978).

Physcomitrium japonicum (Hedw.) Mitt.: Spores maturing in Apr. and May (Ochi 1968); spores collected at Mar. 13 at Yatsuka, Shimane-ken (Nishida 1978).

Physcomitrium sphaericum (Ludw.) Füllr.: Spores collected in Apr. at Nichinan, Miyazaki-ken (Muraoka 1967).

Splachnaceae

Tayloria hornschurchii (Grev. & Arn.) Broth.: Spores collected at Sept. 1 at Mt. Kitadake, Yamanashi-ken (Nishida & Iwatsuki 1980b).

Schistostegaceae

Schistostega pennata (Hedw.) F. Weber & Mohr: Spores maturing in Apr. and May (Okamura 1915 as *S. osmundacea*); spores maturing at May (Horikawa 1950 as *S. osmundacea*); spores maturing at May (Horikawa 1972); spores collected at Aug. 28 at Nagano-ken (Miyoshi 1969b).

Bryaceae

Anomobryum filiforme (Griff.) A. Jaeger var. *concinatum* (Spr.) Loeske: Spores maturing in July and Aug. (Ochi 1959 as *Bryum julaceum* var. *concinatum*).

Anomobryum yasudae Broth.: Spores maturing in Aug. (Ochi 1959 as *Bryum*).

Brachymenium nepalense Hook.: Spores maturing in Sept. to Oct. (Ochi 1959).

Bryum algovicum Sendtn.: Spores maturing at June

- (Horikawa 1950 as *B. pendulum*).
- Bryum alpinum* Huds. ex With.: Spores maturing in June to July (Horikawa 1950).
- Bryum argenteum* Hedw.: Spores maturing in Apr. to May (Horikawa 1950); spores collected at Aug. 4 at Shimane-ken (Nishida 1978); spores dispersing in Apr. and also in Oct. to Dec. at Hiruzen, Okayama-ken (Nishimura 1993).
- Bryum atrovirens* Vill. ex Brid.: Spores ripening in May to June (Ochi 1959 as *B. erythrocarpum*).
- Bryum caespiticum* Hedw.: Spores maturing at June (Horikawa 1950).
- Bryum capillare* Hedw.: Spores maturing in May to June (Horikawa 1950); spores dispersing in July to Aug. at Hiruzen. Okayama-ken (Nishimura 1993).
- Bryum cellulare* Hook.: Spores maturing in late autumn or winter (Ochi 1959).
- Bryum cyclophyllum* (Schwägr.) Bruch & Schimp.: Spores maturing in summer (Ochi 1959 as *B. tortifolium*).
- Bryum dichotomum* Hedw.: Spores ripening in June to July (Ochi 1959 as *B. bicolor*).
- Bryum mayrii* Broth.: Spores ripening in summer (Ochi 1959).
- Bryum pachytheca* Müll. Hal.: Spores ripening in early summer (Ochi 1959 as *B. versicolor*).
- Bryum pallens* Sw.: Spores maturing at June (Horikawa 1950).
- Bryum paradoxum* Schwägr.: Spores maturing in summer (Ochi 1959 as *B. pseudo-alpinum*).
- Bryum radiculosum* Brid.: Spores ripening in late spring or early summer (Ochi 1959 as *B. murale*).
- Leptobryum pyriforme* (Hedw.) Wilson: Spores maturing at June (Horikawa 1950).
- Mielichoferia japonica* Besch.: Spores ripening in late summer or early autumn (Ochi 1959 as *M. mielichoferiana* var. *japonica*).
- Mielichoferia sasaokae* Broth.: Spores maturing in summer (Ochi 1959).
- Plagiobryum japonicum* Nog.: Spores ripening in Aug. to Sept. (Ochi 1959).
- Pohlia cruda* (Hedw.) Lindb.: Spores maturing at Sept. (Horikawa 1950).
- Pohlia elongata* Hedw.: Spores maturing at Sept. (Horikawa 1950).
- Pohlia fauriei* (Card.) Iisiba: Spores maturing in April (Okamura 1915 as *Mniobryum nipponense*): spores ripening in late Apr. to May (Ochi 1959).
- Pohlia filum* (Schimp.) Mart.: Spores ripening in Aug. (Ochi 1959 as *P. gracilis*).
- Pohlia flexuosa* Hook.: Spores ripening in late spring or early summer (Ochi 1959).
- Pohlia nutans* (Hedw.) Lindb.: Spores maturing at June (Horikawa 1950); spores ripening in Aug. (Ochi 1959 as *P. schimperi*).
- Pohlia otaruensis* (Card.) Iisiba: Spores maturing in summer (Ochi 1959).
- Pohlia prolifera* (Kindb.) Lindb. ex Arn.: Spores maturing in summer (Ochi 1959).
- Pohlia pseudodeflecta* Ochi: Spores maturing in summer (Ochi 1959).
- Pohlia revolvens* (Card.) Nog.: Spores ripening in Sept. (Ochi 1959 as *P. crudoides* var. *revolvens*).
- Rhodobryum giganteum* (Schwägr.) Paris: Fruiting in late autumn (Ochi 1959 as *Bryum*).

Mniacene

- Mnium hornum* Hedw.: Spores maturing at May (Horikawa 1950).
- Mnium lycopodioides* (Hook.) Schwägr.: Spores collected at Aug. 26 at Mt. Sanbe, Shimane-ken (Nishida 1978 as *M. laevinerve*).
- Mnium stellare* Reichard ex Hedw.: Spores maturing in May to June (Horikawa 1950).
- Plagiomnium acutum* (Lindb.) T. J. Kop.: Spores collected at Aug. 17 at Mt. Sanbe, Shimane-ken (Nishida 1978); fruiting season in Mar. to July at Okutama, Tokyo-to (Tsujimura 1974).

Plagiomnium confertidens (Lindb. & Arn.) T. J. Kop.:

Spores maturing at May (Horikawa 1950 as *Mnium undulatum*).

Plagiomnium cuspidatum (Hedw.) T. J. Kop.: Spores maturing in Apr. to May (Horikawa 1950 as *Mnium*).

Plagiomnium vesicatum (Besch.) T. J. Kop.: Spores maturing in May to June (Horikawa 1950 as *Mnium rostratum*).

Pseudobryum speciosum (Mitt.) T. J. Kop.: Spores maturing at June (Horikawa 1950 as *Mnium*); spores maturing in Apr. (Horikawa 1972 as *Mnium*).

Rhizomnium parvulum (Mitt.) T. J. Kop.: Spores collected at Oct. 3 at Yatsuka, Shimane-ken (Nishida 1978).

Rhizomnium striatulum (Mitt.) T. J. Kop.: Fruiting season in Sept. to Apr. in Okutama, Tokyo-to (Tsu-
jimura 1974).

Trachycystis flagellaris (Sull. & Lesq.) Lindb.: Spores maturing in Apr. to May (Horikawa 1972 as *Mnium*); fruiting season in Apr. to May in Okutama, Tokyo-to (Tsu-
jimura 1974); sporophytes maturing in July to Aug. in Niigata-ken (Shirasaki 1998).

Trachycystis microphylla (Dozy & Molk.) Lindb.: Spores maturing in Mar. to Apr. (Horikawa 1972 as *Mnium*); sporophytes maturing in Jan. to June, and most frequently observed in Apr. to May, in Niigata-ken (Shirasaki 1998).

Aulacomniaceae

Aulacomnium androgynum (Hedw.) Schwägr.: Spores maturing at June (Horikawa 1950).

Aulacomnium palustre (Hedw.) Schwägr.: Spores maturing at June (Horikawa 1950).

Rhizogoniaceae

Pyrrhobryum dozyanum (Sande Lac.) Manuel: Spores collected at Mar. 26 at Hirata, Shimane-ken (Nishida 1978).

Bartramiaceae

Bartramia pomiformis Hedw.: Spores maturing at May (Horikawa 1950 as *B. crispata*); fruiting season in Feb. to June in Okutama, Tokyo-to (Tsu-
jimura 1974); spores dispersing in May to June at Hiruzen, Okayama-ken (Nishimura 1993).

Philonotis fontana (Hedw.) Brid.: Spores maturing at June (Horikawa 1950); spores collected at June 28 at Iishi, Shimane-ken (Nishida 1978).

Philonotis thwaitesii Mitt.: Spores maturing in summer (Ochi 1962 as *P. revoluta*).

Philonotis turneriana (Schwägr.) Mitt.: Spores collected at Mar. 21 at Tokunoshima Isl. (Miyoshi 1973).

Plagiopus oederi (Brid.) Limpr.: Spores maturing in May to June (Horikawa 1950).

Orthotrichaceae

Drummondia sinensis Müll. Hal.: Spores collected at May 21 at Matsue, Shimane-ken (Nishida 1973); mature sporophytes collected in late Mar. at Kaizuka-shi, Osaka-fu (Muraoka 1968 as *D. prorepens*).

Macromitrium comatum Mitt.: Spores collected at Sept. 13 and at Oct. 7 at Mt. Azuma, Hiroshima-ken (Une 1985a).

Macromitrium ferriei Card. & Thér.: Spores collected at Apr. 11 at Togocho, Hiroshima-ken, at May 10 at Gokei, Okayama-ken, at July 24 at Mt. Azuma, Hiroshima-ken (Une 1985a).

Macromitrium gymnostomum Sull. & Lesq.: Spores collected at Mar. 30 at Obi, Miyazaki-ken, at May 9 at Taishaku, Hiroshima-ken (Une 1985a).

Macromitrium japonicum Dozy & Molk.: Spores collected at Dec. 17 at Matsue, Shimane-ken (Nishida 1971c); spores collected at July 15 and at Nov. 3 at Miyajima, Hiroshima-ken, at Mar. 31 at Inohae, Miyazaki-ken (Une 1985a); spores collected at Dec. 24 at Okinoerabu, Ryukyu (Une 1985b).

Macromitrium prorogatum Mitt.: Spores collected

at July 22 at Mt. Tachieboshi, Hiroshima-ken, at Nov. 13 at Mt. Azuma, Hiroshima-ken, at Sept. 7 at Mt. Marusasa, Tokushima-ken, at July 31 at Mt. Ichifusa, Kumamoto-ken (Une 1985a).

Orthotrichum consobrinum Card.: Spores collected at May 15 at Matsue, Shimane-ken (Nishida 1971c); spores dispersing in June to July at Hiruzen, Okayama-ken (Nishimura 1993).

Ulotia crispa (Hedw.) Brid.: Spores maturing in summer (Iwatsuki 1959); spores dispersing in July to Aug. at Hiruzen, Okayama-ken (Nishimura 1993).

Ulotia japonica (Sull. & Lesq.) Mitt.: Spores collected at May 15 at Matsue, Shimane-ken (Nishida 1971c as *M. nipponensis*).

Fontinalaceae

Dichelyma japonicum Card.: Spores maturing in Oct. (Okamura 1911 as *D. hatakeyamae*); sporophytes maturing in Oct. to Nov. in Niigata-ken (Shirasaki 1997).

Fontinalis antipyretica Hedw.: Spores maturing at Aug. (Horikawa 1950).

Climaciaceae

Climacium dendroides (Hedw.) F. Weber & Mohr: Spores maturing in Mar. to Apr. (Horikawa 1950).

Pleuroziopsidaceae

Pleuroziopsis ruthenica (Weinm.) Kindb.: Spores maturing in Aug. to Sept. (Horikawa 1972).

Hedwigiaceae

Hedwigia ciliata (Hedw.) P. Beauv.: Spores maturing at June (Horikawa 1950 as *H. albicans*); spores collected at May 21 at Kumamoto-ken (Noguchi & Mizuno 1959); spores collected at May 3 at Yamaguchi-ken (Miyoshi 1969b); spores maturing in Mar. to May (Horikawa 1972); spores collected at Apr. (Takami & Takio 1987).

Cryphaeaceae

Cryphaea obovatocarpa S. Okam.: Spores maturing in Mar. to Apr. (Okamura 1911).

Forsstroemia trichomitria (Hedw.) Lindb.: Spores dispersing in Oct. at Hiruzen, Okayama-ken (Nishimura 1993).

Leucodontaceae

Dozya japonica Sande Lac.: Spores collected at Apr. 6 at Matsue, Shimane-ken (Nishida 1978).

Leucodon Schwägr.: Spores mature in winter in most species, excepting *L. pendulus* (Akiyama 1988).

Leucodon atrovirens Nog.: Spores collected at early Feb. at Izumi-mura, Kumamoto-ken (Muraoka 1968 as *Macrosporiella scabriseta*).

Leucodon nipponicus Nog.: Spores collected at Dec. 4 at Izumo, Shimane-ken (Nishida 1978).

Leucodon pendulus Lindb.: Sporophytes mature in late summer to autumn (Akiyama 1988).

Trachypodaceae

Duthiella speciosissima Broth. ex Card.: Spores maturing in autumn (Okamura 1915 as *Matsumuraea japonica*).

Pterobryaceae

Pterobryum arbuscula Mitt.: Spores maturing in Apr. to May (Horikawa 1972); spores collected at June 10 at Hirata, Shimane-ken (Nishida 1978).

Meteoriaceae

Aerobryopsis subdivergens (Broth.) Broth.: Spores collected at Nov. 20-22 at Miyazaki-ken (Nishida & Iwatsuki 1981b).

Barbella flagellifera (Card.) Nog.: Spores collected at Nov. 20-22 at Miyazaki-ken (Nishida & Iwatsuki 1981b).

Pseudobarbella levieri (Renauld & Card.) Nog.: Spores collected at Nov. 20-22 at Miyazaki-ken (Nishida

& Iwatsuki 1981b).

Trachycladiella aurea (Mitt.) M. Menzel: Spores collected at Nov. 20-22 at Miyazaki-ken (Nishida & Iwatsuki 1981b as *Floribundaria aurea* subsp. *nipponica*).

Neckeraceae

Homalia trichomanoides (Hedw.) Schimp.: Spores maturing in Jan. to Feb. (Horikawa 1950).

Homaliadelphus targionianus (Mitt.) Dixon & P. de la Varde: Spores collected at Apr. 2 at Matsue, Shimane-ken (Nishida 1978).

Homaliodendron flabellatum (Sm.) M. Fleisch.: Spores maturing in Apr. to May (Horikawa 1972 as *H. scalpellifolium*).

Neckera humilis Mitt.: Spores collected at Aug. 13 at Hirata, Shimane-ken (Nishida 1978).

Neckera yezoana Besch.: Spores collected at Aug. 13 at Hirata, Shimane-ken (Nishida 1978); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Thamnobryaceae

Thamnobryum alopecurum (Hedw.) Nieuwl.: Spores maturing in Mar. to Apr. (Horikawa 1950 as *Thamnium*).

Thamnobryum plicatulum (Sande Lac.) Z. Iwats.: Spores collected at Dec. 2 at Mt. Sanbe, Shimane-ken (Nishida 1978).

Thamnobryum subseriatum (Mitt. ex Sande Lac.) B. C. Tan: Spores collected at Oct. 6 at Hirata, Shimane-ken (Nishida 1978 as *T. sandei*); fruiting season in Sept. to Nov. in Okutama, Tokyo-to (Tsujimura 1974); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Lembophyllaceae

Dolichomitriopsis diversiformis (Mitt.) Nog.: Spores

collected at Feb. 4 at Hirata, Shimane-ken (Nishida 1978); fruiting season in Sept. to Nov. in Okutama, Tokyo-to (Tsujimura 1974.); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Isothecium subdiversiforme Broth.: Spores collected at Feb. 4 at Hirata, Shimane-ken (Nishida 1978); fruiting season in Sept. to Nov. in Okutama, Tokyo-to (Tsujimura 1974).

Hookeriaceae

Distichophyllum maibarae Besch.: Spores dispersing in late autumn to early spring at Hiruzen-kohgon, Okayama-ken (Nishimura 1993).

Hookeria acutifolia Hook. & Grev.: Spores collected at May 22 at Matsue, Shimane-ken (Nishida 1978).

Hypopterygiaceae

Hypopterygium japonicum Mitt.: Spores collected at Feb. 11 at Hirata, Shimane-ken (Nishida 1978).

Theliaceae

Fauriella tenuis (Mitt.) Card.: Spores dispersing in autumn at Hiruzen, Okayama-ken (Nishimura 1993).

Fabroniaceae

Fabronia matsumurae Besch.: Spores maturing in Mar. to Apr. (Horikawa 1950); fertilization at June, meiosis in Oct. to Mar., spores dispersing at May, in Kochi-ken (Deguchi & Hidaka 1987); sporophytes to observe sporogenesis collected at Dec. 8 in Kochi (Deguchi et al. 1993).

Schwetschkeopsis fabronia (Schwägr.) Broth.: Spores dispersing in autumn at Hiruzen, Okayama-ken (Nishimura 1993).

Leskeaceae

Lescuraea mutabilis (Brid.) Lindb. ex Hag.: Spores

maturing in May to June (Horikawa 1950 as *L. striata*).

Leakea polycarpa Ehrh. ex Hedw.: Spores maturing in July to Aug. (Horikawa 1950).

Okamuraea Broth.: Spores maturing in winter (Noguchi 1953).

Okamuraea hakoniensis (Mitt.) Broth.: Spores collected at May 20 at Matsue, Shimane-ken (Nishida 1978).

Okamuraea plicata Card.: Spores maturing in winter (Okamura 1915).

Orthoamblystegium spurio-subtile (Broth. & Paris) Kanda & Nog.: Spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Pterigynandrum filiforme Hedw.: Spores maturing in June to July (Horikawa 1950); spores maturing in early summer (Mizushima 1960).

Rigodiadelphus robustus (Lindb.) Nog.: Spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Thuidiaceae

Anomodon giraldii Müll. Hal.: Spores collected at Apr. 6 at Shimane-ken (Nishida 1978).

Boulaya mittenii (Broth.) Card.: Spores maturing in Feb. to Mar. (Horikawa 1972).

Haplocladium angustifolium (Hampe & Müll. Hal.) Broth.: Spores dispersing in May to June at Hiruzen, Okayama-ken (Nishimura 1993).

Haplohymenium pseudo-triste (Müll. Hal.) Broth.: Spores collected at May 20 at Matsue, Shimane-ken (Nishida 1978).

Thuidium kanedae Sakurai: Spores collected at Mar. 8 at Matsue, Shimane-ken (Nishida 1978); fruiting season in Sept. to Oct. in Okutama, Tokyo-to (Tsujimura 1974); spores dispersing in autumn at Hiruzen-kohgen, Okayama-ken (Nishimura 1993).

Thuidium pristocalyx (Müll. Hal.) A. Jaeger.: Spores

collected at Mar. 8 at Matsue, Shimane-ken (Nishida 1978).

Amblystegiaceae

Amblystegium serpens (Hedw.) Schimp.: Spores maturing at June (Horikawa 1950).

Hygrohypnum alpinum (Lindb.) Loeske var. *tsurugizanicum* (Card.) Nog. & Z. Iwats.: Spores maturing in summer (Okamura 1915 as *H. cordifolium*).

Sanionia uncinata (Hedw.) Loeske: Spores maturing at July (Horikawa 1950 as *Drepanocladus*).

Brachytheciaceae

Brachythecium brotheri Paris: Fruiting season in Sept. to Nov. in Okutama, Tokyo-to (Tsujimura 1974): spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Brachythecium buchananii (Hook.) A. Jaeger: Fruiting season in Aug. to Nov. in Okutama, Tokyo-to (Tsujimura 1974); spores collected at May 18 at Shimane-ken (Nishida 1978).

Brachythecium coreanum Card.: Spores collected at May 18 at Shimane-ken (Nishida 1978); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Brachythecium helminthocladum Broth. & Paris: Spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Brachythecium plumosum (Hedw.) Schimp.: Spores maturing at Apr. (Horikawa 1950); fruiting season in Sept. to Nov. in Okutama, Tokyo-to (Tsujimura 1974): spores collected at Mar. 8 at Shimane-ken (Nishida 1978).

Brachythecium populeum (Hedw.) Schimp.: Spores maturing at Mar. (Horikawa 1950); spores collected at Mar. 8 at Shimane-ken (Nishida 1978); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Brachythecium reflexum (Starke) Schimp.: Spores ma-

- turing at Mar. (Horikawa 1950).
- Brachythecium rivulare* Schimp.: Spores maturing at Mar. (Horikawa 1950); fruiting season in Sept. to Nov. in Okutama, Tokyo-to (Tsujimura 1974).
- Brachythecium rutabulum* (Hedw.) Bruch & Schimp.: Spores maturing in Mar. to Apr. (Horikawa 1950).
- Bryhnia novae-angliae* (Sull. & Lesq.) Grout: Spores collected at Dec. 12 at Mt. Daisen, Tottori-ken (Nishida 1978).
- Eurhynchium angustirete* (Broth.) T. J. Kop.: Spores maturing at Mar. (Horikawa 1950 as *E. striatum*).
- Eurhynchium hians* (Hedw.) Sande Lac.: Spores collected at Dec. 20 at Hirata, Shimane-ken (Nishida 1978).
- Eurhynchium pulchellum* (Hedw.) Jenn. : Spores maturing at Mar. (Horikawa 1950 as *E. strigosum*).
- Homalothecium laevisetum* Sande Lac.: Spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).
- Kindbergia arbuscula* (Broth.) Ochyra: Spores collected at Dec. 5 at Matsue, Shimane-ken (Nishida 1978 as *Eurhynchium*).
- Myuroclada maximowiczii* (Borz.) Steere & W. B. Schofield: Spores maturing in Jan. to Feb. (Horikawa 1972); spores collected at Dec. 6 at Hirata, Shimane-ken (Nishida 1978); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).
- Palamocladium leskeoides* (Hook.) E. G. Britton: Spores maturing in Feb. to Mar. (Horikawa 1950 as *Homalothecium sciureum*).
- Rhynchostegium pallidifolium* (Mitt.) A. Jaeger: Spores collected at Mar. 29 at Mt. Daisen, Tottori-ken (Nishida 1978); spores dispersing in autumn at Hiruzen, Okayama-ken (Nishimura 1993).
- Entodontaceae**
- Entodon calycinus* Card.: Spores maturing in autumn (Mizushima 1960 as *E. brevisetus*).
- Entodon challengerii* (Paris) Card.: Spores maturing in autumn (Mizushima 1960 as *E. compressus*); spores collected at May 11 at Matsue, Shimane-ken (Nishida 1978); fertilization at June, meiosis in Oct. to Dec., spore maturation in Jan. to Feb., spores dispersing in Feb. to Mar. in Kochi (Deguchi & Hidaka 1987); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).
- Entodon conchophylla* Card.: Spores maturing in winter (Mizushima 1960); spores maturing at and from Oct. in southern Kyushu (Shin & Muroya 1965).
- Entodon diversinervis* Card.: Spores maturing in autumn (Mizushima 1960).
- Entodon flavescens* (Hook.) A. Jaeger & Sauerb.: Spores collected at May 18 at Hirata, Shimane-ken (Nishida 1978 as *E. rubicundus*).
- Entodon giraldii* Müll. Hal.: Spores maturing in spring (Mizushima 1960).
- Entodon luridus* (Griff.) A. Jaeger: Spores maturing in Oct. (Okamura 1915 as *E. andoi*): spores maturing in autumn (Mizushima 1960 as *E. okamurae*).
- Entodon macropodus* (Hedw.) Müll. Hal.: Spores maturing in summer (Mizushima 1960).
- Entodon scabridens* Lindb.: Spores maturing in autumn (Okamura 1915 as *E. ohinatae*): spores maturing in autumn (Mizushima 1960); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).
- Entodon sullivantii* (Müll. Hal.) Lindb.: Fruiting season in Sept. to Nov. in Okutama, Tokyo-to (Tsujimura 1974 as *E. sullivantii* var. *versicolor*).
- Orthothecium rufescens* (Brid.) Schimp.: Spores maturing in summer (Mizushima 1960 as *Holmgrenia*).
- Plagiotheciaceae**
- Plagiolthecium denticulatum* (Hedw.) Schimp.: Spores maturing at July (Horikawa 1950).
- Plagiothecium euryphyllum* (Card. & Thér.) Z. Iwats.:

Spores maturing in spring (Okamura 1915 as *P. matsumurae*); fruiting season in Apr. to Sept. in Okutama, Tokyo-to (Tsujimura 1974).

Plagiothecium nemorale (Mitt.) A. Jaeger: Spores collected at Mar. 29 at Oki, Shimane-ken (Nishida 1978).

Myuriaceae

Oedycladium serricuspe (Broth.) Nog. & Z. Iwats.: Spores collected at June 9 at Miyazaki-ken (Nishida & Iwatsuki 1980a as *O. doii*).

Palisadula chrysophylla (Card.) Toyama: Spores collected at July 5 at Miyazaki-ken (Nishida & Iwatsuki 1980a).

Sematophyllaceae

Brotherella henonii (Duby) M. Fleisch.: Spores collected at Feb. 1 at Shimane-ken (Nishida 1978); spores dispersing in autumn at Hiruzen, Okayama-ken (Nishimura 1993).

Pylaisiadelphina tenuirostris (Bruch & Schimp.) W. R. Buck: Spores collected at Mar. 8 at Mt. Sanbe, Shimane-ken (Nishida 1978 as *Clastobryelle kusatsuensis*); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Sematophyllum subhumile (Müll. Hal.) M. Fleisch.: Sporophytes of any stage observed at July and at Nov. at Hiruzen, Okayama-ken (Nishimura 1993 as *S. subhumile* subsp. *japonicum*).

Sematophyllum subpinnatum (Brid.) E. G. Britton: Fertilization and spore dispersion observed almost all through the year (Deguchi & Hidaka 1987 as *S. robustulum*).

Hypnaceae

Callicladium haldanianum (Grev.) H. A. Crum: Spores collected at May 6 at Mt. Sanbe, Shimane-ken (Nishida 1978); spores dispersing in late autumn to

early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Ctenidium capillifolium (Mitt.) Broth.: Spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).

Ctenidium hastile (Mitt.) Lindb.: Spores collected at May 2 at Mt. Sanbe, Shimane-ken (Nishida 1978).

Herzogiella perrobusta (Broth. & Card.) Z. Iwats.: Spores dispersing in June to July at Hiruzen, Okayama-ken (Nishimura 1993).

Hypnum calcicolum Ando: Spores maturing in late spring or early summer (Ando 1958); spores maturing in spring to summer (Ando 1994).

Hypnum callichroum Brid. subsp. *japonicum* Ando: Spores maturing in spring to summer (Ando 1994).

Hypnum cupressiforme Hedw.: Spores maturing in Jan. to Mar. (Horikawa 1950); spores maturing in autumn to winter (Ando 1994).

Hypnum densirameum Ando: Spores maturing in late spring to summer (Ando 1957); spores maturing in spring to summer (Ando 1994).

Hypnum dieckii Renaud & Card.: Spores maturing in spring to summer (Ando 1995).

Hypnum erectiusculum Sull. & Lesq.: Spores maturing in early summer (Ando 1958); spores maturing in spring to summer (Ando 1995).

Hypnum fauriei Card.: Spores maturing in late spring to summer (Ando 1957); spores maturing in spring to summer (Ando 1995).

Hypnum fujiyamae (Broth.) Paris: Spores maturing in late autumn or early winter (Ando 1957); spores maturing in autumn to winter (Ando 1995).

Hypnum lindbergii Mitt.: Spores maturing in spring to summer (Ando 1995).

Hypnum oldhamii (Mitt.) A. Jaeger & Sauerb.: Spores maturing in spring (Ando 1958); spores collected at Feb. 1 at Matsue, Shimane-ken (Nishida 1978); fruiting seasons in Apr. to May, and in Aug. to Sept.

- in Okutama, Tokyo-to (Tsuji-mura 1974); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993); spores maturing in winter to spring (Ando 1995).
- Hypnum pallescens* (Hedw.) P. Beauv.: Spores maturing in June to July (Horikawa 1950); spores maturing in Sept. to Oct. (Horikawa 1950 as *H. reptile*); spores maturing in summer to autumn (Ando 1995).
- Hypnum plicatulum* (Lindb.) A. Jaeger & Sauerb.: Spores maturing in spring to summer (Ando 1995).
- Hypnum plumaeforme* Wilson: Spores maturing from late spring to summer (Ando 1958); spores collected at Aug. 26 at Mataue, Shimane-ken (Nishida 1978); spores dispersing in June to July at Hiruzen, Okayama-ken (Nishimura 1993); spores maturing in spring to summer (Ando 1995).
- Hypnum sakuraii* (Sakurai) Ando: Spores maturing in early spring (Ando 1958); spores maturing in summer to spring (Ando 1995).
- Hypnum subimponens* Lesq. subsp. *ulophyllum* (Müll. Hal.) Ando: Spores maturing in spring to summer (Ando 1995).
- Hypnum tristo-viride* (Broth.) Paris: Spores maturing in late autumn to early winter (Ando 1956); spores maturing in autumn to winter (Ando 1995).
- Pseudotaxiphyllum pohliaecarpum* (Sull. & Lesq.) Z. Iwats.: Spores collected at Mar. 29 at Oki, Shimane-ken (Nishida 1978); spores dispersing in June to July at Hiruzen, Okayama-ken (Nishimura 1993).
- Ptilium crista-castrensis* (Hedw.) De Not.: Spores maturing at Aug. (Horikawa 1972).
- Pylaisiella brotheri* (Besch.) Z. Iwats. & Nog.: Spores collected at Dec. 21 at Yatsuka, Shimane-ken (Nishida 1978); spores dispersing in late autumn to early spring at Hiruzen, Okayama-ken (Nishimura 1993).
- Pylaisiella nana* (Mitt.) Higuchi & Ando: Spores maturing in June to July (Higuchi 1999).
- Pylaisiella polyantha* (Hedw.) Grout: Spores maturing in Feb. to Mar. (Horikawa 1950 as *Pylaisia*).
- Taxiphyllum cuspidifolium* (Card.) Z. Iwats.: Spores collected at Mar. at Matsue, Shimane-ken (Nishida 1978).

Hylocomiaceae

- Hylocomium splendens* (Hedw.) Schimp.: Spores maturing in Apr. to May (Horikawa 1950 as *H. proliferum*); spores maturing in Apr. to May (Horikawa 1972).
- Loeskeobryum cavifolium* (Sande Lac.) M. Fleisch. ex Broth.: Spores maturing in Mar. to Apr. (Horikawa 1950 as *L. brevirostre*); spores collected at June 30 at Matsue, Shimane-ken (Nishida 1978 as *Hylocomium brevirostre* var. *cavifolium*).
- Neodolichomitra yunnannensis* (Besch.) T. J. Kop.: Sporophyte maturing in Nov. to Dec. at Nagano-ken (Nishimura & Higuchi 1999).
- Pleurozium schreberi* (Brid.) Mitt.: Spores maturing in Feb. to Mar. (Horikawa 1950); spores maturing in Feb. to Mar. (Horikawa 1972).
- Rhytidiadelphus japonicus* (Reimers) T. J. Kop.: Fruiting season in Sept. to Oct. in Okutama, Tokyo-to (Tsuji-mura 1974).
- Rhytidiadelphus triquetrus* (Hedw.) Warnst.: Spores maturing in Mar. to Apr. (Horikawa 1950); spores maturing in Mar. to Apr. (Horikawa 1972).

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