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## Keys for the Pollen of Ashiu, Central Japan

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**ABSTRACT** The keys for the pollen flora of the research forest of Kyoto University in Ashiu, Kyoto, Central Japan are provided with information on the flowering season. Of 123 families 793 species distributed in the area, 550 species of all the families are treated in the keys. The pollen morphology of 248 species are described in detail on the basis of the materials collected from Ashiu or near places.

**KEY WORDS** Pollen morphology/key/flowering season/Kyoto/Japan

### Introduction

Pollen analysis is not only the most important methods for reconstruction of past flora, vegetation and environment, but also an useful research tool for pollination biology and food utilization of animals visiting flowers (Kearns and Inouye, 1993). Among such animals visiting flowers, bees are the predominant pollinators. Bees collect pollen grains and nectar from flowers and pollinate the plants. This bee-plant relationship can be investigated by analyzing the pollen grains on the body of bees, in the nest, and in honey (O'Rourke and Buchmann, 1991). The use of pollen is surveyed by applying these methods, in honeybees (Syngce, 1947; Severson and Parry, 1981; Pearson and Braiden, 1990), bumblebees (Brian, 1951; Ranta and Lundberg, 1981), stingless bees (Roubik et al., 1986), and solitary bees (Cripps and Rust, 1989).

For quick identification of pollen grains to the lower taxonomic level, the keys for the pollen flora are indispensable. There are several keys available for restricted areas, e.g., Taiwan (Huang, 1972), North America and a part of Europe (Moore and Webb, 1978; Moore et al., 1991), northwestern Europe (Faegri and Iversen, 1989), Barro Colorado Island, Panama (Roubik and Moreno P., 1991), however, those for pollen flora of Japan have not yet been published except for an original approach by Ikuse (1956), although the pollen morphology of Japanese plants has been well studied (Ikuse, 1956; Shimakura, 1973; Nakamura, 1980a, b). It is hard to identify pollen grains to species level even though using the keys. There may be two ways to resolve such difficulties by reducing the number of plant species taken into consideration: 1) to treat the flora of a small area, and 2) to treat only the plants flowering when the pollen grains are obtained. An example for 1) is the keys to species level for the pollen flora of Barro Colorado Island, Panama (Roubik and Moreno P., 1991), and for 2) is Ikuse (1956) showed the information on flowering seasons of treated plants.

The research forest of Kyoto University in Ashiu (35°20' N, 135°45' E) is located about 30 km north of Kyoto city. The half of this area, about 1800 ha, is covered

by well-reserved primary mixed forests dominated by Siebold's beech (*Fagus crenata* Blume) and Japanese Red Cedar (*Cryptomeria japonica* (L. f.) D. Don). To reveal the insect-flower relationship in the primary beech forest in Japan, the flowering phenology and the seasonal pattern of insect visits have been surveyed (Kato et al., 1990; Nagamitsu, unpublished).

Here, we provide the keys and descriptions available for identification of the pollen grains mainly used by bees, of the plants only in Ashiu with information on flowering season. Of 123 families 793 species of seed plants reported from Ashiu (Watanabe, 1970), 550 species of all the families are treated in the keys. The morphological characters of pollen grains of 248 species, which is highly possible to be used by bees, are described on the basis of the materials collected from Ashiu or near places. No photomicrographs of pollen grains are presented in this work, because good ones for the pollen flora of Japan are available in the literature (Ikuse, 1956; Shimakura, 1973; Nakamura 1980a, b; Kurosawa, 1991). The results of pollen analysis using these keys will be soon published.

### Materials and Methods

The pollen grains of 248 species are obtained from the dried herbarium specimens collected from Ashiu or near places. The voucher specimens are preserved in the Herbarium (KYO), Faculty of Sciences, Kyoto University, and showed in parentheses in the description with the localities abbreviated as follows: A: Ashiu; F: Fukui Pref.; H: Hyogo Pref.; I: Ishikawa Pref.; K: Kyoto Pref. except Ashiu; S: Shiga Pref. The pollen samples were acetolysed following the standard method (Erdtman, 1960), and mounted in Silicon oil for light microscopy.

The morphological information of adding 302 species was obtained from the literature. The quoted references are indicated by the number in the description as follows: 1: Ikuse, 1956; 2: Huang, 1972; 3: Shimakura, 1973; 4: Nakamura, 1980a, b.

Totally 550 species of all the families recorded from Ashiu are treated in the keys. The species listed in Watanabe (1970) but not included in the present work are listed in Appendix.

Morphological characters of pollen grains and flowering season in the study site are described. The flowering season is defined in monthly scale on the basis of field observations in 1991 and some references (Kato et al., 1990; Satake et al., 1981, 1982a, 1982b, 1989a, 1989b).

The descriptions of morphological characters of pollen grains are arranged as follows: 1) pollen type defined by arrangement of apertures (see the key to pollen types); 2) thickness ( $\mu\text{m}$ ) of exine; 3) sculpture on sexine, and if conspicuous, the size of sculpting elements; 4) shape of aperture, and the size; 5) shape of pollen grain in equatorial and polar view; 6) range and average of diameter of grains in equatorial and polar axis ( $n \geq 20$ ), range and average of P/E ratio ( $n \geq 20$ ). The terminology used here follows those of Faegri and Iversen (1989) and Roubik and Moreno P.(1991). The definitions of the terms used for the six characters above are

listed in Glossary.

The keys are shown in a hierarchical arrangement. We provided a key to the 22 pollen types found in the study site at first, then showed a key to the families in each pollen type. The general descriptions of the families are arranged in alphabetical order irrespective of the systematic position. If the different kinds of pollen types are found in a family, general descriptions are divided to each kind of them. The key to the genera or species and morphological character of species are shown in at least observed materials and some additional species from the references.

### Key to the pollen types

- 1a. Grains arranged in groups
  - 2a. Grains agglutinated, forming a mass, showing asymmetrical arrangement .....Pollinia
  - 2b. Groups free, usually showing symmetrical arrangement
    - 3a. >8 grains per group .....Polyads
    - 3b. 4 grains per group .....Tetrads
- 1b. Grains single (Monads)
  - 4a. With air-sacks projecting from the body of grain .....Vesiculate
  - 4b. With a coarse, high network of crest or ridges separated by depressed areas .....Fenestrate
  - 4c. Without sacks and such ridges
    - 5a. Apertures absent .....Inaperturate
    - 5b. Apertures present
      - 6a. Apertures occurring singly
        - 7a. Apertures pore type (shorter axis larger than half of the longer axis) .....Monoporate
        - 7b. Apertures furrow type (shorter axis smaller than half of the longer axis) .....Monocolpate
      - 6b. Apertures multiple
        - 8a. Exclusively pori
          - 9a. Pori 2 .....Diporate
          - 9b. Pori 3 .....Triporate
          - 9c. Pori more than 3
            - 10a. Pori arranged equatorially .....Stephanoporate
            - 10b. Pori scattered over the surface .....Periporate
        - 8b. Exclusively colpi
          - 11a. Colpi 2 .....Dicolpate
          - 11b. Colpi 3 .....Tricolpate
          - 11c. Colpi more than 3
            - 12a. Colpi meridional, arranged equatorially .....Stephanocolpate
            - 12b. Colpi scattered over the grain surface .....Pericolpate
        - 8c. Both pori and colpi (colpori) present
          - 13a. Colpori 2 .....Dicolporate
          - 13b. Colpori 3 .....Tricolporate
          - 13c. Colpori more than 3
            - 14a. Colpori meridional, arranged equatorially .....Stephanocolporate
            - 14b. Colpori scattered over the surface .....Pericolporate
        - 8d. Both colpi and colpori present .....Heterocolpate
        - 8e. Colpi or colpori fused, forming branched furrow, ring or spiral .....Syncolpate

### Key to the Families

#### Pollinia

- 1a. 2 similar pollinia united by 2 caudicles to a central corpusculum .....Asclepiadaceae  
 1b. 1, 2, 4, 8 pollinia per pollinarium, if 2 pollinia present, 2 pollinia attached by 1 caudicle to glandula .....Orchidaceae

#### Polyads

- Polyads with 16 grains, circular, symmetrically arranged, 85-90 $\mu$ m .....Leguminosae (*Albizia*)

#### Tetrads

- 1a. Tetrads linear, flat or irregular, grains monoporate or diporate; sexine reticulate .....Typhaceae  
 1b. Tetrads tetrahedral  
   2a. Grains inaperturate, exine 0.5 $\mu$ m thick, occasionally broken in distal face, sexine scabrate .....Juncaceae  
   2b. Grains tricolporate, exine 1.0-2.5 $\mu$ m thick, sexine rugulate, verrucate, scabrate .....Ericaceae and Pyrolaceae (*Chimaphila* and *Pyrola*)

#### Vesiculate

- 1a. 2 globular sacks attached to the grain .....Pinaceae (*Abies* and *Pinus*)  
 1b. Continuous or interrupted ring-shaped rudimentary sack around the grain .....Pinaceae (*Tsuga*)

#### Fenestrate

- Sexine echinate; echinate ridges forming a network over the grain separating lacunae; grains 16-35 $\mu$ m .....Compositae (Lactuoidae)

#### Inaperturate

- 1a. Sexine echinate  
   2a. Grains <20 $\mu$ m .....Araceae (*Arisaema*)  
   2b. Grains >20 $\mu$ m, usually damaged by acetolysis .....Lauraceae  
 1b. Sexine striate; striae 1.0-2.0 $\mu$ m wide, grains elliptic, 90-130  $\times$  50-80 $\mu$ m, damaged by acetolysis .....Zingiberaceae  
 1c. Sexine psilate, scabrate, verrucate, gemmate  
   3a. Grains pear-shaped .....Cyperaceae  
   3b. Grains not pear-shaped  
     4a. Exine 2.0-3.0 $\mu$ m thick  
       5a. Verrucae 1.0 $\mu$ m wide .....Nymphaeaceae  
       5b. Verrucae 2.0-3.0 $\mu$ m wide, formed by some bacula .....Sciadopityaceae  
     4b. Exine 0.5-1.5 $\mu$ m thick  
       6a. Grains <17 $\mu$ m .....Liliaceae (*Smilax*) and Saururaceae  
       6b. Grains 17-30 $\mu$ m  
         7a. Grains slightly ridged in proximal face .....Cephalotaxaceae and Taxaceae  
         7b. Grains circular  
           8a. Sexine gemmate, scabrate .....Cupressaceae  
           8b. Sexine verrucate, verrucae dense, occasionally forming broken reticulum, damaged by acetolysis .....Salicaceae (*Populus*)  
           8c. Sexine verrucate, scabrate, verrucae scattered, never forming reticulum .....Liliaceae (*Smilax*)  
     6c. Grains >30 $\mu$ m .....Liliaceae (*Trillium*)

**Monoporate**

- 1a. Grains pear-shaped .....Cyperaceae  
 1b. Grains not so  
   2a. Pori  $>20\ \mu\text{m}$  wide, more than half of the grain; sexine verrucate  
     3a. Pori with operculum, exine  $2.0\ \mu\text{m}$  thick; verrucae  $1.0\ \mu\text{m}$  wide  
        .....Nymphaeaceae  
     3b. Pori without operculum, exine  $2.5\text{-}3.0\ \mu\text{m}$  thick; verrucae  $2.0\text{-}3.0\ \mu\text{m}$  wide  
        .....Sciadopityaceae  
   2b. Pori  $<5.0\ \mu\text{m}$  wide  
     4a. Pori prominent,  $3.0\text{-}6.0\ \mu\text{m}$  high .....Taxodiaceae  
     4b. Pori not prominent  
       4a. Anulus distinct ..... Gramineae  
       4b. Anulus absent  
         5a. Sexine scabrate, gemmate .....Cupressaceae  
         5b. Sexine reticulate, lumina  $0.5\text{-}1.5\ \mu\text{m}$  wide .....Sparganiaceae

**Diporate**

- 1a. Grains compressed oval in equatorial view, elliptic in polar view, prolate; exine thickest at equator .....Acanthaceae (*Justicia*)  
 1b. Grains circular, spherical  
   2a. Pori circular  $1.0\ \mu\text{m}$  wide, grains  $7\text{-}16\ \mu\text{m}$  .....Urticaceae  
   2b. Pori circular  $2.0\text{-}3.0\ \mu\text{m}$  wide, grains  $11\text{-}29\ \mu\text{m}$  .....Moraceae

**Triporate**

- 1a. Vestibulum  $5.0\text{-}12\ \mu\text{m}$  high .....Onagraceae  
 1b. Vestibulum absent  
   2a. Sexine echinate  
     3a. Exine  $4.0\text{-}5.0\ \mu\text{m}$  thick, annuli thinned .....Verbenaceae (*Caryopteris*)  
     3b. Exine  $1.0\text{-}2.0\ \mu\text{m}$  thick  
       4a. Annuli dropped inside, echini  $<1.0\ \mu\text{m}$  high  
        .....Campanulaceae  
       4b. Annuli never dropped inside,  $>2.0\ \mu\text{m}$  high echini present  
        .....Caprifoliaceae (*Weigela*) and Tiliaceae (*Corchoropsis*)  
   2b. Sexine scabrate, verrucate, rugulate  
     6a. Pori lolongate  $3.5\text{-}6.0\ \mu\text{m}$  wide, grains oblate .....Pyrolaceae (*Monotropastrum*)  
     6b. Pori circular  $2.0\text{-}3.0\ \mu\text{m}$  wide, grains spherical .....Moraceae  
     6c. Pori circular  $1.5\text{-}2.0\ \mu\text{m}$  wide, grains oblate .....Betulaceae  
     6d. Pori circular  $1.0\ \mu\text{m}$  wide, grains spherical .....Urticaceae

**Stephanoporate**

- 1a. Sexine echinate .....Campanulaceae  
 1b. Sexine rugulate  
   2a. Pori lolongate  $2.0\text{-}3.5\ \mu\text{m}$  long .....Ulmaceae (*Ulmus* and *Zelkova*)  
   2b. Pori circular  $1.5\text{-}2.0\ \mu\text{m}$  wide .....Betulaceae  
 1c. Sexine scabrate, verrucate  
   3a. Pori 5-8 .....Juglandaceae (*Pterocarya*)  
   3b. Pori 4  
     4a. Equatorial axis  $<20\ \mu\text{m}$ , annuli absent .....Liliaceae (*Chionographis*)  
     4b. Equatorial axis  $>20\ \mu\text{m}$ , annuli present .....Betulaceae

**Periporate**

- 1a. Grains irregular, usually pear-shaped, pori indistinct .....Cyperaceae  
 1b. Grains oblate  
   2a. Triangular or lobate in polar view, each lobe with 2 pori arranged meridionally

- .....Leguminosae (*Dumasia*)
- 2b. Pentagonal or hexagonal in polar view, 2 pori in distal face and 5-7 pori on equator .....Juglandaceae (*Juglans*)
- 1c. Grains spherical.
- 3a. Sexine echinate .....Alismataceae (*Sagittaria*)
- 3b. Sexine reticulate, lumina 3.0-6.0  $\mu\text{m}$  wide  
.....Buxaceae and Polygonaceae (*Persicaria*)
- 3c. Sexine scabrate, verrucate, or baculate
- 4a. Annuli absent
- 5a. Grains  $>50\mu\text{m}$ , exine 5.5  $\mu\text{m}$  thick, pori dropped inside  
.....Convolvulaceae (*Calystegia*)
- 5b. Grains  $<40\mu\text{m}$
- 6a. Exine 3.5-4.0  $\mu\text{m}$  thick .....Thymelaeaceae
- 6b. Exine 1.5-2.0  $\mu\text{m}$  thick
- 7a. Sexine verrucate; verrucae 1.0-4.0  $\mu\text{m}$  wide, pori  $<10$ , 1.0-3.0  $\mu\text{m}$  wide  
.....Plantaginaceae (*Plantago*)
- 7b. Sexine scabrate, pori  $>10$ , 3.5-6.0  $\mu\text{m}$  wide
- 8a. Grains polyhedral .....Alismataceae (*Alisma*)
- 8b. Grains globose .....Ranunculaceae (*Coptis* and *Thalictrum*)
- 4b. Annuli present
- 9a. Pori  $<5$  .....Moraceae
- 9b. Pori 6-15
- 10a. Grains 15-22  $\mu\text{m}$ , exine 1.5  $\mu\text{m}$  thick .....Papaveraceae (*Macleaya*)
- 10b. Grains 21-59  $\mu\text{m}$ , exine 2.5-3.0  $\mu\text{m}$  thick .....Caryophyllaceae
- 9c. Pori 15-30
- 11a. Grains  $<20\mu\text{m}$  .....Caryophyllaceae
- 11b. Grains  $>30\mu\text{m}$  .....Apocynaceae
- 9d. Pori usually 30-50 .....Chenopodiaceae and Amaranthaceae

### Monocolpate

- 1a. Sexine echinate, damaged by acetolysis .....Commelinaceae
- 1b. Sexine striate .....Dioscoreaceae
- 1c. Sexine rugulate
- 2a. Exine 1.0  $\mu\text{m}$  thick, equatorial axis  $<35\mu\text{m}$   
.....Magnoliaceae (*Magnolia salicifolia*)
- 2b. Exine 1.5-2.0  $\mu\text{m}$  thick, equatorial axis  $>35\mu\text{m}$  .....Pontederiaceae
- 1d. Sexine reticulate
- 3a. Equatorial axis  $<25\mu\text{m}$  .....Dioscoreaceae and Liliaceae
- 3b. Equatorial axis 25-65  $\mu\text{m}$  .....Liliaceae
- 3c. Equatorial axis  $>65\mu\text{m}$  .....Amaryllidaceae, Iridaceae and Liliaceae
- 1e. Sexine scabrate, verrucate, gemmate
- 4a. Equatorial axis  $<18\mu\text{m}$  .....Araceae (*Acorus*) and Saururaceae
- 4b. Equatorial axis 18-30  $\mu\text{m}$  .....Liliaceae
- 4c. Equatorial axis 30-55  $\mu\text{m}$  .....Comelinaceae, Liliaceae and Pontederiaceae
- 4d. Equatorial axis  $>55\mu\text{m}$
- 5a. Colpus narrow and prominent .....Magnoliaceae (*Magnolia obovata*)
- 5b. Colpus wide and flat .....Liliaceae

### Tricolpate

- 1a. Sexine echinate
- 2a. Echini 1.5-2.0  $\mu\text{m}$  high, scattered on shield-shaped verrucae .....Valerianaceae
- 2b. Echini not on shield-shaped verrucae
- 3a. Exine  $>3.0\mu\text{m}$  thick, colpi with echinate operculum, or ragged, dropping inside  
.....Dipsacaceae
- 3b. Exine  $<3.0\mu\text{m}$  thick, without operculum

- 4a. Colpi  $<25\mu\text{m}$  long, margo thickened ....Caprifoliaceae (*Abelia* and *Lonicera*)  
 4b. Colpi  $>25\mu\text{m}$  long, ragged, margo thinned .....Verbenaceae (*Clerodendrum*)  
 1b. Sexine clavate, clavae connected on top forming reticulum .....Geraniaceae  
 1c. Sexine striate .....Aceraceae  
 1d. Sexine reticulate  
 5a. Lumina  $4.0\text{-}6.0\mu\text{m}$  wide, muri dupli-triplicolumellate  
 .....Polygonaceae (*Persicaria*)  
 5b. Lumina  $0.5\text{-}2.5\mu\text{m}$  wide, muri simplicolumellate  
 6a. Colpi short, less than half of the polar axis .....Saxifragaceae (*Deinathe*)  
 6b. Colpi long, as long as the polar axis  
 7a. Polar axis  $<20\mu\text{m}$   
 8a.  $>1.0\mu\text{m}$  wide lumina present  
 9a. Grains prolate .....Cruciferae and Salicaceae (*Salix*)  
 9b. Grains spherical .....Cruciferae, Labiatae and Trochodendraceae  
 8b. Lumina  $<1.0\mu\text{m}$  wide  
 .....Hamamelidaceae, Lardizabalaceae and Menispermaceae  
 7b. Polar axis  $>20\mu\text{m}$   
 10a. Grains prolate  
 11a. Colpi rounded at ends, wide and sunken .....Cercidiphyllaceae  
 11b. Colpi acute at ends, narrow and flat  
 12a. Lumina  $<1.0\mu\text{m}$  wide .....Aceraceae, Berberidaceae (*Caulo-*  
*phyllum* and *Epimedium*) and  
 Saxifragaceae (*Saxifraga*)  
 12b.  $>1.0\mu\text{m}$  wide lumina present .....Berberidaceae (*Caulo-*  
*phyllum* and  
*Epimedium*), Cruciferae, Salicaceae  
 (*Salix*) and Trochodendraceae  
 10b. Grains spherical-oblate  
 13a. Equatorial axis  $<20\mu\text{m}$   
 14a.  $>1.0$  wide lumina present .....Labiatae and Trochodendraceae  
 14b. Lumina  $<1.0\mu\text{m}$  wide .....Menispermaceae  
 13b. Equatorial axis  $20\text{-}30\mu\text{m}$   
 15a. Colpi rounded at ends, wide and sunken .....Cercidiphyllaceae  
 15b. Colpi acute at ends, narrow and flat  
 16a.  $>1.0\mu\text{m}$  wide lumina present .....Labiatae  
 16b. Lumina  $<1.0\mu\text{m}$  wide .....Verbenaceae (*Callicarpa*) and Paeoniaceae  
 13c. Equatorial axis  $>30\mu\text{m}$  .....Oxalidaceae and Rubiaceae (*Paederia*)  
 1e. Sexine verrucate, gemmate, rugulate  
 17a. Colpi  $3.5\mu\text{m}$  long, colpi acute at ends .....Haloragaceae  
 17b. Colpi  $>5.0\mu\text{m}$  long  
 18a. Grains  $<30\mu\text{m}$  .....Phrymaceae  
 18b. Grains  $>35\mu\text{m}$   
 19a. Verrucae  $0.5\text{-}1.0\mu\text{m}$  wide .....Solanaceae (*Scopolia*)  
 19b. Gemmae  $1.5\text{-}2.0\mu\text{m}$  wide .....Aristolochiaceae  
 1f. Sexine baculate  
 20a. Tectum reticulate  
 21a. Equatorial axis  $>25\mu\text{m}$  .....Oxalidaceae  
 21b. Equatorial axis  $<25\mu\text{m}$  .....Saxifragaceae (*Saxifraga*)  
 20b. Tectum psilate, scabrate  
 22a. Polar axis  $>32\mu\text{m}$  .....Convolvulaceae (*Cuscuta*) and Ranunculaceae  
 22b. Polar axis  $<32\mu\text{m}$  .....Phytolaccaceae and Scrophulariaceae  
 1g. Sexine scabrate  
 23a. Polar axis  $>30\mu\text{m}$  .....Labiatae (*Teucrium*)  
 23b. Polar axis  $<30\mu\text{m}$  .....Orobanchaceae

## Stephanocolpate

- 1a. Grains distinctly oblate



- 2a. Sexine echinate; polar axis 46-60  $\mu\text{m}$  .....Caprifoliaceae (*Abelia* and *Lonicera*)  
 2b. Sexine reticulate; polar axis 10-17  $\mu\text{m}$  .....Balsaminaceae  
 2c. Sexine verrucate, rugulate; polar axis 17-23  $\mu\text{m}$  .....Haloragaceae
- 1b. Grains prolate-spherical
- 3a. Grains 4-5 colpate
- 4a. Sexine echinate .....Caprifoliaceae (*Abelia* and *Lonicera*)  
 4b. Sexine reticulate
- 5a. Grains 4 colpate, prolate .....Saxifragaceae (*Saxifraga*)  
 5b. Grains 5 colpate, spherical .....Chloranthaceae
- 4c. Sexine baculate, bacula forming tectum on top
- 6a. Polar axis  $<30 \mu\text{m}$  .....Ranunculaceae and Saxifragaceae (*Saxifraga*)  
 6b. Polar axis  $>30 \mu\text{m}$  .....Convolvulaceae (*Cuscuta*) and Ranunculaceae
- 4d. Sexine verrucate, rugulate
- 7a. Grains  $<30 \mu\text{m}$  .....Haloragaceae  
 7b. Grains  $>30 \mu\text{m}$  .....Solanaceae (*Scopolia*)
- 3b. Grains 6 colpate
- 8a. Colpi narrow, sunken, sharp .....Rubiaceae (*Galium* and *Rubia*)  
 8b. Colpi wide, flat, sharp or ragged
- 9a. Sexine reticulate .....Chloranthaceae and Labiatae  
 9b. Sexine baculate, bacula forming tectum on top, tectum scabrate, psilate  
 .....Ranunculaceae
- 3c. Colpi 7-10
- 10a. Grains 14-26  $\mu\text{m}$ , colpi sunken, sharp .....Rubiaceae (*Galium* and *Rubia*)  
 10b. Grains 27-35  $\mu\text{m}$ , colpi flat, ragged .....Campanulaceae (*Codonopsis*)

#### Pericolpate

- 1a. Grains 4-5 colpate, colpi irregularly distributed .....Aristolochiaceae  
 1b. 6 colpate, colpi regularly distributed
- 2a. Sexine baculate, bacula forming tectum on top, colpi narrow, acute at ends  
 .....Ranunculaceae
- 2b. Sexine verrucate, rugulate, colpi wide, rounded at ends  
 .....Papaveraceae (*Corydalis*)
- 2c. Sexine reticulate, colpi wide, rounded at ends .....Eupteleaceae
- 1c.  $>10$  colpate
- 3a. Sexine echinate, grains  $>40 \mu\text{m}$  .....Portulacaceae  
 3b. Sexine reticulate, grains  $<40 \mu\text{m}$  .....Polygonaceae (*Antenoron*)

#### Dicolpate

- Exine thickest in equator, compressed oval in equatorial view, elliptic in polar view,  
 prolate .....Acanthaceae (*Justicia*)

#### Tricolpate

- 1a. Sexine echinate .....Compositae (Asteroideae)  
 1b. Sexine clavate
- 2a. Prolate, equatorial axis 18-33  $\mu\text{m}$ , pori lalongate, apocolpium 7.0-13  $\mu\text{m}$  wide,  
 clavae 1.5-2.0  $\mu\text{m}$  high .....Aquifoliaceae
- 2b. Spherical, equatorial axis 32-44  $\mu\text{m}$ , pori circular, apocolpium 18  $\mu\text{m}$  wide, clavae  
 2.5-3.0  $\mu\text{m}$  high .....Cornaceae (*Aucuba*)
- 1c. Sexine striate, rugulate, reticulate, baculate, verrucate, gemmate, scabrate, or psilate
- 3a. Grains distinctly oblate, P/E ratio  $<0.80$
- 4a. Grains circular, semiangular in polar view
- 5a. Sexine reticulate .....Tiliaceae (*Tilia*)  
 5b. Sexine distinctly rugulate, vallae 1.5-3.0  $\mu\text{m}$  wide .....Alangiaceae
- 4b. Grains angular, lobate in polar view. ....Symplacaceae
- 3b. Grains prolate-spherical, P/E ratio  $>0.80$

- 6a. Grains angular in polar view with distinct vestibulum or thick margo
- 7a. Colpi short, with vestibulum .....Elaeagnaceae
- 7b. Colpi long, without vestibulum
- 8a. Sexine reticulate
- 9a. Pori circular  $1.8\mu\text{m}$  wide .....Vitaceae (*Vitis*)
- 9b. Pori lalongate
- 10a. Grains compressed rhomboidal in equatorial view; exine  $1.0\text{--}1.5\mu\text{m}$  thick  
.....Rhamnaceae
- 10b. Grains depressed rhomboidal in equatorial view; exine  $1.7\text{--}2.7\mu\text{m}$  thick  
.....Araliaceae
- 8b. Sexine baculate, bacula forming tectum on top, tectum scabrate  
.....Umbelliferae
- 8c. Sexine verrucate, rugulate, scabrate
- 11a. Polar axis  $>30\mu\text{m}$
- 12a. Grains prolate .....Cornaceae (*Swida*)
- 12b. Grains spherical .....Styracaceae
- 11b. Polar axis  $<30\mu\text{m}$
- 13a. Equatorial axis  $>25\mu\text{m}$  .....Styracaceae
- 13b. Equatorial axis  $<25\mu\text{m}$
- 14a. Grains compressed rhomboidal in equatorial view .....Rhamnaceae
- 14b. Grains oval or equatorial acute oval in equatorial view  
.....Cornaceae (*Benthamidia*)
- 6b. Grains circular, semiangular in polar view
- 15a. Grains compressed, constricted oval in equatorial view and prolate
- 16a. Pori circular, lolongate
- 17a. Colpi echinate .....Hippocastanaceae
- 17b. Colpi not echinate .....Leguminosae
- 16b. Pori lalongate
- 18a. Sexine reticulate, striate .....Anacardiaceae
- 18b. Sexine baculate, bacula forming tectum on top, tectum scabrate  
.....Umbelliferae
- 18c. Sexine psilate, pori H-shaped .....Primulaceae (*Lysimachia*)
- 15b. Grains not compressed, constricted oval in equatorial view
- 19a. Sexine striate
- 20a. Colpi equatorial prominent
- 21a. Pori lolongate .....Santalaceae (*Buckleya*)
- 21b. Pori lalongate .....Rosaceae
- 20b. Colpi not equatorial prominent
- 22a. Pori lalongate and apiculate at both lateral ends .....Gentianaceae
- 22b. Pori not so
- 23a. Margo thickened .....Cucurbitaceae (*Gynostemma*)
- 23b. Margo not thickened .....Aceraceae
- 19b. Sexine rugulate
- 24a. Equatorial axis  $>50\mu\text{m}$ , vallae  $1.5\text{--}3.0\mu\text{m}$  wide .....Alangiaceae
- 24b. Equatorial axis  $<50\mu\text{m}$ , vallae  $<1.5\mu\text{m}$  wide
- 25a. Pori lolongate and elliptic .....Leguminosae
- 25b. Pori lalongate, circular and sometimes ragged or torn
- 26a. Equatorial axis  $>20\mu\text{m}$  .....Rosaceae and Styracaceae
- 26b. Equatorial axis  $<20\mu\text{m}$  .....Guttiferae and Rosaceae
- 19c. Sexine reticulate
- 27a. Pori lolongate .....Leguminosae and Theaceae
- 27b. Pori circular
- 28a. Colpi prominent at equator
- 29a. Margo thinned
- 30a. Grains prolate .....Guttiferae
- 30b. Grains spherical .....Celastraceae (*Celastrus*)

- 29b. Margo thickened .....Leguminosae and Theaceae
- 28b. Colpi not prominent at equator
- 31a. Exine  $>2.0\mu\text{m}$  thick
- 32a.  $>1.0\mu\text{m}$  wide lumina present, margo thinned .....Celastraceae
- 32b. Lumina indistinct .....Aceraceae
- 31b. Exine  $<2.0\mu\text{m}$  thick .....Saxifragaceae
- 27c. Pori lalongate
- 33a. Equatorial axis  $>40\mu\text{m}$  .....Cucurbitaceae (*Melothria*)
- 33b. Equatorial axis  $<40\mu\text{m}$
- 34a. Pori slit-like,  $<0.5\mu\text{m}$  wide .....Vitaceae (*Ampelopsis*)
- 34b. Pori apiculate at both lateral ends
- 35a. Lumina indistinct,  $<1.0\mu\text{m}$  wide .....Gentianaceae
- 35b.  $>1.0\mu\text{m}$  wide lumina present .....Vitaceae (*Parthenocissus*)
- 34c. Pori oval, or constricted, compressed oval
- 36a.  $>1.0\mu\text{m}$  wide lumina present
- 37a. Muri distinctly visible .....Oleaceae
- 37b. Muri indistinct
- 38a. Equatorial axis  $>25\mu\text{m}$
- 39a. Grains semiangular in polar view ....Araliaceae and Rutaceae
- 39b. Grains circular in polar view  
.....Rubiaceae (*Mitchella*) and Rutaceae
- 38b. Equatorial axis  $<25\mu\text{m}$
- 40a. Polar axis  $>20\mu\text{m}$
- 41a. Margo thinned ....Caprifoliaceae (*Viburnum*) and Rutaceae
- 41b. Margo thickened
- 42a. Grains semiangular in polar view  
.....Araliaceae and Rutaceae
- 42b. Grains circular in polar view.....Rutaceae and Sabiaceae
- 40b. Polar axis  $<20\mu\text{m}$
- 43a. Colpi straight at equator .....Flacourtiaceae (*Idesia*)
- 43b. Colpi convex at equator
- 44a. Margo thinned .....Caprifoliaceae (*Viburnum*)
- 44b. Margo thickened .....Sabiaceae
- 36b. Lumina  $<0.5-1.0\mu\text{m}$  wide
- 45a. Polar axis  $<15\mu\text{m}$  ....Guttiferae, Myrsinaceae and Saxifragaceae
- 45b. Polar axis  $15-20\mu\text{m}$
- 46a. Margo thinned  
.....Caprifoliaceae (*Sambucus*) and Scrophulariaceae
- 46b. Margo not thinned .....Diapensiaceae and Saxifragaceae
- 45c. Polar axis  $>20\mu\text{m}$
- 47a. Margo thickened .....Anacardiaceae
- 47b. Margo thinned .....Scrophulariaceae and Euphorbiaceae
- 47c. Margo neither thickened nor thinned  
.....Aceraceae, Diapensiaceae, Paeoniaceae and Saxifragaceae
- 19d. Sexine baculate
- 48a. Bacula scattered,  $2.0-4.0\mu\text{m}$  high, colpi wide, rounded at ends  
.....Loranthaceae
- 48b. Bacula forming tectum on top, colpi acute at ends, narrow
- 49a. Pori zonorate .....Polygonaceae (*Reynoutria*)
- 49b. Pori lalongate
- 50a. Margo thickened .....Polygonaceae (*Bistorta* and *Polygonum*)
- 50b. Margo thinned .....Euphorbiaceae and Phrymaceae
- 50c. Margo neither thickened nor thinned .....Polygonaceae (*Rumex*)
- 19e. Sexine verrucate, gemmate
- 51a. Pori zonorate .....Euphorbiaceae (*Mallotus*)
- 51b. Pori lolongate .....Daphniphyllaceae

- 51c. Pori circular, indistinct
- 52a. Polar axis  $<19\mu\text{m}$
- 53a. Pori  $5.0\mu\text{m}$  wide .....Leguminosae (*Lotus*)
- 53b. Pori  $3.0\mu\text{m}$  wide .....Compositae (*Artemisia*)
- 52b. Polar axis  $>19\mu\text{m}$
- 54a. Prolate .....Leguminosae
- 54b. Spherical .....Fagaceae (*Quercus* and *Fagus*)
- 51d. Pori lalongate
- 55a. Pori  $>5.0\mu\text{m}$  long
- 56a. Exine  $>1.5\mu\text{m}$  thick .....Rosaceae and Styracaceae
- 56b. Exine  $<1.5\mu\text{m}$  thick .....Icacinaceae and Rosaceae
- 55b. Pori  $<5.0\mu\text{m}$  long .....Cornaceae (*Benthamidia*) and Rosaceae
- 19f. Sexine scabrate, psilate
- 57a. Colpi short, less than half of the grains
- 58a. Polar axis  $<20\mu\text{m}$  .....Euphorbiaceae (*Acalypha*)
- 58b. Polar axis  $>30\mu\text{m}$  .....Leguminosae (*Apios*)
- 57b. Colpi long, more than half of the grains
- 59a. Pori zonorate .....Euphorbiaceae (*Mallotus*)
- 59b. Pori lolongate
- 60a. Polar axis  $<10\mu\text{m}$  .....Gesneriaceae
- 60b. Polar axis  $>10\mu\text{m}$  .....Leguminosae
- 59c. Pori circular
- 61a. Polar axis  $>20\mu\text{m}$  .....Lythraceae (*Rotala*) and Violaceae
- 61b. Polar axis  $<20\mu\text{m}$  .....Crassulaceae and Violaceae
- 59d. Pori lalongate, indistinct, ragged or torn
- 62a. Colpi prominent or constricted at equator
- 63a. Pori meridionally constricted, grains hexagonal in polar view  
.....Stachyuraceae
- 63b. Pori not so, grains semiangular or circular in polar view
- 64a. Polar axis  $<15\mu\text{m}$   
.....Theaceae (*Eurya*), Solanaceae and Rosaceae
- 64b. Polar axis  $15-20\mu\text{m}$
- 65a. Sexine scabrate  
.....Actinidiaceae, Rosaceae, Solanaceae and Violaceae
- 65b. Sexine psilate .....Clethraceae and Violaceae
- 64c. Polar axis  $>20\mu\text{m}$
- 66a. Equatorial axis  $<20\mu\text{m}$
- 67a. Semiangular in polar view .....Rosaceae and Solanaceae
- 67b. Circular in polar view  
..... Actinidiaceae, Cornaceae (*Helwingia*),  
Rosaceae and Violaceae
- 66b. Equatorial axis  $>20\mu\text{m}$
- 68a. Semiangular in polar view  
..... Cornaceae (*Benthamidia*), Rosaceae,  
Solanaceae and Styracaceae
- 68b. Circular in polar view  
..... Cornaceae (*Helwingia*), Rosaceae,  
Violaceae and Icacinaceae
- 62b. Colpi neither prominent nor constricted at equator
- 69a. Polar axis  $<15\mu\text{m}$  .....Fagaceae (*Castanea*)
- 69b. Polar axis  $15-30\mu\text{m}$
- 70a. Colpi rounded at ends .....Campanulaceae (*Lobelia*)
- 70b. Colpi acute at ends ..... Cornaceae (*Helwingia*), Ericaceae  
(*Enkianthus*) and Violaceae
- 69c. Polar axis  $>30\mu\text{m}$  .....Ebenaceae and Violaceae

**Stephanocolporate**

- 1a. Colpi rounded at ends, irregular, pori not in the center of colpus, sometimes 2 pori share the same colpus, pori circular 2.0-3.5  $\mu\text{m}$  wide .....Saxifragaceae (*Ribes*)
- 1b. Colpi acute at ends, always 1 pore in the center of colpus
- 2a. >10 colporate
- 3a. Prolate .....Polygalaceae
- 3b. Spherical-oblate .....Lentibulariaceae
- 2b. 4-8 colporate
- 4a. Sexine rugulate, grains 52-90  $\mu\text{m}$  .....Alangiaceae
- 4b. Sexine striate
- 5a. Pori lalongate .....Rutaceae (*Skimmia*)
- 5b. Pori circular .....Euphorbiaceae (*Phyllanthus*)
- 4c. Sexine reticulate
- 6a. Colpi wide, margo thinned .....Celastraceae
- 6b. Colpi narrow, margo not thinned
- 7a. Colpi shorter, 10  $\mu\text{m}$  long, pori lalongate .....Rubiaceae (*Hedyotis*)
- 7b. Colpi longer, pori circular .....Euphorbiaceae (*Phyllanthus*)
- 4c. Sexine scabrate, colpi short, equatorial prominent.....Euphorbiaceae (*Acalypha*)

**Pericolporate**

- Exine 1.5-2.0  $\mu\text{m}$  thick, colpi acute at ends, costae, grains 15-32  $\mu\text{m}$   
.....Polygonaceae (*Rumex*)

**Syncolpate**

- 1a. Grains heteropolar, pyramid in equatorial view, triangular in polar view, 3 colpi joining at proximal pole .....Santalaceae (*Thesium*)
- 1b. Grains isopolar, oval in equatorial view, circular in polar view
- 2a. Pori present, pori circular 3.0  $\mu\text{m}$  wide, drooped, costae .....Lythraceae (*Rotala*)
- 2b. Pori absent
- 3a. 6 colpi meridional, 3 colpi of 6 joining at polar .....Schisandraceae
- 3b. Colpi forming parallel spirals around the grain
- 4a. 3-4 spirals, sexine echinate, grains 20-26  $\mu\text{m}$  .....Eriocaulaceae
- 4b. 6-8 spirals, sexine psilate, grains 14-21  $\mu\text{m}$  .....Araceae (*Pinellia*)
- 3c. 1-3 colpi forming a ring around the grain
- 5a. Sexine verrucate, a ring around the distal polar seems large pore with operculum .....Nymphaeaceae
- 5b. Sexine psilate, 2 colpi jointing at the poles forming a ring, sometimes broken along the colpi.....Scrophulariaceae (*Pedicularis*)
- 5c. Sexine reticulate, 2-3 colpi jointing at the poles .....Berberidaceae (*Berberis*)

**Heterocolpate**

- 1a. Polar axis 8-12  $\mu\text{m}$ , sexine psilate; grains constricted, compressed oval in equatorial view, prolate .....Boraginaceae
- 1b. Polar axis 18-31  $\mu\text{m}$ , sexine striate, oval in equatorial view, spherical  
.....Lythraceae (*Lythrum*)
- 1c. Polar axis 57-63  $\mu\text{m}$ , sexine reticulate, oval in equatorial view, prolate  
.....Acanthaceae (*Peristrophe*)

## Key to the genera and species, and descriptions

## Acanthaceae (2 genera, 2 species)

*Justicia* (1 species)

*Justicia procumbens* L. var. *leucantha* Honda 'Kitsunenomago'  
Diporate (dicolporate) monad; exine 3.0-5.0  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5-1.5  $\mu\text{m}$  wide; colpi 12  $\mu\text{m}$  wide, 2 rows of verrucae arranged meridionally; pori lalongate 3.0  $\times$  6.0  $\mu\text{m}$  wide; compressed oval in equatorial view, elliptic in polar view; polar axis 23-25-28  $\mu\text{m}$ , longer equatorial axis 15-17-20  $\mu\text{m}$ , P/E ratio 1.33-1.46-1.61; flowering in Aug-Oct. (*G. Murata 12161*; Loc. H)

*Peristrophe* (1 species)

*Peristrophe japonica* (Thunb.) Bremek. 'Hagurosou'  
Heterocolpate (with 3 colpi and 6 furrows) monad; exine 7.5  $\mu\text{m}$  thick; sexine reticulate, lumina 3.0-6.0  $\mu\text{m}$  wide; oval in equatorial view, circular in polar view; polar axis 57-63  $\mu\text{m}$ , equatorial axis 45-56  $\mu\text{m}$ , prolate; flowering in Sep-Oct. (ref. 4)

## Aceraceae (1 genus, 11 species)

Tricolpate, tricolporate monad; exine 1.2-2.7  $\mu\text{m}$  thick; sexine striate, scabrate, reticulate; colpi acute at ends, or rectangular, apocolpium 2.5-7.0  $\mu\text{m}$  wide; if pori present, pori lalongate, circular, lalongate 3.0-7.0  $\mu\text{m}$  long; oval in equatorial view, circular in polar view; polar axis 17-35  $\mu\text{m}$ , equatorial axis 16-29  $\mu\text{m}$ , spherical-prolate; flowering in Apr-Aug.

ref. *Acer cissifolium* (Sieb. et Zucc.) K. Koch, 'Mitsudekaede' (Apr-May): 1.

## 1a. Tricolpate

2a. Sexine striate, apocolpium 3.0-5.0  $\mu\text{m}$  wide

3a. Sexine  $>1.6 \mu\text{m}$  thick ..... *Acer crataegifolium*, *A. rufinerve*

3b. Sexine  $<1.6 \mu\text{m}$  thick ..... *Acer mono*

2b. Sexine scabrate, apocolpium 5.0-7.0  $\mu\text{m}$  wide ..... *Acer carpiniifolium*

## 1b. Ticolporate, sexine striate

## 4a. Pori circular, lalongate

5a. Pori distinct  $>4 \mu\text{m}$  wide

6a. Exine  $>2.4 \mu\text{m}$  thick ..... *Acer palmatum*, *A. sieboldianum*

6b. Exine  $<2.4 \mu\text{m}$  thick

7a. Costae  $>2.0 \mu\text{m}$  thick, prolate ..... *Acer japonicum*

7b. Costae  $<2.0 \mu\text{m}$  thick, spherical ..... *Acer amoenum*

5b. Pori indistinct  $<4 \mu\text{m}$  wide ..... *Acer crataegifolium*

## 4b. Pori lalongate

8a. Polar axis  $>28 \mu\text{m}$ , pori distinct, costae  $>2.0 \mu\text{m}$  thick ..... *Acer japonicum*

8b. Polar axis  $<28 \mu\text{m}$ , pori indistinct, costae  $<2.0 \mu\text{m}$  thick

..... *Acer rufinerve*, *A. nipponicum*

*Acer amoenum* Carr. var. *amoenum*

'Oomomiji'

Tricolporate monad; exine 1.9  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, apocolpium 2.5-4.0  $\mu\text{m}$  wide; pori circular, lalongate 4.0  $\times$  5.0  $\mu\text{m}$ , costae 1.5  $\mu\text{m}$

thick; polar axis 23-25-28  $\mu\text{m}$ , equatorial axis 20-24-28  $\mu\text{m}$ , P/E ratio 0.95-1.08-1.19; flowering in Apr-May. (S. *Okamoto s.n.*; Loc. A)

*A. amoenum* Carr. var. *matsumurae* (Koidz.) Ogata 'Yamamomiji'  
Tricolporate monad; exine 2.2  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, apocolpium 3.0-4.0  $\mu\text{m}$  wide, pori lalongate 4.0  $\times$  5.0-7.0  $\mu\text{m}$ , costae 1.5  $\mu\text{m}$  thick; polar axis 23-26-29  $\mu\text{m}$ , equatorial axis 17-24-27  $\mu\text{m}$ , P/E ratio 0.95-1.10-1.36; flowering in Apr-May. (G. *Murata and N. Fukuoka 319*; Loc. S)

*A. carpinifolium* Sieb. et Zucc. 'Chidorinoki'  
Tricolpate monad; exine 1.6  $\mu\text{m}$  thick; sexine scabrate; colpi acute at ends, apocolpium 5.0-7.0  $\mu\text{m}$  wide; polar axis 22-25-28  $\mu\text{m}$ , equatorial axis 22-24-27  $\mu\text{m}$ , P/E ratio 0.94-1.02-1.12; flowering in May. (S. *Okamoto 15105*; Loc. A)

*A. crataegifolium* Sieb. et Zucc. 'Urikaede'  
Tricolporate, tricolpate monad; exine 2.0  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, apocolpium 3.0-4.0  $\mu\text{m}$  wide; pori lalongate 1.5  $\times$  3.0-4.0  $\mu\text{m}$ , indistinct; polar axis 21-24-27  $\mu\text{m}$ , equatorial axis 16-20-23  $\mu\text{m}$ , P/E ratio 1.00-1.19-1.43; flowering in Apr-May. (*Anonymous s.n.*, Loc. K)

*A. japonicum* Thunb. 'Hauchiwakaede'  
Tricolporate monad; exine 1.8  $\mu\text{m}$  thick; sexine striate; colpi acute at ends or rectangle, apocolpium 3.0-4.0  $\mu\text{m}$  wide; pori circular, lolongate 5.0-6.0  $\mu\text{m}$  wide, costae 2.5  $\mu\text{m}$  thick; polar axis 27-31-35  $\mu\text{m}$ , equatorial axis 20-24-29  $\mu\text{m}$ , P/E ratio 1.14-1.27-1.39; flowering in May-Jun. (H. *Nagamasu 4480*; Loc. A)

*A. mono* Maxim. 'Itayakaede'  
Tricolpate monad; exine 1.2  $\mu\text{m}$ ; sexine striate; colpi acute at ends, apocolpium 3.0-4.0  $\mu\text{m}$  wide; polar axis 21-25-28  $\mu\text{m}$ , equatorial axis 22-24-27  $\mu\text{m}$ , P/E ratio 0.85-1.02-1.17; flowering in Apr-May. (S. *Okamoto s.n.*; Loc. A)

*A. nipponicum* Hara 'Tetsukaede'  
Tricolporate monad; exine 2.0  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, apocolpium 5.0-6.0  $\mu\text{m}$  wide; pori lolongate 5.0-7.0  $\times$  2.0-4.0  $\mu\text{m}$ , costae 1.0-1.5  $\mu\text{m}$  thick; polar axis 20-23-28  $\mu\text{m}$ , equatorial axis 17-21-25  $\mu\text{m}$ , P/E ratio 0.94-1.15-1.43; flowering in Jul-Aug. (G. *Nakai 3342*; Loc. A)

*A. palmatum* Thunb. 'Irohamomiji'  
Tricolporate monad; exine 2.7  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, apocolpium 4.0-5.0  $\mu\text{m}$  wide; pori circular 6.0  $\mu\text{m}$  wide, costae 1.0-1.5  $\mu\text{m}$  thick; polar axis 25-27-30  $\mu\text{m}$ , equatorial axis 21-25-28  $\mu\text{m}$ , P/E ratio 1.04-1.10-1.18; flowering in Apr-May. (H. *Naruhashi and I. Kojima 1432*; Loc. S)

*A. rufinerve* Sieb. et Zucc. 'Urihadakaede'  
Tricolporate monad; exine 2.0  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, apocolpium 3.0-5.0  $\mu\text{m}$  wide; pori lolongate 4.0  $\times$  2.0-3.0  $\mu\text{m}$ , indistinct; polar axis 20-23-25  $\mu\text{m}$ , equatorial axis 20-21-24  $\mu\text{m}$ , P/E ratio 1.00-1.09-1.25; flowering in May.

(*T. Morita s.n.*; Loc. F)

*A. sieboldianum* Miq.

'Kohauchiwakaede'

Tricolporate monad; exine  $2.6\ \mu\text{m}$  thick; sexine striate, reticulate; colpi acute at ends, apocolpium  $4.0\text{-}5.0\ \mu\text{m}$  wide; pori circular, lalongate  $4.0\text{-}5.0 \times 6.0\ \mu\text{m}$ , costae  $1.5\ \mu\text{m}$  thick; polar axis  $22\text{-}24\text{-}27\ \mu\text{m}$ , equatorial axis  $18\text{-}21\text{-}24\ \mu\text{m}$ , P/E ratio  $1.05\text{-}1.15\text{-}1.27$ ; flowering in May-Jun. (*M. Umebayashi 1667*; Loc. A)

#### Actinidiaceae (1 genus, 2 species)

Tricolporate monad; exine  $1.5\ \mu\text{m}$  thick; sexine scabrate; colpi acute at ends, equatorial prominent, apocolpium  $3.0\text{-}5.0\ \mu\text{m}$  wide; pori lalongate  $0.5\text{-}2.0 \times 3.0\text{-}6.0\ \mu\text{m}$ , sometimes ragged H-shape, costae  $1.0\text{-}1.5\ \mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis  $16\text{-}23\ \mu\text{m}$ , equatorial axis  $15\text{-}19\ \mu\text{m}$ , prolate-spherical; flowering in May-Jul.

*Actinidia arguta* (Sieb. et Zucc.) Planch. ex Miq.

'Sarunashi'

Apocolpium  $3.0\text{-}4.0\ \mu\text{m}$  wide; pori  $4.0\text{-}6.0 \times 0.5\text{-}2.0\ \mu\text{m}$ ; polar axis  $16\text{-}18\text{-}20\ \mu\text{m}$ , equatorial axis  $15\text{-}16\text{-}19\ \mu\text{m}$ , P/E ratio  $0.92\text{-}1.11\text{-}1.34$ ; flowering in May-Jul. (*G. Murata 1534*; Loc. K)

*A. polygama* (Sieb. et Zucc.) Planch. ex Maxim.

'Matatabi'

Apocolpium  $4.0\text{-}5.0\ \mu\text{m}$  wide; pori  $3.0\text{-}5.0 \times 0.5\text{-}2.0\ \mu\text{m}$ ; polar axis  $16\text{-}19\text{-}23\ \mu\text{m}$ , equatorial axis  $16\text{-}18\text{-}19\ \mu\text{m}$ , P/E ratio  $1.00\text{-}1.05\text{-}1.20$  ( $n=11$ ); flowering in Jun-Jul. (*S. Kitamura s.n.*; Loc. K)

#### Alangiaceae (1 genus, 1 species)

*Alangium platanifolium* (Sieb. et Zucc.) Harms

'Urinoki'

Tricolporate, stephanocolporate (4-5 colporate) monad; exine  $5.0\text{-}7.0\ \mu\text{m}$  thick; sexine rugulate, vallae  $1.5\text{-}3.0\ \mu\text{m}$  wide; colpi  $40\ \mu\text{m}$  long,  $7\text{-}15\ \mu\text{m}$  wide; pori lalongate  $12 \times 16\ \mu\text{m}$ ; oval in equatorial view, circular in polar view; polar axis  $52\text{-}63\text{-}78\ \mu\text{m}$ ; equatorial axis  $65\text{-}77\text{-}90\ \mu\text{m}$ , P/E ratio  $0.64\text{-}0.82\text{-}1.00$ ; flowering in Jun. (*M. Ito et al. 1264*; Loc. A)

#### Alismataceae (2 genera, 2 species)

*Alisma* (1 species)

*Alisma canaliculatum* A. Br. et Bouche

'Heraomodaka'

Periporate (15-20 porate) monad; exine  $2.0\ \mu\text{m}$  thick; sexine scabrate; pori  $5.0\ \mu\text{m}$  wide, with verrucae, irregular shape, surrounded by hexagonal ridges; grains polyhedral; grains  $26\text{-}30\text{-}34\ \mu\text{m}$ ; flowering in Aug-Oct. (*G. Murata 46628*; Loc. H)

*Sagittaria* (1 species)

*Sagittaria trifolia* L.

'Omodaka'



Periporate (ca. 10 porate) monad; exine  $1.0\ \mu\text{m}$  thick; sexine echinate, echini  $1.0\ \mu\text{m}$  high; pori  $3.0\text{-}6.0\ \mu\text{m}$  wide; grains circular; grains  $17\text{-}22\ \mu\text{m}$ ; flowering in Jul-Oct. (ref. 4)

#### Amaranthaceae (1 genus, 2 species)

Periporate (30-50 porate) monad; exine  $1.0\text{-}2.0\ \mu\text{m}$  thick; sexine scabrate; pori  $2.0\ \mu\text{m}$  wide, annuli present; grains circular; grains  $16\text{-}29\ \mu\text{m}$ ; flowering in Jul-Sep.  
ref. *Amaranthus bidentata* Blume, 'Inokozuchi' (Aug-Sep): 4; *Amaranthus lividus* L., 'Inubiyu' (Jul-Sep): 4.

#### Amaryllidaceae (1 genus, 1 species)

*Lycoris radiata* Herb. 'Higanbana'  
Monocolpate monad; exine  $3.0\text{-}4.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $1.0\text{-}2.5\ \mu\text{m}$  wide, muri duplicolumellate, heterobrochate; grains elliptic; polar axis  $25\text{-}38\text{-}50\ \mu\text{m}$ , longer equatorial axis  $65\text{-}73\text{-}80\ \mu\text{m}$ ; flowering in Sep. (*S. Tsugaru 15417*; Loc. K)

#### Anacardiaceae (1 genus, 5 species)

Tricolporate monad; exine  $1.5\text{-}1.8\ \mu\text{m}$  thick; sexine reticulate, striate, lumina  $0.5\text{-}1.0\ \mu\text{m}$  wide; colpi rounded at ends, margo thickened, apocolpium  $2.5\text{-}5.0\ \mu\text{m}$  wide; pori lalongate  $1.5\text{-}2.0 \times 7.0\text{-}13\ \mu\text{m}$ , costae  $1.5\text{-}2.0\ \mu\text{m}$  thick; oval, compressed rhomboidal in equatorial view, circular, semiangular, hexagonal in polar view; polar axis  $19\text{-}32\ \mu\text{m}$ , equatorial axis  $17\text{-}27\ \mu\text{m}$ , prolate; flowering in May-Sep.

ref. *Rhus sylvestris* Sieb et Zucc., 'Yamahaze' (May-Jun): 4; *R. verniciflua* Stokes, 'Urushi' (May-Jun): 1.

- 1a. Sexine striate, pori  $>12\ \mu\text{m}$  long ..... *Rhus javanica*  
1b. Sexine reticulate, lumina  $0.5\text{-}1.0\ \mu\text{m}$  wide, pori  $<12\ \mu\text{m}$  long  
2a. Pori  $>9.0\ \mu\text{m}$  long, apocolpium  $<4.0\ \mu\text{m}$  wide ..... *R. trichocarpa*  
2b. Pori  $<9.0\ \mu\text{m}$  long, apocolpium  $>4.0\ \mu\text{m}$  wide ..... *R. ambigua*

*Rhus ambigua* Lavall. ex Dipp. 'Tsutaurushi'  
Exine  $1.8\ \mu\text{m}$  thick; sexine reticulate, striate; apocolpium  $4.0\text{-}5.0\ \mu\text{m}$  wide; pori lalongate  $7.0\text{-}1.5\text{-}2.0 \times 8.0\ \mu\text{m}$ , costae  $1.5\text{-}2.0\ \mu\text{m}$  thick; semiangular in polar view; polar axis  $25\text{-}27\text{-}30\ \mu\text{m}$ , equatorial axis  $16\text{-}19\text{-}22\ \mu\text{m}$ , P/E ratio  $1.23\text{-}1.42\text{-}1.85$ ; flowering in Jun-Jul. (*G. Nakai 2279*; Loc. K)

*R. javanica* L. 'Nurude'  
Exine  $1.5\ \mu\text{m}$  thick; sexine striate; apocolpium  $4.0\text{-}5.0\ \mu\text{m}$  wide; pori lalongate  $2.0 \times 13\ \mu\text{m}$ , ragged, costae  $1.5\ \mu\text{m}$  thick; hexagonal in polar view; polar axis  $27\text{-}29\text{-}32\ \mu\text{m}$ , equatorial axis  $21\text{-}24\text{-}27\ \mu\text{m}$ , P/E ratio  $1.10\text{-}1.23\text{-}1.36$ ; flowering in Aug-Sep. (*S. Hosomi 7490*; Loc. H)

*R. trichocarpa* Miq. 'Yamaurushi'

Exine  $1.5\ \mu\text{m}$  thick; sexine reticulate, striate, lumina  $0.5\text{-}1.0\ \mu\text{m}$  wide; apocolpium  $2.5\text{-}4.0\ \mu\text{m}$  wide; pori lalongate  $2.0 \times 9.0\text{-}10\ \mu\text{m}$ , costae  $1.5\text{-}2.0\ \mu\text{m}$  thick; circular, hexagonal in polar view; polar axis  $20\text{-}24\text{-}28\ \mu\text{m}$ , equatorial axis  $17\text{-}20\text{-}22\ \mu\text{m}$ , P/E ratio  $1.00\text{-}1.22\text{-}1.38$ ; flowering in Jun-Jul. (*G. Murata and T. Shimizu 1664*; Loc. H)

**Apocynaceae** (1 genus, 1 species)

*Trachelospernum asiaticum* (Sieb. et Zucc.) Nakai 'Teikakazura'  
Periporate (15-20 porate) monad; exine  $1.0\ \mu\text{m}$  thick; sexine scabrate; pori circular  $2.0\text{-}3.5\ \mu\text{m}$  wide, annuli and costae  $0.5\ \mu\text{m}$  thick; grains circular; grains  $35\text{-}41\text{-}45\ \mu\text{m}$ ; flowering in May-Jun. (*S. and T. Fujii 2036*; Loc. K)

**Aquifoliaceae** (1 genus, 6 species)

Tricolporate monad; exine  $3.0\text{-}4.0\ \mu\text{m}$  thick; sexine clavate, clavae  $1.5\text{-}2.0\ \mu\text{m}$  high,  $1.0\text{-}2.0\ \mu\text{m}$  wide; colpi rounded at ends, constricted at equator, apocolpium  $7.0\text{-}13\ \mu\text{m}$  wide, margo thinned; pori lalongate  $1.0\text{-}3.0 \times 5.0\text{-}8.0\ \mu\text{m}$ , indistinct, costae  $1.5\text{-}2.0\ \mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis  $20\text{-}38\ \mu\text{m}$ , equatorial axis  $18\text{-}33\ \mu\text{m}$ , prolate; flowering in Jun-Jul.

ref. *Ilex geniculata* Maxim., 'Fuurin'umemodoki' (Jun-Jul): 3; *I. sugerokii* Maxim., 'Kurosoyogo' (Jul): 1.

- 1a. Polar axis  $>31\ \mu\text{m}$   
 2a. Exine  $>3.5\ \mu\text{m}$  thick ..... *Ilex macropoda*, *I. pedunculosa*  
 2b. Exine  $<3.5\ \mu\text{m}$  thick ..... *I. leucoclada*  
 1b. Polar axis  $<31\ \mu\text{m}$  ..... *I. macropoda*, *I. crenata*

*Ilex crenata* Thunb. 'Inutsuge'  
Exine  $3.5\ \mu\text{m}$  thick; clavae  $1.5\ \mu\text{m}$  high,  $1.0\ \mu\text{m}$  wide; apocolpium  $8.0\text{-}9.0\ \mu\text{m}$  wide; pori lalongate  $2.0 \times 8.0\ \mu\text{m}$ , costae  $1.5\text{-}2.0\ \mu\text{m}$  thick; polar axis  $23\text{-}26\text{-}29\ \mu\text{m}$ , equatorial axis  $22\text{-}24\text{-}27\ \mu\text{m}$ , P/E ratio  $1.00\text{-}1.09\text{-}1.17$  ( $n=9$ ); flowering in Jun-Jul. (*K. Nagai 25010*; Loc. K)

*I. leucoclada* (Maxim.) Makino 'Himemochi'  
Exine  $3.0\ \mu\text{m}$  thick; clavae  $1.5\text{-}2.0\ \mu\text{m}$  high,  $1.0\text{-}2.0\ \mu\text{m}$  wide; apocolpium  $7.0\text{-}10\ \mu\text{m}$  wide; pori lalongate  $2.5 \times 7.5\ \mu\text{m}$ , costae  $1.5\ \mu\text{m}$  thick; polar axis  $32\text{-}34\text{-}37\ \mu\text{m}$ , equatorial axis  $23\text{-}26\text{-}29\ \mu\text{m}$ , P/E ratio  $1.17\text{-}1.33\text{-}1.47$  ( $n=12$ ); flowering in Jun-Jul. (*S. Tsugaru 6925*; Loc. I)

*I. macropoda* Miq. 'Aohada'  
Exine  $4.0\ \mu\text{m}$  thick; clavae  $2.0\ \mu\text{m}$  high,  $1.0\text{-}2.0\ \mu\text{m}$  wide; colpi rounded at ends, apocolpium  $9.0\text{-}10\ \mu\text{m}$  wide; pori lalongate  $1.0\text{-}3.0 \times 5.0\text{-}7.0\ \mu\text{m}$ , costae  $2.0\ \mu\text{m}$  thick; polar axis  $27\text{-}30\text{-}33\ \mu\text{m}$ , equatorial axis  $23\text{-}27\text{-}30\ \mu\text{m}$ , P/E ratio  $1.00\text{-}1.12\text{-}1.26$ ; flowering in Jun. (*M. Ito et al. 1286*; Loc. A)

*I. pedunculosa* Miq. 'Soyogo'

Exine 4.0  $\mu\text{m}$  thick; clavae 2.0  $\mu\text{m}$  high, 1.0-2.0  $\mu\text{m}$  wide; apocolpium 9.0-13  $\mu\text{m}$  wide; pori lalongate 1.5  $\times$  6.0  $\mu\text{m}$ , indistinct, costae 1.5-2.0  $\mu\text{m}$  thick; polar axis 31-33-38  $\mu\text{m}$ , equatorial axis 25-28-33  $\mu\text{m}$ , P/E ratio 1.03-1.18-1.43; flowering in Jun-Jul. (*N. Kurosaki 15787*; Loc. H)

### Araceae (3 genera, 5 species)

#### *Acorus* (1 species)

*Acorus calamus* L.

'Shoubu'

Monocolpate monad; exine 1.0  $\mu\text{m}$  thick; sexine scabrate; grains elliptic; polar axis 10-18  $\mu\text{m}$ , equatorial axis 10-17  $\mu\text{m}$ ; flowering in May-Jul. (ref. 4)

#### *Arisaema* (3 species)

Inaperturate monad; exine 1.0-1.5  $\mu\text{m}$  thick; sexine echinate, echini <0.5  $\mu\text{m}$  high; grains circular; grains 10-20  $\mu\text{m}$ ; flowering in Apr-Jun.

ref. *Arisaema serratum* (Thunb.) Schott, 'Kouraitennanshou' (Apr-Jun): 3; *A. yamatense* (Nakai) Nakai, 'Muroutennanshou' (Apr-Jun): 1.

*Arisaema amurense* Maxim. ssp. *robustum* (Engler) Ohashi et J. Murata

var. *ovale* (Nakai) Ohashi et J. Murata

'Ashiutennanshou'

Grains 15-17-20  $\mu\text{m}$ ; flowering in Apr-Jun. (*H. Nagamasu 4494*; Loc. A)

#### *Pinellia* (1 species)

*Pinellia ternata* (Thunb.) Breit.

'Karasubishaku'

Syncolpate monad; exine 1.0-1.5  $\mu\text{m}$  thick; sexine psilate; colpi parallel 6-8 spirals around the grain; grains circular; grains 14-21  $\mu\text{m}$ ; flowering in May-Aug. (ref. 4)

### Araliaceae (5 genera, 8 species)

Tricolporate monad; exine 1.7-2.7  $\mu\text{m}$  thick, thicker in mesocolpia; sexine reticulate, lumina 0.5-1.5  $\mu\text{m}$  wide; colpi acute at ends, apocolpium 5.0-12  $\mu\text{m}$  wide, margo thickened; pori lalongate 2.0-6.0  $\times$  6.0-11  $\mu\text{m}$ , costae 1.0-2.0  $\mu\text{m}$  thick; depressed rhomboidal, oval in equatorial view, angular, semiangular in polar view; polar axis 21-36  $\mu\text{m}$ , equatorial axis 17-36  $\mu\text{m}$ , prolate-spherical; flowering in May-Sep.

ref. *Acanthopanax divaricatus* Seem., 'Keyamaukogi' (Aug-Sep): 4; *A. spinosus* (L. fil.) Miq., 'Yamaukogi', (May-Jun): 4; *Panax japonicus* C. A. Mayer, 'Tochibaninjin' (Jun-Aug): 4.

- 1a. Apocolpium <8.0  $\mu\text{m}$  wide ..... *Evodiopanax innovans*
- 1b. Apocolpium >8.0  $\mu\text{m}$  wide
  - 2a. Grains prolate, P/E ratio >1.15
    - 3a. Polar axis >30  $\mu\text{m}$  ..... *Acanthopanax divaricatus*
    - 3b. Polar axis <30  $\mu\text{m}$  ..... *Acanthopanax sciadophylloides*, *Kalopanax pictus*
  - 2b. Grains spherical, P/E ratio <1.15
    - 4a. Oval in equatorial view, lumina <1.0  $\mu\text{m}$  wide  
..... *Aralia cordata*, *Panax japonicus*
    - 4b. Depressed rhomboidal in equatorial view, >1.0  $\mu\text{m}$  wide lumina present

- 5a. Pori  $>7.0\ \mu\text{m}$  long ..... *Kalopanax pictus*  
 5b. Pori  $<7.0\ \mu\text{m}$  long ..... *Aralia elata*

*Acanthopanax sciadophylloides* Fr. et Sav. 'Koshiabura'  
 Exine  $2.0\ \mu\text{m}$  thick; lumina  $0.5\text{-}1.0\ \mu\text{m}$  wide, muri  $0.5\ \mu\text{m}$  wide; apocolpium  $9.0\text{-}10\ \mu\text{m}$  wide; pori lalongate  $2.0\text{-}4.0 \times 8.0\text{-}10\ \mu\text{m}$ , costae  $1.0\text{-}2.0\ \mu\text{m}$  thick; equatorial acute oval in equatorial view, angular in polar view; polar axis  $23\text{-}27\text{-}30\ \mu\text{m}$ , equatorial axis  $17\text{-}22\text{-}27\ \mu\text{m}$ , P/E ratio  $1.10\text{-}1.24\text{-}1.47$ ; flowering in Aug-Sep. (S. Okamoto s.n.; Loc. A)

*Aralia cordata* Thunb. 'Udo'  
 Exine  $1.7\ \mu\text{m}$  thick; lumina  $0.5\ \mu\text{m}$  wide, muri  $0.5\ \mu\text{m}$  wide; apocolpium  $8.0\text{-}12\ \mu\text{m}$  wide; pori lalongate  $3.0\text{-}5.0 \times 6.0\text{-}9.0\ \mu\text{m}$ , costae  $1.0\text{-}1.5\ \mu\text{m}$  thick; oval in equatorial view, semiangular in polar view; polar axis  $25\text{-}28\text{-}30\ \mu\text{m}$ , equatorial axis  $22\text{-}26\text{-}29\ \mu\text{m}$ , P/E ratio  $0.95\text{-}1.08\text{-}1.34$ ; flowering in Aug-Sep. (Y. Araki 13523; Loc K)

*A. elata* (Miq.) Seemann 'Taranoki'  
 Exine  $2.0\ \mu\text{m}$  thick; lumina  $0.5\text{-}1.5\ \mu\text{m}$  wide, muri  $<0.5\ \mu\text{m}$  wide; apocolpium  $10\text{-}12\ \mu\text{m}$  wide; pori lalongate  $3.0\text{-}4.0 \times 6.0\text{-}7.0\ \mu\text{m}$ , costae  $1.0\text{-}1.5\ \mu\text{m}$  thick; equatorial acute oval in equatorial view, angular in polar view; polar axis  $21\text{-}25\text{-}28\ \mu\text{m}$ , equatorial axis  $20\text{-}24\text{-}27\ \mu\text{m}$ , P/E ratio  $0.95\text{-}1.04\text{-}1.17$ ; flowering in Aug. (G. Nakai 5674; Loc. K)

*Evodiopanax innovans* (Sieb. et Zucc.) Nakai 'Takanotsume'  
 Exine  $1.7\ \mu\text{m}$  thick; lumina  $0.5\text{-}1.0\ \mu\text{m}$  wide, muri  $<0.5\ \mu\text{m}$  wide; apocolpium  $5.0\text{-}8.0\ \mu\text{m}$  wide, margo  $2.0\text{-}2.5\ \mu\text{m}$  thick; pori lalongate  $4.0\text{-}6.0 \times 8.0\text{-}11\ \mu\text{m}$ ; equatorial acute oval in equatorial view, semiangular in polar view; polar axis  $28\text{-}31\text{-}34\ \mu\text{m}$ , equatorial axis  $26\text{-}29\text{-}32\ \mu\text{m}$ , P/E ratio  $1.00\text{-}1.07\text{-}1.23$ ; flowering in May-Jun. (S. Tanaka s.n.; Loc. K)

*Kalopanax pictus* (Thunb.) Nakai 'Harigiri'  
 Exine  $1.8\ \mu\text{m}$  thick; lumina  $0.5\text{-}1.0\ \mu\text{m}$  wide, muri simplicolumellate,  $<0.5\ \mu\text{m}$  wide; apocolpium  $8.0\text{-}11\ \mu\text{m}$  wide, margo  $2.0\ \mu\text{m}$  thick; pori lalongate  $4.0 \times 7.0\text{-}10\ \mu\text{m}$ , costae  $1.0\text{-}1.5\ \mu\text{m}$  thick; equatorial acute oval in equatorial view, semiangular in polar view; polar axis  $25\text{-}28\text{-}30\ \mu\text{m}$ , equatorial axis  $22\text{-}25\text{-}27\ \mu\text{m}$ , P/E ratio  $1.00\text{-}1.12\text{-}1.23$ ; flowering in Jul-Aug. (T. Sakuya 109; Loc. K)

#### Aristolochiaceae (1 genus, 1 species)

*Asarum caulescens* Maxim. 'Futabaoi'  
 Tricolpate, pericolpate (4-5 colpate) monad; exine  $1.0\text{-}2.0\ \mu\text{m}$  thick; sexine verrucate, gemmate, gemmae  $1.5\text{-}2.0\ \mu\text{m}$  wide; colpi ragged, acute at ends,  $10\text{-}15\ \mu\text{m}$  long; grains circular; grains  $36\text{-}42\text{-}51\ \mu\text{m}$ ; flowering in Mar-May. (S. Tugaru and T. Takahashi 7985; Loc. K)

**Asclepiadaceae** (3 genera, 4 species)

Pollinia; 2 similar pollinia per pollinarium, pollinia united by 2 caudicles to a central corpusculum; grains inaperturate monad; flowering in Jul-Sep.  
ref. 1, 3.

**Balsaminaceae** (1 genus, 2 species)

Stephanocolpate (4 colpate) monad; exine  $1.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\text{-}2.0\ \mu\text{m}$  wide; colpi  $6.0\ \mu\text{m}$  long,  $0.5\ \mu\text{m}$  wide; depressed oval in equatorial view; rectangular in polar view; polar axis  $10\text{-}17\ \mu\text{m}$ , equatorial axis  $25\text{-}32\ \mu\text{m} \times 13\text{-}23\ \mu\text{m}$ , oblate; flowering in Jul-Oct.

- 1a. Grains larger, shorter equatorial axis  $>20\ \mu\text{m}$ ,  $>1.5\ \mu\text{m}$  wide lumina present  
.....*Impatiens noli-tangere*  
1b. Grains smaller, shorter equatorial axis  $<18\ \mu\text{m}$ , lumina  $<1.5\ \mu\text{m}$  wide  
.....*I. textori*

*Impatiens noli-tangere* L.

'Kitsurifune'

Lumina  $1.0\text{-}2.0\ \mu\text{m}$  wide; polar axis  $12\text{-}15\text{-}17\ \mu\text{m}$ , equatorial axis  $26\text{-}27\text{-}29\ \mu\text{m} \times 20\text{-}21\text{-}23\ \mu\text{m}$ ; flowering in Jul-Sep. (*T. Takahashi 1337*; Loc. K)

*I. textori* Miq.

'Tsurifunesou'

Lumina  $0.5\text{-}1.5\ \mu\text{m}$  wide; polar axis  $10\text{-}12\text{-}14\ \mu\text{m}$ , equatorial axis  $25\text{-}29\text{-}32\ \mu\text{m} \times 13\text{-}16\text{-}18\ \mu\text{m}$ ; flowering in Aug-Oct. (*S. Kitamura s.n.*; Loc. K)

**Berberidaceae** (3 genera, 3 species)

*Berberis* (1 species)

*Berberis thunbergii* DC.

'Megi'

Syncolpate (1-3 colpate) monad; exine  $2.0\ \mu\text{m}$  thick; sexine reticulate; colpi irregularly surrounding the grain; grains circular; grains  $26\text{-}35\ \mu\text{m}$ ; flowering in Apr-May. (ref. 4)

*Caulophyllum* and *Epimedium* (2 species)

Tricolpate monad; exine  $2.0\text{-}2.5\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\text{-}1.5\ \mu\text{m}$  wide; colpi acute at ends, ragged, margo thinned; oval in equatorial view, circular in polar view; polar axis  $26\text{-}45\ \mu\text{m}$ , equatorial axis  $22\text{-}43\ \mu\text{m}$ , prolate; flowering in Apr-Jun.  
ref. *Caulophyllum robustum* Maxim., 'Ruiyoubotan' (Apr-Jun): 4.

- 1a. Equatorial axis  $>29\ \mu\text{m}$ , polar axis  $>36\ \mu\text{m}$  .....*Caulophyllum robustum*  
1b. Equatorial axis  $<29\ \mu\text{m}$ , polar axis  $<36\ \mu\text{m}$  .....*Epimedium sempervirens*

*Epimedium sempervirens* Nakai

'Tokiwaikarisou'

Exine  $2.0\ \mu\text{m}$  thick; lumina  $0.5\ \mu\text{m}$  wide; colpi verrucate, apocolpium  $3.0\text{-}4.0\ \mu\text{m}$  wide; polar axis  $26\text{-}30\text{-}35\ \mu\text{m}$ , equatorial axis  $22\text{-}24\text{-}27\ \mu\text{m}$ , P/E ratio  $1.10\text{-}1.24\text{-}1.48$ ; flowering in Apr-May. (*M. Wakabayashi 292*; Loc. A)

**Betulaceae (3 genera, 6 species)**

Triporate, stephanoporate (4-6 porate) monad; exine 1.0-1.7  $\mu\text{m}$  thick; sexine scabrate, rugulate; pori circular 1.5-2.0  $\mu\text{m}$  wide, with annuli or vestibulum; oval in equatorial view, circular, semiangular in polar view; polar axis 16-27  $\mu\text{m}$ , equatorial axis 21-33  $\mu\text{m}$ , oblate; flowering in Mar-May.

ref. *Betula grossa* Sieb. et Zucc., 'Mizume' (Apr): 3; *Carpinus cordata* Bl., 'Sawashiba' (Apr-May): 4; *C. tschonoskii* Maxim., 'Inushide' (Apr-May): 4.

- 1a. Pori with vestibulum .....*Betula grossa*
- 1b. Pori with annuli
  - 2a. Grains 5-6 porate .....*Carpinus tschonoskii*
  - 2b. Grains 3-4 porate
    - 3a. Equatorial axis  $<24\mu\text{m}$ , polar axis  $<20\mu\text{m}$ , annuli formed by both endexine and ektexine, semiangular in polar view .....*Corylus sieboldiana*
    - 3b. Equatorial axis  $>24\mu\text{m}$ , polar axis  $>20\mu\text{m}$ , annuli formed by ektexine, circular in polar view .....*Carpinus cordata*, *Carpinus japonica*, *C. laxiflora*

*Carpinus japonica* Blume

'Kumashide'

Triporate, stephanoporate (4 porate) monad; exine 1.3-1.6  $\mu\text{m}$  thick; pori circular 2.0  $\mu\text{m}$  wide, annuli formed by ektexine, 1.5  $\mu\text{m}$  high, 5.0-6.0  $\mu\text{m}$  wide; circular in polar view; polar axis 22-24-27  $\mu\text{m}$ , equatorial axis 25-27-32  $\mu\text{m}$ , P/E ratio 0.78-0.87-0.91; flowering in Apr-May. (II. Nagamasu 4468; Loc. A)

*C. laxiflora* (Sieb. et Zucc.) Blume

'Akashide'

Triporate, stephanoporate (4 porate) monad; exine 1.0  $\mu\text{m}$  thick; pori circular 1.5-2.0  $\mu\text{m}$  wide, annuli formed by ektexine, 1.5-2.0  $\mu\text{m}$  high, 6.0-8.0  $\mu\text{m}$  wide; circular in polar view; polar axis 20-23-25  $\mu\text{m}$ , equatorial axis 22-26-29  $\mu\text{m}$ , P/E ratio 0.76-0.87-0.95; flowering in Apr-May. (H. Nagamasu 4464; Loc. A)

*Corylus sieboldiana* Blume

'Tsunohashibami'

Triporate monad; exine 1.3-1.7  $\mu\text{m}$  thick; pori circular 1.5-2.0  $\mu\text{m}$ , annuli formed by both ektexine and endexine, 2.0-2.5  $\mu\text{m}$  high, 10  $\mu\text{m}$  wide; semiangular in polar view; polar axis 16-18-20  $\mu\text{m}$ , equatorial axis 21-23-24  $\mu\text{m}$ , P/E ratio 0.73-0.80-0.89; flowering in Mar-May. (H. Nagamasu 4497; Loc. A)

**Boraginaceae (3 genera, 4 species)**

Heterocolpate (with 3 colpi and 3 furrows) monad; exine 1.0  $\mu\text{m}$  thick; sexine psilate; constricted, compressed oval in equatorial view, hexagonal, lobate in polar view; polar axis 8-12  $\mu\text{m}$ , equatorial axis 5-7  $\mu\text{m}$ , prolate; flowering in Apr-Nov.

ref. *Bothriospermum tenellum* (Hornem.) Fisch. et C. A. Mey., 'Hanaibana' (Apr-Nov): 3; *Cynoglossum asperrimum* Nakai, 'Onirurisou' (Jun-Aug): 1; *C. zeylanicum* (Vahl) Thunb., 'Oorurisou' (Jul-Aug): 2; *Omphalodes japonica* (Thunb.) Maxim., 'Yamarurisou' (Apr-May): 1.

**Buxaceae** (1 genus, 1 species)

*Pachysandra terminalis* Sieb. et Zucc. 'Fukkisou'  
 Periporate (10-20 porate) monad; exine 3.5-4.5  $\mu\text{m}$  thick; sexine reticulate, lumina 3.0-6.0  $\mu\text{m}$  wide, muri 2.0  $\mu\text{m}$  wide, dupri-tripricolumellate; pori circular 2.0  $\mu\text{m}$  wide; grains circular; grains 34-38-43  $\mu\text{m}$ ; flowering in Apr-May. (*H. Imai s.n.*; Loc. H)

**Campanulaceae** (5 genera, 6 species)

*Adenophora*, *Campanula* and *Peracarpa* (4 species)

Triporate, stephanoporate (4-5 porate) monad; exine 1.6-1.8  $\mu\text{m}$  thick; sexine echinate, echini <1.0  $\mu\text{m}$  high; pori circular 4.0-5.5  $\mu\text{m}$  wide, annuli dropped inside; oval in equatorial view, circular in polar view; grains 24-43  $\mu\text{m}$ , spherical; flowering in Jun-Oct.

ref. *Adenophora remotiflora* (Sieb. et Zucc.) Miq. 'Sobana' (Aug): 1; *A. triphylla* (Thunb.) A. DC., 'Tsuriganeninjin' (Aug-Oct): 4; *Peracarpa carnosus* (Wall.) Hook. fil. et Thomson, 'Tanigikyou' (Jun-Aug): 3.

- 1a. Grains >35  $\mu\text{m}$  ..... *Adenophora triphylla*  
 1b. Grains <35  $\mu\text{m}$  ..... *Campanula punctata*

*Campanula punctata* Lam.

'Hotarubukuro'

Triporate, stephanoporate (4 porate) monad; exine 1.6  $\mu\text{m}$  thick; echini 1.0  $\mu\text{m}$  high, <0.5  $\mu\text{m}$  wide; pori circular 4.0-5.0  $\mu\text{m}$  wide, annuli 2.0-3.0 deep; polar axis 25-29-33  $\mu\text{m}$ , equatorial axis 26-31-35  $\mu\text{m}$ , P/E ratio 0.88-0.94-1.05; flowering in Jun-Jul. (*K. Nagai 25460*; Loc. K)

*Codonopsis* (1 species)

*Codonopsis lanceolata* (Sieb. et Zucc.) Trautv.

'Tsuruninjin'

Stephanocolpate (7-10 colpate) monad; exine 2.0-3.0  $\mu\text{m}$  thick; sexine scabrate; colpi ragged; oval in equatorial view, circular in polar view; grains 27-35  $\mu\text{m}$ , spherical; flowering in Aug-Oct. (ref. 4)

*Lobelia* (1 species)

*Lobelia chinensis* Lour.

'Mizokakushi'

Tricolpate monad; exine 1.2  $\mu\text{m}$  thick; sexine scabrate; colpi rounded at ends, long, margo thickened; pori lalongate; oval in equatorial view, circular in polar view; polar axis 23-29  $\mu\text{m}$ , equatorial axis 19-26  $\mu\text{m}$ , prolate; flowering in Jun-Oct. (ref. 4)

**Caprifoliaceae** (5 genera, 11 species)

*Abelia* and *Lonicera* (2 species)

Tricolpate, stephanocolpate (4-5 colpate) monad; exine 2.0-3.0  $\mu\text{m}$  thick; sexine echinate, echini 0.5-1.5  $\mu\text{m}$  high; colpi 16-20  $\mu\text{m}$  long; oval in equatorial view, semiangular in polar view; polar axis 46-60  $\mu\text{m}$ , equatorial axis 47-74  $\mu\text{m}$ , oblate-spherical; flowering in Apr-Jul.

ref. *Abelia serrata* Sieb., et Zucc. 'Kotsukubaneutsugi' (Apr-Jun): 4; *Lonicera japonica* Thunb., 'Suikazura' (May-Jul): 4.

- 1a. Echini smaller  $<1.0\mu\text{m}$  high and dense  $>20$  per  $10 \times 10\mu\text{m}^2$  .....*Abelia serrata*  
 1b. Echini bigger  $>1.0\mu\text{m}$  high and scatter  $<10$  per  $10 \times 10\mu\text{m}^2$  .....*Lonicera japonica*

*Sambucus* and *Viburnum* (9 species)

Tricolporate monad; exine  $1.1\text{-}2.5\mu\text{m}$  thick; sexine reticulate, lumina  $<0.5\text{-}2.0\mu\text{m}$  wide; colpi acute at ends, apocolpium  $2.0\text{-}9.0\mu\text{m}$  wide, margo thinned; pori lalongate  $<0.5\text{-}3.0 \times 3.0\text{-}8.0\mu\text{m}$ , costae  $1.0\text{-}3.0\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis  $16\text{-}29\mu\text{m}$ , equatorial axis  $15\text{-}25\mu\text{m}$ , prolate-spherical; flowering in Apr-Aug.

ref. *Sambucus chinensis* Lindley, 'Sokuzu' (Jul-Aug): 4; *Viburnum dilatatum* Thunb., 'Gamazumi' (May-Jun): 4; *V. phlebotricum* Sieb. et Zucc., 'Otokoyouzome' (Apr-Jun): 4.

- 1a. Pori  $<5\mu\text{m}$  long, exine  $<1.5\mu\text{m}$  thick, lumina  $<0.5\mu\text{m}$  wide  
 .....*Sambucus racemosa*  
 1b. Pori  $>5\mu\text{m}$  long, exine  $>1.5\mu\text{m}$  thick, lumina  $>0.5\mu\text{m}$  wide  
 2a. Apocolpium  $<4.0\mu\text{m}$  wide, costae  $<1.0\mu\text{m}$  thick, lumina  $<1.0\mu\text{m}$  wide  
 .....*Viburnum furcatum*  
 2b. Apocolpium  $4.0\text{-}5.0\mu\text{m}$  wide, costae  $1.0\text{-}1.5\mu\text{m}$  thick, lumina  $1.0\text{-}1.5\mu\text{m}$  wide  
 .....*V. plicatum*, *V. erosum*  
 2c. Apocolpium  $>5.0\mu\text{m}$  wide, costae  $>1.5\mu\text{m}$  thick, lumina  $1.0\text{-}2.0\mu\text{m}$  wide  
 3a. Polar axis  $<24\mu\text{m}$ , equatorial axis  $<21\mu\text{m}$ , apocolpium  $<7.0\mu\text{m}$  wide, costae  
 $<2.0\mu\text{m}$  thick, lumina  $<1.5\mu\text{m}$  wide .....*V. wrightii*  
 3b. Polar axis  $>24\mu\text{m}$ , equatorial axis  $>21\mu\text{m}$ , apocolpium  $>7.0\mu\text{m}$  wide, costae  
 $>2.0\mu\text{m}$  thick,  $>1.5\mu\text{m}$  wide lumina present .....*V. urceolatum*

*Sambucus racemosa* L.

'Niwatoko'

Exine  $1.1\mu\text{m}$  thick; lumina  $<0.5\mu\text{m}$  wide; colpi constricted at equator, apocolpium  $3.0\text{-}4.0\mu\text{m}$  wide; pori lalongate  $0.5 \times <3.0\text{-}4.0\mu\text{m}$ , costae  $1.0\mu\text{m}$  thick; polar axis  $16\text{-}19\text{-}20\mu\text{m}$ , equatorial axis  $15\text{-}16\text{-}18\mu\text{m}$ , P/E ratio  $1.00\text{-}1.13\text{-}1.33$ ; flowering in Apr-May. (M. Ito and A. Iwami 3371; Loc. S)

*Viburnum erosum* Thunb.

'Kobanogamazumi'

Exine  $2.1\mu\text{m}$  thick; lumina  $1.0\text{-}1.5\mu\text{m}$  wide, muri simplicolumellate; colpi constricted at equator, apocolpium  $4.0\text{-}5.0\mu\text{m}$  wide; pori lalongate  $2.0\text{-}2.5 \times 7.0\mu\text{m}$ , costae  $1.0\text{-}1.5\mu\text{m}$  thick; polar axis  $20\text{-}22\text{-}25\mu\text{m}$ , equatorial axis  $16\text{-}20\text{-}23\mu\text{m}$ , P/E ratio  $0.94\text{-}1.14\text{-}1.43$ ; flowering in Apr-Jun. (M. Hiroe 16259; Loc. K)

*V. furcatum* Blume ex Maxim.

'Ookamenoki'

Exine  $2.3\mu\text{m}$  thick; lumina  $0.5\text{-}1.0\mu\text{m}$  wide, muri simplicolumellate; apocolpium  $2.0\text{-}4.0\mu\text{m}$  wide; pori lalongate  $2.5\text{-}3.0 \times 7.0\text{-}8.0\mu\text{m}$ , costae  $1.0\mu\text{m}$  thick; polar axis  $18\text{-}21\text{-}23\mu\text{m}$ , equatorial axis  $20\text{-}21\text{-}23\mu\text{m}$ , P/E ratio  $0.93\text{-}0.98\text{-}1.07$ ; flowering in Apr-May. (K. Ueda et al. 527; Loc. A)

*V. plicatum* Thunb.

'Yabudemari'

Exine  $2.5\mu\text{m}$  thick; lumina  $1.0\text{-}1.5\mu\text{m}$  wide, muri simplicolumellate; apocolpium  $4.0\text{-}$



5.0  $\mu\text{m}$  wide; pori lalongate 2.0  $\times$  7.0  $\mu\text{m}$ , costae 1.5  $\mu\text{m}$  thick; polar axis 17-20-22  $\mu\text{m}$ , equatorial axis 17-19-20  $\mu\text{m}$ , P/E ratio 1.00-1.05-1.15; flowering in May-Jun. (*H. Takahashi 931*; Loc. A)

*V. urceolatum* Sieb. et Zucc.

'Miyamashigure'

Exine 2.0  $\mu\text{m}$  thick; lumina 1.0-2.0  $\mu\text{m}$  wide, muri simplicolumellate 0.5  $\mu\text{m}$  wide, apocolpium 7.0-9.0  $\mu\text{m}$  wide; pori lalongate 2.0-3.0  $\times$  8.0  $\mu\text{m}$ , costae 2.0-3.0  $\mu\text{m}$  thick; polar axis 23-27-29  $\mu\text{m}$ , equatorial axis 20-23-25  $\mu\text{m}$ , P/E ratio 1.00-1.15-1.44; flowering in Jun-Aug. (*N. Satomi 21867*; Loc. T)

*V. wrightii* Miq.

'Miyamagamazumi'

Exine 2.0  $\mu\text{m}$  thick; lumina 1.0-1.5  $\mu\text{m}$  wide, muri simplicolumellate <0.5  $\mu\text{m}$  wide, apocolpium 5.0-7.0  $\mu\text{m}$  wide; pori lalongate 2.0-3.0  $\times$  6.0-8.0  $\mu\text{m}$ , costae 1.5-2.0  $\mu\text{m}$  thick; polar axis 20-22-24  $\mu\text{m}$ , equatorial axis 16-19-22  $\mu\text{m}$ , P/E ratio 0.94-1.14-1.39; flowering in Apr-Jun. (*G. Murata 7070*; Loc. A)

*Weigela* (1 species)

*Weigela hortensis* (Sieb. et Zucc.) K. Koch

'Taniutsugi'

Triporate monad; exine 1.0  $\mu\text{m}$  thick; sexine echinate, echini 2.0-5.0  $\mu\text{m}$  high; pori circular 5.0-8.0  $\mu\text{m}$  wide, annuli 3.0  $\mu\text{m}$  thick, 1.5  $\mu\text{m}$  wide; oval in equatorial view, circular in polar view; polar axis 33-41-47  $\mu\text{m}$ , equatorial axis 37-44-50  $\mu\text{m}$ , P/E ratio 0.85-0.92-0.97; flowering in May-Jun. (*H. Takahashi s.n.*; Loc. A)

#### Caryophyllaceae (5 genera, 8 species)

Periporate (6-30 porate) monad; exine 2.3-3.0  $\mu\text{m}$ ; sexine baculate, bacula forming tectum on top, tectum scabrate; pori circular 2.0-7.0  $\mu\text{m}$ , annuli thinned; grains circular; grains 21-59  $\mu\text{m}$ ; flowering in Apr-Oct.

ref. *Cerastium holosteoides* Fries, 'Miminagusa' (May-Jun): 4; *Cucubalus baccifer* L., 'Nanbanhakobe' (Jul-Oct): 3; *Lychnis miqueliana* Rohrb., 'Fushigurosenou' (Jul-Oct): 4; *Sagina japonica* (Sw.) Ohwi, 'Tsumekusa' (Apr-Jul): 4; *Sterallia alsine* Grimm, 'Nominofusuma' (Apr-Oct): 1; *S. diversiflora* Maxim., 'Sawahakobe' (May-Jul): 1; *S. media* (L.) Villars, 'Hakobe' (Apr-Sep): 3.

- 1a. Grains >40  $\mu\text{m}$  ..... *Lychnis miqueliana*  
 1b. Grains <40  $\mu\text{m}$   
   2a. Pori >5.0  $\mu\text{m}$  wide ..... *Cerastium holosteoides*  
   2b. Pori <5.0  $\mu\text{m}$  wide ..... *Sagina japonica*, *Stellaria monosperma*

*Stellaria monosperma* Buch.-Hamilt. var. *japonica* Maxim.

'Ooyamahakobe'

Periporate (12-15 porate) monad; exine 2.3  $\mu\text{m}$  thick; bacula 1.2  $\mu\text{m}$  high, 0.5-1.0  $\mu\text{m}$  wide; pori circular 3.0-4.0  $\mu\text{m}$  wide, annuli 0.5  $\mu\text{m}$  wide; grains 27-31-35  $\mu\text{m}$ ; flowering in Aug-Oct. (*G. Nakai 5598*; Loc. A)

## Celastraceae (2 genera, 6 species)

Tricolporate monad; exine 2.4-3.8  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5-2.0  $\mu\text{m}$  wide, muri simplicolumellate; colpi acute at ends, apocolpium 5.0-13  $\mu\text{m}$  wide, margo thinned; pori circular, lalongate 3.0-6.0  $\mu\text{m}$  wide, costae 1.5-2.5  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 17-32  $\mu\text{m}$ , equatorial axis 17-33  $\mu\text{m}$ , spherical; flowering in May-Jul.

ref. *Euonymus melananthus* Fr. et Sav., 'Sawadatsu' (Jun-Jul): 1.

- 1a. Equatorial axis  $>27\mu\text{m}$ , polar axis  $>27\mu\text{m}$ , exine  $>3.3\mu\text{m}$  thick, apocolpium  $>10\mu\text{m}$  wide ..... *Euonymus oxyphyllus*
- 1b. Equatorial axis  $<25\mu\text{m}$ , polar axis  $<27\mu\text{m}$ , exine  $<3.3\mu\text{m}$  thick, apocolpium  $<9.0\mu\text{m}$  wide
  - 2a. Margo slightly prominent in equator,  $>2.0\mu\text{m}$  thick costae present ..... *Celastrus orbiculatus*
  - 2b. Margo flat, costae  $<2.0\mu\text{m}$  thick
    - 3a. Pori  $<4.0\mu\text{m}$  wide, lumina  $<1.0\mu\text{m}$  wide, apocolpium  $>8.0\mu\text{m}$  wide ..... *E. fortunei*
    - 3b. Pori  $>4.0\mu\text{m}$  wide, lumina  $>1.0\mu\text{m}$  wide, apocolpium  $<8.0\mu\text{m}$  wide
      - 4a. Pori circular, lalongate  $>5.0\mu\text{m}$  wide ..... *E. sieboldianus*
      - 4b. Pori circular  $<5.0\mu\text{m}$  wide ..... *E. alatus*

*Celastrus orbiculatus* Thunb.

'Tsuruumemodoki'

Exine 2.6  $\mu\text{m}$  thick; lumina 0.5-1.0  $\mu\text{m}$  wide, muri simplicolumellate 0.5  $\mu\text{m}$  wide; apocolpium 5.0-7.0  $\mu\text{m}$  wide, colpi equatorial prominent,  $<0.5\mu\text{m}$  high; pori circular 3.0-4.0  $\mu\text{m}$  wide, costae 1.5-2.5  $\mu\text{m}$  thick; polar axis 20-22-27  $\mu\text{m}$ , equatorial axis 18-23-25  $\mu\text{m}$ , P/E ratio 0.89-0.93-1.20; flowering in May-Jun. (*G. Koidzumi s.n.*; Loc. K)

*Euonymus alatus* Sieb. var. *microphyllus* (Nakai) Hara

'Kobamayumi'

Exine 2.9  $\mu\text{m}$  thick; lumina 1.0-2.0  $\mu\text{m}$  wide, muri simplicolumellate 0.5  $\mu\text{m}$  wide; apocolpium 6.0-8.0  $\mu\text{m}$  wide; pori circular 4.0-4.5  $\mu\text{m}$  wide, costae 1.5  $\mu\text{m}$  thick; polar axis 20-22-24  $\mu\text{m}$ , equatorial axis 18-21-23  $\mu\text{m}$ , P/E ratio 0.94-1.05-1.13; flowering in May-Jun. (*G. Murata et al. s.n.*; Loc. A)

*E. fortunei* (Turcz.) Hand.-Mazz.

'Tsurumasaki'

Exine 2.4  $\mu\text{m}$  thick; lumina 0.5-1.0  $\mu\text{m}$  wide, muri simplicolumellate; apocolpium 9.0  $\mu\text{m}$  wide; pori lalongate, circular  $3.0 \times 3.0$ -4.0  $\mu\text{m}$ , costae 1.5-2.0  $\mu\text{m}$  thick; polar axis 17-20-23  $\mu\text{m}$ , equatorial axis 17-21-23  $\mu\text{m}$ , P/E ratio 0.88-0.99-1.08; flowering in Jun-Jul. (*G. Koidzumi s.n.*; Loc. K)

*E. oxyphyllus* Miq.

'Tsuribana'

Exine 3.8  $\mu\text{m}$  thick; lumina 1.0-1.5  $\mu\text{m}$  wide, muri simplicolumellate; apocolpium 10-13  $\mu\text{m}$  wide; pori circular 3.0-4.0  $\mu\text{m}$  wide, costae 1.5  $\mu\text{m}$  thick; polar axis 27-29-32  $\mu\text{m}$ , equatorial axis 27-30-33  $\mu\text{m}$ , P/E ratio 0.88-0.96-1.04; flowering in May-Jun. (*G. Murata s.n.*; Loc. K)

*E. sieboldianus* Blume

'Mayumi'

Exine 2.5  $\mu\text{m}$  thick; lumina 1.0-2.0  $\mu\text{m}$  wide, muri simplicolumellate; apocolpium 7.0

$\mu\text{m}$  wide; pori circular, lalongate  $5.0 \times 6.0 \mu\text{m}$ ; polar axis 20-22-24  $\mu\text{m}$ , equatorial axis 20-22-24  $\mu\text{m}$ , P/E ratio 0.89-1.01-1.06; flowering in May-Jun. (*Anonymous s.n.*; Loc. K)

**Cephalotaxaceae** (1 genus, 1 species)

*Cephalotaxus harringtonia* (Knight) K. Koch var. *nana* (Nakai) Rehder

'Haiinugaya'

Inaperturate monad; exine 1.0-1.5  $\mu\text{m}$  thick; sexine scabrate, verrucate; slightly ridged in proximal face, circular in polar view; grains 21-24-28  $\mu\text{m}$ ; flowering in Mar-Apr. (*G. Murata 20941*; Loc. K)

**Cercidiphyllaceae** (1 genus, 1 species)

*Cercidiphyllum japonicum* Sieb. et Zucc.

'Katsura'

Tricolpate monad; exine 1.5-2.0  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5  $\mu\text{m}$  wide; colpi rounded at ends, wide, sunken, apocolpium 12-16  $\mu\text{m}$  wide, margo thinned; oval in equatorial view, semiangular in polar view; polar axis 21-26-31  $\mu\text{m}$ , equatorial axis 20-24-29  $\mu\text{m}$ , P/E ratio 0.89-1.07-1.20; flowering in Mar-May. (*T. Makino MAK 120595*; Loc. Saitama Pref.)

**Chenopodiaceae** (1 genus, 1 species)

*Chenopodium album* L.

'Shiroza'

Periporate (40-50 porate) monad; exine 2.0  $\mu\text{m}$  thick; sexine baculate, bacula forming tectum on top, tectum scabrate; pori circular 1.5-2.0  $\mu\text{m}$ , annuli present; grains circular; grains  
15-17-19  $\mu\text{m}$ ; flowering in Sep-Oct. (*S. Hosomi 7317*; Loc. K)

**Chloranthaceae** (1 genus, 1 species)

*Chloranthus serratus* (Thunb.) Roem. et Schult.

'Futarishizuka'

Stephanocolpate (5-6 colpate) monad; exine 1.8  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5-1.0  $\mu\text{m}$  wide; colpi ragged, apocolpium width variable; oval in equatorial view, circular in polar view; polar axis 20-21-23  $\mu\text{m}$ , equatorial axis 20-22-23  $\mu\text{m}$  wide, P/E ratio 0.88-0.98-1.13 (n=8); flowering in May. (*M. Tagawa s.n.*; Loc. K)

**Clethraceae** (1 genus, 1 species)

*Clethra barvinervis* Sieb. et Zucc.

'Ryoubu'

Tricolporate monad; exine 1.5  $\mu\text{m}$  thick; sexine psilate; colpi acute at ends, equatorial prominent, apocolpium 6.0-7.0 wide; pori lalongate 2.5-7.0  $\mu\text{m}$  wide, costae 1.5  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 16-18-20  $\mu\text{m}$ , equatorial axis 17-20-23  $\mu\text{m}$ , P/E ratio 0.82-0.92-1.15; flowering in Jul-Aug. (*M. Tagawa s.n.*; Loc. A)

## Commelinaceae (2 genera, 2 species)

Damaged by acetolysis; monocolpate monad; exine 1.0-2.5  $\mu\text{m}$  thick; sexine echinate, verrucate, echini 0.5-1.5  $\mu\text{m}$  high; grains elliptic; polar axis 17-35  $\mu\text{m}$ , equatorial axis 32-48  $\mu\text{m}$ ; flowering in Jul-Oct.

ref. *Commelina communis* L., 'Tsuyukusa' (Jul-Sep): 4; *Murdannia keisak* (Hassk.) Hand.-Mazz., 'Ibokusa' (Sep-Oct): 4.

- 1a. Polar axis  $>25\mu\text{m}$ , sexine echinate .....*Commelina communis*  
 1b. Polar axis  $<25\mu\text{m}$ , sexine verrucate .....*Murdannia keisak*

## Compositae (35 genera, 48 species)

Lactucoideae (6 genera, 9 species)

Fenestrate monad; exine 4.0-5.0  $\mu\text{m}$  thick; sexine echinate, echini 1.5-2.5  $\mu\text{m}$  high; echinate ridges forming a coarse network over the grain surface separating lacunae which are arranged in a geometric pattern; oval, hexagonal in equatorial view, triangular, hexagonal in polar view; grains 16-35  $\mu\text{m}$ , spherical; flowering in Apr-Nov.

ref. *Ixeris stolonifera* A.Gray, 'Iwanigana' (Apr-Jul): 2; *Lactuca indica* L., 'Akinogoshi' (Aug-Nov): 3; *L. raddeana* Maxim., 'Yamanigana' (Aug-Sep): 1; *L. sororia* Miq., 'Murasakinigana' (Jun-Aug): 1; *Lapsana apogonoides* Maxim., 'Koonitabirako' (Apr-May): 1; *Picris hieracoides* L., 'Kouzorina' (May-Oct): 4; *Taraxacum officinale* Weber, 'Seiyoutanpopo' (Apr-Nov): 4; *Youngia japonica* (L.) DC., 'Onitabirako' (May-Oct): 4.

*Ixeris dentata* (Thunb.) Nakai

'Nigana'

Exine 4.0-4.5  $\mu\text{m}$  thick; echini 2.0  $\mu\text{m}$  high; echinate ridge 4.0  $\mu\text{m}$  wide; grains 30-33-35  $\mu\text{m}$  (n=5); flowering in May-Jul. (S. Kitamura s.n.; Loc. K)

Asteroideae (27 genera, 39 species)

Tricolporate monad; exine 1.5-5.0  $\mu\text{m}$  thick; sexine echinate, verrucate, echini 0.5-5.5  $\mu\text{m}$  high; colpi acute at ends; pori lalongate, circular 1.0-12  $\mu\text{m}$  wide, costae 0.5-3.0  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 13-53  $\mu\text{m}$ , equatorial axis 15-52  $\mu\text{m}$ , oblate-spherical-prolate; flowering in Apr-Nov.

ref. *Ainsliaea apiculata* Sch. Bip., 'Kikkouhaguma' (Sep-Oct): 1; *Ambrosia artemisiaefolia* L., 'Butakusa' (Jul-Oct): 4; *Anaphalis margaritacea* (L.) Benth. et Hook. fil., 'Hosobanoyamahahako' (Aug-Sep): 4; *Arnica mallatopus* (Fr. et Sav.) Makino, 'Choujigiku' (Aug-Oct): 1; *Artemisia japonica* Thunb., 'Otokoyomogi' (Aug-Nov): 4; *Aster scaber* Thunb., 'Shirayamagiku' (Aug-Oct): 4; *Bidens frondosa* L., 'Amerikasendangusa' (Sep-Oct): 4; *Carpesium abrotanoides* L., 'Yabutabako' (Sep-Nov): 4; *Centipeda minima* (L.) A. Br. et Ascherson, 'Tokinsou' (Jul-Oct): 4; *Cirsium japonicum* DC., 'Noazami' (May-Aug): 4; *Cirsium nipponicum* (Maxim.) Makino, 'Yoshinoazami' (Aug-Oct): 4; *Erechtites hieracifolia* (L.) Raf. 'Dandoborogiku' (Sep-Oct): 4; *Erigeron canadensis* L., 'Himemukashiyomogi'

(Aug-Oct): 1; *Eupatorium chinense* L., 'Hiyodoribana' (Aug-Oct): 3; *E. lindleyum* DC., 'Sawahiyodori' (Aug-Oct): 4; *Gnaphalium affine* D. Don, 'Hahakogusa' (Apr-Jun): 3; *G. japonicum* Thunb., 'Chichikogusa' (May-Oct): 1; *Kalimeris pinnatifida* (Maxim.) Kitam., 'Yuugagiku' (Jul-Oct): 1; *Leibnitzia anandria* (L.) Turcz., 'Senbon'yari' (Apr-Oct): 4; *Ligularia fischerii* (Ledeb.) Turcz., 'Otakarakou' (Jul-Oct) 1; *Pertya robusta* (Maxim.) Beauv., 'Kashiwabahaguma' (Sep-Nov): 1; *P. scadens* Sch. Bip., 'Kouyabouki' (Sep-Oct): 3; *Senesio nikoensis* Miq., 'Sawagiku' (Jun-Aug): 4; *Synurus palmatopinnatifidus* (Makino) Kitam., 'Kikubayamabokuchi' (Sep-Nov): 1.

- 1a. Polar axis  $>36\mu\text{m}$   
 2a. Echini  $>4.0\mu\text{m}$  high,  $>5.0\mu\text{m}$  wide ..... *Circium kagamontanum*  
 2b. Echini  $<1.0\mu\text{m}$  high,  $<2.0\mu\text{m}$  wide, exine thicker in polar area.  
 ..... *Ainsliaea acerifolia*
- 1b. Polar axis  $<36\mu\text{m}$   
 3a. Echini, verrucae  $<1.0\mu\text{m}$  high  
 4a. Polar axis  $>22\mu\text{m}$ , pori lalongate, costae  $>2.0\mu\text{m}$  thick  
 ..... *Adenocaulon himalaicum*  
 4b. Polar axis  $<19\mu\text{m}$ , pori circular, costae  $<2.0\mu\text{m}$  thick  
 ..... *Artemisia princeps*
- 3b. Echini  $>1.5\mu\text{m}$  high  
 5a. Pori circular  
 6a. Equatorial axis  $<19\mu\text{m}$ , pori indistinct  $<1.5\mu\text{m}$  wide ..... *Stenactis annus*  
 6b. Equatorial axis  $22-27\mu\text{m}$ , pori  $1.5-3.0\mu\text{m}$  wide ..... *Cacalia delphiniifolia*  
 6c. Equatorial axis  $>27\mu\text{m}$ , pori  $>3.0\mu\text{m}$  wide ..... *Aster glehnii*
- 5b. Pori lalongate  
 7a. Colpi short,  $<10\mu\text{m}$  long  
 8a. Echini  $<3.0\mu\text{m}$  high ..... *Solidago virgaurea*  
 8b. Echini  $>3.0\mu\text{m}$  high ..... *Petasites japonicus*, *Sigesbeckia orientalis*
- 7b. Colpi long,  $>10\mu\text{m}$  long  
 9a. Equatorial axis  $>28\mu\text{m}$  ..... *Cacalia nikomontana*  
 9b. Equatorial axis  $<28\mu\text{m}$   
 10a. Pori  $>7.5\mu\text{m}$  long ..... *Carpesium divaricatum*  
 10b. Pori  $5.0-7.5\mu\text{m}$  long ..... *Kalimeris yomena*, *Miyamayomena savatieri*  
 10c. Pori  $<5.0\mu\text{m}$  long ..... *Aster ageratoides*

*Adenocaulon himalaicum* Edgew. 'Nobuki'  
 Exine  $2.0-3.0\mu\text{m}$  thick; sexine echinate, echini  $0.5-1.0\mu\text{m}$  high; apocolpium  $7.0\mu\text{m}$  wide; pori lalongate  $2.0 \times 12\mu\text{m}$ , ragged, costae  $3.0\mu\text{m}$  thick; polar axis  $22-26-29\mu\text{m}$ , equatorial axis  $22-25-27\mu\text{m}$ , P/E ratio  $0.94-1.08-1.17$ ; flowering in Aug-Oct. (S. Okamoto s.n.; Loc. A)

*Ainsliaea acerifolia* Sch. Bip. 'Okumomijihaguma'  
 Exine  $3.5\mu\text{m}$  thick,  $5.0\mu\text{m}$  thick in polar area; sexine echinate, echini  $0.5\mu\text{m}$  high,  $1.0\mu\text{m}$  wide; colpi  $22\mu\text{m}$  long, apocolpium  $19\mu\text{m}$  wide; pori lalongate  $10 \times 12-13\mu\text{m}$ , costae  $0.5-1.0\mu\text{m}$  thick; polar axis  $36-39-42\mu\text{m}$ , equatorial axis  $31-33-35\mu\text{m}$ , P/E ratio  $1.11-1.18-1.24$ ; flowering in Aug-Oct. (Y. Araki s.n.; Loc. A)

*Artemisia princeps* Pamp. 'Yomogi'  
 Exine  $3.0\mu\text{m}$  thick; sexine verrucate, verrucae  $<0.5\mu\text{m}$  high,  $0.5-1.0\mu\text{m}$  wide; apocolpium  $5.0\mu\text{m}$  wide; pori circular  $3.0\mu\text{m}$  wide, costae  $1.0\mu\text{m}$  thick; polar axis

17-18-19  $\mu\text{m}$ , equatorial axis 17-20-23  $\mu\text{m}$ , P/E ratio 0.78-0.90-1.00; flowering in Sep-Oct. (*M. Tagawa 456*; Loc. K)

*Aster ageratoides* Turcz. ssp. *ovatus* Fr. et Sav. 'Nokongiku'  
Exine 1.9  $\mu\text{m}$  thick; sexine echinate, echini 3.0-3.5  $\mu\text{m}$  high, 3.0-4.0  $\mu\text{m}$  wide; apocolpium 8.0-11  $\mu\text{m}$  wide; pori lalongate 2.5-3.0  $\times$  4.0-5.0  $\mu\text{m}$ , costae 1.0-1.5  $\mu\text{m}$  thick; polar axis 20-22-24  $\mu\text{m}$ , equatorial axis 20-22-25  $\mu\text{m}$ , P/E ratio 0.88-0.99-1.12; flowering in Aug-Nov. (*S. Okamoto s.n.*; Loc. K)

*A. glehnii* Fr. Schm. 'Gomana'  
Exine 2.5-3.0  $\mu\text{m}$  thick; sexine echinate, echini 5.0  $\mu\text{m}$  high, 3.0-3.5  $\mu\text{m}$  wide; colpi 7.0-8.0  $\mu\text{m}$  long; pori circular 4.0-5.0  $\mu\text{m}$  wide, costae 1.0  $\mu\text{m}$  thick; polar axis 26-28-30  $\mu\text{m}$ , equatorial axis 27-29-30  $\mu\text{m}$ , P/E ratio 0.91-0.96-1.05; flowering in Sep-Oct. (*S. Okamoto s.n.*; Loc. A)

*Cacalia delphiniifolia* Sieb. et Zucc. 'Momijigasa'  
Exine 2.5-3.0  $\mu\text{m}$  thick; sexine echinate, echini 4.0  $\mu\text{m}$  high, 3.5-4.0  $\mu\text{m}$  wide; colpi 8.0-9.0  $\mu\text{m}$  long; pori circular 2.0  $\mu\text{m}$  wide; polar axis 22-26-28  $\mu\text{m}$ , equatorial axis 22-25-27  $\mu\text{m}$ , P/E ratio 0.95-1.03-1.11 (n=19); flowering in Aug-Sep. (*G. Murata 18952*; Loc. S)

*C. nikomontana* Matsum. 'Ookanikoumori'  
Exine 3.9  $\mu\text{m}$  thick; sexine echinate, echini 3.5-4.0  $\mu\text{m}$  high, 3.0  $\mu\text{m}$  wide; colpi 11-12  $\mu\text{m}$  long; pori lalongate 2.5-3.5  $\times$  7.0-9.0  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; polar axis 27-31-35  $\mu\text{m}$ , equatorial axis 28-30-33  $\mu\text{m}$ , P/E ratio 0.95-1.04-1.13; flowering in Aug-Oct. (*S. Kitamura s.n.*; Loc. A)

*Carpesium divaricatum* Sieb. et Zucc. 'Gankubisou'  
Exine 2.0-2.5  $\mu\text{m}$  thick; sexine echinate, echini 3.0  $\mu\text{m}$  high, 2.5-3.0  $\mu\text{m}$  wide; colpi 12  $\mu\text{m}$  long; pori lalongate 3.0  $\times$  8.0  $\mu\text{m}$ ; polar axis 18-22-24  $\mu\text{m}$ , equatorial axis 21-22-24  $\mu\text{m}$ , P/E ratio 0.88-0.97-1.00; flowering in Aug-Oct. (*K. Iwatsuki 5514*; Loc. A)

*Circium kagamontanum* Nakai 'Kaganoazami'  
Exine 3.5-4.0  $\mu\text{m}$  thick; sexine echinate, echini 4.5  $\mu\text{m}$  high, 7.0  $\mu\text{m}$  wide; colpi 20  $\mu\text{m}$  long; pori lalongate 7.0-9.0  $\times$  9.0-12  $\mu\text{m}$ ; polar axis 36-41-48  $\mu\text{m}$ , equatorial axis 38-43-52  $\mu\text{m}$ , P/E ratio 0.92-0.96-1.00; flowering in Aug-Oct. (*S. Kitamura s.n.*; Loc. A)

*Kalimeris yomena* Kitam. 'Yomena'  
Exine 2.0  $\mu\text{m}$  thick; sexine echinate, echini 2.5-3.0  $\mu\text{m}$  high; colpi 13  $\mu\text{m}$  long, apocolpium 11-13  $\mu\text{m}$  wide; pori lalongate 3.0  $\times$  7.0-5.0  $\mu\text{m}$ ; polar axis 17-21-24  $\mu\text{m}$ , equatorial axis 20-22-25  $\mu\text{m}$ , P/E ratio 0.87-0.96-1.12; flowering in Jul-Oct. (*T. Tsuchiya 2121*; Loc. K)

*Miyamayomena savatieri* (Makino) Kitam. 'Miyamayomena'  
Exine 1.9  $\mu\text{m}$  thick; sexine echinate, echini 3.0-3.5  $\mu\text{m}$  high, 3.5  $\mu\text{m}$  wide; colpi 13-16

$\mu\text{m}$  long, apocolpium  $12\ \mu\text{m}$  wide; pori lalongate  $2.0\text{-}2.5 \times 7.0\text{-}5.0\ \mu\text{m}$ , costae  $1.5\ \mu\text{m}$  thick; polar axis  $18\text{-}22\text{-}27\ \mu\text{m}$ , equatorial axis  $18\text{-}22\text{-}27\ \mu\text{m}$ , P/E ratio  $0.83\text{-}1.00\text{-}1.14$ ; flowering in May-Jun. (*G. Koidzumi s.n.*; Loc. K)

*Petasites japonicus* (Sieb. et Zucc.) Maxim. 'Fuki'  
Exine  $1.5\text{-}2.0\ \mu\text{m}$  thick; sexine echinate, echini  $3.5\text{-}4.0\ \mu\text{m}$  high; colpi  $8.0\ \mu\text{m}$  long; pori lalongate  $4.0\text{-}4.5 \times 7.0\ \mu\text{m}$ ; polar axis  $21\text{-}23\text{-}24\ \mu\text{m}$ , equatorial axis  $23\text{-}25\text{-}28\ \mu\text{m}$ , P/E ratio  $0.85\text{-}0.91\text{-}0.95$ ; flowering in Apr-May. (*G. Murata s.n.*; Loc. K)

*Sigesbeckia orientalis* L. 'Komenamomi'  
Exine  $2.0\ \mu\text{m}$  thick; sexine echinate, echini  $3.5\text{-}4.0\ \mu\text{m}$  high; colpi  $9.0\text{-}10\ \mu\text{m}$  long; pori lalongate  $3.5 \times 8.0\text{-}9.0\ \mu\text{m}$ ; polar axis  $21\text{-}22\text{-}23\ \mu\text{m}$ , equatorial axis  $24\ \mu\text{m}$ , P/E ratio  $0.89\text{-}0.93\text{-}0.95$  ( $n=4$ ); flowering in Sep-Oct. (*T. Takahashi 2074*; Loc. K)

*Solidago virgaurea* L. 'Akinokirinsou'  
Exine  $1.8\text{-}2.0\ \mu\text{m}$  thick; sexine echinate, echini  $2.0\text{-}2.5\ \mu\text{m}$  high,  $2.5\ \mu\text{m}$  wide; colpi  $8.0\ \mu\text{m}$  long, apocolpium  $9.0\ \mu\text{m}$  wide; pori lalongate  $2.0\text{-}3.5 \times 5.0\text{-}6.5\ \mu\text{m}$ , costae  $1.0\ \mu\text{m}$  thick; polar axis  $16\text{-}18\text{-}20\ \mu\text{m}$ , equatorial axis  $17\text{-}20\text{-}22\ \mu\text{m}$ , P/E ratio  $0.81\text{-}0.94\text{-}1.00$ ; flowering in Aug-Nov. (*T. Takahashi 457*; Loc. K)

*Stenactis annuus* (L.) Cass. 'Himejoon'  
Exine  $1.5\text{-}2.0\ \mu\text{m}$  thick; sexine echinate, echini  $1.5\text{-}2.0\ \mu\text{m}$  high; colpi  $13\ \mu\text{m}$  long, apocolpium  $4.0\text{-}8.0\ \mu\text{m}$  wide; pori indistinct  $1.0\ \mu\text{m}$  wide; polar axis  $13\text{-}16\text{-}18\ \mu\text{m}$ , equatorial axis  $15\text{-}17\text{-}19\ \mu\text{m}$ , P/E ratio  $0.78\text{-}0.93\text{-}1.00$ ; flowering in Jun-Oct. (*S. Hosomi 6797*; Loc. K)

#### Convolvulaceae (2 genera, 2 species)

*Calystegia* (1 species)

*Calystegia japonica* Choisy 'Hirugao'  
Periporate (10-20 porate) monad; exine  $5.5\ \mu\text{m}$  thick; sexine baculate; pori circular  $5.0\text{-}7.0\ \mu\text{m}$  wide, dropped inside; grains circular; grains  $56\text{-}90\ \mu\text{m}$ ; flowering in Jul-Aug. (ref. 3)

*Cuscuta* (1 species)

*Cuscuta japonica* Chisy 'Nenashikazura'  
Tricolpate, stephanocolpate (4 colpate) monad; exine  $2.5\ \mu\text{m}$  thick; sexine baculate, bacula forming tectum on top; oval in equatorial view, circular in polar view; polar axis  $32\text{-}36\ \mu\text{m}$ , equatorial axis  $28\text{-}36\ \mu\text{m}$ , spherical; flowering in Aug-Oct. (ref. 4)

#### Cornaceae (4 genera, 5 species)

*Aucuba* (1 species)

*Aucuba japonica* Thunb. 'Himeaoki'  
Tricolporate monad; exine  $3.0\text{-}3.5\ \mu\text{m}$  thick; sexine clavate, clavae  $0.5\text{-}1.0\ \mu\text{m}$  wide,

2.5-3.0  $\mu\text{m}$  high; colpi constricted at equator, apocolpium 18  $\mu\text{m}$  wide; pori indistinct, circular 4.0-5.0  $\mu\text{m}$  wide, costae 3.0-4.0  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 32-38-43  $\mu\text{m}$ , equatorial axis 32-40-44  $\mu\text{m}$ , P/E ratio 0.88-0.97-1.03; flowering in Apr-May. (*Y. Inamasu 45*; Loc. A)

*Benthamidia* (1 species)

*Benthamidia japonica* (Sieb. et Zucc.) Hara 'Yamaboushi'  
Tricolporate monad; exine 1.0-1.5  $\mu\text{m}$  thick; sexine verrucate, scabrate; colpi acute at ends, equatorial prominent, apocolpium 6.0-7.5  $\mu\text{m}$  wide, margo 4.0  $\mu\text{m}$  thick, 4.0-5.0  $\mu\text{m}$  wide; pori lalongate 2.0  $\times$  3.0  $\mu\text{m}$ , costae 1.5  $\mu\text{m}$  thick; oval, equatorial acute oval in equatorial view, angular, semiangular in polar view; polar axis 22-24-27  $\mu\text{m}$ , equatorial axis 21-24-26  $\mu\text{m}$ , P/E ratio 0.91-1.03-1.17 (n=11); flowering in Jun-Jul. (*S. Okamoto s.n.*; Loc. A)

*Helwingia* (1 species)

*Helwingia japonica* (Thunb.) F. G. Dietrich 'Hanaikada'  
Tricolporate monad; exine 1.3  $\mu\text{m}$  thick; sexine scabrate; colpi acute at ends, constricted at equator, apocolpium 4.0-8.0  $\mu\text{m}$  wide; pori indistinct, costae 1.0  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 21-25-29  $\mu\text{m}$ , equatorial axis 16-20-23  $\mu\text{m}$ , P/E ratio 1.05-1.25-1.47; flowering in May-Jun. (*H. Nagamasu 71*; Loc. K)

*Swida* (2 species)

Tricolporate monad; exine 1.0-1.8  $\mu\text{m}$  thick; sexine verrucate, scabrate; colpi acute at ends, constricted at equator, apocolpium 6.0-16  $\mu\text{m}$  wide, margo 3.0  $\mu\text{m}$  thick, 5.0-6.0  $\mu\text{m}$  wide; pori lalongate 3.0-4.0  $\times$  4.0-8.0  $\mu\text{m}$ , costae 2.0-2.5  $\mu\text{m}$  thick; equatorial acute oval in equatorial view, angular in polar view; polar axis 35-53  $\mu\text{m}$  equatorial axis 25-34  $\mu\text{m}$ , prolate; flowering in May-Jul.

- 1a. Polar axis  $>42\mu\text{m}$ , exine  $>1.4\mu\text{m}$  thick, apocolpium  $>10\mu\text{m}$  wide, pori  $>6.0\mu\text{m}$  long .....*Swida macrophylla*  
1b. Polar axis  $<42\mu\text{m}$ , exine  $<1.4\mu\text{m}$  thick, apocolpium  $<10\mu\text{m}$  wide, pori  $<6.0\mu\text{m}$  long .....*S. controversa*

*Swida controversa* (Hemsl.) Sojak 'Mizuki'  
Exine 1.0  $\mu\text{m}$  thick; apocolpium 6.0-7.0  $\mu\text{m}$  wide, margo thickened, 5.0-6.0  $\mu\text{m}$  wide; pori lalongate 3.0  $\times$  4.0-5.0  $\mu\text{m}$ , costae 2.0  $\mu\text{m}$  thick; polar axis 35-39-43  $\mu\text{m}$ , equatorial axis 25-29-32  $\mu\text{m}$ , P/E ratio 1.21-1.36-1.53; flowering in May-Jun. (*G. Koidzumi s.n.*; Loc. K)

*S. macrophylla* (Wall.) Sojak 'Kumanomizuki'  
Exine 1.4-1.8  $\mu\text{m}$  thick; apocolpium 16  $\mu\text{m}$  wide, margo 3.0  $\mu\text{m}$  thick, 5.0-6.0  $\mu\text{m}$  wide; pori lalongate 4.0  $\times$  8.0  $\mu\text{m}$ , costae 2.0-2.5  $\mu\text{m}$  thick; polar axis 42-46-53  $\mu\text{m}$ , equatorial axis 25-31-34  $\mu\text{m}$ , P/E ratio 1.25-1.50-1.87; flowering in Jun-Jul. (*T. Takahashi 184*; Loc. K)



**Crassulaceae** (1 genus, 1 species)

*Hylotelephium verticillatum* (L.) H. Ohba 'Mitsubabenkeisou'  
Tricolporate monad; exine  $1.0\ \mu\text{m}$  thick; sexine scabrate; colpi acute at ends, apocolpium  $5.0\ \mu\text{m}$  wide, margo thickened; pori circular  $2.0\text{-}3.0\ \mu\text{m}$  wide, costae  $2.0\ \mu\text{m}$  thick; oval in equatorial view, circular, semiangular in polar view; polar axis  $16\text{-}17\text{-}19\ \mu\text{m}$ , equatorial axis  $12\text{-}14\text{-}17\ \mu\text{m}$ , P/E ratio  $1.08\text{-}1.25\text{-}1.40$ ; flowering in Aug-Sep. (*M. Ito 7007*; Loc. S)

**Cruciferae** (5 genera, 7 species)

Tricolpate monad; exine  $1.5\text{-}2.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\text{-}2.0\ \mu\text{m}$  wide; colpi long, margo thinned; oval in equatorial view, circular in polar view; grains  $12\text{-}29\ \mu\text{m}$ , spherical-prolate; flowering in Apr-Sep.

ref. *Arabis hirsuta* (L.) Scopoli, 'Yamahatazao' (May-Jul): 1; *Capsella bursa-pastoris* Medicus, 'Nazuna' (Apr-Jun): 4; *Cardamine flexuosa* With., 'Tanetsukebana' (Apr-Jun): 3; *C. leucantha* (Tausch) O. E. Schulz, 'Konronsou' (Apr-Jul): 4; *C. regeliana* Miq., 'Oobatanetsubana' (Apr-Jun): 2; *Rorippa indica* (L.) Hiern, 'Inugarashi' (Apr-Sep): 3.

*Wasabia japonica* (Miq.) Matsum. 'Wasabi'  
Exine  $2.0\ \mu\text{m}$  thick; colpi acute at ends, apocolpium  $5.0\text{-}7.0\ \mu\text{m}$  wide; polar axis  $16\text{-}20\text{-}23\ \mu\text{m}$ , equatorial axis  $10\text{-}12\text{-}15\ \mu\text{m}$ , P/E ratio  $1.12\text{-}1.40\text{-}1.98$ ; flowering in Apr-May.  
(*K. Ueda et al. 516*; Loc. A)

**Cucurbitaceae** (2 genera, 2 species)*Gynostemma* (1 species)

*Gynostemma pentaphylla* (Thunb.) Makino 'Amachaduru'  
Tricolporate monad; exine  $1.5\ \mu\text{m}$  thick; sexine striate; colpi acute at ends, long, margo thickened; pori lalongate; oval in equatorial view, circular in polar view; polar axis  $21\text{-}24\ \mu\text{m}$ , equatorial axis  $16\text{-}20\ \mu\text{m}$ , prolate; flowering in Aug-Sep. (ref. 4)

*Melothria* (1 species)

*Melothria japonica* (Thunb.) Maxim. ex Cogn. 'Suzumeuri'  
Tricolporate monad; exine  $2.0\ \mu\text{m}$  thick; sexine reticulate; colpi acute at ends, long, margo thickened; pori lalongate; oval in equatorial view, circular in polar view; polar axis  $43\text{-}47\ \mu\text{m}$ , equatorial axis  $45\text{-}49\ \mu\text{m}$ , spherical; flowering in Aug-Sep. (ref. 4)

**Cupressaceae** (2 genera, 2 species)

Monoporate, inaperturate monad; exine  $1.0\text{-}1.5\ \mu\text{m}$  thick; sexine scabrate, gemmate; pori circular  $2.0\ \mu\text{m}$  wide, annulus absent; grains circular; grains  $20\text{-}37\ \mu\text{m}$ ; flowering

in Apr-May.

ref. *Thujaopsis dolabrata* Sieb. et Zucc., 'Asunaro' (May): 4.

*Camaecypris obtusa* (Sieb. et Zucc.) Endl.

'Hinoki'

Exine 1.5  $\mu\text{m}$  thick; grains 20-23-27  $\mu\text{m}$ ; flowering in Apr-May. (S. Tsugaru 15577; Loc. K)

### Cyperaceae

Inaperturate, monoporate, periporate (>4 porate) monad; sexine scabrate, verrucate; 1 pore in distal face, >3 pori in equator, indistinct; grains irregular, usually pear-shaped.

ref. 1, 3, 4

### Daphniphyllaceae (1 genus, 1 species)

*Daphniphyllum macropodum* Miq. ssp. *humile* (Maxim.) Rosenthal 'Ezoyuzuriha'  
Tricolporate monad; exine 1.5  $\mu\text{m}$  thick; sexine verrucate; colpi acute at ends, apocolpium 6.0-8.0  $\mu\text{m}$  wide, margo thinned; pori lolongate, irregular, 5.0  $\times$  2.0  $\mu\text{m}$  wide, costae 1.0  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 15-17-20  $\mu\text{m}$ , equatorial axis 16-19-22  $\mu\text{m}$ , P/E ratio 0.82-0.92-1.07; flowering in Apr-May. (G. Murata and T. Takahashi 15993; Loc. 1)

### Diapensaceae (2 genera, 2 species)

Tricolporate monad; exine 1.2-1.5  $\mu\text{m}$  thick; sexine reticulate; colpi long, acute at ends; oval in equatorial view, circular in polar view; polar axis 18-27  $\mu\text{m}$ , equatorial axis 18-25, spherical-prolate; flowering in Apr-Jul.

ref. *Shortia uniflora* (Maxim.) Maxim., 'Iwauchiwa' (Apr-May): 1.

*Schizocodon soldanelloides* Sieb. et Zucc.

'Ooiwakagami'

Exine 1.2  $\mu\text{m}$  thick; lumina <0.5  $\mu\text{m}$  wide; colpi constricted at equator, apocolpium 4.0-6.0  $\mu\text{m}$  wide; pori indistinct, lalongate 1.5  $\times$  4.0-5.0  $\mu\text{m}$ , costae 1.0-1.5  $\mu\text{m}$  thick; polar axis 18-21-25  $\mu\text{m}$ , equatorial axis 18-22-25  $\mu\text{m}$ , P/E ratio 0.83-0.96-1.11; flowering in Apr-Jul. (H. Nagamasu 4506; Loc. A)

### Dioscoreaceae (1 genus, 6 species)

Monocolpate monad; exine 1.0  $\mu\text{m}$  thick; sexine reticulate, striate; grains circular, elliptic; polar axis 10-21  $\mu\text{m}$ , equatorial axis 12-25  $\mu\text{m}$ ; flowering in Jun-Aug.

ref. *Dioscorea japonica* Thunb., 'Yamanoimo' (Jul-Aug): 3; *D. nipponica* Makino, 'Uchiwadokoro' (Jul-Aug): 1; *D. quinqueloba* Thunb., 'Kaededokoro' (Jul-Aug): 1; *D. septemloba* Thunb., 'Kikubadokoro' (Jun-Jul): 1; *D. tokoro* Makino, 'Onidokoro' (Jul-Aug): 3.

*Dioscorea gracillima* Miq.

'Tachidokoro'

Sexine striate, striae in spirals around the grain; polar axis 15-18-21  $\mu\text{m}$ , equatorial axis 20-23-25  $\mu\text{m}$ ; flowering in Jun-Jul. (*G. Nakai 4438*; Loc. H)

**Dipsacaceae** (1 genus, 1 species)

*Dipsacus japonicus* Miq.

'Nabena'

Tricolpate monad; exine 3.5  $\mu\text{m}$  thick; sexine echinate, echini 2.0  $\mu\text{m}$  high; colpi ragged, 20-25  $\mu\text{m}$  long, 10-12  $\mu\text{m}$  wide, margo thickened, dropping inside, sometimes with operculum; oval in equatorial view, semiangular in polar view; polar axis 56-64-74  $\mu\text{m}$ , equatorial axis 58-65-73  $\mu\text{m}$ , P/E ratio 0.88-0.97-1.08; flowering in Aug-Sep. (*S. Okamoto s.n.*; Loc. A)

**Ebenaceae** (1 genus, 1 species)

*Diospyros kaki* Thunb.

'Kakinoki'

Tricolporate monad; exine 1.5-2.0  $\mu\text{m}$  thick; sexine scabrate; colpi acute at ends, sometimes joining to another at the poles, apocolpium 8.0-12  $\mu\text{m}$  wide, margo thickened; pori lalongate 4.0  $\times$  10  $\mu\text{m}$ , costae 2.5  $\mu\text{m}$  thick; oval in equatorial view, semiangular in polar view; polar axis 35-38-43  $\mu\text{m}$ , equatorial axis 32-36-39  $\mu\text{m}$ , P/E ratio 0.90-1.04-1.15; flowering in May-Jun. (*G. Murata 68441*; Loc. K)

**Elaeagnaceae** (1 genus, 2 species)

Tricolporate monad; exine 1.5-2.0  $\mu\text{m}$  thick; sexine scabrate; colpi narrow, short, equatorial prominent; pori circular, lalongate 5.0-8.0  $\mu\text{m}$  wide, with vestibulum; oval in equatorial view, angular in polar view; polar axis 25-40  $\mu\text{m}$ , equatorial axis 30-47  $\mu\text{m}$ , oblate; flowering in Apr-May.

ref. *Elaeagnus umbellata* Thunb., 'Akigumi' (Apr-May): 3.

*Elaeagnus multiflora* Thunb.

'Tougumi'

Colpi 1.0  $\mu\text{m}$  wide, apocolpium 16-23  $\mu\text{m}$  wide; pori lalongate 8.0  $\times$  6.0  $\mu\text{m}$  wide, with vestibulum 6.0-8.0  $\mu\text{m}$  high; polar axis 25-29-32  $\mu\text{m}$ , equatorial axis 33-39-43  $\mu\text{m}$  include vestibulum, P/E ratio 0.68-0.74-0.85; flowering in Apr-May. (*Anonymous s.n.*; Loc. ?)

**Ericaceae** (10 genera, 17 species)

*Enkianthus* (1 species)

*Enkianthus campanulatus* (Miq.) Nicholson

'Sarasadoudan'

Tricolporate monad; exine 1.2  $\mu\text{m}$  thick; sexine scabrate; colpi long, acute at ends; pori lalongate, with costae oval in equatorial view, circular, semiangular in polar view; grains 21-24  $\mu\text{m}$ , spherical-prolate; flowering in May-Jun. (ref. 4)

*Elliottia*, *Epigaea*, *Gaultheria*, *Leucothoe*, *Lyonia*, *Menziesia*, *Pieris*, *Rhododendron*

and *Vaccinium* (16 species)

Tricolporate tetrads; exine 1.0-2.5  $\mu\text{m}$  thick; sexine rugulate, verrucate, scabrate; colpi acute at ends, margo thickened; pori lalongate 1.0-3.0  $\times$  3.5-8.0  $\mu\text{m}$ , costae 1.0-1.5  $\mu\text{m}$  thick; tetrads tetrahedral; grains, polar axis 13-29  $\mu\text{m}$ , equatorial axis 18-39  $\mu\text{m}$ ; flowering in Apr-Aug.

ref. *Gaultheria adenothrix* (Miq.) Maxim., 'Akamono' (May-Jun): 4; *Leucothoe grayana* Maxim., 'Hanahirinoki' (Jun-Jul): 1; *Rhododendron japonicum* (A. Gray) Suringar, 'Rengetsutsuji' (May-Jun): 3; *R. keiskei* Miq., 'Hikagetsutsuji' (Apr-May) 4; *R. lagopus* Nakai, 'Saikokumitsubatsutsuji' (Apr-May) 4; *Vaccinium oldhami* Miq., 'Natsuhaze' (May-Jun): 1; *V. smalli*: A. Gray, 'Oobasunoki' (Jun-Jul): 1.

1a. Polar axis <16  $\mu\text{m}$

2a. Pori >5.0  $\mu\text{m}$  long ..... *Vaccinium hirtum*

2b. Pori <5.0  $\mu\text{m}$  long ..... *Lyonia ovalifolia*

1b. Polar axis >16  $\mu\text{m}$

3a. Equatorial axis <26  $\mu\text{m}$

..... *Epigaea asiatica*, *Menziesia cilicalyx*, *Pieris japonica*, *V. hirtum*

3b. Equatorial axis >26  $\mu\text{m}$  ..... *Elliottia paniculata*, *Epigaea asiatica*, *Menziesia cilicalyx*, *Pieris japonica*, *Rhododendron degronianum*, *R. obtusum*, *R. reticulatum*

*Elliottia paniculata* (Sieb. et Zucc.) Benth. et Hook. 'Hotsutsuji'

Exine 1.9  $\mu\text{m}$  thick; sexine verrucate, scabrate; colpi 7.0-8.0  $\mu\text{m}$  long; pori lalongate 3.0  $\times$  7.0-8.0  $\mu\text{m}$ , costae 1.0-1.5  $\mu\text{m}$  thick; grains, polar axis 17-22-28  $\mu\text{m}$ , equatorial axis 26-30-33  $\mu\text{m}$ ; flowering in Jul-Aug. (*K. Iwatsuki 5488*; Loc. A)

*Epigaea asiatica* Maxim. 'Iwanashi'

Exine 2.0  $\mu\text{m}$  thick; sexine verrucate, verrucae 1.0-1.5  $\mu\text{m}$  wide; colpi 6.0-8.0  $\mu\text{m}$  long; pori lalongate 1.5-2.0  $\times$  5.0-6.0  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; grains, polar axis 16-18-22  $\mu\text{m}$ , equatorial axis 22-25-28  $\mu\text{m}$ ; flowering in May-Jun. (*G. Murata 5974*; Loc. K)

*Lyonia ovalifolia* (Wall.) Drude 'Nejiki'

Exine 1.7  $\mu\text{m}$  thick; sexine verrucate, verrucae 0.5-1.5  $\mu\text{m}$  wide; colpi 7.0  $\mu\text{m}$  long; pori lalongate 1.0  $\times$  3.5  $\mu\text{m}$ , costae 1.5  $\mu\text{m}$  thick; grains, polar axis 13-15-15  $\mu\text{m}$ , equatorial axis 18-21-23  $\mu\text{m}$ ; flowering in May-Jun. (*G. Koidzumi s.n.*; Loc. K)

*Menziesia cilicalyx* (Miq.) Maxim. 'Tsuriganetsutsuji'

Exine 1.6-2.0  $\mu\text{m}$  thick; sexine rugulate, verrucate; colpi 4.0-6.0  $\mu\text{m}$  long, margo 2.0  $\mu\text{m}$  thick, 2.5  $\mu\text{m}$  wide; pori lalongate 1.5-3.0  $\times$  6.0-7.0  $\mu\text{m}$ ; grains, polar axis 16-20-24  $\mu\text{m}$ , equatorial axis 23-28-30  $\mu\text{m}$ ; flowering in Apr-Jun. (*H. Nagamasu 4489*; Loc. A)

*Pieris japonica* (Thunb.) D. Don 'Asebi'

Exine 1.9  $\mu\text{m}$  thick; sexine verrucate, rugulate; colpi 8.0-10  $\mu\text{m}$  long; pori lalongate 1.5-2.0  $\times$  8.0-10  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; grains, polar axis 16-18-20  $\mu\text{m}$ , equatorial axis 23-27-30  $\mu\text{m}$ ; flowering in Apr-May. (*G. Murata 5974*; Loc. K)

*Rhododendron degronianum* Carrière 'Honshakunage'

Exine  $2.2\ \mu\text{m}$  thick; sexine verrucate, rugulate, verrucae  $2.0\ \mu\text{m}$  wide; colpi  $8.0\text{-}9.0\ \mu\text{m}$  long; pori lalongate  $2.0\text{-}3.0 \times 8.0\ \mu\text{m}$ , costae  $1.0\text{-}1.5\ \mu\text{m}$  thick; grains, polar axis  $22\text{-}25\text{-}28\ \mu\text{m}$ , equatorial axis  $30\text{-}35\text{-}39\ \mu\text{m}$ ; flowering in May-Jun. (*Anonymous s.n.*; Loc. K)

*R. obtusum* (Lindl.) Planchon var. *kaempferi* (Planchon) Wilson 'Yamatsutsuji'  
Exine  $2.5\ \mu\text{m}$  thick; sexine verrucate, scabrate, verrucae  $0.5\text{-}1.0\ \mu\text{m}$  wide; colpi  $7.0\ \mu\text{m}$  long; pori lalongate  $2.0\text{-}3.0 \times 7.0\text{-}8.0\ \mu\text{m}$ , costae  $1.0\text{-}1.5\ \mu\text{m}$  thick; grains, polar axis  $20\text{-}22\text{-}25\ \mu\text{m}$ , equatorial axis  $28\text{-}32\text{-}35\ \mu\text{m}$ ; flowering in Apr-Jun. (*G. Murata 18019*; Loc. K)

*R. reticulatum* D. Don 'Kobanomitsubatsutsuji'  
Exine  $1.8\text{-}2.0\ \mu\text{m}$  thick; sexine verrucate, rugulate; colpi  $7.0\text{-}9.0\ \mu\text{m}$  long, margo  $2.5\ \mu\text{m}$  thick,  $2.0\ \mu\text{m}$  wide; pori lalongate  $2.5 \times 8.0\ \mu\text{m}$ , costae  $2.5\ \mu\text{m}$  thick; grains, polar axis  $20\text{-}24\text{-}29\ \mu\text{m}$ , equatorial axis  $28\text{-}33\text{-}37\ \mu\text{m}$ ; flowering in Apr. (*H. Nagamasu 4491*; Loc. A)

*Vaccinium hirtum* Thunb. var. *pubescens* (Koidz.) Yamazaki 'Usunoki'  
Exine  $1.5\ \mu\text{m}$  thick; sexine verrucate, verrucae  $0.5\text{-}1.0\ \mu\text{m}$  wide; colpi  $8.0\text{-}9.0\ \mu\text{m}$  long; pori lalongate  $1.0\text{-}1.5 \times 6.0\text{-}8.0\ \mu\text{m}$ , costae  $1.0\text{-}1.5\ \mu\text{m}$  thick; grains, polar axis  $12\text{-}15\text{-}18\ \mu\text{m}$ , equatorial axis  $20\text{-}23\text{-}26\ \mu\text{m}$ ; flowering in Apr-May. (*Z. Tashiro s.n.*; Loc. K)

#### Eriocaulaceae (1 genus, 2 species)

Syncolpate monad; exine  $1.0\text{-}1.5\ \mu\text{m}$  thick; sexine echinate, echini  $<1.0\ \mu\text{m}$  high; colpi in 3-4 parallel spirals around the grain; grains circular; grains  $20\text{-}26\ \mu\text{m}$ ; flowering in Aug-Oct.

ref. *Eriocaulon cinereum* R. Br., 'Hoshikusa' (Aug-Oct): 1; *E. miquelianum* Koernicke, 'Inunohige' (Aug-Oct): 3.

#### Euphorbiaceae (6 genera, 8 species)

*Acalypha* (1 species)

*Acalypha australis* L. 'Enokigusa'  
Tricolporate, stephanocolporate (4 colporate) monad; exine  $1.2\ \mu\text{m}$  thick; sexine scabrate; colpi short, equatorial prominent; pori circular  $1.2\ \mu\text{m}$  wide; oval in equatorial view, circular in polar view; grains  $16\text{-}20\ \mu\text{m}$ , spherical-oblate; flowering in Aug-Oct. (ref. 4)

*Euphorbia*, *Mercurialis* and *Sapium* (4 species)

Tricolporate monad; exine  $1.8\text{-}2.5\ \mu\text{m}$  thick; sexine baculate, bacula forming tectum on top, tectum sometimes reticulate; colpi long, acute at ends; pori lalongate, with costae; oval in equatorial view, circular in polar view; polar axis  $21\text{-}45\ \mu\text{m}$ , equatorial axis  $18\text{-}40\ \mu\text{m}$ , prolate-spherical; flowering in Apr-Jul.

ref. *Euphorbia sieboldiana* Morr. et Decne., 'Natsutoudai' (Apr-Jun): 4; *E. supina*

Rafin., 'Konishikisou' (Jun-Jul): 4; *Mercurialis leiocarpa* Sieb. et Zucc., 'Yamaai' (Apr-Jul): 4.

- 1a. Polar axis  $>29\mu\text{m}$  .....*Euphorbia sieboldiana*, *Mercurialis leiocarpa*, *Sapium japonicum*  
 1b. Polar axis  $<29\mu\text{m}$  .....*E. supina*

*Sapium japonicum* (Sieb. et Zucc.) Pax et K. Hoffm. 'Shiraki'  
 Exine  $2.1\mu\text{m}$  thick; bacula coarse, tectum reticulate, lumina  $0.5\mu\text{m}$  wide; apocolpium  $4.0-7.0\mu\text{m}$  wide, margo thinned; pori lalongate  $4.0-5.0 \times 7.0-9.0\mu\text{m}$ , costae  $2.0-2.5\mu\text{m}$  thick; polar axis  $30-35-40\mu\text{m}$ , equatorial axis  $26-29-33\mu\text{m}$ , P/E ratio  $1.00-1.18-1.43$ ; flowering in May-Jul. (Y. Tateishi and J. Murata 4178; Loc. A)

*Mallotus* (1 species)

*Mallotus japonicus* Muell. Arg. 'Akamegashiwa'  
 Tricolporate monad; exine  $2.4-2.7\mu\text{m}$  thick; sexine verrucate, verrucae  $0.5-1.0\mu\text{m}$  wide; colpi acute at ends, narrow, apocolpium  $9.0-10\mu\text{m}$  wide, margo thickened; pori zonorate  $2.5-3.0\mu\text{m}$  wide, costae  $3.0\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis  $21-24-29\mu\text{m}$ , equatorial axis  $21-24-30\mu\text{m}$ , P/E ratio  $0.90-0.98-1.06$  ( $n=18$ ); flowering in Jul. (M. Hiroe 7182; Loc. A)

*Phyllanthus* (2 species)

Stephanocolporate (4-6 colporate) monad; exine  $1.5\mu\text{m}$  thick; sexine striate, reticulate; colpi long; pori circular  $1.5-3.5\mu\text{m}$  wide, with costae; oval in equatorial view, circular in polar view; grains  $16-26\mu\text{m}$ , spherical; flowering in May-Aug.

ref. *Phyllanthus flexuosus* (Sieb. et Zucc.) Muell. Arg., 'Kobannoki' (May): 4; *P. matsumurae* Hayata, 'Himemikansou' (Jun-Aug): 3.

- 1a. Sexine reticulate .....*Phyllanthus flexuosus*  
 1b. Sexine striate .....*P. matsumurae*

#### Eupteleaceae (1 genus, 1 species)

*Euptelea polyandra* Sieb. et Zucc. 'Fusazakura'  
 Pericolpate (6 colpate) monad; exine  $1.5\mu\text{m}$  thick; sexine reticulate, lumina  $0.5-1.0\mu\text{m}$  wide; colpi rounded at ends,  $12-18\mu\text{m}$  long,  $5.0-7.0\mu\text{m}$  wide, verrucate, scabrate; grains circular; grains  $21-24-27\mu\text{m}$ ; flowering in Mar-May. (G. Murata 22446; Loc. K)

#### Fagaceae (3 genera, 7 species)

Tricolporate monad; exine  $1.0-2.0\mu\text{m}$  thick; sexine psilate, verrucate; colpi acute at ends, margo thickened; pori circular, lalongate; oval in equatorial view, circular in polar view; polar axis  $12-41\mu\text{m}$ , equatorial axis  $8-45\mu\text{m}$ , spherical-prolate; flowering in Apr-Jul.

ref. *Fagus japonica* Maxim., 'Inubuna' (Apr-May): 4; *Quercus crispula* Blume,

'Mizunara' (May): 4; *Q. salicina* Blume, 'Urajirogashi' (May): 4; *Q. serrata* Thunb. ex Murray, 'Konara' (May): 4; *Q. sessilifolia* Blume, 'Tsukubanegashi' (May): 4.

- 1a. Grains small,  $<15\mu\text{m}$ , pori lalongate, sexine psilate ..... *Castanea crenata*  
 1b. Grains large,  $>18\mu\text{m}$ , pori circular, sexine verrucate  
     2a. Polar axis  $<27\mu\text{m}$ , pori indistinct ..... *Quercus* (4 spp.)  
     2b. Polar axis  $>27\mu\text{m}$ , pori  $>7.0\mu\text{m}$  wide  
         3a. Apocolpium  $>17\mu\text{m}$  wide ..... *Fagus crenata*  
         3b. Apocolpium  $<8.0\mu\text{m}$  wide ..... *F. japonica*

*Castanea crenata* Sieb. et Zucc. 'Kuri'  
 Exine  $1.0\mu\text{m}$  thick; sexine psilate; apocolpium  $1.5\text{-}2.0\mu\text{m}$  wide; pori lalongate  $1.5\text{-}2.0 \times 2.5\text{-}3.5\mu\text{m}$ , costae  $1.0\mu\text{m}$  thick; polar axis  $11\text{-}14\text{-}15\mu\text{m}$ , equatorial axis  $7\text{-}10\text{-}12\mu\text{m}$ , P/E ratio  $1.22\text{-}1.38\text{-}1.72$ ; flowering in Jun-Jul. (S. *Fujii* 143; Loc. K)

*Fagus crenata* Blume 'Bunanoki'  
 Exine  $2.0\mu\text{m}$  thick; sexine verrucate; colpi ragged, apocolpium  $17\text{-}23\mu\text{m}$  wide; pori circular  $6.0\text{-}8.0\mu\text{m}$  wide, costae  $1.5\text{-}2.0\mu\text{m}$  thick; polar axis  $28\text{-}34\text{-}39\mu\text{m}$ , equatorial axis  $32\text{-}36\text{-}42\mu\text{m}$ , P/E ratio  $0.85\text{-}0.94\text{-}1.04$ ; flowering in Apr-May. (H. *Nagamasu* 4499; Loc. A)

#### Flacourtiaceae (1 genus, 1 species)

*Idesia polycarpa* Maxim. 'Iigiri'  
 Tricolporate monad; exine  $1.2\mu\text{m}$  thick; sexine reticulate, lumina  $0.5\text{-}1.0\mu\text{m}$  wide; colpi acute at ends, constricted at equator, apocolpium  $5.0\text{-}6.0\mu\text{m}$  wide; pori lalongate  $1.0\text{-}2.0 \times 5.0\text{-}6.0\mu\text{m}$ , costae  $1.0\text{-}1.5\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis  $16\text{-}19\text{-}20\mu\text{m}$ , equatorial axis  $13\text{-}16\text{-}18\mu\text{m}$ , P/E ratio  $1.00\text{-}1.20\text{-}1.37$ ; flowering in Apr-May. (G. *Murata* 668; Loc. K)

#### Gentianaceae (3 genera, 7 species)

Tricolporate monad; exine  $2.0\text{-}3.0\mu\text{m}$  thick; sexine striate, reticulate; colpi long, acute at ends, margo thinned; pori lalongate, equatorial apiculate, with costae; oval in equatorial view, circular, semiangular in polar view; polar axis  $23\text{-}45\mu\text{m}$ , equatorial axis  $18\text{-}35\mu\text{m}$ , prolate; flowering in Mar-May, Aug-Nov.  
 ref. *Gentiana thunbergii* (G. Don) Griseb., 'Harurindou' (Apr-May): 4; *G. triflora* Pallas, 'Ezorindou' (Sep-Oct): 4; *G. zollingeri* Fawcett, 'Fuderindou' (Apr-May): 4; *Swertia bimaculata* (Sieb. et Zucc.) Hook. et Thoms., 'Akebonosou' (Sep-Oct): 4; *S. japonica* (Schult.) Makino, 'Senburi' (Aug-Nov): 4.

- 1a. Polar axis  $>36\mu\text{m}$  ..... *Gentiana thunbergii*  
 1b. Polar axis  $32\text{-}36\mu\text{m}$ , sexine striate ..... *Gentiana scabra*, *G. triflora*  
 1c. Polar axis  $<32\mu\text{m}$ , sexine striate, reticulate  
     ..... *G. zollingeri*, *Swertia bimaculata*, *Tripterospermum japonicum*

*Gentiana scabra* Bunge var. *buengeri* (Miq.) Maxim. 'Rindou'  
 Exine  $2.2\mu\text{m}$  thick; sexine striate, striae  $0.5\text{-}1.0\mu\text{m}$  wide; apocolpium  $8.0\text{-}9.0\mu\text{m}$

wide; pori  $4.0-5.0 \times 6.0-7.0 \mu\text{m}$ , costae  $1.0-1.5 \mu\text{m}$  thick; circular in polar view; polar axis  $27-30-33 \mu\text{m}$ , equatorial view  $21-26-29 \mu\text{m}$ , P/E ratio  $1.04-1.16-1.48$ ; flowering in Sep-Nov. (*H. Koyama* 928; Loc. A)

*Tripterospermum japonicum* (Sieb. et Zucc.) Maxim. 'Tsururindou'  
Exine  $2.0 \mu\text{m}$  thick; sexine striate, reticulate; apocolpium  $8.0-9.0 \mu\text{m}$  wide; pori  $4.0-5.0 \times 8.0 \mu\text{m}$ , costae  $1.0 \mu\text{m}$  thick; circular in polar view; polar axis  $32-34-38 \mu\text{m}$ , equatorial view  $27-29-30 \mu\text{m}$ , P/E ratio  $1.08-1.18-1.27$ ; flowering in Aug-Oct. (*T. Takabayashi* 582; Loc. K)

#### Geraniaceae (1 genus, 2 species)

Tricolpate monad; exine  $5.0-7.0 \mu\text{m}$  thick; sexine clavate, clavae forming reticulum on top; colpi rounded at ends; oval in equatorial view, circular in polar view; grains  $53-78 \mu\text{m}$ , oblate-spherical; flowering in Jul-Oct.

ref. *Geranium wilfordii* Maxim., 'Mitsubafuuro' (Jul-Oct): 3.

*Geranium nepalense* Sweet 'Gennoshouko'  
Exine  $5.0-6.0 \mu\text{m}$  thick; colpi  $12-21 \mu\text{m}$  long,  $11 \mu\text{m}$  wide; polar axis  $53-58-62 \mu\text{m}$ , equatorial axis  $58-62-65 \mu\text{m}$ , P/E ratio  $0.91-0.94-0.98$  ( $n=8$ ); flowering in Jul-Oct. (*C. Hashimoto s.n.*; Loc. K)

#### Gesneriaceae (1 genus, 1 species)

*Conandron ramondioides* Sieb. et Zucc. 'Iwatabako'  
Tricolporate monad; exine  $0.5-1.0 \mu\text{m}$  thick; sexine scabrate; colpi acute at ends, apocolpium  $4.0 \mu\text{m}$  wide, margo thickened; pori lalongate  $3.0 \times 2.0 \mu\text{m}$ ; oval in equatorial view, circular, semiangular in polar view; polar axis  $6-7-8 \mu\text{m}$ , equatorial axis  $6-7 \mu\text{m}$ , P/E ratio  $1.00-1.17-1.20$ ; flowering in Jun-Aug. (*S. Hosomi s.n.*; Loc. K)

#### Gramineae

Monoporate monad; sexine verrucate; pori circular  $<5.0 \mu\text{m}$  wide, distinct annulus present; grains circular; flowering in May-Nov.

ref. 1, 3, 4.

#### Guttiferae (1 genus, 3 species)

Tricolporate monad; exine  $1.5-2.0 \mu\text{m}$  thick; sexine reticulate, rugulate; colpi acute at ends, long, equatorial prominent, margo thinned; pori circular, lalongate, with costae; oval in equatorial view, circular in polar view; polar axis  $14-24 \mu\text{m}$ , equatorial axis  $12-18 \mu\text{m}$ , prolate; flowering in Jul-Aug.

ref. *Hypericum ascyron* L., 'Tomoesou' (Jul-Aug): 4; *H. oliganthum* Fr. et Sav., 'Azeotogiri' (Jul-Aug): 3.



*Hypericum erectum* Thunb.

'Otogirisou'

Sexine reticulate, lumina  $0.5\ \mu\text{m}$  wide; apocolpium  $4.0\ \mu\text{m}$  wide; pori lalongate  $2.0 \times 4.0\ \mu\text{m}$  wide, costae  $1.0\ \mu\text{m}$  thick; polar axis  $13\text{-}15\text{-}17\ \mu\text{m}$ , equatorial axis  $11\text{-}12\text{-}14\ \mu\text{m}$ , P/E ratio  $1.09\text{-}1.24\text{-}1.44$ ; flowering in Jul-Aug. (*Y. Araki 532*; Loc. A)

**Haloragaceae** (1 genus, 1 species)

*Haloragis micrantha* (Thunb.) R. Br.

'Arinotougusa'

Tricolpate, stephanocalpate (4-5 colpate) monad; exine  $2.0\text{-}2.5\ \mu\text{m}$  thick; sexine verrucate, rugulate; colpi acute at ends,  $3.5\text{-}4.0\ \mu\text{m}$  long,  $1.0\ \mu\text{m}$  wide, margo  $3.0\ \mu\text{m}$  thick; oval in equatorial view, circular, semiangular in polar view; polar axis  $17\text{-}20\text{-}23\ \mu\text{m}$ , equatorial axis  $20\text{-}23\text{-}28\ \mu\text{m}$ , P/E ratio  $0.76\text{-}0.86\text{-}1.00$ ; flowering in Jul-Sep. (*M. Tagawa 1758*; Loc. A)

**Hamamelidaceae** (1 genus, 1 species)

*Hamamelis japonica* Sieb. et Zucc.

'Marubamansaku'

Tricolpate monad; exine  $1.2\text{-}1.5\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\text{-}1.0\ \mu\text{m}$  wide; colpi acute at ends, apocolpium  $4.0\text{-}6.0\ \mu\text{m}$  wide, margo thinned; oval in equatorial view, circular in polar view; polar axis  $13\text{-}15\text{-}17\ \mu\text{m}$ , equatorial axis  $13\text{-}17\text{-}19\ \mu\text{m}$ , P/E ratio  $0.78\text{-}0.90\text{-}1.10$ ; flowering in Mar-Apr. (*M. Tagawa 2004*; Loc. K)

**Hippocastanaceae** (1 genus, 1 species)

*Aesculus turbinata* Blume

'Tochinoki'

Tricolporate monad; exine  $1.0\ \mu\text{m}$  thick; sexine striate, reticulate, lumina  $<0.5\ \mu\text{m}$  wide; colpi acute at ends, echinate, apocolpium  $3.0\text{-}4.0\ \mu\text{m}$  wide; pori lalongate  $6.0\text{-}7.0 \times 3.0\text{-}4.0\ \mu\text{m}$ ; compressed oval in equatorial view, circular in polar view; polar axis  $22\text{-}25\text{-}28\ \mu\text{m}$ , equatorial axis  $12\text{-}15\text{-}17\ \mu\text{m}$ , P/E ratio  $1.58\text{-}1.68\text{-}1.83$ ; flowering in May-Jun. (*H. Takahashi 928*; Loc. A)

**Icacinaceae** (1 genus, 1 species)

*Hosiea japonica* (Makino) Makino

'Kurotakikazura'

Tricolporate monad; exine  $0.5\text{-}1.0\ \mu\text{m}$  thick; sexine verrucate, scabrate; colpi acute at ends, equatorial prominent, apocolpium  $17\ \mu\text{m}$  wide; pori lalongate  $4.0 \times 8.0\ \mu\text{m}$ , costae  $0.5\ \mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis  $22\text{-}27\text{-}33\ \mu\text{m}$ , equatorial axis  $22\text{-}25\text{-}29\ \mu\text{m}$ , P/E ratio  $0.86\text{-}1.08\text{-}1.22$ ; flowering in May. (*S. Kitamura s.n.*; Loc. K)

**Iridaceae** (1 genus, 3 species)

Monocolpate monad; exine  $1.5\text{-}3.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $1.0\text{-}4.0\ \mu\text{m}$  wide, muri simplicolumellate; grains elliptic; polar axis  $40\text{-}63\ \mu\text{m}$ , equatorial axis  $5\text{-}90\ \mu\text{m}$ ; flowering in Apr-Jul.

ref. *Iris gracilipes* A. Gray, 'Himeshaga' (May-Jun): 1; *I. sanguinea* Hornem., 'Ayame' (May-Jul): 4.

*Iris japonica* Thunb.

'Shaga'

Exine 3.0  $\mu\text{m}$  thick; lumina 2.0-4.0  $\mu\text{m}$  wide, muri coarsely simplicolumellate; polar axis 45-53-60  $\mu\text{m}$ , equatorial axis 65-78-90  $\mu\text{m}$ ; flowering in Apr-May. (*H. Murakami* 58; Loc. K)

#### Juglandaceae (2 genera, 2 species)

*Juglans* (1 species)

*Juglans mandshurica* Maxim.

'Onigurumi'

Periporate (6-9 porate) monad; exine 1.0-1.5  $\mu\text{m}$  thick; sexine verrucate; 5-7 pori on equator and 1-2 pori in proximal face, pori circular 2.0-3.0  $\mu\text{m}$  wide, annuli formed by ektexine; oval in equatorial view, angular in polar view; polar axis 21-36  $\mu\text{m}$ , equatorial axis 27-42  $\mu\text{m}$ , oblate; flowering in May-Jun. (ref. 4)

*Pterocarya* (1 species)

*Pterocarya rhoifolia* Sieb. et Zucc.

'Sawagurumi'

Stephanoporate (5-8 porate) monad; exine 1.0-1.5  $\mu\text{m}$  thick; sexine scabrate; pori circular 2.0-3.0  $\mu\text{m}$  wide, annuli formed by ektexine 2.0  $\mu\text{m}$  thick; oval in equatorial view, angular in polar view; polar axis 17-22-25  $\mu\text{m}$ , equatorial axis 30-33-35  $\mu\text{m}$ , P/E ratio 0.57-0.69-0.75; flowering in Apr-Jun. (*S. Okamoto s.n.*; Loc. A)

#### Juncaceae (1 genus, 3 species)

Inaperturate tetrads; exine 0.5  $\mu\text{m}$  thick, sometimes torn in distal face; sexine scabrate; tetrads tetrahedral; tetrads 23-45  $\mu\text{m}$ ; flowering in Apr-Jul.

ref. *Luzula capitata* (Miq.) Miq., 'Suzumenoyari' (Apr-May): 3; *L. multiflora* Lejeune, 'Yamasuzumenohie' (May-Jul): 1; *L. plumosa* E. Meyer, 'Nukaboshisou' (Apr-May): 4.

#### Labiatae (13 genera, 20 species)

*Ajuga*, *Chelonopsis*, *Leucosceptrum* and *Scutellaria* (6 species)

Tricolpate monad; exine 1.5-2.1  $\mu\text{m}$  thick; sexine reticulate, rugulate, lumina 1.0-2.5  $\mu\text{m}$  wide; colpi long, acute at ends, margo thinned; oval in equatorial view, circular in polar view; polar axis 16-36  $\mu\text{m}$ , equatorial axis 18-45  $\mu\text{m}$ , spherical-oblate; flowering in Mar-May and Aug-Oct.

ref. *Ajuga decumbens* Thunb., 'Kiransou' (Apr-May): 4; *Leucosceptrum japonicum* (Miq.) Kitam. et Murata, 'Tenninsou' (Sep-Oct): 4; *L. stellipilum* (Miq.) Kitam. et Murata, 'Mikaerisou' (Sep-Oct): 3; *Scutellaria indica* L., 'Kobanolatsunamisou' (May-Jun): 4; *S. pekinensis* Maxim., 'Yamatatsunamisou' (May-Jun): 1.

1a. Polar axis  $>22\mu\text{m}$  .....*Chelonopsis moschata*

- 1b. Polar axis  $<22\ \mu\text{m}$   
 2a. Sexine reticulate ..... *Ajuga decumbens*, *Leucosceptrum japonicum*  
 2b. Sexine rugulate ..... *Ajuga decumbens*, *Scutellaria indica*

*Chelonopsis moschata* Miq. 'Jakousou'  
 Exine  $2.1\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\text{-}1.5\ \mu\text{m}$  wide; colpi ragged, apocolpium  $5.0\text{-}6.0\ \mu\text{m}$  wide; polar axis  $22\text{-}24\text{-}27\ \mu\text{m}$ , equatorial axis  $22\text{-}26\text{-}28\ \mu\text{m}$ , P/E ratio  $0.85\text{-}0.93\text{-}1.12$ ; flowering in Aug-Sep. (*M. Tagawa 984*; Loc. K)

*Teucrium* (1 species)

*Teucrium viscidum* Blume 'Tsurunigakusa'  
 Tricolpate monad; exine  $1.5\ \mu\text{m}$  thick; sexine scabrate; colpi acute at ends, long, margo thinned; oval in equatorial view, circular in polar view; polar axis  $30\text{-}32\ \mu\text{m}$ , equatorial axis  $21\text{-}23\ \mu\text{m}$ , prolate; flowering in Jul-Sep. (ref. 3)

*Clinopodium*, *Elsholtzia*, *Glechoma*, *Isodon*, *Lycopus*, *Meehanian*, *Prunella* and *Salvia* (13 species)

Stephanocolpate (6 colpate) monad; exine  $1.5\text{-}3.0\ \mu\text{m}$  thick; sexine baculate, reticulate, lumina  $0.5\text{-}4.0\ \mu\text{m}$  wide; colpi acute at ends; oval in equatorial view, circular in polar view; polar axis  $19\text{-}42\ \mu\text{m}$ , equatorial axis  $17\text{-}43\ \mu\text{m}$ , spherical; flowering in Apr-Oct.

ref. *Clinopodium chinense* (Benth.) O. Kuntze, 'Kurumabana' (Sug-Sep): 4; *C. gracile* (Benth.) O. Kuntze, 'Toubana' (May-Aug): 4; *C. micranthum* (Regel) Hara, 'Inutoubana' (Aug-Oct): 1; *C. sachalinense* (Fr. Schm.) Koidz., 'Miyamatoubana' (Jul-Sep): 1; *Elsholtzia ciliana* (Thunb.) Hylander, 'Naginatakouju' (Sep-Oct): 1; *Glechoma hederacea* L., 'Kakidooshi' (Apr-May): 4; *Isodon inflexa* (Thunb.) Kudo, 'Yamahakka' (Sep-Oct): 1; *Lycopus ramosissimus* Makino, 'Koshirone' (Aug-Oct): 1; *Prunella vulgaris* L., 'Utsubogusa' (Jun-Aug): 4.

- 1a. Sexine baculate ..... *Clinopodium*, *Glechoma*  
 1b. Sexine reticulate  
 2a. Equatorial axis  $<30\ \mu\text{m}$   
 3a. Polar axis  $>27\ \mu\text{m}$ ,  $>3.0\ \mu\text{m}$  wide lumina present ..... *Isodon longituba*  
 3b. Polar axis  $<27\ \mu\text{m}$ , lumina  $1.0\text{-}3.0\ \mu\text{m}$  wide ..... *I. trichocarpa*  
 2b. Equatorial axis  $>30\ \mu\text{m}$   
 4a.  $>2.0\ \mu\text{m}$  wide lumina present ..... *I. longituba*  
 4b. Lumina  $1.0\text{-}2.0\ \mu\text{m}$  wide  
 5a. Exine  $>2.5\ \mu\text{m}$  thick ..... *Salvia glabrescens*  
 5b. Exine  $<2.5\ \mu\text{m}$  thick ..... *Meehanian urticifolia*

*Isodon longituba* (Miq.) Kudo 'Akichouji'  
 Exine  $2.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $1.0\text{-}4.0\ \mu\text{m}$  wide, heterobrochate, muri diplicolumellae; apocolpium  $7.0\text{-}8.0\ \mu\text{m}$  wide, margo thinned; polar axis  $26\text{-}30\text{-}33\ \mu\text{m}$ , equatorial axis  $25\text{-}32\text{-}35\ \mu\text{m}$ , P/E ratio  $0.84\text{-}0.95\text{-}1.20$ ; flowering in Aug-Oct. (*G. Koidzumi s.n.*; Loc. K)

*I. trichocarpa* (Maxim.) Kudo 'Kurobanahikiokoshi'  
 Exine  $1.5\ \mu\text{m}$  thick; sexine reticulate, lumina  $1.0\text{-}2.5\ \mu\text{m}$  wide, heterobrochate;

apocolpium  $6.0\ \mu\text{m}$  wide, margo thinned; polar axis  $23\text{-}25\text{-}27\ \mu\text{m}$ , equatorial axis  $23\text{-}25\text{-}27\ \mu\text{m}$ , P/E ratio  $0.90\text{-}0.99\text{-}1.11$  ( $n=7$ ); flowering in Aug-Sep. (*G. Koidzumi s.n.*; Loc. K)

*Meehania urticifolia* (Miq.) Makino

'Rashoumonkazura'

Exine  $2.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $1.0\text{-}2.0\ \mu\text{m}$  wide; apocolpium  $4.0\text{-}9.0\ \mu\text{m}$  wide, margo thinned; polar axis  $32\text{-}38\text{-}42\ \mu\text{m}$ , equatorial axis  $33\text{-}38\text{-}43\ \mu\text{m}$ , P/E ratio  $0.76\text{-}1.01\text{-}1.15$  ( $n=15$ ); flowering in Apr-May. (*Y. Inamasu 21*; Loc. A)

*Salvia glabrescens* Makino

'Akigiri'

Exine  $2.5\text{-}3.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $1.0\text{-}2.0\ \mu\text{m}$  wide, homobrochate; apocolpium  $7.0\text{-}15\ \mu\text{m}$  wide; polar axis  $27\text{-}33\text{-}38\ \mu\text{m}$ , equatorial axis  $31\text{-}36\text{-}43\ \mu\text{m}$ , P/E ratio  $0.76\text{-}0.90\text{-}1.04$ ; flowering in Aug-Oct. (*S. Okamoto s.n.*; Loc. A)

#### Lardizabalaceae (1 genus, 2 species)

Tricolpate monad; exine  $1.2\text{-}2.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\ \mu\text{m}$  wide; oval in equatorial view, circular in polar view; polar axis  $15\text{-}19\ \mu\text{m}$ , equatorial axis  $15\text{-}22\ \mu\text{m}$ , spherical-prolate; flowering in Apr-May.

ref. *Akebia trifoliata* (Thunb.) Koidz., 'Mitsubaakebi' (Apr-May): 4.

*Akebia quinata* (Thunb.) Decne.

'Akebi'

Exine  $1.2\ \mu\text{m}$  thick; colpi acute at ends, ragged, apocolpium  $6.0\text{-}8.0\ \mu\text{m}$  wide; polar axis  $15\text{-}5\text{-}16\text{-}18\ \mu\text{m}$ , equatorial axis  $15\text{-}18\text{-}20\ \mu\text{m}$ , P/E ratio  $0.75\text{-}0.90\text{-}1.17$ ; flowering in Apr-May. (*M. Hiroe 16270*; Loc. K)

#### Lauraceae

Damaged by acetolysis; inaperturate monad; exine  $1.0\ \mu\text{m}$  thick; sexine echinate; grains circular; grains  $30\text{-}33\ \mu\text{m}$ ; flowering in Mar-Apr.

ref. 1, 3.

#### Leguminosae (14 genera, 16 species)

*Albizia* (1 species)

*Albizia julibrissin* Durazz.

'Nemunoki'

Periporate polyads (16 grains); exine  $1.5\ \mu\text{m}$  thick; sexine psilate, scabrate; polyads oval, circular, symmetrically arranged; polyads  $85\text{-}90\ \mu\text{m}$ ; flowering in Jul-Aug. (ref. 4)

*Dumasia* (1 species)

*Dumasia truncata* Sieb. et Zucc.

'Nosasage'

Periporate (6 porate) monad; exine  $1.8\ \mu\text{m}$  thick; sexine rugulate, reticulate; 2 pori meridionally arranged at each apex, pori circular  $9.0\ \mu\text{m}$  wide; depressed oval in equatorial view, angular in polar view; polar axis  $36\text{-}41\ \mu\text{m}$ , equatorial axis  $20\text{-}22$

$\mu\text{m}$ , oblate; flowering in Aug-Sep. (ref. 4)

*Apios* (1 species)

*Apios fortunei* Maxim.

'Hodoimo'

Tricolporate monad; exine  $2.5\ \mu\text{m}$  thick; sexine scabrate; colpi acute at ends, short,  $14\text{--}15\ \mu\text{m}$  long, verrucate; pori lolongate  $10\text{--}12\ \mu\text{m}$  long; oval in equatorial view, semiangular in polar view; polar axis  $36\text{--}42\ \mu\text{m}$ , equatorial axis  $34\text{--}42\ \mu\text{m}$ , spherical; flowering in Jul-Sep. (ref. 4)

*Amphicarpaea*, *Astragalus*, *Cassia*, *Desmodium*, *Lespedeza*, *Lotus*, *Pueraria*, *Trifolium* and *Wisteria* (13 species)

Tricolporate monad; exine  $1.0\text{--}1.8\ \mu\text{m}$  thick; sexine reticulate, verrucate, rugulate, scabrate; colpi long, sometimes prominent at equator; pori circular, lolongate  $5.0\text{--}10\ \mu\text{m}$  long, with costae; oval, compressed oval in equatorial view, circular, semiangular, angular in polar view; polar axis  $11\text{--}32\ \mu\text{m}$ , equatorial axis  $9\text{--}33\ \mu\text{m}$ , prolate-spherical; flowering in Apr-Oct.

ref. *Amphicarpaea bracteata* (L.) Fernald, 'Yabumame' (Aug-Oct): 4; *Astragalus sinicus* L., 'Genge' (Apr-Jun): 4; *Cassia mimosoides* L., 'Kawaraketsumei' (Aug-Oct): 1; *Desmodium oldhamii* Oliver, 'Fujikanzou' (Aug-Sep): 1; *Lespedeza cyrtobotrya* Miq., 'Marubahagi' (Aug-Oct): 3; *L. juncea*: (L. fil.) Pers., 'Medohagi' (Aug-Oct): 3; *L. striata* (Thunb.) Hook. et Arn., 'Yahazousou' (Aug-Sep): 1; *Lotus corniculatus* L., 'Miyakogusa' (Apr-Oct): 4.

- 1a. Polar axis  $<16\ \mu\text{m}$  ..... *Lotus corniculatus*
- 1b. Polar axis  $16\text{--}21\ \mu\text{m}$ 
  - 2a. Equatorial axis  $<12\ \mu\text{m}$  ..... *Astragalus sinicus*
  - 2b. Equatorial axis  $>12\ \mu\text{m}$  ..... *Lespedeza bicolor*
- 1c. Polar axis  $>21\ \mu\text{m}$ 
  - 3a. Angular in polar view ..... *Amphicarpaea bracteata*
  - 3b. Circular, semiangular in polar view
    - 4a. Apocolpium  $<7.0\ \mu\text{m}$  wide ..... *Trifolium repens*
    - 4b. Apocolpium  $>7.0\ \mu\text{m}$  wide
      - 5a. Oval in equatorial view, sexine verrucate, pori circular  $<7.0\ \mu\text{m}$  wide, costae  $>1.5\ \mu\text{m}$  thick ..... *Desmodium podocarpum*
      - 5b. Compressed oval in equatorial view, sexine reticulate, pori lolongate  $>7.0\ \mu\text{m}$  long, costae  $<1.5\ \mu\text{m}$  thick ..... *Pueraria lobata*, *Wisteria floribunda*

*Desmodium podocarpum* DC.

'Nusubito-hagi'

Exine  $1.5\ \mu\text{m}$  thick; sexine verrucate, rugulate; colpi constricted and prominent at equator, ragged, apocolpium  $10\ \mu\text{m}$  wide; pori circular  $6.0\text{--}7.5\ \mu\text{m}$  wide, costae  $2.0\ \mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis  $25\text{--}27\text{--}29\ \mu\text{m}$ , equatorial axis  $20\text{--}22\text{--}25\ \mu\text{m}$ , P/E ratio  $1.10\text{--}1.25\text{--}1.44$ ; flowering in Jul-Sep. (*M. Tagawa* 746; Loc. K)

*Lespedeza bicolor* Turcz.

'Yamahagi'

Exine  $1.2\text{--}1.5\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\ \mu\text{m}$  wide; colpi acute at ends, ragged, apocolpium  $5.0\text{--}6.0\ \mu\text{m}$  wide; pori lolongate  $6.0 \times 5.0\ \mu\text{m}$ , costae  $1.5\ \mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis  $15\text{--}18\text{--}20\ \mu\text{m}$ ,

equatorial axis 12-15-17  $\mu\text{m}$ , P/E ratio 1.09-1.22-1.37; flowering in Jul-Sep. (*Z. Tashiro s.n.*; Loc. K)

*Pueraria lobata* (Willd.) Ohwi

'Kuzu'

Exine 1.5  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5-1.0  $\mu\text{m}$  wide, muri 0.5  $\mu\text{m}$  wide; colpi prominent at equator, apocolpium 12-13  $\mu\text{m}$  wide, margo 1.5-2.0  $\mu\text{m}$  thick; pori lolongate 7.0-8.0  $\times$  6.0-7.0  $\mu\text{m}$ , costae 1.0-1.5  $\mu\text{m}$  thick; compressed oval in equatorial view, circular in polar view; polar axis 23-28-30  $\mu\text{m}$ , equatorial axis 20-22-28  $\mu\text{m}$ , P/E ratio 1.00-1.24-1.38; flowering in Aug-Oct. (*S. Tsugaru 15184*; Loc. K)

*Trifolium repens* L.

'Shirotsunekusa'

Exine 1.5  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5-1.5  $\mu\text{m}$  wide, muri 0.5-1.0  $\mu\text{m}$  wide; colpi ragged, prominent at equator, apocolpium 5.0  $\mu\text{m}$  wide; pori circular 5.0-6.0  $\mu\text{m}$  wide, costae 1.5  $\mu\text{m}$  thick; oval, compressed oval in equatorial view, circular in polar view; polar axis 23-27-32  $\mu\text{m}$ , equatorial axis 18-20-22  $\mu\text{m}$ , P/E ratio 1.17-1.35-1.60; flowering in May-Oct. (*S. Hosomi 6711*; Loc. K)

*Wisteria floribunda* (Willd.) DC.

'Fuji'

Exine 1.9  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5  $\mu\text{m}$  wide; colpi ragged, prominent at equator, apocolpium 14-16  $\mu\text{m}$  wide, margo thickened; pori lolongate 7.0-9.0  $\times$  4.0-6.0  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; compressed oval in equatorial view, circular, semiangular in polar view; polar axis 21-27-32  $\mu\text{m}$ , equatorial axis 20-24-33  $\mu\text{m}$ , P/E ratio 0.88-1.15-1.34; flowering in May. (*G. Murata et al. 33*; Loc. A)

### Lentibulariaceae

Stephanocolporate monad; sexine psilate, scabrate; colpi acute at ends, prominent at equator; pori zonorate, lalongate; equatorial acute oval in equatorial view, circular in polar view; oblate-spherical; flowering in Jun-Oct.  
ref. 1, 4.

### Liliaceae (16 genera, 22 species)

*Smilax* and *Trillium* (4 species)

Inaperturate monad; exine 0.8-1.0  $\mu\text{m}$  thick; sexine verrucate, scabrate; grains circular; grains 12-33  $\mu\text{m}$ ; flowering in Apr-Aug.

ref. *Smilax china* L., 'Sarutoriibara' (Apr-May): 4; *S. nipponica* Miq., 'Tachishiode' (May-Jun): 1; *Trillium smallii* Maxim., 'Enreisou' (Apr-May): 3.

- 1a. Grains  $>30\mu\text{m}$ , sexine scabrate .....*Trillium smallii*  
1b. Grains  $<25\mu\text{m}$ , sexine verrucate .....*Smilax china*, *S. riparia*

*Smilax riparia* A.DC.

'Shiode'

Exine 0.8  $\mu\text{m}$  thick; sexine verrucate, verrucae 0.5-1.0  $\mu\text{m}$  wide; grains 12-16-20  $\mu\text{m}$ ; flowering in Jul-Aug. (*K. Nagai 25503*; Loc. K)

*Chionographis* (1 species)

*Chionographis japonica* Maxim.

'Shiraitosou'

Stephanoporate (4 porate) monad; exine  $1.5\ \mu\text{m}$  thick; sexine verrucate; pori circular  $2.0\text{-}2.5\ \mu\text{m}$  wide, annuli absent; grains circular; grains  $12\text{-}18\ \mu\text{m}$ ; flowering in May-Jun. (ref. 4)

*Cardiocrinum*, *Disporum*, *Heloniopsis*, *Hemerocallis*, *Hosta*, *Lilium*, *Metanartheicum*, *Paris*, *Polygonatum*, *Scilla*, *Smilacina*, *Tricyrtis* and *Veratrum* (17 species)  
Monocolpate monad; exine  $1.0\text{-}3.0\ \mu\text{m}$  thick; sexine reticulate, verrucate, gemmate, lumina  $0.5\text{-}7.0\ \mu\text{m}$  wide, smaller in margo; colpi usually ragged; grains elliptic; polar axis  $12\text{-}65\ \mu\text{m}$ , equatorial axis  $18\text{-}103\ \mu\text{m}$ ; flowering in Apr-Oct.

ref. *Cardiocrinum cordatum* (Thunb.) Makino, 'Ubayuri' (Jul-Aug): 4; *Disporum smilacinum* A. Gray, 'Chigoyuri' (Apr-May): 4; *Heloniopsis orientalis* (Thunb.) C. Tanaka, 'Shoujoubakama' (Apr-May): 4; *Hemerocallis dumortieri* Morr., 'Nikkoukisuge' (Jul-Aug): 3; *H. fulva* L., 'Yabukanzou' (Jul-Oct): 4; *Lilium lancifolium* Thunb., 'Oniyuri' (Jul-Aug): 4; *Metanartheicum luteo-viride* Maxim., 'Nogiran' (Jun-Aug): 1; *Paris tetrphylla* A. Gray, 'Tsukubanesou' (May-Aug): 3; *Polygonatum falcatum* A. Gray, 'Narukoyuri' (May-Jun): 3; *P. lasianthum* Maxim., 'Miyamanarukoyuri' (May-Jun): 1; *Scilla scilloides* (Lindl.) Druce, 'Tsurubo' (Aug-Sep): 4; *Smilacina japonica* A. Gray, 'Yukizasa' (May-Jul): 4.

- 1a. Sexine gemmate ..... *Paris tetrphylla*
- 1b. Sexine verrucate
  - 2a. Equatorial axis  $>60\ \mu\text{m}$  ..... *Hosta sieboldiana*
  - 2b. Equatorial axis  $<60\ \mu\text{m}$ 
    - 3a. Exine  $1.5\text{-}2.0\ \mu\text{m}$  thick  
..... *Disporum smilacinum*, *D. sessile*, *Smilacina japonica*
    - 3b. Exine  $1.0\ \mu\text{m}$  thick ..... *Heloniopsis orientalis*
- 1c. Sexine reticulate
  - 4a. Equatorial axis  $<25\ \mu\text{m}$  ..... *Metanartheicum luteo-viride*
  - 4b. Equatorial axis  $>25\ \mu\text{m}$ 
    - 5a. Lumina large,  $>4.0\ \mu\text{m}$  wide lumina present, muri irregular in shape, duplicolumellate ..... *Hemerocallis fulva*, *Lilium lancifolium*
    - 5b. Lumina medium size,  $1.5\text{-}4.0\ \mu\text{m}$  wide lumina present
      - 6a. Equatorial axis  $>60\ \mu\text{m}$  ..... *Cardiocrinum cordatum*
      - 6b. Equatorial axis  $<40\ \mu\text{m}$  ..... *Veratrum album*
  - 5c. Lumina small,  $<1.5\ \mu\text{m}$  wide
    - 7a. Ragged colpi with  $3.0\text{-}6.0\ \mu\text{m}$  long crack ..... *Tricyrtis affinis*
    - 7b. Ragged colpi without crack  
..... *Polygonatum falcatum*, *P. macranthum*, *Scilla scilloides*

*Disporum sessile* Don

'Houchakusou'

Exine  $1.8\ \mu\text{m}$  thick; sexine verrucate, verrucae  $0.5\ \mu\text{m}$  wide; polar axis  $27\text{-}32\text{-}35\ \mu\text{m}$ , equatorial axis  $37\text{-}43\text{-}48\ \mu\text{m}$ ; flowering in Apr-May. (S. Kitamura s.n.; Loc. K)

*Hosta sieboldiana* (Lodd.) Engler

'Oobagiboushi'

Exine  $1.7\ \mu\text{m}$  thick; sexine verrucate, verrucae  $1.0\text{-}1.5\ \mu\text{m}$  wide; polar axis  $38\text{-}51\text{-}64\ \mu\text{m}$ , equatorial axis  $66\text{-}80\text{-}94\ \mu\text{m}$ ; flowering in Jun-Aug. (S. Okamoto s.n.; Loc. A)

*Polygonatum macranthum* (Makino) Koidz.

'Oonarukoyuri'

Exine  $1.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\ \mu\text{m}$  wide; polar axis  $27\text{-}36\text{-}40\ \mu\text{m}$ ,

equatorial axis 42-47-53  $\mu\text{m}$ ; flowering in May-Jun. (*G. Murata s.n.*; Loc. S)

*Tricyrtis affinis* Makino

'Yamajinohototogisu'

Exine 1.5  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5  $\mu\text{m}$  wide; colpi ragged with cracks 3.0-6.0  $\mu\text{m}$  long; polar axis 22-30-35  $\mu\text{m}$ , equatorial axis 41-45-48  $\mu\text{m}$ ; flowering in Aug-Oct. (*H. Takahashi 2074*; Gifu Pref.)

*Veratrum album* L.

'Baikaisou'

Exine 1.7  $\mu\text{m}$  thick; sexine reticulate, lumina 1.0-2.0  $\mu\text{m}$  wide, muri simpli-duplicolumellate; polar axis 22-26-29  $\mu\text{m}$ , equatorial axis 30-33-36  $\mu\text{m}$ ; flowering in Jul-Aug. (*S. Okamoto s.n.*; Loc. A)

Loranthaceae (1 genus, 1 species)

*Viscum album* L.

'Yadorigi'

Tricolporate monad; exine 2.0-2.3  $\mu\text{m}$  thick; sexine baculate, bacula 2.0-4.0  $\mu\text{m}$  high, 1.2  $\mu\text{m}$  wide; colpi wide, rounded at ends, apocolpium 15-20  $\mu\text{m}$  wide; pori lalongate 2.0-4.0  $\times$  10-13  $\mu\text{m}$ , indistinct, costae 3.0  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; 31-36-40  $\mu\text{m}$ , 28-33-40  $\mu\text{m}$ , P/E ratio 0.93-1.08-1.21; flowering in Feb-Apr. (*H. Nagamasu 4498*; Loc. A)

Lythraceae (2 genera, 2 species)

*Lythrum* (1 species)

*Lythrum anceps* (Koehne) Makino

'Misohagi'

Heterocolpate (with 3 colpi and 3 furrows) monad; exine 1.5  $\mu\text{m}$  thick; sexine striate; colpi rounded at ends, verrucate; pori circular 3.0-5.0  $\mu\text{m}$  wide; oval in equatorial view, circular in polar view; grain size dimorphic, smaller grains: polar axis 18  $\mu\text{m}$ , equatorial axis 18-22  $\mu\text{m}$ , larger grains: polar axis 25-31  $\mu\text{m}$ , equatorial axis 23-31  $\mu\text{m}$ , spherical; flowering in Jul-Aug. (ref. 4)

*Rotala* (1 species)

*Rotala indica* (Willd.) Koehne

'Kikashigusa'

Syncolpate, tricolporate monad; exine 1.8  $\mu\text{m}$  thick; sexine scabrate, psilate; if 4 colpi present, colpi joining; pori circular 3.0  $\mu\text{m}$  wide, with costae; oval in equatorial view, circular in polar view; polar axis 23-26  $\mu\text{m}$ , equatorial axis 18-22  $\mu\text{m}$ , prolate; flowering in Aug-Oct. (ref. 4)

Magnoliaceae (1 genus, 2 species)

Monocolpate monad; exine 1.0  $\mu\text{m}$  thick; sexine rugulate, scabrate; colpi narrow-prominent or wide flat; grains elliptic; polar axis 20-43  $\mu\text{m}$ , equatorial axis 23-74  $\mu\text{m}$ ; flowering in Apr-Jun.

1a. Grains larger, equatorial axis  $>60\mu\text{m}$ , colpi narrow-prominent, sexine scabrate



- .....*Magnolia obovata*  
 1b. Grains smaller, equatorial axis  $<40\mu\text{m}$ , colpi wide-flat, sexine rugulate .  
 .....*M. salicifolia*

*Magnolia obovata* Thunb. 'Hoonoki'  
 Sexine scabrate; colpi narrow-prominent; polar axis 32-39-43  $\mu\text{m}$ , equatorial axis 62-68-74  $\mu\text{m}$ ; flowering in May-Jun. (*G. Murata 9738*; Loc. K)

*M. salicifolia* Maxim. 'Tamushiba'  
 Sexine rugulate, vallae 0.5-1.0  $\mu\text{m}$  wide; colpi wide-flat; polar axis 20-26-29  $\mu\text{m}$ , equatorial axis 23-30-35  $\mu\text{m}$ ; flowering in Apr-May. (*Z. Tashiro s.n.*; Loc. A)

#### Menispermaceae (2 genera, 2 species)

Tricolpate monad; exine 1.0-1.5  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5  $\mu\text{m}$  wide; colpi long, acute at ends; oval in equatorial view, circular in polar view; polar axis 14-18  $\mu\text{m}$ , equatorial axis 11-20  $\mu\text{m}$ , prolate-spherical; flowering in May-Aug.  
 ref. *Cocculus trilobus* (Thunb.) DC., 'Aotsudurafuji' (Jul-Aug): 4.

*Sinomenium acutum* (Thunb.) Rehd. et Wils. 'Tsudurafuji'  
 Exine 1.0  $\mu\text{m}$  thick; colpi 0.5  $\mu\text{m}$  wide, apocolpium 5.0  $\mu\text{m}$  wide; polar axis 15-17-18, equatorial axis 11-13-14  $\mu\text{m}$ , P/E ratio 1.18-1.32-1.44; flowering in Jul. (*G. Murata 67770*; Loc. K)

#### Moraceae (4 genera, 4 species)

Diporate, triporate, periporate (4 porate) monad; exine 1.0  $\mu\text{m}$  thick; sexine scabrate; pori circular 2.0-3.0  $\mu\text{m}$ , annuli slightly thickened; grains circular; grains 11-29  $\mu\text{m}$ ; flowering in Apr-Jun and Sep-Oct.  
 ref. *Broussonetia kazinoki* Sieb., 'Himekouzo' (Apr-Jun): 4; *Fatoua villosa* (Thunb.) Nakai, 'Kuwakusa' (Sep-Oct): 1; *Humulus japonicus* Sieb. et Zucc., 'Kanamugura' (Sep-Oct): 4.

*Morus australis* Poir. 'Yamaguwa'  
 Grains 13-17-20  $\mu\text{m}$ ; flowering in Apr-May. (*S. Watanabe s.n.*; Loc. F)

#### Myrsinaceae (1 genus, 1 species)

*Ardisia japonica* (Thunb.) Blume 'Yabukouji'  
 Tricolporate monad; exine 1.5  $\mu\text{m}$  thick; sexine reticulate lumina 0.5  $\mu\text{m}$  wide; colpi acute at ends, apocolpium 4.0  $\mu\text{m}$  wide; pori lalongate 1.0  $\times$  5.0  $\mu\text{m}$ , costae 0.5  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 11-13-14  $\mu\text{m}$ , equatorial axis 8-10-13  $\mu\text{m}$ , P/E ratio 1.00-1.22-1.38; flowering in Jul-Aug. (*G. Koidzumi s.n.*; Loc. A)

#### Nymphaeaceae (1 genus, 1 species)

*Nymphaea tetragona* Georgi 'Hitsujigusa'

Monoporate (syncolpate) monad; exine  $2.0\ \mu\text{m}$  thick; sexine verrucate, verrucae  $1.0\ \mu\text{m}$  wide; pori  $20\text{-}35\ \mu\text{m}$  wide with operculum, or colpi like a ring around the distal pole; oval in equatorial view, circular in polar view; polar axis  $20\text{-}25\text{-}30\ \mu\text{m}$ , equatorial axis  $22\text{-}30\text{-}34\ \mu\text{m}$ , P/E ratio  $0.64\text{-}0.85\text{-}1.22$ ; flowering in Jun-Sep. (*S. Hosomi s.n.*; Loc. K)

#### Oleaceae (2 genera, 4 species)

Tricolporate monad; exine  $1.5\text{-}3.5\ \mu\text{m}$  thick; sexine reticulate, bacula or clavae forming reticulum on top, lumina  $0.5\text{-}3.0\ \mu\text{m}$  wide, muri simplicolumellate; copi acute at ends, apocolpium  $6.0\text{-}13\ \mu\text{m}$  wide; pori lalongate  $1.0\text{-}3.0 \times 2.0\text{-}5.0\ \mu\text{m}$ , costae  $1.0\ \mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis  $21\text{-}30\ \mu\text{m}$ , equatorial axis  $17\text{-}30\ \mu\text{m}$ , spherical-prolate; flowering in Apr-Jul.

ref. *Ligustrum tschonoskii* Decne., 'Miyamaibota' (Jun-Jul): 3.

- 1a. Polar axis  $>26\ \mu\text{m}$ , lumina  $1.5\text{-}3.0\ \mu\text{m}$  wide, apocolpium  $>10\ \mu\text{m}$  wide, exine  $>3.0\ \mu\text{m}$  thick ..... *Ligustrum obtusifolium*  
 1b. Polar axis  $<26\ \mu\text{m}$ , lumina  $0.5\text{-}1.5\ \mu\text{m}$  wide, apocolpium  $<10\ \mu\text{m}$  wide, exine  $<3.0\ \mu\text{m}$  thick ..... *Fraxinus lanuginosa*, *F. sieboldiana*

*Fraxinus lanuginosa* Koidz.

'Aodamo'

Exine  $1.5\text{-}2.0\ \mu\text{m}$  thick; lumina  $0.5\text{-}1.0\ \mu\text{m}$  wide; apocolpium  $6.0\text{-}9.0\ \mu\text{m}$  wide; pori lalongate  $1.5\text{-}3.0 \times 4.0\text{-}5.0\ \mu\text{m}$ , indistinct, costae  $1.0\ \mu\text{m}$  thick; polar axis  $21\text{-}24\text{-}27\ \mu\text{m}$ , equatorial axis  $21\text{-}24\text{-}28\ \mu\text{m}$ , P/E ratio  $0.81\text{-}0.99\text{-}1.24$ ; flowering in May-Jun. (*M. Hotta 5682*; Loc. F)

*F. sieboldiana* Blume

'Marubaaodamo'

Exine  $1.9\ \mu\text{m}$  thick; lumina  $1.0\text{-}1.5\ \mu\text{m}$  wide; apocolpium  $6.0\text{-}7.0\ \mu\text{m}$  wide; pori lalongate  $3.0 \times 5.0\ \mu\text{m}$ , costae  $1.0\ \mu\text{m}$  thick; polar axis  $21\text{-}22\text{-}24\ \mu\text{m}$ , equatorial axis  $17\text{-}20\text{-}22\ \mu\text{m}$ , P/E ratio  $1.00\text{-}1.11\text{-}1.29$ ; flowering in Apr-May. (*Y. Inamasu 26*; Loc. K)

*Ligustrum obtusifolium* Sieb. et Zucc.

'Ibotanoki'

Exine  $3.5\ \mu\text{m}$  thick; lumina  $1.5\text{-}3.0\ \mu\text{m}$  wide; apocolpium  $12\text{-}13\ \mu\text{m}$  wide; pori lalongate  $1.0 \times 2.0\ \mu\text{m}$ , ragged; polar axis  $26\text{-}28\text{-}30\ \mu\text{m}$ , equatorial axis  $25\text{-}28\text{-}30\ \mu\text{m}$ , P/E ratio  $0.91\text{-}1.00\text{-}1.10$ ; flowering in May-Jun. (*D. N. s.n.*, Loc. A)

#### Onagraceae (3 genera, 4 species)

Triporate monad; exine  $1.5\text{-}5.5\ \mu\text{m}$  thick; sexine reticulate, rugulate; pori lalongate  $5.0\text{-}12\ \mu\text{m}$  wide, with vestibulum  $5.0\text{-}12\ \mu\text{m}$  high; equatorial acute oval in equatorial view, angular, semiangular in polar view; equatorial axis  $43\text{-}76\ \mu\text{m}$ , oblate; flowering in Jul-Oct.

ref. *Circaea mollis* Sieb. et Zucc., 'Mizutamasou' (Aug-Sep): 4; *Epilobium pyrricholophum* Franch. et Savat., 'Akabana' (Jul-Sep): 4; *Ludwigia epilobioides* Maxim., 'Choujitade' (Aug-Oct): 4.

- 1a. Equatorial axis  $<50\mu\text{m}$ , vestibulum  $>10\mu\text{m}$  high  
 .....*Circaea erubescens*, *Circaea mollis*  
 1b. Equatorial axis  $>50\mu\text{m}$ , vestibulum  $<10\mu\text{m}$  high  
 2a. Proximal pole thickened forming 3 ridges .....*Ludwigia epilobioides*  
 2b. Proximal pole not thickened .....*Epilobium pyrricholophum*

*Circaea erubescens* Fr. et Sav.

'Tanitade'

Exine 1.5-2.0  $\mu\text{m}$  thick; sexine reticulate, rugulate, lumina 0.5  $\mu\text{m}$  wide; pori lalongate  $5.0 \times 8.0\mu\text{m}$ , with vestibulum 12-16  $\mu\text{m}$  wide, 9.0-12  $\mu\text{m}$  high; polar axis 27-30-33  $\mu\text{m}$ , equatorial axis 40-43-48  $\mu\text{m}$ , P/E ratio 0.65-0.70-0.76 with vestibulum (n=13); flowering in Jul-Oct. (S. Okamoto s.n.; Loc. A)

### Orchidaceae

Pollinia; 1, 2, 4, 8 pollinia per pollinarium, 1 pollinium attached to glandula, 2 pollinia attached by 1 caudicle to glandula, 4 pollinia directly attached to glandula, 4 pollinia attached by caudicles, or 8 pollinia attached by caudicles; grains forming tetrads or monads; flowering in Apr-Oct.  
 ref. 1, 3.

### Orobanchaceae (1 genus, 1 species)

*Aeginetia indica* L.

'Nanbangiseru'

Tricolpate monad; exine 1.0  $\mu\text{m}$  thick; sexine scabrate; colpi long, ragged; oval in equatorial view, circular in polar view; polar axis 19-27  $\mu\text{m}$ , equatorial axis 18-24  $\mu\text{m}$ , spherical-prolate; flowering in Jul-Sep. (ref. 4)

### Oxalidaceae (1 genus, 2 species)

Tricolpate monad; exine 1.8-2.0  $\mu\text{m}$  thick; sexine reticulate, baculate; colpi ragged, verrucate; oval in equatorial view, circular in polar view; polar axis 25-38  $\mu\text{m}$ , equatorial axis 28-40  $\mu\text{m}$ , spherical-oblate; flowering in Mar-Sep.  
 ref. *Oxalis corniculata* L., 'Katabami' (May-Sep): 4.

*Oxalis griffithii* Edgew. et Hook. fil.

'Miyamakatabami'

Exine 2.0  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5-1.0  $\mu\text{m}$  wide, muri simplicimellae; apocolpium variable; polar axis 25-30-34  $\mu\text{m}$ , equatorial axis 30-35-40  $\mu\text{m}$ , P/E ratio 0.73-0.87-1.00; flowering in Apr-May. (M. Tagawa 967; Loc. K)

### Paeoniaceae (1 genus, 1 species)

*Paeonia japonica* (Makino) Miyabe et Takeda

'Yamashakuyaku'

Tricolpate, tricolporate monad; exine 2.0  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5  $\mu\text{m}$  wide; colpi acute at ends, apocolpium 6.0  $\mu\text{m}$  wide; if pori present, pori torn, irregular in shape, 5.0-10  $\mu\text{m}$  wide, costae 1.0  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 23-25-27  $\mu\text{m}$ , equatorial axis 26-28-30  $\mu\text{m}$ , P/E ratio 0.83-0.90-1.00 (n=6); flowering in May. (K. Nagai 24797; Loc. K)

## Papaveraceae (2 genera, 2 species)

*Corydalis* (3 species)

Pericolpate (6 colpate) monad; exine 1.0-1.5  $\mu\text{m}$  thick; sexine verrucate, rugulate, verrucae 0.5-1.0  $\mu\text{m}$  wide; colpi rounded at ends, scabrate, margo slightly thickened; grains circular; grains 23-35  $\mu\text{m}$ ; flowering in Apr-Jul.

*Corydalis incisa* (Thunb.) Pers.

'Murasakikeman'

Exine 1.5  $\mu\text{m}$  thick; grains 25-27-29  $\mu\text{m}$ ; flowering in Apr-Jun. (*Y. Inamasu* 2; Loc. A)

*C. lineariloba* Sieb. et Zucc.

'Himeengosaku'

Exine 1.0  $\mu\text{m}$  thick; grains 27-32-35  $\mu\text{m}$ ; flowering in Apr-May. (*Ueda et al.* 523; Loc. A)

*C. pallida* (Thunb.) Pers.

'Miyamakikeman'

Exine 1.0-1.5  $\mu\text{m}$  thick; grains 23-28-30  $\mu\text{m}$ ; flowering in Apr-Jul. (*S. Okamoto s.n.*; Loc. A)

*Macleaya* (1 species)*Macleaya cordata* (Willd.) R. Br.

'Takenigusa'

Periporate (6-8 porate) monad; exine 1.5  $\mu\text{m}$  thick; sexine verrucate; pori circular 3.5  $\mu\text{m}$  wide, with annuli; grains circular; grains 15-22  $\mu\text{m}$ , spherical; flowering in Jul-Aug. (ref. 4)

## Phrymaceae (1 genus, 1 species)

*Phryma leptostachya* L. var. *asiatica* Hara

'Haedokusou'

Tricolpate monad; exine 2.0-2.5  $\mu\text{m}$  thick, sexine baculate; colpi acute at ends, apocolpium 6.0-8.0  $\mu\text{m}$  wide, margo thinned; pori lolate, circular 2.0-5.0  $\mu\text{m}$  wide; oval in equatorial view, circular in polar view; polar axis 16-19-22  $\mu\text{m}$ , equatorial axis 17-20-23  $\mu\text{m}$ , P/E ratio 0.82-0.93-1.06; flowering in Jul-Aug. (*S. Hosomi* 7108; Loc. K)

## Phytolaccaceae (1 genus, 1 species)

*Phytolacca japonica* Makino

'Maruminoyamagobou'

Tricolpate monad; exine 2.0-2.5  $\mu\text{m}$  thick; sexine baculate, bacula 1.5-2.0  $\mu\text{m}$  high, forming partly tectum, tectum scabrate; colpi acute at ends, apocolpium 8.0-12  $\mu\text{m}$  wide; oval in equatorial view, circular in polar view; polar axis 20-23-25  $\mu\text{m}$ , equatorial axis 21-25-28  $\mu\text{m}$ , P/E ratio 0.80-0.92-1.18; flowering in Jun-Sep. (*G. Murata* 19426; Loc. K)

**Pinaceae** (3 genera, 5 species)*Abies* and *Pinus* (4 species)

Vesiculate monad with 2 distinct, subglobular sacks; exine 2.8-6.0  $\mu\text{m}$  thick; sexine reticulate, rugulate, distal face thinner, scabrate, verrucate, sacks reticulate; grains oval, elliptic; grains exclude sacks, polar axis 21-78  $\mu\text{m}$ , equatorial axis 30-88  $\mu\text{m}$ ; flowering in Apr-May.

ref. *Abies firma* Sieb. et Zucc., 'Momi': 4; *Pinus parvifolia* Sieb. et Zucc., 'Himekomatsu': 4; *Pinus thunbergii* Parlatore, 'Kuromatsu': 4.

- 1a. Proximal face of the exine  $>5.0\mu\text{m}$  thick, equatorial axis, excluding sacks  $>60\mu\text{m}$   
 .....*Abies firma*  
 1b. Proximal face of the exine  $<5.0\mu\text{m}$  thick, equatorial axis, excluding sacks  $<60\mu\text{m}$   
 2a. Sacks hemiglobose, verrucate in the inner side of the distal face between sacks  
 .....*Pinus parviflora*  
 2b. Sacks subglobose, scabrate in the inner side of the distal face between sacks  
 .....*P. densiflora*, *P. thunbergii*

*Pinus densiflora* Sieb. et Zucc.

'Akamatsu'

Exine 3.0-5.0  $\mu\text{m}$  thick; polar axis 21-26-30  $\mu\text{m}$ , equatorial axis 31-34-38  $\mu\text{m}$ , excluding sacks, sacks 18-22-24  $\mu\text{m}$ ; flowering in Apr-May. (N. Fukuoka s.n.; Loc. S)

*Tsuga* (1 species)*Tsuga sieboldii* Carr.

'Tsuga'

Vesiculate monad; continuous or interrupted ring-shaped rudimentary sack around the grain, 6.0-10  $\mu\text{m}$  wide; exine 2.0  $\mu\text{m}$  thick; sexine verrucate, echinate, verrucae 1.5-3.0  $\mu\text{m}$  wide, echini 1.0  $\mu\text{m}$  high, exine thinner and verrucae smaller in distal face; oval in equatorial view, circular in polar view; grains 56-71  $\mu\text{m}$ ; flowering in Apr-May. (ref. 4)

**Plantaginaceae** (1 genus, 1 species)*Plantago asiatica* L.

'Oobako'

Periporate (ca. 7 porate) monad; exine 1.5  $\mu\text{m}$  thick; sexine verrucate, verrucae 1.0-4.0  $\mu\text{m}$  wide; pori circular 1.0-3.0  $\mu\text{m}$  wide, ragged; grains circular; grains 20-22-25  $\mu\text{m}$ ; flowering in Apr-Sep. (S. Okamoto s.n.; Loc. A)

**Polygalaceae** (1 genus, 2 species)

Stephanocolporate (15-18 colporate) monad; exine 1.5-2.5  $\mu\text{m}$  thick; sexine scabrate; colpi long, acute at ends, equatorial prominent; pori zonorate; equatorial acute oval in equatorial view, circular in polar view; polar axis 30-46  $\mu\text{m}$ , equatorial axis 17-43  $\mu\text{m}$ , prolate; flowering in Apr-Jul.

ref. *Polygala reinii* Fr. et Sav., 'Kakinohagusa' (May-Jun): 1.

*Polygala japonica* Houtt.

'Himehagi'

Exine 2.5  $\mu\text{m}$  thick; pori 3.0-4.0  $\mu\text{m}$  wide, costae 2.5  $\mu\text{m}$  thick; polar axis 22-24-27  $\mu\text{m}$ ,

equatorial axis 17-21-23  $\mu\text{m}$ , P/E ratio 1.00-1.16-1.29; flowering in Apr-Jul. (*K. Nagai s.n.*; Loc. S)

**Polygonaceae** (6 genera, 19 species)

*Antenoron* (1 species)

*Antenoron filiforme* (Thunb.) Roberty et Vartier 'Mizuhiki'  
Pericolpate (16 colpate) monad; exine 2.0  $\mu\text{m}$  thick; sexine reticulate, lumina 1.0-2.0  $\mu\text{m}$  wide, muri duplicolumellate; colpi acute at ends, 24  $\mu\text{m}$  long; grains circular; grains 33-37-39  $\mu\text{m}$  ( $n=7$ ); flowering in Aug-Oct. (*G. Koidzumi s.n.*; Loc. K)

*Bistorta*, *Polygonum* and *Reynoutria* (3 species)

Tricolporate monad; exine 2.0-3.0  $\mu\text{m}$  thick; sexine baculate, bacula forming tectum, tectum reticulate; colpi acute at ends, margo thickened; pori lalongate, zonorate, with costae; oval in equatorial view, circular in polar view; polar axis 23-40  $\mu\text{m}$ , equatorial axis 20-37  $\mu\text{m}$ , prolate; flowering in Apr-Oct.

ref. *Polygonum aviculare* L., 'Michiyanagi' (May-Oct): 4.

- 1a. Pori zonorate .....*Reynoutria japonica*  
1b. Pori lalongate  
    2a. Pori rounded at ends, tectum perforate, columellae branched ...*Bistorta vivipara*  
    2b. Pori acute at ends, tectum not perforate, columellae not branched  
        .....*Polygonum aviculare*

*Bistorta tenuicaulis* (Bisset et Moore) Nakai

'Harutoranoo'

Exine 2.5  $\mu\text{m}$  thick at poles, 1.5  $\mu\text{m}$  thick at equator; apocolpium 11-13  $\mu\text{m}$  wide; pori lalongate 6.0  $\times$  8.0  $\mu\text{m}$ , costae 1.5-2.0  $\mu\text{m}$  thick; polar axis 25-31-39  $\mu\text{m}$ , equatorial axis 21-27-34  $\mu\text{m}$ , P/E ratio 1.05-1.16-1.24 ( $n=16$ ); flowering in Apr-Jun. (*K. Iwatsuki 686*; Loc. A)

*Reynoutria japonica* Houtt.

'Itadori'

Exine 2.0-2.5  $\mu\text{m}$  thick; tectum reticulate, lumina  $<0.5$   $\mu\text{m}$  wide; apocolpium 4.0  $\mu\text{m}$  wide; pori zonorate, with costae; polar axis 23-26-29  $\mu\text{m}$ , equatorial axis 20-22-24  $\mu\text{m}$ , P/E ratio 1.15-1.21-1.26 ( $n=12$ ); flowering in Jul-Sep. (*S. Fujii 1296*; Loc. Osaka Pref.)

*Persicaria* (11 species)

Periporate (20-30 porate), tricolpate monad; exine 4.0-8.0  $\mu\text{m}$  thick; sexine reticulate, lumina 3.0-5.5  $\mu\text{m}$  wide, muri dipli-triplicolumellate, 2.0-4.0  $\mu\text{m}$  wide; pori circular 2.0-5.0  $\mu\text{m}$  wide in the lumina; grains circular; grains 36-73  $\mu\text{m}$ ; flowering in May-Nov.

ref. *Persicaria conspicua* (Nakai) Nakai, 'Sakuratade' (Aug-Oct): 4; *P. debilis* (Meisn.) H. Gross, 'Miyamatani-soba' (Jul-Oct): 1; *P. hydropiper* (L.) Spach 'Yanagitade' (Jul-Oct): 4; *P. longiseta* (De Bruyn) Kitag., 'Inutade' (Jun-Oct): 4; *P. makinoi* (Nakai) Nakai, 'Oonebaritade' (Jul-Oct): 1; *P. nepalensis* (Meisn.) H. Gross, 'Tanisoba' (Jul-Oct): 4; *P. nipponensis* (Makino) H. Gross, 'Yanonegusa'

(Sep-Oct): 4.

- 1a. Tricolpate ..... *Persicaria nepalensis*  
 1b. Periporate ..... *Persicaria* (10 spp.)

*Persicaria aestiva* Ohki 'Unagitsukami'  
 Periporate monad; exine 6.0-7.0  $\mu\text{m}$  thick; lumina 3.0-5.0  $\mu\text{m}$  wide, muri 3.0-4.0  $\mu\text{m}$  wide; pori circular 2.5-3.0  $\mu\text{m}$  wide; grains 42-45-48  $\mu\text{m}$  (n=6); flowering in Sep-Oct. (*G. Murata 11384*; Loc. A)

*P. pubescens* (Blume) Hara 'Bontokutade'  
 Periporate monad; exine 6.0-8.0  $\mu\text{m}$  thick; lumina 3.0-5.0  $\mu\text{m}$  wide, muri 2.5-3.5  $\mu\text{m}$  wide; pori circular 3.0-4.0  $\mu\text{m}$  wide; grains 42-47-53  $\mu\text{m}$  (n=17), flowering in Sep-Oct. (*H. Koyama 798*; Loc. K)

*P. senticosa* (Fr. et Sav.) H. Gross 'Mamakanoshirinugui'  
 Periporate monad; exine 6.0  $\mu\text{m}$  thick; lumina 2.0-5.0  $\mu\text{m}$  wide, muri 2.5-3.0  $\mu\text{m}$  wide; pori circular 2.0-3.0  $\mu\text{m}$  wide; grains 36-44-48  $\mu\text{m}$ ; flowering in Sep-Oct. (*S. Kitamura s.n.*; Loc. K)

*P. thunbergii* (Sieb. et Zucc.) H. Gross 'Mizosoba'  
 Periporate monad; exine 5.0-7.0  $\mu\text{m}$  thick; lumina 4.5-5.5  $\mu\text{m}$  wide, muri 3.0-3.5  $\mu\text{m}$  wide; pori circular 4.0-5.0  $\mu\text{m}$  wide; grains 51-59-73  $\mu\text{m}$ ; flowering in Jul-Oct. (*T. Takahashi 1268*; Loc. K)

*Rumex* (4 species)

Tricolporate, pericolarporate (6, 12 colporate) monad; exine 1.5-2.0  $\mu\text{m}$  thick; sexine baculate, bacula forming tectum on top, tectum reticulate; colpi acute at ends; pori circular, lalongate, with costae; oval in equatorial view, circular in polar view; grains 15-32  $\mu\text{m}$ , spherical-oblate; flowering in May-Sep.

ref. *Rumex acetosa* L., 'Suiba' (May-Aug): 4; *R. acetosella* L., 'Himesuiba' (May-Aug): 3; *R. japonicus* Houtt., 'Gishigishi' (Jun-Aug): 4; *R. obtusifolius* L., 'Ezonogishigishi' (Jun-Sep): 3.

**Pontederiaceae** (1 genus, 1 species)

*Monochoria vaginalis* (Burm. fil.) Presl var. *plantaginea* (Roxb.) Solms-Laub.

'Konagi'

Monocolpate monad; exine 1.5-2.0  $\mu\text{m}$  thick; sexine verrucate, rugulate, verrucae 1.0  $\mu\text{m}$  wide; colpi ragged; grains elliptic; polar axis 19-23-26  $\mu\text{m}$ , equatorial axis 37-41-46  $\mu\text{m}$ ; flowering in Sep-Oct. (*S. Okamoto s.n.*; Loc. A)

**Portulacaceae** (1 genus, 1 species)

*Portulaca oleracea* L. 'Suberihiyu'  
 Pericolarporate (10-15 colporate) monad; exine 3.5  $\mu\text{m}$  thick; sexine echinate, echini 1.0-1.5  $\mu\text{m}$  high; colpi rounded at ends, 10  $\mu\text{m}$  long, 2.0  $\mu\text{m}$  wide; grains circular; grains

42-50-60  $\mu\text{m}$ ; flowering in Jul-Sep. (*S. Tsugaru and N. Sawada 15134*; Loc. K)

**Primulaceae** (1 genus, 3 species)

Tricolporate monad; exine 1.5-2.0  $\mu\text{m}$  thick; sexine psilate; colpi acute at ends, constricted at equator; pori lalongate, H-shaped, with costae; compressed oval in equatorial view, circular in polar view; polar axis 21-33  $\mu\text{m}$ , equatorial axis 18-24  $\mu\text{m}$ , prolate; flowering in May-Aug.

ref. *Lysimachia fortunei* Maxim., 'Numatoranoo' (Jul-Aug): 4; *L. japonica* Thunb., 'Konasubi' (May-Jun): 1.

*Lysimachia clethroides* Duby

'Okatoranoo'

Exine 1.5-2.0  $\mu\text{m}$  thick; apocolpium 8.0  $\mu\text{m}$  wide; pori 10-11  $\times$  2.0-2.5  $\mu\text{m}$  wide, costae 2.0  $\mu\text{m}$  thick; polar axis 25-29-33  $\mu\text{m}$ , equatorial axis 18-20-23  $\mu\text{m}$ , P/E ratio 1.33-1.48-1.73; flowering in Jun-Jul. (*Anonymous s.n.*, Loc. S)

**Pyrolaceae** (3 genera, 3 species)

*Chimaphila* and *Pyrola* (2 species)

Tricolporate tetrads; exine 2.0  $\mu\text{m}$  thick; sexine verrucate, rugulate; colpi acute at ends, margo thickened; pori lalongate, with costae; tetrads tetrahedral; grains, polar axis 13-23  $\mu\text{m}$ , equatorial axis 15-29  $\mu\text{m}$ ; flowering in Jun-Jul.

ref. *Chimaphila japonica* Miq., 'Umegasasou' (Jun-Jul): 1.

*Pyrola japonica* Klenze

'Ichiyakusou'

Colpi 7.0-10  $\mu\text{m}$  long, margo 2.5  $\mu\text{m}$  thick; pori 0.5-1.0  $\times$  7.0-12  $\mu\text{m}$ , costae 2.5  $\mu\text{m}$  thick; grains, polar axis 17-20-23  $\mu\text{m}$ , equatorial axis 22-26-29  $\mu\text{m}$ ; flowering in Jun-Jul. (*T. Takahashi and M. Sawada 1902*; Loc. K)

*Monotropastrum* (1 species)

*Monotropastrum humile* (D. Don) Hara

'Ginryousou'

Triporate monad; exine 1.0  $\mu\text{m}$  thick; sexine scabrate; pori lolongate 5.0-6.0  $\times$  4.0-5.0  $\mu\text{m}$  wide, costae 1.2  $\mu\text{m}$  thick; oval in equatorial view, semiangular in polar view; polar axis 20-21-23  $\mu\text{m}$ , equatorial axis 23-25-28  $\mu\text{m}$ , P/E ratio 0.77-0.85-0.90; flowering in May-Aug. (*H. Takahashi 914*; Loc. A)

**Ranunculaceae** (10 genera, 14 species)

*Aconitum*, *Actaea*, *Anemone*, *Aquilegia*, *Caltha*, *Cimicifuga*, *Clematis* and *Ranunculus* (11 species)

Tricolpate, stephanocolpate (4-6 colpate), pericolpate (6 colpate) monad; exine 1.5-2.2  $\mu\text{m}$  thick; sexine baculate, bacula forming tectum on top, tectum scabrate, psilate; colpi long, usually ragged; oval in equatorial view, circular in polar view; polar axis 17-36  $\mu\text{m}$ , equatorial axis 14-33  $\mu\text{m}$ , oblate-spherical-prolate; flowering in Apr-Oct.



ref. *Actaea asiatica* Hara, 'Ruiyoushouma' (May-Jun): 3; *Anemone nikoensis* Maxim., 'Ichirinsou' (Apr-May): 4; *Aquilegia burgeriana* Sieb. et Zucc., 'Yamaodamaki' (Jun-Aug): 3; *Caltha palustris* L., 'Ryuukinka' (May-Jul): 4; *Cimicifuga simplex* Wormsk., 'Sarashinashouma' (Aug-Oct): 4; *Clematis japonica* Thunb., 'Hanshouduru' (May-Jun): 4.

- 1a. Stephanocolpate (6 colpate) ..... *Anemone flaccida*  
 1b. Pericolpate  
   2a. Bacula dense, >50 bacula/10 × 10 μm<sup>2</sup> ..... *Ranunculus silerifolius*  
   2b. Bacula scattered, 15-18 bacula/10 × 10 μm<sup>2</sup> ..... *R. japonicus*  
 1c. Tricolpate  
   3a. Polar axis <20 μm ..... *Clematis apiifolia*  
   3b. Polar axis >20 μm  
     4a. Colpi wide, distinctly verrucate ..... *Aconitum sanyoense*  
     4b. Colpi narrow  
       5a. Bacula dense, >50 per 10 × 10 μm<sup>2</sup> ..... *Ranunculus silerifolius*  
       5b. Bacula scattered, 15-18 per 10 × 10 μm<sup>2</sup> ..... *R. japonicus*

*Aconitum sanyoense* Nakai 'San'youbushi'  
 Tricolpate monad; exine 1.7 μm thick; tectum thick, psilate; colpi acute at ends, wide, ragged, apocolpium 6.0-7.0 μm wide, verrucate, verrucae 0.5-1.0 μm; polar axis 21-23-25 μm, equatorial axis 20-22-24 μm, P/E ratio 0.94-1.02-1.19; flowering in Sep-Oct. (*G. Nakai 5603*; Loc. A)

*Anemone flaccida* Fr. Schm. 'Nirinsou'  
 Stephanocolpate (6 colpate) monad; exine 2.0 μm thick; tectum perforate, scabrate; colpi ragged, apocolpium 5.0-7.0 μm wide; polar axis 20-23-26 μm, equatorial axis 22-24-27 μm, P/E ratio 0.76-0.93-1.05; flowering in Apr-May. (*Y. Imai s.n.*; Loc. H)

*Clematis apiifolia* DC. 'Botanduru'  
 Tricolpate monad; exine 1.9 μm thick; baculae varying in width, large and small bacula present, tectum scabrate; colpi acute at ends, apocolpium 6.0-8.0 μm wide; polar axis 17-19-20 μm, equatorial axis 17-20-23 μm, P/E ratio 0.87-0.97-1.07; flowering in Aug-Sep. (*G. Koidzumi s.n.*; Loc. A)

*Ranunculus japonicus* Thunb. 'Umanoashigata'  
 Tricolpate, pericolpate (4-6 colpate) monad; exine 2.2 μm thick; baculae varying in width, large and small bacula present, bacula scattered, 15-18/10 × 10 μm<sup>2</sup>, tectum scabrate; colpi ragged, apocolpium 7.0-9.0 μm wide; polar axis 23-27-32 μm, equatorial axis 23-27-33 μm, P/E ratio 0.91-1.00-1.10; flowering in Apr-May. (*S. Okamoto s.n.*; Loc. A)

*R. silerifolius* Lévl. 'Kitsunenobotan'  
 Tricolpate, pericolpate (4-6 colpate) monad; exine 2.1 μm thick; baculae varying in width, large and small bacula present, bacula scattered, >50/10 × 10 μm<sup>2</sup>, tectum scabrate; colpi ragged, apocolpium 6.0-10 μm wide; grains 22-27-33 μm, spherical; flowering in Apr-Jul. (*S. Tsugaru and T. Takahashi 14200*; Loc. K)

*Coptis* and *Thalictrum* (3 species)

Periporate (10-15 porate) monad; exine  $2.0\ \mu\text{m}$  thick; sexine scabrate; pori circular  $3.5\text{-}5.0\ \mu\text{m}$  wide, annuli absent; grains circular; grains  $18\text{-}24\ \mu\text{m}$ ; flowering in Mar-May and Jul-Sep.

ref. *Coptis japonica* (Thunb.) Makino, 'Ouren' (Apr): 1; *C. quinquefolia* Miq., 'Baikaouren' (Apr-May): 1; *Thalictrum minus* L., 'Akikaramatsu' (Jul-Sep): 4.

- 1a. Pori  $<12$ ,  $<4.0\ \mu\text{m}$  wide ..... *Thalictrum minus*  
 1b. Pori  $>12$ ,  $>4.0\ \mu\text{m}$  wide ..... *Coptis japonica*, *C. quinquefolia*

**Rhamnaceae** (3 genera, 5 species)

Tricolporate monad; exine  $1.0\text{-}1.5\ \mu\text{m}$  thick; sexine reticulate, rugulate, lumina  $<0.5\text{-}1.5\ \mu\text{m}$  wide; colpi acute at ends, long, margo thickened; pori lalongate, with costae; compressed rhomboidal in equatorial view, angular in polar view; polar axis  $14\text{-}26\ \mu\text{m}$ , equatorial axis  $16\text{-}25\ \mu\text{m}$ , oblate-spherical-prolate; flowering in Apr-Aug.

ref. *Berchemia racemosa* Sieb. et Zucc., 'Kumayanagi' (Jul-Aug): 4; *Hovenia dulcis* Thunb., 'Kenponashi' (Jun-Jul): 4; *Rhamnus crenata* Sieb. et Zucc., 'Isonoki' (Jun-Jul): 4; *R. japonica* Maxim., 'Kuroumemodoki' (Apr-May): 3.

- 1a. Polar axis  $<18\ \mu\text{m}$ , sexine rugulate ..... *Berchemia racemosa*  
 1b. Polar axis  $>18\ \mu\text{m}$   
 2a. Equatorial axis  $<21\ \mu\text{m}$ , sexine reticulate,  $>1.0\ \mu\text{m}$  wide lumina present  
 ..... *Rhamnus crenata*  
 2b. Equatorial axis  $>21\ \mu\text{m}$ , sexine reticulate, rugulate, lumina  $<0.5\text{-}1.0\ \mu\text{m}$  wide  
 ..... *Hovenia dulcis*, *Hovenia tomentella*

*Hovenia tomentella* (Makino) Nakai

'Kekenponashi'

Exine  $1.0\ \mu\text{m}$  thick; lumina  $<0.5\ \mu\text{m}$  wide; apocolpium  $5.0\text{-}6.0\ \mu\text{m}$  wide, margo  $2.0\ \mu\text{m}$  wide; pori lalongate  $5.0 \times 2.0\ \mu\text{m}$  wide, costae  $1.0\text{-}1.5\ \mu\text{m}$  thick; polar axis  $18\text{-}20\text{-}22\ \mu\text{m}$ , equatorial axis  $21\text{-}24\text{-}25\ \mu\text{m}$ , P/E ratio  $0.75\text{-}0.85\text{-}1.00$ ; flowering in Jun-Jul. (S. Okamoto s.n.; Loc. K)

**Rosaceae** (15 genera, 34 species)

Tricolporate monad; exine  $0.5\text{-}2.5\ \mu\text{m}$  thick; sexine striate, rugulate, verrucate, scabrate; colpi usually prominent and constricted at equator, acute at ends, operculum present in some species; pori lalongate, ragged  $1.5\text{-}9.0\ \mu\text{m}$  wide, if pori torn, pori variable in shape, with costae; oval in equatorial view, circular, semiangular in polar view; polar axis  $12\text{-}40\ \mu\text{m}$ , equatorial axis  $10\text{-}44\ \mu\text{m}$ , spherical-prolate; flowering in Apr-Oct.

ref. *Amelanchier asiatica* (Sieb. et Zucc.) Endl. ex Walp., 'Zaifuriboku' (Apr-May): 4; *Duchesnea chrysantha* (Zoll. et Mor.) Miq., 'Hebiichigo' (Apr-May): 1; *D. indica* (Andr.) Focke, 'Yabuhebiichigo' (Apr-Jun): 3; *Kerria japonica* (L.) DC., 'Yamabuki' (Apr-May): 4; *Potentilla centigrana* Maxim., 'Himehebiichigo' (Jun-Aug): 1; *P. cryptotaeniae* Maxim., 'Mitsumotosou' (Jul-Sep): 1; *P. fragarioides* L., 'Kijimushiro'

(Apr-May):1; *P. freyniana* Bornm., 'Mitsubatsuchiguri' (Apr-May):3; *P. stolonifera* Lehm., 'Tsurukiji-mushiro' (Apr-Jul): 1; *Pyrus pyrifolia* (Burm. fil.) Nakai, 'Yamanashi' (Apr):1; *Rubus hakonensis* Fr. et Sav., 'Miyamafuyuichigo' (Aug-Oct): 4; *R. hirsutus* Thunb., 'Kusaichigo' (Apr): 4; *Sorbus gracilis* (Sieb. et Zucc.) C. Koch, 'Nankinnanakamado' (Apr-Jun): 1.

- 1a. Polar axis  $<15\mu\text{m}$  ..... *Aruncus dioicus*  
 1b. Polar axis  $>15\mu\text{m}$   
 2a. Colpi with tectate operculum  
 3a. Polar axis  $<23\mu\text{m}$  ..... *Potentilla* (5 spp.) and *Duchesnea* (2 spp.)  
 3b. Polar axis  $23-29\mu\text{m}$  ..... *Rosa multiflora*  
 3c. Polar axis  $>29\mu\text{m}$  ..... *Agrimonia nipponica*  
 2b. Colpi without tectate operculum  
 4a. Sexine scabrate, verrucate  
 5a. Equatorial axis  $<24\mu\text{m}$  ..... *Filipendula multijuga*, *Rubus crataegifolius*  
 5b. Equatorial axis  $>24\mu\text{m}$  ..... *Prunus incisa*, *Rubus buergeri*, *R. hakonensis*  
 4b. Sexine striate, rugulate  
 6a. Vallae coarse, distinct  
 7a. Polar axis  $<20\mu\text{m}$  ..... *Geum japonicum*  
 7b. Polar axis  $>20\mu\text{m}$   
 8a. Vallae usually parallel ..... *Prunus salicina*, *P. jamasakura*  
 8b. Vallae irregular, rugulate ..... *Prunus incisa*, *P. grayana*  
 6b. Vallae fine, indistinct  
 9a. Pori torn, shape variable, H-shaped,  $>6.0\mu\text{m}$  long, grains spherical  
 10a. Pori, meridional axis  $>8.0\mu\text{m}$  long, longer than equatorial axis  
 ..... *Malus toringo*, *M. tschonoskii*  
 10b. Pori, meridional axis  $<8.0\mu\text{m}$  long, shorter than equatorial axis  
 ..... *Pourthiaea*, *Sorbus alnifolia*, *S. americanus*, *S. japonicus*  
 9b. Pori ragged, lalongate,  $<6.0\mu\text{m}$  long, grains prolate-spherical  
 11a. Equatorial axis  $>24\mu\text{m}$  ..... *Rubus buergeri*, *R. hakonensis*  
 11b. Equatorial axis  $<24\mu\text{m}$   
 12a. Apocolpium  $>6.0\mu\text{m}$  wide ..... *Rubus palmatus*  
 12b. Apocolpium  $<6.0\mu\text{m}$  wide  
 .. *Rubus crataegifolius*, *R. illecebrosus*, *R. microphyllus*, *R. parvifolius*

*Agrimonia nipponica* Koidz.

'Himekinmizuhiki'

Exine  $2.0-2.5\mu\text{m}$  thick; sexine striate, verrucate; colpi equatorial prominent, apocolpium  $8.0-9.0\mu\text{m}$  wide, with tectate operculum; pori lalongate  $8.0-9.0 \times 4.0\mu\text{m}$  wide, ragged, costae  $2.0\mu\text{m}$  thick; circular in polar view; polar axis  $30-34-38\mu\text{m}$ , equatorial axis  $23-26-29\mu\text{m}$ , P/E ratio 1.14-1.31-1.53; flowering in Aug-Sep. (S. Okamoto s.n.; Loc. A)

*Aruncus dioicus* (Walt.) Fern.

'Yamabukishouma'

Exine  $0.5-1.0\mu\text{m}$  thick; sexine striate; colpi equatorial prominent, apocolpium  $2.5\mu\text{m}$  wide; pori circular  $1.5\mu\text{m}$  wide; circular in polar view; polar axis  $12-13-15\mu\text{m}$ , equatorial axis  $10-11-13\mu\text{m}$ , P/E ratio 1.10-1.19-1.38 (n=12); flowering in Jun-Aug. (G. Murata s.n.; Loc. S)

*Filipendula multijuga* Maxim.

'Shimotsukesou'

Exine  $1.7\mu\text{m}$  thick; sexine scabrate; colpi acute at ends, constricted, slightly prominent at equator, apocolpium  $4.0-5.0\mu\text{m}$  wide; pori lalongate  $0.5-1.5 \times 3.0-4.0$

$\mu\text{m}$ , ragged, costae 1.0-1.5  $\mu\text{m}$  thick; circular in polar view; polar axis 15-17-19  $\mu\text{m}$ , equatorial axis 13-16-18  $\mu\text{m}$ , P/E ratio 1.00-1.08-1.19; flowering in Jul-Aug. (*M. Tagawa 2075*; Loc. A)

*Geum japonicum* Thunb.

'Daikonsou'

Exine 1.5  $\mu\text{m}$  thick; sexine rugulate, striate; colpi constricted and prominent at equator, apocolpium 4.0-5.0  $\mu\text{m}$  wide; pori lalongate 2.0  $\times$  5.0  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; circular in polar view; polar axis 16-17-19  $\mu\text{m}$ , equatorial axis 15-17-18  $\mu\text{m}$ , P/E ratio 0.93-1.00-1.08; flowering in Jul-Aug. (*M. Hotta 15075*; Loc. A)

*Malus toringo* (Sieb.) Sieb. ex Vriese

'Zumi'

Exine 2.1  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, constricted and prominent at equator, apocolpium 4.0-6.0  $\mu\text{m}$  wide; pori lalongate 15  $\times$  10  $\mu\text{m}$  wide, torn, costae 1.0  $\mu\text{m}$  thick; circular in polar view; polar axis 21-25-30  $\mu\text{m}$ , equatorial axis 22-28-33  $\mu\text{m}$ , P/E ratio 0.70-0.93-1.11; flowering in May-Jun. (*S. Okamoto s.n.*; Loc. A)

*M. tschonoskii* (Maxim.) C. K. Schm.

'Ourajironoki'

Exine 2.0  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, constricted and prominent at equator, apocolpium 4.0-8.0  $\mu\text{m}$  wide, margo thickened; pori lalongate 8.0-12  $\mu\text{m}$  long, torn; circular in polar view; polar axis 23-27-30  $\mu\text{m}$ , equatorial axis 22-25-28  $\mu\text{m}$ , P/E ratio 0.90-1.07-1.34; flowering in May. (*G. Murata 18042*; Loc. K)

*Pourthiaea villosa* (Thunb.) Decne.

'Kamatsuka'

Exine 1.8  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, constricted and prominent at equator, apocolpium 3.0-5.0  $\mu\text{m}$  wide; pori lalongate 3.0-4.0  $\times$  6.0-8.0  $\mu\text{m}$ , ragged; circular in polar view; polar axis 22-26-32  $\mu\text{m}$ , equatorial axis 21-26-30  $\mu\text{m}$ , P/E ratio 0.85-1.04-1.15; flowering in Apr-May. (*S. Kitamura s.n.*; Loc. K)

*Prunus grayana* Maxim.

'Uwamizuzakura'

Exine 1.5-2.0  $\mu\text{m}$  thick; sexine striate, rugulate; colpi constricted and prominent at equator, apocolpium 6.0-8.0  $\mu\text{m}$  wide; pori lalongate 3.0-4.0  $\times$  6.0-7.0  $\mu\text{m}$ , ragged; circular in polar view; polar axis 22-26-29  $\mu\text{m}$ , equatorial axis 22-25-28  $\mu\text{m}$ , P/E ratio 0.90-1.04-1.16; flowering in Apr-May. (*E. Araki 4778*; Loc. K)

*P. incisa* Thunb.

'Kinkimamezakura'

Exine 2.0  $\mu\text{m}$  thick; sexine striate, scabrate; colpi equatorial prominent, apocolpium 4.0-7.0  $\mu\text{m}$  wide; pori lalongate 3.0-4.0  $\times$  8.0-9.0  $\mu\text{m}$ , ragged; circular in polar view; polar axis 23-28-34  $\mu\text{m}$ , equatorial axis 26-29-33  $\mu\text{m}$ , P/E ratio 0.87-0.99-1.17 (n=21); flowering in Apr-May. (*T. Fujii T-1812*; Loc. S)

*P. jamasakura* Sieb. ex Koidz.

'Yamazakura'

Exine 1.8-2.0  $\mu\text{m}$  thick; sexine striate, striae 0.5-1.0  $\mu\text{m}$  wide; colpi prominent and constricted at equator, apocolpium 7.0-11  $\mu\text{m}$  wide; pori lalongate 5.0-9.0  $\mu\text{m}$  wide, ragged variable in shape, costae 3.0  $\mu\text{m}$  thick; semiangular in polar view; polar axis 22-29-35  $\mu\text{m}$ , equatorial axis 25-30-34  $\mu\text{m}$ , P/E ratio 0.75-0.99-1.17; flowering in Apr-May. (*H. Nagamasu 4493*; Loc. A)

*P. salicina* Lindley

'Sumomo'

Exine 1.5  $\mu\text{m}$  thick; sexine striate, striae 0.5  $\mu\text{m}$  wide; colpi prominent and constricted at equator, apocolpium 7.0-9.0  $\mu\text{m}$  wide; pori lalongate-circular 6.0-9.0  $\times$  4.0-7.0  $\mu\text{m}$ , ragged variable in shape, costae 3.0-5.0  $\mu\text{m}$  thick; circular in polar view; polar axis 25-30-35  $\mu\text{m}$ , equatorial axis 22-28-32  $\mu\text{m}$ , P/E ratio 0.87-1.07-1.27; flowering in Apr-May. (*G. Murata s.n.*; Loc. K)

*Rosa multiflora* Thunb.

'Noibara'

Exine 1.5-2.0  $\mu\text{m}$  thick; sexine rugulate; colpi prominent and constricted at equator, apocolpium 6.0-7.0  $\mu\text{m}$  wide, with tectate operculum; pori lalongate 2.0-3.0  $\times$  7.0-8.0  $\mu\text{m}$ , ragged, costae 1.5-2.0  $\mu\text{m}$  thick; circular in polar view; polar axis 23-26-28  $\mu\text{m}$ , equatorial axis 18-21-24  $\mu\text{m}$ , P/E ratio 1.11-1.21-1.40; flowering in May-Jun. (*G. Murata 19733*; Loc. K)

*Rubus buergeri* Miq.

'Fuyuichigo'

Exine 2.4  $\mu\text{m}$  thick; sexine verrucate, rugulate; colpi acute at ends, prominent and constricted at equator, apocolpium 5.0-8.0  $\mu\text{m}$  wide; pori lalongate 6.0-9.0  $\times$  3.0-4.0  $\mu\text{m}$  wide, costae 1.5-2.0  $\mu\text{m}$  thick; circular in polar view; polar axis 31-35-40  $\mu\text{m}$ , equatorial axis 32-37-44  $\mu\text{m}$ , P/E ratio 0.91-0.96-1.00 (n=6); flowering in Aug-Oct. (*G. Nakai 4183*; Loc. K)

*R. crataegifolius* Bunge

'Kumaichigo'

Exine 1.8  $\mu\text{m}$  thick; sexine scabrate, rugulate; colpi acute at ends, prominent and constricted at equator, apocolpium 3.0  $\mu\text{m}$  wide; pori lalongate 2.5-3.0  $\times$  5.0-7.0  $\mu\text{m}$ , costae 1.0-1.5  $\mu\text{m}$  thick; circular in polar view; polar axis 18-22-25  $\mu\text{m}$ , equatorial axis 12-16-19  $\mu\text{m}$ , P/E ratio 1.13-1.42-1.90; flowering in Apr-Jun. (*T. Yamazaki 21*; Loc. K)

*R. illecebrosus* Focke

'Baraichigo'

Exine 1.5  $\mu\text{m}$  thick; sexine striate, rugulate; colpi acute at ends, prominent and constricted at equator, apocolpium 3.0-4.0  $\mu\text{m}$  wide; pori lalongate 2.5  $\times$  6.0  $\mu\text{m}$ , costae 2.0  $\mu\text{m}$  thick; circular in polar view; polar axis 17-19-22  $\mu\text{m}$ , equatorial axis 15-17-20  $\mu\text{m}$ , P/E ratio 1.00-1.12-1.33; flowering in Jun-Jul. (*H. Takahashi 852*; Loc. A)

*R. microphyllus* L.

'Nigaichigo'

Exine 1.0-1.5  $\mu\text{m}$  thick; sexine striate, rugulate; colpi acute at ends, prominent and constricted at equator, apocolpium 3.0-5.0  $\mu\text{m}$  wide; pori lalongate 2.0  $\times$  6.0  $\mu\text{m}$  wide, costae 2.0  $\mu\text{m}$  thick; circular in polar view; polar axis 17-19-22  $\mu\text{m}$ , equatorial axis 15-16-19  $\mu\text{m}$ , P/E ratio 1.00-1.17-1.25; flowering in Apr-May. (*G. Murata 18013*; Loc. K)

*R. palmatus* Thunb.

'Nagabanomomijiichigo'

Exine 1.5  $\mu\text{m}$  thick; sexine striate, rugulate; colpi acute at ends, equatorial prominent, apocolpium 7.0-8.0  $\mu\text{m}$  wide; pori lalongate 2.0  $\times$  5.0  $\mu\text{m}$ , costae 2.0  $\mu\text{m}$  thick; circular in polar view; polar axis 21-25-29  $\mu\text{m}$ , equatorial axis 17-21-24  $\mu\text{m}$ ,

P/E ratio 1.00-1.20-1.53; flowering in May-Jun. (*G. Murata 7036*; Loc. A)

*R. parvifolius* L.

'Nawashiroichigo'

Exine 1.5  $\mu\text{m}$  thick; sexine striate, rugulate; colpi acute at ends, prominent and constricted at equator, apocolpium 4.0  $\mu\text{m}$  wide; pori lalongate 3.0-4.0  $\mu\text{m}$  wide, ragged, costae 1.5-2.0  $\mu\text{m}$  thick; circular in polar view; polar axis 17-19-22  $\mu\text{m}$ , equatorial axis 16-18-20  $\mu\text{m}$ , P/E ratio 0.87-1.01-1.14; flowering in May-Jul. (*T. Takahashi 1178*; Loc. K)

*Sorbus alnifolia* (Sieb. et Zucc.) C. Koch.

'Azukinashi'

Exine 1.5  $\mu\text{m}$  thick; sexine striate, scabrate; colpi acute at ends, prominent and constricted at equator, apocolpium 4.0-5.0  $\mu\text{m}$  wide; pori lalongate 4.0  $\times$  8.0  $\mu\text{m}$ , torn, H-shaped, costae 2.0  $\mu\text{m}$  thick; semiangular in polar view; polar axis 20-23-25  $\mu\text{m}$ , equatorial axis 22-25-27  $\mu\text{m}$ , P/E ratio 0.81-0.95-1.06; flowering in May-Jun. (*G. Murata et al. 1173*; Loc. A)

*S. americana* Marsh. ssp. *japonica* (Maxim.) Kitam.

'Nanakamado'

Exine 1.7  $\mu\text{m}$  thick; sexine striate, scabrate; colpi acute at ends, prominent and constricted at equator, apocolpium 4.0-5.0  $\mu\text{m}$  wide; pori variable in shape 5.0-8.0  $\mu\text{m}$  wide, torn, costae 1.0  $\mu\text{m}$  thick; circular in polar view; polar axis 18-21-24  $\mu\text{m}$ , equatorial axis 18-20-23  $\mu\text{m}$ , P/E ratio 0.94-1.02-1.13; flowering in May-Jul. (*M. Ito et al. 1288*; Loc. A)

*S. japonica* (Decne.) Hedlund

'Urajironoki'

Exine 1.6  $\mu\text{m}$  thick; sexine striate, scabrate; colpi acute at ends, prominent and constricted at equator, apocolpium 4.0-6.0  $\mu\text{m}$  wide; pori variable in shape 6.0-8.0  $\mu\text{m}$  wide, torn, costae 1.0-1.5  $\mu\text{m}$  thick; circular in polar view; polar axis 22-25-29  $\mu\text{m}$ , equatorial axis 21-24-27  $\mu\text{m}$ , P/E ratio 0.90-1.06-1.35; flowering in May-Jun. (*H. Nagamasu 93*; Loc. S)

#### Rubiaceae (5 genera, 11 species)

*Galium* and *Rubia* (8 species)

Stephanocolpate (6-8 colpate) monad; exine 2.0  $\mu\text{m}$  thick; sexine baculate, bacula forming perforate tectum, or reticulate, lumina  $< 0.5 \mu\text{m}$  wide; colpi sunken, long, narrow; oval in equatorial view, circular in polar view; grains 14-26  $\mu\text{m}$ , spherical; flowering in May-Sep.

ref. *Galium kinuta* Nakai et Hara, 'Kinutasou' (Jul-Aug): 4; *G. spurium* L., 'Yaemugura' (May-Jun): 3; *G. tokyoense* Makino, 'Hanamugura' (May-Jul): 1; *G. trachyspermum* A. Gray, 'Yotsubamugura' (May-Jun): 3; *G. trifloriforme* Komar., 'Kurumamugura' (Jun-Jul): 1; *G. verum* L., 'Kawaramatsuba' (Jul-Aug): 4; *Rubia argyi* (Lév.) Hara, 'Akane' (Aug-Sep): 4; *R. chinensis* Regel et Maack, 'Ookinutasou' (May-Jul): 1.

*Hedyotis* (1 species)

*Hedyotis lindleyana* Hook.

'Hashikagusa'

Stephanocolporate (5-8 colporate) monad; exine  $2.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $1.0\text{-}2.0\ \mu\text{m}$  wide, muri simplicolumellate; colpi short  $10\ \mu\text{m}$  long; pori lalongate, indistinct; oval in equatorial view, circular in polar view; grains  $18\text{-}21\ \mu\text{m}$ , spherical; flowering in Aug-Sep. (ref. 3)

*Mitchella* (1 species)

*Mitchella undulata* Sieb. et Zucc.

'Tsuruaridooshi'

Tricolporate monad; exine  $2.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $1.0\ \mu\text{m}$  wide; colpi long, acute at ends; pori lalongate; oval in equatorial view, circular in polar view; polar axis  $28\text{-}32\ \mu\text{m}$ , equatorial axis  $25\text{-}30\ \mu\text{m}$ , prolate-spherical; flowering in Jun-Jul. (ref. 3)

*Paederia* (1 species)

*Paederia scadens* (Lour.) Merrill

'Hekusokazura'

Tricolporate monad; exine  $1.8\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\text{-}1.0\ \mu\text{m}$  wide; colpi acute at ends, long, narrow; oval in equatorial view, circular in polar view; polar axis  $30\text{-}35\ \mu\text{m}$ , equatorial axis  $32\text{-}38\ \mu\text{m}$ , oblate-spherical; flowering in Aug-Sep. (ref. 4)

#### Rutaceae (4 genera, 6 species)

*Boennighausenia*, *Phellodendron* and *Zanthoxylum* (5 species)

Tricolporate monad; exine  $1.2\text{-}2.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $<0.5\text{-}3.5\ \mu\text{m}$  wide; colpi long, acute at ends; pori lalongate, with costae; oval in equatorial view, circular, semiangular in polar view; polar axis  $21\text{-}33\ \mu\text{m}$ , equatorial axis  $14\text{-}29\ \mu\text{m}$ , prolate; flowering in Apr-Oct.

ref. *Boennighausenia japonica* Nakai, 'Matsukazesou' (Aug-Oct): 4; *Zanthoxylum ailanthoides* Sieb. et Zucc., 'Karasuzanshou' (Jul-Aug): 4; *Z. piperitum* (L.) DC., 'Sanshou' (Apr-May): 4; *Z. schinifolium* Sieb. et Zucc., 'Inuzanshou' (Aug-Sep): 4.

1a. Lumina  $<1.0\ \mu\text{m}$  wide

2a. Polar axis  $>25\ \mu\text{m}$  ..... *Boennighausenia japonica*

2b. Polar axis  $<25\ \mu\text{m}$  ..... *Zanthoxylum pipericum*

1b. Lumina  $>1.0\ \mu\text{m}$  wide

3a. Equatorial axis  $>22\ \mu\text{m}$  ..... *Phellodendron amurense*

3b. Equatorial axis  $<22\ \mu\text{m}$

4a. Lumina larger,  $>2.5\ \mu\text{m}$  wide lumina present ..... *Z. ailanthoides*

4b. Lumina smaller,  $1.0\text{-}2.5\ \mu\text{m}$  wide ..... *Z. schinifolium*

*Phellodendron amurense* Rupr.

'Kihada'

Exine  $2.0\ \mu\text{m}$  thick; lumina  $1.0\text{-}2.0\ \mu\text{m}$  wide, muri simplicolumellate; apocolpium  $5.0\ \mu\text{m}$  wide, margo thinned; pori lalongate  $2.5 \times 8.0\ \mu\text{m}$ , costae  $2.0\text{-}2.5\ \mu\text{m}$  thick; circular in polar view; polar axis  $26\text{-}30\text{-}33\ \mu\text{m}$ , equatorial axis  $22\text{-}26\text{-}29\ \mu\text{m}$ , P/E ratio  $0.91\text{-}1.14\text{-}1.30$ ; flowering in Jun. (*G. Koidzumi* s.n.; Loc. K)

*Skimmia* (1 species)*Skimmia japonica* Thunb.

'Tsurushikimi'

Stephanocolporate (5 colporate) monad; exine 2.0-2.5  $\mu\text{m}$  thick; sexine striate, striae 0.5  $\mu\text{m}$  wide; colpi acute at ends, 0.5-1.0  $\mu\text{m}$  wide, apocolpium 6.0-9.0  $\mu\text{m}$  wide; pori lalongate 5.0-6.5  $\times$  0.5-3.0  $\mu\text{m}$ , costae 1.5-2.0  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 30-32-40  $\mu\text{m}$ , equatorial axis 26-30-37  $\mu\text{m}$ , P/E ratio 0.96-1.07-1.20; flowering in Apr-May. (*H. Nagamasu 4504*; Loc. A)

## Sabiaceae (1 genus, 2 species)

Tricolporate monad; exine 1.5  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5-1.0  $\mu\text{m}$  wide; colpi acute at ends, margo thickened; pori lalongate, with costae; oval in equatorial view, circular in polar view; polar axis 17-22  $\mu\text{m}$ , equatorial axis 14-18  $\mu\text{m}$ , prolate; flowering in May-Jul.

ref. *Meliosma myriantha* Sieb. et Zucc., 'Awabuki' (Jun-Jul): 4.

*Meliosma tenuis* Maxim.

'Miyamahahaso'

Apocolpium 4.0-5.0  $\mu\text{m}$  wide; pori 1.0-1.5  $\times$  6.0-7.0  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; polar axis 17-20-22  $\mu\text{m}$ , equatorial axis 15-16-18  $\mu\text{m}$ , P/E ratio 1.00-1.27-1.42; flowering in May-Jul. (*G. Nakai 3295*; Loc. K)

## Salicaceae (2 genera, 4 species)

*Populus* (1 species)*Populus sieboldii* Miq.

'Yamanarashi'

Inaparturate monad; exine 1.5  $\mu\text{m}$  thick; sexine verrucate, verrucae occasionally forming broken reticulum; grains circular; grains 21-28  $\mu\text{m}$ ; flowering in Apr. (ref. 4)

*Salix* (3 species)

Tricolpate monad; exine 1.0-1.5  $\mu\text{m}$  thick; sexine reticulate, lumina 1.0-2.0  $\mu\text{m}$  wide, smaller near colpi; colpi acute at ends, margo thinned; oval in equatorial view, circular in polar view; polar axis 16-26  $\mu\text{m}$ , equatorial axis 11-20  $\mu\text{m}$ , prolate; flowering in Mar-May.

ref. *Salix sachalinensis* Fr. Schm., 'Onoeyanagi' (Apr-May): 4; *S. sieboldiana* Blume, 'Yamayanagi' (Mar-Apr): 4.

*Salix gracilistyla* Miq.

'Nekoyanagi'

Apocolpium 3.0-4.0  $\mu\text{m}$  wide; polar axis 16-18-21  $\mu\text{m}$ , equatorial axis 12-14-17  $\mu\text{m}$ , P/E ratio 1.15-1.28-1.46; flowering in Mar-Apr. (*Y. Araki s.n.*; Loc. K)

## Santalaceae (2 genera, 2 species)

*Buckleya* (1 species)*Buckleya lanceolata* (Sieb. et Zucc.) Miq.

'Tsukubane'



Tricolporate monad; exine 1.5-2.0  $\mu\text{m}$  thick; sexine striate; colpi acute at ends, apocolpium 6.0-7.0  $\mu\text{m}$  wide, prominent at equator, margo thinned; pori lologate 4.0  $\times$  3.0  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; oval in equatorial view, circular, semiangular in polar view; polar axis 21-25-28  $\mu\text{m}$ , equatorial axis 21-23-26  $\mu\text{m}$ , P/E ratio 0.92-1.11-1.23; flowering in May-Jun. (*G. Murata 19709*; Loc. K)

*Thesium* (1 species)

*Thesium chinense* Turcz.

'Kanabikisou'

Syncolpate monad; sexine reticulate, lumina 2.0-3.0  $\mu\text{m}$  wide; 3 colpi joining at proximal pole; pyramid shape in equatorial view, angular in polar view; grains 21-29; flowering in Apr-Jun. (ref. 4)

#### Saururaceae (1 genus, 1 species)

*Houttuynia cordata* Thunb.

'Dokudami'

Inaperturate, monocolpate monad; exine 1.0  $\mu\text{m}$  thick; sexine scabrate; colpi indistinct; grains circular, elliptic; grains 8-13-17  $\mu\text{m}$ ; flowering in Jun-Jul (*S. Tsugaru 16654*; Loc. A)

#### Saxifragaceae (13 genera, 21 species)

*Deinathe* (1 species)

*Deinathe bifida* Maxim.

'Ginbaisou'

Tricolpate monad; exine 2.0  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5-1.5  $\mu\text{m}$  wide; colpi short 10-15  $\mu\text{m}$  long, acute at ends, narrow, margo thickened; oval in equatorial view, circular in polar view; grains 27-33  $\mu\text{m}$ , spherical; flowering in Jul-Aug. (ref. 4)

*Ribes* (1 species)

*Ribes ambiguum* Maxim.

'Yashabishaku'

Stephanocolporate (6-7 colporate) monad; exine 1.5  $\mu\text{m}$  thick; sexine scabrate; colpi rounded at ends, irregular; pori circular 2.0-3.5  $\mu\text{m}$  wide, sometimes 2 pori share the same colpi; oval in equatorial view, circular in polar view; grains 19-26  $\mu\text{m}$ , spherical; flowering in Apr-May. (ref. 1)

*Saxifraga* (1 species)

*Saxifraga fortunei* Hook. fil.

'Daimonjisou'

Tricolpate, stephanocolpate (4 colpate) monad; exine 2.0  $\mu\text{m}$  thick; sexine baculate, baculae forming tectum on top, tectum reticulate, lumina 0.5  $\mu\text{m}$  wide; colpi long, acute at ends; oval in equatorial view, circular in polar view; polar axis 19-26  $\mu\text{m}$ , equatorial axis 16-24  $\mu\text{m}$ , prolate; flowering in Jul-Oct. (ref. 4)

*Astilbe*, *Cardiandra*, *Chrysosplenium*, *Deutzia*, *Hydrangea*, *Mitella*, *Parnassia*, *Philadelphus*, *Rodgersia* and *Schizophragma* (18 species)

Tricolporate monad; exine 1.0-2.0  $\mu\text{m}$  thick; sexine reticulate, lumina  $<0.5\text{-}1.5\ \mu\text{m}$  wide; colpi acute at ends, long, usually constricted, occasionally prominent at equator, apocolpium 1.0-5.0  $\mu\text{m}$  wide; pori lalongate sometimes indistinct 1.0-4.0  $\mu\text{m}$  wide, or circular 3.5  $\mu\text{m}$  wide, with costae; oval in equatorial view, circular in polar view; polar axis 7-29  $\mu\text{m}$ , equatorial axis 7-24  $\mu\text{m}$ , prolate-spherical; flowering in Mar-Oct.

ref. *Chrysosplenium grayanum* Maxim., 'Nekonomesou' (Apr-May): 1; *C. japonicum* (Maxim.) Makino, 'Yamanekonomesou' (Mar-Apr): 4; *C. macrostemon* Maxim., 'Iwabotan' (Apr): 1; *Deutzia gracilis* Sieb. et Zucc., 'Himeutsugi' (May-Jun): 4; *Parnassia palustris* L., 'Umebachisou' (Aug-Oct): 4; *Rodgersia podophylla* A. Gray, 'Yagurumasou' (Jun-Jul): 1.

- 1a. Pori circular and  $>3.0\ \mu\text{m}$  wide,  $>1.0\ \mu\text{m}$  wide lumina present  
 .....*Parnassia palustris*
- 1b. If pori  $>3.0\ \mu\text{m}$  wide, pori lalongate; or if pori  $<3.0\ \mu\text{m}$  wide, lumina  $<1.0\ \mu\text{m}$  wide
- 2a. Polar axis  $>15\ \mu\text{m}$
- 3a. Lumina 1.0  $\mu\text{m}$  wide .....*Deutzia crenata*
- 3b. Lumina  $<0.5\ \mu\text{m}$  wide
- 4a. Pori  $>3.0\ \mu\text{m}$  wide, grains prolate .....*Philadelphus satsumi*
- 4b. Pori  $<3.0\ \mu\text{m}$  wide, grains spherical-prolate  
 ..*Chrysosplenium fauriei*, *Hydrangea paniculata*, *Mitella acerina*, *M. furusei*
- 2b. Polar axis  $<15\ \mu\text{m}$
- 5a. Pori  $>3.0\ \mu\text{m}$  wide, 1.0  $\mu\text{m}$  wide lumina present .....*Hydrangea petiolaris*
- 5b. Pori  $<3.0\ \mu\text{m}$  wide, lumina  $<0.5\ \mu\text{m}$  wide
- 6a. Apocolpium  $>3.0\ \mu\text{m}$  wide
- 7a. Equatorial axis  $<13\ \mu\text{m}$  .....*Astilbe thunbergii*
- 7b. Equatorial axis  $>13\ \mu\text{m}$  .....*Mitella furusei*
- 6b. Apocolpium  $<3.0\ \mu\text{m}$  wide
- 8a. Colpi equatorial prominent .....*Schizophragma hydrangeoides*
- 8b. Colpi not equatorial prominent  
 .....*Cardiandra alternifolia*, *Chrysosplenium fauriei*,  
*Hydrangea hirta*, *H. serrata*, *Rodgersia podophylla*

*Astilbe thunbergii* (Sieb. et Zucc.) Miq. 'Akashouma'  
 Exine 1.0  $\mu\text{m}$  thick; lumina  $<0.5\ \mu\text{m}$  wide; colpi equatorial prominent, apocolpium 3.0-3.5  $\mu\text{m}$  wide; pori lalongate 0.5  $\times$  2.0  $\mu\text{m}$ ; polar axis 11-12-13  $\mu\text{m}$ , equatorial axis 10-12-13  $\mu\text{m}$ , P/E ratio 0.90-1.03-1.13; flowering in Jul-Aug. (S. Okamoto s.n.; Loc. A)

*Cardiandra alternifolia* Sieb. et Zucc. 'Kusaajisai'  
 Exine 1.0  $\mu\text{m}$  thick; lumina  $<0.5\ \mu\text{m}$  wide; colpi constricted at equator, apocolpium 2.0-2.5  $\mu\text{m}$  wide; pori lalongate 0.5  $\times$  2.0  $\mu\text{m}$ , indistinct; polar axis 10-12-13  $\mu\text{m}$ , equatorial axis 10-10-12  $\mu\text{m}$ , P/E ratio 1.00-1.17-1.25; flowering in Jul-Sep. (M. Tagawa 1739; Loc. A)

*Chrysosplenium fauriei* Franch. 'Botannekonomesou'  
 Exine 1.2  $\mu\text{m}$  thick; lumina  $<0.5\ \mu\text{m}$  wide; colpi ragged, apocolpium 1.0-3.0  $\mu\text{m}$  wide;

pori lalongate  $0.5-1.5 \times 2.0-3.0 \mu\text{m}$ , costae  $0.5 \mu\text{m}$  thick; polar axis  $13-16-19 \mu\text{m}$ , equatorial axis  $12-14-17 \mu\text{m}$ , P/E ratio  $0.91-1.14-1.30$ ; flowering in May. (*G. Koidzumi s.n.*; Loc. K)

*Deutzia crenata* Sieb. et Zucc. 'Utsugi'  
Exine  $1.5 \mu\text{m}$  thick; lumina  $1.0 \mu\text{m}$  wide; colpi constricted at equator, apocolpium  $3.0 \mu\text{m}$  wide; pori lalongate  $0.5 \times 2.5 \mu\text{m}$ ; polar axis  $15-17-19 \mu\text{m}$ , equatorial axis  $15-17-19 \mu\text{m}$ , P/E ratio  $0.80-1.05-1.17$ ; flowering in May-Jun. (*S. Okamoto s.n.*; Loc. A)

*Hydrangea hirta* (Thunb. ex Murray) Sieb. et Zucc. 'Koajisai'  
Exine  $1.0 \mu\text{m}$  thick; lumina  $<0.5 \mu\text{m}$  wide; colpi constricted at equator, apocolpium  $2.5-3.0 \mu\text{m}$  wide; pori lalongate  $0.5 \times 2.0 \mu\text{m}$ ; polar axis  $12-13-15 \mu\text{m}$ , equatorial axis  $10-11-13 \mu\text{m}$ , P/E ratio  $1.00-1.18-1.38$ ; flowering in Jun-Jul. (*H. Nagamasu 163*; Loc. K)

*H. paniculata* Sieb. et Zucc. 'Noriutsugi'  
Exine  $1.2 \mu\text{m}$  thick; lumina  $<0.5 \mu\text{m}$  wide; colpi constricted at equator, apocolpium  $3.0-4.0 \mu\text{m}$  wide; pori lalongate  $0.5 \times 2.0-3.0 \mu\text{m}$ ; polar axis  $15-16-18 \mu\text{m}$ , equatorial axis  $12-15-18 \mu\text{m}$ , P/E ratio  $1.00-1.12-1.30$ ; flowering in Jul-Aug. (*Mitsuda and Takamiya s.n.*; Loc. A)

*H. petiolaris* Sieb. et Zucc. 'Tsuruajisai'  
Exine  $1.0 \mu\text{m}$  thick; lumina  $0.5-1.0 \mu\text{m}$  wide; colpi prominent at equator, apocolpium  $2.0-3.0 \mu\text{m}$  wide; pori lalongate, circular  $1.0-3.0 \times 3.0-4.0 \mu\text{m}$ , costae  $0.5 \mu\text{m}$  thick; polar axis  $10-12-13 \mu\text{m}$ , equatorial axis  $10-12-13 \mu\text{m}$ , P/E ratio  $0.88-0.98-1.13$ ; flowering in Jun. (*H. Takahashi 932*; Loc. A)

*H. serrata* (Thunb. ex Murray) Seringe 'Yamaajisai'  
Exine  $1.0 \mu\text{m}$  thick; lumina  $<0.5 \mu\text{m}$  wide; colpi constricted at equator, apocolpium  $1.0-2.0 \mu\text{m}$  wide; pori lalongate  $0.5 \times 2.0 \mu\text{m}$ , indistinct; polar axis  $10-13-15 \mu\text{m}$ , equatorial axis  $10-11-14 \mu\text{m}$ , P/E ratio  $0.90-1.16-1.38$ ; flowering in Jun-Jul. (*H. Nagamasu 149*; Loc. K)

*Mitella acerina* Makino 'Momijicharumerusou'  
Exine  $1.6 \mu\text{m}$  thick; lumina  $<0.5 \mu\text{m}$  wide; colpi constricted at equator, apocolpium  $3.0-4.0 \mu\text{m}$  wide; pori lalongate, circular  $1.0-1.5 \mu\text{m}$  wide, ragged, costae  $1.5 \mu\text{m}$  thick; polar axis  $17-20-23 \mu\text{m}$ , equatorial axis  $15-18-20 \mu\text{m}$ , P/E ratio  $0.93-1.11-1.34$ ; flowering in Apr-Jun. (*H. Nagamasu 4505*; Loc. A)

*M. furusei* Ohwi 'Charumerusou'  
Exine  $1.4 \mu\text{m}$  thick; lumina  $<0.5 \mu\text{m}$  wide; colpi apocolpium  $4.0-4.5 \mu\text{m}$  wide; pori lalongate  $1.0-1.5 \times 2.0-3.0 \mu\text{m}$ , costae  $1.0 \mu\text{m}$  thick; polar axis  $12-15-18 \mu\text{m}$ , equatorial axis  $13-16-18 \mu\text{m}$ , P/E ratio  $0.78-0.96-1.17$ ; flowering in Apr-May. (*H. Nagamasu 4467*; Loc. A)

*Philadelphus satsumi* Sieb. ex Lindl. et Paht. 'Baikautsugi'  
Exine  $1.1 \mu\text{m}$  thick; lumina  $<0.5 \mu\text{m}$  wide; colpi equatorial prominent, apocolpium

3.0  $\mu\text{m}$  wide; pori lalongate 0.5-1.0  $\times$  3.0-4.0  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; polar axis 15-16-18  $\mu\text{m}$ , equatorial axis 12-13-15  $\mu\text{m}$ , P/E ratio 1.08-1.25-1.40; flowering in Jun-Jul. (*M. Hiroe 18038*; Loc. K)

*Schizophragma hydrangeoides* Sieb. et Zucc.

'Iwagarami'

Exine 1.1  $\mu\text{m}$  thick; lumina 0.5  $\mu\text{m}$  wide; colpi prominent and constricted at equator, apocolpium 2.0-3.0  $\mu\text{m}$  wide; pori lalongate, circular 1.5-2.0  $\times$  2.0-3.0  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; polar axis 11-12-14  $\mu\text{m}$ , equatorial axis 10-12-13  $\mu\text{m}$ , P/E ratio 0.90-1.06-1.25; flowering in May-Jul. (*S. Okamoto s.n.*; Loc. A)

#### Schisandraceae (1 genus, 1 species)

*Schisandra nigra* Maxim.

'Matsubusa'

Syncolpate (6 colpate) monad; exine 1.5-2.0  $\mu\text{m}$  thick; sexine reticulate, lumina 1.0-2.5  $\mu\text{m}$  wide, muri simplicolumellate; 6 colpi meridional, 3 of them joining at the poles, colpi 0.5-1.0  $\mu\text{m}$  wide, margo thinned; oval in equatorial view, circular in polar view; polar axis 17-20-23  $\mu\text{m}$ , equatorial axis 24-27-30  $\mu\text{m}$ , P/E ratio 0.77-0.85-0.97; flowering in Jun-Jul. (*T. Tashiro s.n.*; Loc. S)

#### Sciadopityaceae (1 genus, 1 species)

*Sciadopitys verticillata* (Thunb.) Sieb. et Zucc.

'Kouyamaki'

Monoporate monad; exine 2.0-3.0  $\mu\text{m}$  thick in proximal face; sexine verrucate, verrucae 2.0-3.0  $\mu\text{m}$  wide, 1.5-2.0  $\mu\text{m}$  high, formed by some bacula; pori circular 20-25  $\mu\text{m}$  wide; grains circular, elliptic; grains 27-33-40  $\mu\text{m}$ ; flowering in Mar-Apr. (*G. Murata 16133*; Loc. S)

#### Scrophulariaceae (7 genera, 10 species)

*Deinostema*, *Mazus* and *Mimulus* (4 species)

Tricolporate monad; exine 1.8-4.0  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5  $\mu\text{m}$  wide; colpi acute at ends, margo thinned; pori lalongate; oval in equatorial view, circular in polar view; polar axis 18-24  $\mu\text{m}$ , equatorial axis 17-26  $\mu\text{m}$ , spherical-prolate; flowering in Apr-Oct.

ref. *Mazus miquelii* Makino, 'Sagigoke' (Apr-May): 4; *M. pumilus* (Burm. fil.) van Steenis, 'Tokiwahaze' (Apr-Oct): 1; *Mimulus nepalensis* Benth., 'Mizohozuki' (Jun-Aug): 1.

*Deinostema adenocaulum* (Maxim.) Yamazaki

'Marubanosawatougarashi'

Exine 4.0  $\mu\text{m}$  thick; apocolpium 5.0  $\mu\text{m}$  wide; pori 5.0  $\times$  3.0  $\mu\text{m}$  wide, costae 0.5  $\mu\text{m}$  thick; polar axis 18-21-23  $\mu\text{m}$ , equatorial axis 17-20-23  $\mu\text{m}$ , P/E ratio 0.93-1.03-1.11; flowering in Aug-Oct. (*S. Hosomi 9007*; Loc. K)

*Pedicularis* (1 species)

*Pedicularis resupinata* L.

'Shiogamagiku'

Syncolpate monad; exine  $1.2\ \mu\text{m}$  thick; sexine psilate; 2 colpi joining at the poles, ring-shaped; oval in equatorial view, circular in polar view, sometimes broken along the colpi; grains  $16-24\ \mu\text{m}$ , spherical-prolate; flowering in Aug-Sep. (ref. 4)

*Lindernia*, *Melampyrum* and *Veronica* (5 species)

Tricolpate monad; exine  $1.0-2.0\ \mu\text{m}$  thick; sexine baculate, bacula forming tectum, tectum scabrate; colpi acute at ends, long, if wide, ragged and verrucate, if narrow, sometimes exine thinner in mesocolpia; oval, compressed oval in equatorial view, circular, triangular in polar view; polar axis  $14-32\ \mu\text{m}$ , equatorial axis  $10-29\ \mu\text{m}$ , spherical; flowering in May-Oct.

ref. *Lindernia angustifolia* (Benth.) Wettst., 'Azetougarashi' (Aug-Oct): 4; *L. procumbens* (Krock.) Philcox, 'Azena' (Aug-Oct): 1; *Melampyrum laxum* Miq., 'Miyamamakona' (Aug-Sep): 3; *M. roseum* Maxim., 'Mamakona' (Jul-Sep): 1; *Veronica miqueliana* Nakai, 'Kokuwagata' (May-Jun): 1.

- 1a. Polar axis  $>25\ \mu\text{m}$ , colpi wide, ragged, verrucate ..... *Veronica miqueliana*
- 1b. Polar axis  $<20\ \mu\text{m}$ , colpi narrow, sharp
  - 2a. Exine thinner, concave in the center between colpi, compressed oval in equatorial view, angular in polar view ..... *Melampyrum laxum*
  - 2b. Exine not thinner in the center between colpi, oval in equatorial view, circular, semiangular in polar view ..... *Lindernia angustifolia*

#### Solanaceae (5 genera, 6 species)

*Scopolia* (1 species)

*Scopolia japonica* Maxim.

'Hashiridokoro'

Tricolpate, stephanocolpate (4-5 colpate) monad; exine  $1.2\ \mu\text{m}$  thick; sexine verrucate, verrucae  $0.5-1.0\ \mu\text{m}$  wide; colpi indistinct, ragged; grains irregularly circular; grains  $41-45\ \mu\text{m}$ , spherical; flowering in Apr-May. (ref. 4)

*Physalium*, *Physalis*, *Solanum* and *Tubocapsicum* (5 species)

Tricolporate monad; exine  $1.2-1.8\ \mu\text{m}$  thick; sexine scabrate; colpi long, acute at ends or rounded at ends, constricted and prominent at equator, margo thickened; pori lalongate, with costae oval, rhomboidal in equatorial view, semiangular in polar view; polar axis  $9-26\ \mu\text{m}$ , equatorial axis  $12-27\ \mu\text{m}$ , spherical-oblate; flowering in Jun-Sep.

ref. *Physalium japonicum* (Fr. et Sav.) Honda, 'Igahozuki' (Jun-Aug): 1; *Physalis alkekengi* L., 'Hoozuki' (Jun-Jul): 4; *Solanum japonense* Nakai, 'Yamahoroshi' (Jul-Aug): 4; *S. lyratum* Thunb., 'Hiyodorijougo' (Aug-Sep): 4; *Tubocapsicum anomalum* (Fr. et Sav.) Makino, 'Hadakahozuki' (Aug-Sep): 1.

- 1a. Polar axis  $>23\ \mu\text{m}$  ..... *Physalis alkekengi*
- 1b. Polar axis  $16-23\ \mu\text{m}$  ..... *Physalium japonicum*, *Tubocapsicum anomalum*
- 1c. Polar axis  $<16\ \mu\text{m}$  ..... *Solanum japonense*, *S. lyratum*

## Sparganiaceae (1 genus, 1 species)

*Sparganium erectum* L.

'Mikuri'

Monoporate monad; exine  $2.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\text{--}1.5\ \mu\text{m}$  wide, muri simplicolumellate; pori circular  $2.0\text{--}3.0\ \mu\text{m}$  wide, annulus absent; grains circular; grains  $21\text{--}24\text{--}28\ \mu\text{m}$ ; flowering in Jun-Aug. (*S. Watanabe s.n.*; Loc. S)

## Stachyuraceae (1 genus, 1 species)

*Stachyurus praecox* Sieb. et Zucc.

'Kibushi'

Tricolporate monad; exine  $1.0\text{--}1.5\ \mu\text{m}$  thick; sexine scabrate; colpi acute at ends, equatorial prominent, apocolpium  $6.0\ \mu\text{m}$  wide; pori lalongate, meridionally constricted,  $3.0 \times 8.0\text{--}9.0\ \mu\text{m}$ , costae  $2.0\ \mu\text{m}$  thick; oval in equatorial view, hexagonal in polar view; polar axis  $18\text{--}20\text{--}23\ \mu\text{m}$ , equatorial axis  $17\text{--}20\text{--}22\ \mu\text{m}$ , P/E ratio  $0.94\text{--}1.02\text{--}1.14$ ; flowering in Mar-Apr. (*N. Kinashi s.n.*; Loc. K)

## Styracaceae (2 genera, 3 species)

Tricolporate monad; exine  $1.8\text{--}2.0\ \mu\text{m}$  thick; sexine verrucate, rugulate, scabrate; colpi acute at ends, prominent and constricted at equator, apocolpium  $5.0\text{--}9.0\ \mu\text{m}$  wide, margo thickened; pori lalongate, ragged, H-shaped,  $2.0\text{--}7.0 \times 7.0\text{--}9.0\ \mu\text{m}$ , costae  $1.5\text{--}3.0\ \mu\text{m}$  thick; oval, rhomboidal in equatorial view, angular, semiangular in polar view; polar axis  $22\text{--}38\ \mu\text{m}$ , equatorial axis  $25\text{--}36\ \mu\text{m}$ , spherical-oblate; flowering in May-Jun.

- 1a. Polar axis  $<29\ \mu\text{m}$ , grains oblate ..... *Pterostyrax hispida*  
 1b. Polar axis  $>29\ \mu\text{m}$ , grains spherical  
     2a. Pori  $>5.0\ \mu\text{m}$  wide, costae  $>2.0\ \mu\text{m}$  thick ..... *Styrax japonica*  
     2b. Pori  $<5.0\ \mu\text{m}$  wide, costae  $<2.0\ \mu\text{m}$  thick ..... *Styrax obassia*

*Pterostyrax hispida* Sieb. et Zucc.

'Oobaasagara'

Exine  $1.9\ \mu\text{m}$  thick; sexine verrucate, rugulate; apocolpium  $5.0\text{--}7.0\ \mu\text{m}$  wide; pori ragged, H-shaped,  $2.0\text{--}3.0 \times 7.0\text{--}8.0\ \mu\text{m}$ , costae  $1.5\ \mu\text{m}$  thick; semiangular in polar view; polar axis  $22\text{--}25\text{--}29\ \mu\text{m}$ , equatorial axis  $25\text{--}28\text{--}30\ \mu\text{m}$ , P/E ratio  $0.79\text{--}0.89\text{--}1.05$ ; flowering in Jun. (*M. Hotta 11276*; Loc. K)

*Styrax japonica* Sieb. et Zucc.

'Egonoki'

Exine  $2.0\ \mu\text{m}$  thick; sexine verrucate, scabrate; apocolpium  $6.0\text{--}9.0\ \mu\text{m}$  wide; pori ragged,  $7.0 \times 9.0\ \mu\text{m}$ , costae  $2.0\text{--}3.0\ \mu\text{m}$  thick; angular in polar view; polar axis  $31\text{--}33\text{--}38\ \mu\text{m}$ , equatorial axis  $30\text{--}33\text{--}36\ \mu\text{m}$ , P/E ratio  $0.89\text{--}1.00\text{--}1.17$ ; flowering in May-Jun. (*H. Nagamasu 159*; Loc. K)

*S. obassia* Sieb. et Zucc.

'Hakuunboku'

Exine  $1.8\ \mu\text{m}$  thick; sexine verrucate, scabrate; apocolpium  $5.0\text{--}6.0\ \mu\text{m}$  wide; pori ragged, variable in shape,  $4.0 \times 7.0\ \mu\text{m}$ , costae  $1.5\text{--}2.0\ \mu\text{m}$  thick; semiangular in polar view; polar axis  $28\text{--}32\text{--}37\ \mu\text{m}$ , equatorial axis  $27\text{--}32\text{--}35\ \mu\text{m}$ , P/E ratio  $0.88\text{--}1.01\text{--}1.13$ ; flowering in May-Jun. (*S. Fujii and H. Kudo 2463*; Loc. A)

**Symplocaceae** (1 genus, 2 species)

Tricolporate monad; exine  $2.0\ \mu\text{m}$  thick; sexine reticulate, rugulate, lumina  $1.0\text{-}2.0\ \mu\text{m}$  wide; colpi short  $7.0\text{-}8.0\ \mu\text{m}$  long, acute, margo thickened; pori lalongate  $3.0 \times 5.0\text{-}7.0\ \mu\text{m}$ , with costae oval in equatorial view, angular, lobate in polar view; polar axis  $15\text{-}23\ \mu\text{m}$ , equatorial axis  $26\text{-}33\ \mu\text{m}$ , oblate; flowering in May-Jun.

ref. *Symplocos coreana* (Lév.) Ohwi, 'Tannasawafutagi' (Jun): 4.

*Symplocos sawafutagi* Nagamasu

'Sawafutagi'

Pori lalongate  $3.0 \times 5.0\text{-}6.0\ \mu\text{m}$ , with costae polar axis  $15\text{-}18\text{-}23\ \mu\text{m}$ , equatorial axis  $26\text{-}28\text{-}33\ \mu\text{m}$ , P/E ratio  $0.54\text{-}0.63\text{-}0.75$ ; flowering in May-Jun. (*A. Nitta 11946*; Loc. A)

**Taxaceae** (2 genera, 2 species)

Inaperturate monad; exine  $0.5\text{-}1.0\ \mu\text{m}$  thick; sexine scabrate; ridged in proximal face, circular in polar view; grains  $17\text{-}36\ \mu\text{m}$ ; flowering in Mar-May.

ref. *Taxus cuspidata* Sieb. et Zucc., 'Ichii': 4.

*Torreya nucifera* (L.) Sieb. et Zucc. var. *radicans* Nakai

'Chabogaya'

Grains  $17\text{-}21\text{-}25\ \mu\text{m}$ ; flowering in Mar-May. (*T. Horikawa 352*; Loc. A)

**Taxodiaceae** (1 genus, 1 species)

*Cryptomeria japonica* (L. fil.) var. *radicans* Nakai

'Ashiusugi'

Monoporate monad; exine  $1.0\text{-}1.5\ \mu\text{m}$  thick; sexine scabrate, gemmate; pore prominent,  $3.0\text{-}6.0\ \mu\text{m}$  high,  $2.0\text{-}6.0\ \mu\text{m}$  wide; grains circular; grains  $20\text{-}23\text{-}27\ \mu\text{m}$ ; flowering in Mar-Apr. (*G. Murata 70520*; Loc. K)

**Theaceae** (3 genera, 4 species)

Tricolporate monad; exine  $1.0\text{-}3.3\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\ \mu\text{m}$  wide, scabrate, psilate; colpi acute at ends, usually prominent and constricted at equator, apocolpium  $4.0\text{-}9.0\ \mu\text{m}$  wide, margo thickened; pori lolongate, circular, lalongate  $3.0\text{-}12\ \mu\text{m}$  long, costae  $1.0\text{-}1.5\ \mu\text{m}$  thick; oval, rhomboidal in equatorial view, semiangular, circular in polar view; polar axis  $12\text{-}42\ \mu\text{m}$ , equatorial axis  $11\text{-}39\ \mu\text{m}$ , prolate-spherical-oblate; flowering in Jun-Jul and Oct-Apr.

ref. *Camellia sinesis* (L.) O. Kuntze, 'Chanoki' (Oct-Nov): 4.

1a. Polar axis  $<15\ \mu\text{m}$ , sexine scabrate-psilate .....*Eurya japonica*

1b. Polar axis  $>25\ \mu\text{m}$ , sexine reticulate

2a. Margo thickened, colpi flat at equator, pori lolongate

.....*Stewartia pseudocamellia*

2b. Margo not thickened, colpi equatorial prominent, pori circular

3a. Exine  $>2.5\ \mu\text{m}$  thick .....*Camellia japonica*

3b. Exine  $<2.5\ \mu\text{m}$  thick .....*Camellia sinesis*

*Eurya japonica* Thunb.

'Hisakaki'

Exine  $1.0\ \mu\text{m}$  thick; sexine scabrate, psilate; colpi equatorial prominent, apocolpium

4.0  $\mu\text{m}$  wide; pori lalongate 2.0-3.0  $\times$  3.0-4.0  $\mu\text{m}$ , costae 1.0  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 12-13-14  $\mu\text{m}$ , equatorial axis 11-13-14  $\mu\text{m}$ , P/E ratio 0.90-1.04-1.12; flowering in Mar-Apr. (S. Hosomi 470; Loc. K)

*Camellia japonica* L.

'Yabutsubaki'

Exine 3.3  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5  $\mu\text{m}$  wide; colpi prominent and constricted at equator, apocolpium 6.0-9.0  $\mu\text{m}$  wide; pori circular 4.0-5.0  $\mu\text{m}$  wide, costae 1.0  $\mu\text{m}$  thick; oval, rhomboidal in equatorial view, semiangular in polar view; polar axis 32-35-42  $\mu\text{m}$ , equatorial axis 31-36-39  $\mu\text{m}$ , P/E ratio 0.89-0.99-1.14; flowering in Oct-Apr. (S. Okamoto s.n.; Loc. A)

*Stewartia pseudocamellia* Maxim.

'Natsutsubaki'

Exine 2.1  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5  $\mu\text{m}$  wide; apocolpium 5.0-7.0  $\mu\text{m}$  wide, margo 1.5-2.0  $\mu\text{m}$  wide; pori lalongate 8.0-12  $\times$  5.0-8.0  $\mu\text{m}$ , costae 1.5  $\mu\text{m}$  thick; oval in equatorial view, semiangular in polar view; polar axis 25-27-30  $\mu\text{m}$ , equatorial axis 28-32-34  $\mu\text{m}$ , P/E ratio 0.77-0.86-0.92; flowering in Jun-Jul. (T. Takahashi and H. Murakami 1103; Loc. F)

**Thymelaeaceae** (1 genus, 1 species)

*Daphne miyabeana* Makino

'Karasushikimi'

Periporate (15 porate) monad; exine 3.5-4.0  $\mu\text{m}$  thick; sexine baculate, bacula 2.5  $\mu\text{m}$  high; pori circular 1.5  $\mu\text{m}$ , annuli absent; grains circular; grains 24-30-34  $\mu\text{m}$ ; flowering in Jun. (M. Tagawa 1533; Loc. K)

**Tiliaceae** (2 genera, 3 species)

*Corchoropsis* (1 species)

*Corchoropsis tomentosa* (Thunb.) Makino

'Karasunogoma'

Triporate monad; exine 2.0  $\mu\text{m}$  thick; sexine echinate, echini 2.0-3.0  $\mu\text{m}$  high; pori circular 7.0-9.0  $\mu\text{m}$ , annuli thickened; grains circular, grains 41-54  $\mu\text{m}$ , spherical; flowering in Aug-Sep. (ref. 4)

*Tilia* (2 species)

Tricolporate monad; exine 2.0-2.2  $\mu\text{m}$  thick; sexine verrucate, reticulate; colpi short, narrow, margo thickened, with vestibulum; pori circular, lalongate, with costae oval in equatorial view, circular, semiangular in polar view; polar axis 16-23  $\mu\text{m}$ , equatorial axis 27-36  $\mu\text{m}$ , oblate; flowering in Jun-Jul.

ref. *Tilia kiusiana* Makino et Shirakawa, 'Heranoki' (Jul): 4.

*Tilia japonica* (Miq.) Simonkai

'Shinanoki'

Exine 2.2  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5  $\mu\text{m}$  wide; colpi 8.0  $\mu\text{m}$  long, margo 4.0-5.0  $\mu\text{m}$  thick; pori 4.0  $\mu\text{m}$  wide, costae 5.0  $\mu\text{m}$  thick; polar axis 20-21-23  $\mu\text{m}$ , equatorial axis 27-31-33  $\mu\text{m}$ , P/E ratio 0.61-0.69-0.82; flowering in Jun-Jul. (G. Murata and S. Kitamura 3361; Loc. S)



**Trochodendraceae** (1 genus, 1 species)*Trochodendron aralioides* Sieb. et Zucc.

'Yamaguruma'

Tricolpate monad; exine  $1.8\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\text{-}1.5\ \mu\text{m}$  wide, smaller near colpi, muri simplicolumellate; colpi acute at ends, apocolpium  $5.0\text{-}6.0\ \mu\text{m}$  wide; oval in equatorial view, circular in polar view; polar axis  $17\text{-}19\text{-}22\ \mu\text{m}$ , equatorial axis  $17\text{-}19\text{-}20\ \mu\text{m}$ , P/E ratio  $0.93\text{-}1.05\text{-}1.22$ ; flowering in May-Jun. (Y. Tateishi and J. Murata 4180; Loc. A)

**Typhaceae** (1 genus, 1 species)*Typha latifolia* L.

'Gama'

Monoporate, diporate tetrads; exine  $1.5\text{-}2.5\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\ \mu\text{m}$  wide; pori circular  $2.0\text{-}2.5\ \mu\text{m}$  wide, annuli absent; linear, flat or irregular tetrads; grains  $15\text{-}20\text{-}26\ \mu\text{m}$ ; flowering in Jun-Aug. (H. Kanai and M. Morita 234; Loc. S)

**Ulmaceae** (2 genera, 2 species)

Stephanoporate (4-5 porate) monad; exine  $1.5\text{-}2.0\ \mu\text{m}$  thick in proximal face,  $1.0\ \mu\text{m}$  thick in distal face; sexine rugulate; pori lolongate  $2.0\text{-}4.0\ \mu\text{m}$  long, annuli present; oval in equatorial view, angular in polar view; polar axis  $24\text{-}30\ \mu\text{m}$ , equatorial axis  $26\text{-}40\ \mu\text{m}$ , oblate; flowering in Apr-Jun.

ref. *Ulmus laciniata* (Trautv.) Mayr, 'Ohyou' (Apr-May): 4.

*Zelkova serrata* (Thunb.) Makino

'Keyaki'

Pori lolongate  $4.0 \times 2.0\ \mu\text{m}$  wide, annuli  $2.5\ \mu\text{m}$  thick; polar axis  $24\text{-}27\text{-}30\ \mu\text{m}$ , equatorial axis  $31\text{-}35\text{-}39\ \mu\text{m}$ , P/E ratio  $0.69\text{-}0.77\text{-}0.93$ ; flowering in Apr. (N. Kurosaki 12380; Loc. F)

**Umbelliferae** (11 genera, 12 species)

Tricolporate monad; exine  $1.5\text{-}2.0\ \mu\text{m}$  thick; sexine baculate, bacula forming tectum on top, tectum scabrate, verrucate; colpi acute at ends, narrow, sometimes equatorial prominent, long, but hardly visible in polar view; pori lalongate, elliptic or H-shaped,  $5.0\text{-}12\ \mu\text{m}$  long, costae  $0.5\text{-}2.0\ \mu\text{m}$  thick; compressed, constricted oval, rhomboidal in equatorial view, circular, semiangular, angular in polar view; polar axis  $17\text{-}35\ \mu\text{m}$ , equatorial axis  $10\text{-}25\ \mu\text{m}$ , prolate; flowering in Apr-Nov.

ref. *Chamaele decumbens* (Thunb.) Makino, 'Sentousou' (Apr-May): 4; *Heracleum nipponicum* Kitag., 'Hanaudo' (May-Jun): 1; *Hydrocotyle maritima* Honda, 'Nochidome' (Jun-Sep): 4; *Oenanthe javanica* DC., 'Seri' (Jul-Aug): 4; *Osmorhiza aristata* (Thunb.) Rydb., 'Yabuninjin' (Apr-May): 3; *Torilis japonica* (Houtt.) DC., 'Yabujirami' (May-Jul): 4.

1a. Colpi equatorial prominent, angular in polar view

.....*Hydrocotyle maritima*, *Osmorhiza aristata*

- 1b. Colpi not equatorial prominent, circular, semiangular in polar view
  - 2a. Constricted oval in equatorial view
    - 3a. Polar axis  $>26\mu\text{m}$  .....*Angelica polymorpha*
    - 3b. Polar axis  $<26\mu\text{m}$  .....*Torilis japonica*
  - 2b. Compressed oval in equatorial vie
    - 4a. Coarse, long, branched bacula at the polar .....*Heracleum nipponicum*
    - 4b. Bacula at the polar same as the other surface
      - 5a. Pori elliptic .....*Angelica polymorpha*, *A. pubescens*, *Anthriscus aemula*, *Chamaele decumbens*, *Oenanthe javanica*
      - 5b. Pori H-shaped, margo thickened .....*Sanicula chinensis*
  - 2c. Oval in equatorial view
    - 6a. Polar axis  $<24\mu\text{m}$  .....*Cryptotaenia japonica*
    - 6b. Polar axis  $>24\mu\text{m}$ 
      - 7a. Pori elliptic .....*Spuriopimpinella niloensis*
      - 7b. Pori H-shaped, margo thickened .....*Sanicula chinensis*

*Angelica polymorpha* Maxim. 'Shiranesenkyuu'  
 Exine  $1.5\mu\text{m}$  thick; sexine verrucate; colpi  $18\mu\text{m}$  long, apocolpium  $8.0-10\mu\text{m}$  wide; pori  $3.5 \times 5.0-6.0\mu\text{m}$  wide, elliptic, costae  $2.0\mu\text{m}$  thick; compressed, constricted oval in equatorial view, semiangular in polar view; polar axis  $26-31-34\mu\text{m}$ , equatorial axis  $12-15-18\mu\text{m}$ , P/E ratio 1.84-2.14-2.37; flowering in Sep-Nov. (*K. Tsuchiya* 469; Loc. K)

*A. pubescens* Maxim. 'Shishiudo'  
 Exine  $1.5\mu\text{m}$  thick; sexine verrucate; colpi  $0.5\mu\text{m}$  wide, apocolpium  $7.0-8.0\mu\text{m}$  wide; pori  $3.0 \times 5.0\mu\text{m}$  wide, elliptic, costae  $1.5\mu\text{m}$  thick; compressed oval in equatorial view, semiangular in polar view; polar axis  $27-31-33\mu\text{m}$ , equatorial axis  $12-14-15\mu\text{m}$ , P/E ratio 1.91-2.22-2.50; flowering in Aug-Nov. (*Y. Araki* 13822; Loc. K)

*Anthriscus aemula* Schischkin 'Shaku'  
 Exine  $1.5\mu\text{m}$  thick; sexine verrucate; colpi  $0.5\mu\text{m}$  wide, apocolpium  $8.0\mu\text{m}$  wide; pori  $3.0 \times 5.0-6.0\mu\text{m}$ , elliptic, costae  $1.5\mu\text{m}$  thick; compressed oval in equatorial view, semiangular, circular in polar view; polar axis  $25-27-29\mu\text{m}$ , equatorial axis  $12-14-15\mu\text{m}$ , P/E ratio 1.81-2.02-2.30; flowering in May-Jun. (*K. Iwatsuki* 675; Loc. A)

*Cryptotaenia japonica* Hassk. 'Mitsuba'  
 Exine  $1.5-2.0\mu\text{m}$  thick; sexine verrucate, scabrate; colpi  $13\mu\text{m}$  long,  $<0.5\mu\text{m}$  wide, ragged; pori  $1.5-2.0 \times 5.0-6.0\mu\text{m}$ , elliptic, costae  $1.5-2.0\mu\text{m}$  thick; compressed, constricted oval in equatorial view, circular in polar view; polar axis  $17-19-22\mu\text{m}$ , equatorial axis  $13-16-19\mu\text{m}$ , P/E ratio 1.07-1.24-1.46; flowering in Jun-Jul. (*N. Kinashi* 469; Loc. K)

*Sanicula chinensis* Bunge 'Umanomitsuba'  
 Exine  $1.6\mu\text{m}$  thick; sexine verrucate, scabrate; apocolpium  $9.0-10\mu\text{m}$  wide, margo thickened; pori H-shaped,  $4.0-6.0 \times 9.0-12\mu\text{m}$ , costae  $1.5\mu\text{m}$  thick; compressed oval in equatorial view, circular in polar view; polar axis  $27-32-35\mu\text{m}$ , equatorial axis  $16-19-22\mu\text{m}$ , P/E ratio 1.52-1.71-1.86; flowering in Jul-Sep. (*Muroi s.n.*; Loc. A)

*Spuriopimpinella nikoensis* (Yabe ex Hisauti) Kitag. 'Hikagemitsuba'  
Exine  $1.5\ \mu\text{m}$  thick; sexine verrucate, scabrate; colpi  $18\ \mu\text{m}$  long,  $<0.5\ \mu\text{m}$  wide; pori  $5.0-6.0 \times 3.0-3.5\ \mu\text{m}$  wide, elliptic, costae  $0.5-1.0\ \mu\text{m}$  thick; compressed, constricted oval in equatorial view, circular in polar view; polar axis  $26-29-33\ \mu\text{m}$ , equatorial axis  $15-17-18\ \mu\text{m}$ , P/E ratio 1.50-1.73-1.86; flowering in Jul-Sep. (*M. Tagawa 2070*; Loc. A)

#### Urticaceae (4 genera, 7 species)

Diporate, triporate monad; exine  $0.5-1.0\ \mu\text{m}$  thick; sexine verrucate, scabrate; pori circular  $1.0\ \mu\text{m}$  wide, annuli present; grains circular; grains  $7-16\ \mu\text{m}$ ; flowering in May-Oct.

ref. *Boehmeria nipononivea* Koidz., 'Karamushi' (Jul-Sep): 4; *B. tricuspis* (Hance) Makino, 'Akaso' (Jul-Sep): 1; *Elatostema laetevirens* Makino, 'Yamatokihokori' (Aug-Oct): 1; *E. umbellatum* Blume, 'Uwabamisou' (Apr-Sep): 1; *Laportea bulbifera* (Sieb. et Zucc.) Wedd., 'Mukagoirakusa' (Aug-Sep): 4; *L. macrostachya* (Maxim.) Ohwi, 'Miyamairakusa' (Jul-Sep): 1; *Pilea mongolica* Wedd., 'Aomizu' (Jul-Oct): 1.

#### Valerianaceae (2 genera, 3 species)

Tricolpate monad; exine  $3.0\ \mu\text{m}$  thick; sexine echinate, echini  $1.5-2.0\ \mu\text{m}$  high, on shielded-shaped verrucae; colpi acute at ends, ragged, margo thickened; oval in equatorial view, semiangular in polar view; polar axis  $27-50\ \mu\text{m}$ , equatorial axis  $30-53\ \mu\text{m}$ , oblate-spherical; flowering in Apr-May and Aug-Oct.

ref. *Patrinia scabiosaefolia* Fisch., 'Ominaeshi' (Aug-Oct): 4; *Valeriana flaccidissima* Maxim., 'Tsurukanokosou' (Apr-May): 4.

- 1a. Polar axis  $>40\ \mu\text{m}$  ..... *Patrinia villosa*  
1b. Polar axis  $<40\ \mu\text{m}$  ..... *Patrinia scabiosaefolia*, *Valeriana flaccidissima*

*Patrinia villosa* (Thunb.) Juss. 'Otokoeshi'  
Apocolpium  $20-24\ \mu\text{m}$  wide, margo  $2.0-3.0\ \mu\text{m}$  wide; polar axis  $40-43-50\ \mu\text{m}$ , equatorial axis  $43-49-53\ \mu\text{m}$ , P/E ratio 0.76-0.89-1.09; flowering in Aug-Oct. (*Y. Araki 13675*; Loc. K)

#### Verbenaceae (3 genera, 4 species)

##### *Callicarpa* (2 species)

Tricolpate monad; exine  $2.0\ \mu\text{m}$  thick; sexine reticulate, lumina  $0.5\ \mu\text{m}$  wide; colpi long, ragged, verrucate, margo thinned; oval in equatorial view, circular in polar view; polar axis  $23-29\ \mu\text{m}$ , equatorial axis  $26-33\ \mu\text{m}$ , spherical; flowering in Jun-Aug.  
ref. *Callicarpa mollis* Sieb. et Zucc., 'Yabumurasaki' (Jun-Jul): 4.

*Callicarpa japonica* Thunb. 'Murasakishikibu'  
Apocolpium  $7.0-9.0\ \mu\text{m}$  wide; polar axis  $23-25-28\ \mu\text{m}$ , equatorial axis  $26-27-29\ \mu\text{m}$ , P/E ratio 0.86-0.93-1.05; flowering in Jun-Aug. (*G. Murata 11419*; Loc. K)

*Caryopteris* (1 species)*Caryopteris divaricata* (Sieb. et Zucc.) Maxim.

'Kariganesou'

Triporate monad; exine 4.0-5.0  $\mu\text{m}$  thick; sexine echinate, echini 2.0-2.5  $\mu\text{m}$  high; pori circular 6.0-9.0  $\mu\text{m}$  wide, annuli thinned, 3.0  $\mu\text{m}$  thick; polar axis 45-50-57  $\mu\text{m}$ , equatorial axis 47-52-57  $\mu\text{m}$ , P/E ratio 0.86-0.96-1.18 (n=18); flowering in Aug-Sep. (*M. Togashi 7754*; Loc. H)

*Clerodendrum* (1 species)*Clerodendrum trichotomum* Thunb.

'Kusagi'

Tricolpate monad; exine 2.8  $\mu\text{m}$  thick; sexine echinate, echini 1.5  $\mu\text{m}$  high, 1.0  $\mu\text{m}$  wide; colpi ragged, apocolpium 20-25  $\mu\text{m}$  wide, margo thinned; oval in equatorial view, circular in polar view; polar axis 51-59-65  $\mu\text{m}$ , equatorial axis 51-56-60  $\mu\text{m}$ , P/E ratio 0.85-1.06-1.22; flowering in Aug-Sep. (*T. Takahashi 1021*; Loc. K)

## Violaceae (1 genus, 8 species)

Tricolpate monad; exine 1.0-2.0  $\mu\text{m}$  thick; sexine psilate, scabrate; colpi acute at ends, long, usually prominent and constricted at equator, margo sometimes prominent; pori ragged, variable in shape, 2.0-10  $\mu\text{m}$  wide, with costae oval in equatorial view, circular in polar view; polar axis 17-49  $\mu\text{m}$ , equatorial axis 18-44  $\mu\text{m}$ , spherical-prolate; flowering in Apr-Jul.

ref. *Viola eizanensis* Makino, 'Eizansumire' (Apr-May): 4; *V. keiskei* Miq., 'Marubasumire, Kemarubasumire' (Apr-May): 1.

- 1a. Polar axis  $>40\mu\text{m}$  ..... *Viola eizanensis*
- 1b. Polar axis 25-40  $\mu\text{m}$ 
  - 2a. Apocolpium  $>6.0\mu\text{m}$  wide
    - 3a. Costae  $>1.5\mu\text{m}$  thick, colpi constricted at equator ..... *V. vaginata*
    - 3b. Costae  $<1.5\mu\text{m}$  thick, colpi not constricted at equator ..... *V. mandshurica*
  - 2b. Apocolpium  $<6.0\mu\text{m}$  wide
    - 4a. Colpi prominent at equator ..... *V. verecunda*, *V. violacea*
    - 4b. Colpi not prominent at equator ..... *V. mandshurica*
- 1c. Polar axis  $<25\mu\text{m}$ 
  - 5a. Apocolpium  $<6.0\mu\text{m}$  wide ..... *V. kusanoana*, *V. verecunda*, *V. violacea*
  - 5b. Apocolpium  $>6.0\mu\text{m}$  wide ..... *V. grypoceras*, *V. kusanoana*

*Viola grypoceras* A. Gray

'Tachitsubosumire'

Exine 1.0  $\mu\text{m}$  thick; colpi prominent and constricted at equator, apocolpium 6.0-8.0  $\mu\text{m}$  wide; pori ragged, circular 3.5  $\mu\text{m}$  wide; polar axis 17-21-25  $\mu\text{m}$ , equatorial axis 20-22-25  $\mu\text{m}$ , P/E ratio 0.84-0.96-1.25; flowering in Apr-May. (*K. Ueda and E. Kinoshita 545*; Loc. A)

*V. kusanoana* Makino

'Ootachitsubosumire'

Exine 1.1-1.3  $\mu\text{m}$  thick; colpi constricted at equator, apocolpium 5.0-7.0  $\mu\text{m}$  wide; pori ragged, variable in shape, 2.0-5.0  $\mu\text{m}$  wide, costae 1.5-2.5  $\mu\text{m}$  thick; polar axis 20-23-25  $\mu\text{m}$ , equatorial axis 18-21-25  $\mu\text{m}$ , P/E ratio 0.89-1.11-1.27; flowering in Apr-May. (*H. Nagamasu 4163*; Loc. A)

*V. mandshurica* W. Becker 'Sumire'  
Exine 1.3  $\mu\text{m}$  thick; apocolpium 4.0-8.0  $\mu\text{m}$  wide; pori ragged, variable in shape, 4.0-10  $\mu\text{m}$  wide, costae 1.0  $\mu\text{m}$  thick; polar axis 25-29-34  $\mu\text{m}$ , equatorial axis 25-31-37  $\mu\text{m}$ , P/E ratio 0.69-0.96-1.35; flowering in Apr-May. (*G. Koidzumi s.n.*; Loc. K)

*V. vaginata* Maxim. 'Sumiresaishin'  
Exine 1.5-2.0  $\mu\text{m}$  thick; colpi constricted at equator, apocolpium 7.0-8.0  $\mu\text{m}$  wide; pori ragged, lalongate 4.0  $\times$  3.0  $\mu\text{m}$  wide, costae 1.5-2.0  $\mu\text{m}$  thick; polar axis 25-30-35  $\mu\text{m}$ , equatorial axis 25-28-32  $\mu\text{m}$ , P/E ratio 0.95-1.08-1.40; flowering in Apr-May. (*K. Iwatsuki 704*; Loc. A)

*V. verecunda* A. Gray 'Tsubosumire'  
Exine 1.5  $\mu\text{m}$  thick; colpi prominent at equator, apocolpium 3.0-5.0  $\mu\text{m}$  wide; pori ragged, variable in shape 3.0-4.0  $\mu\text{m}$  wide; polar axis 20-25-27  $\mu\text{m}$ , equatorial axis 22-27-30  $\mu\text{m}$ , P/E ratio 0.84-0.92-1.00 (n=19); flowering in Apr-May. (*K. Ueda et al. 514*; Loc. A)

*V. violacea* Makino 'Shihaisumire'  
Exine 1.3  $\mu\text{m}$  thick; colpi prominent at equator, apocolpium 3.0-6.0  $\mu\text{m}$  wide; pori ragged, variable in shape, 3.0-7.0  $\mu\text{m}$  wide, costae 1.0-2.0  $\mu\text{m}$  thick; polar axis 21-25-30  $\mu\text{m}$ , equatorial axis 20-25-29  $\mu\text{m}$ , P/E ratio 0.81-0.99-1.19; flowering in Apr-May. (*H. Nagamasu 4461*; Loc. A)

#### Vitaceae (3 genera, 5 species)

Tricolporate monad; exine 1.5-2.5  $\mu\text{m}$  thick; sexine reticulate, lumina 0.5-1.5  $\mu\text{m}$  wide; colpi acute at ends, long, margo thickened; pori lalongate 5.0-7.0  $\mu\text{m}$  long, or circular 1.8  $\mu\text{m}$  wide, with costae oval, compressed rhomboidal in equatorial view, circular, angular in polar view; polar axis 17-43  $\mu\text{m}$ , equatorial axis 14-33  $\mu\text{m}$ , prolate, spherical; flowering in May-Aug.

ref. *Vitis coignetiae* Pulliat ex Planch., 'Yamabudou' (Jun): 4; *V. flexuosa* Thunb., 'Sankakuduru' (May-Jun): 4; *V. thunbergii* Sieb. et Zucc., 'Ebiduru' (May-Aug): 4.

- 1a. Polar axis <20  $\mu\text{m}$ , angular in polar view ..... *Vitis flexuosa*
- 1b. Polar axis 20-30  $\mu\text{m}$ , angular in polar view ..... *Vitis coignetiae*, *V. thunbergii*
- 1c. Polar axis >30  $\mu\text{m}$ , circular in polar view
  - 2a. Pori slit-like, 7.0  $\times$  <0.5  $\mu\text{m}$  wide ..... *Ampelopsis brevipedunculata*
  - 2b. Pori equatorial apiculate, 5.0-6.0  $\times$  3.0-4.0  $\mu\text{m}$  wide  
..... *Parthenocissus tricuspidata*

*Ampelopsis brevipedunculata* (Maxim.) Trautv. 'Nobudou'  
Exine 2.5  $\mu\text{m}$  thick; lumina 0.5-1.0  $\mu\text{m}$  wide; apocolpium 8.0-10  $\mu\text{m}$  wide; pori lalongate 7.0  $\times$  <0.5  $\mu\text{m}$ , slit like, costae 1.5  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 36-38-40  $\mu\text{m}$ , equatorial axis 27-31-33  $\mu\text{m}$ , P/E ratio 1.15-1.23-1.39; flowering in Jul-Aug. (*N. Nagai 25215*; Loc. K)

*Parthenocissus tricuspidata* (Sieb. et Zucc.) Planch. 'Tsuta'

Exine 2.0  $\mu\text{m}$  thick; lumina 0.5-1.5  $\mu\text{m}$  wide, smaller near colpi, muri simplicolumellate; apocolpium 6.0-8.0  $\mu\text{m}$  wide; pori lalongate, apiculate at both lateral ends, 5.0-6.0  $\times$  3.0-4.0  $\mu\text{m}$ , costae 1.0-1.5  $\mu\text{m}$  thick; oval in equatorial view, circular in polar view; polar axis 33-37-43  $\mu\text{m}$ , equatorial axis 27-29-33  $\mu\text{m}$ , P/E ratio 1.11-1.27-1.48; flowering in Jun-Jul. (*A. Nitta 12435*; Loc. H)

#### Zingiberaceae (1 genus, 1 species)

*Zingiber mioga* (Thunb.) Roscoe

'Myouga'

Damaged by acetolysis; inaperturate monad; exine 0.5-1.0  $\mu\text{m}$  thick; sexine striate, striae 1.0-2.0  $\mu\text{m}$  wide; grains elliptic 90-110-130  $\times$  50-70-80  $\mu\text{m}$ ; flowering in Aug-Oct. (*S. Tsugaru and G. Murata 16929*; Loc. I)

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### Glossary

- acetolysis**: a process of acetylation for removing the organic matter of pollen except sporopollenin.
- angular**: a shape of grain in polar view, outline between apertures is straight, apertures at apex.
- annulus/annuli** : thicker or thinner part of exine surrounding a pore.
- aperture**: an opening or a thinner part of exine for germination of pollen tube and regulation of pollen volume with changing of water content.
- apocolpium**: the polar area beyond the ends of colpi, the measurements are given for the distance between ends of two colpi.
- baculate, baculum/bacula**: with sculpting element like  $>1\mu\text{m}$  rod, height longer than diameter, and showing uniform diameter from base to top.
- brochus/brochi**: a unit of reticulum measured between center of muri.
- caudicle**: a connective element of a pollinarium extending from the base of pollinium.
- circular**: shape of grain and pore round without apex, longer diameter  $<1.33$  times of shorter one.
- clavate, clava/clavae**: with sculpting element like  $>1\mu\text{m}$  rod, and top end wider than the base.
- colporus/colpori**: aperture complex of colpus and pore.
- colpus/colpi**: aperture like furrow, length  $>2$  times of width.
- compressed**: a shape of grain in equatorial view, outline near the equator straight.
- constricted**: a shape of grain in equatorial view, outline near the equator concave.
- corpusculum**: an anchor-like object attaching to pollinator.
- costa/costae** : a thicker edge of endexine surrounding a pore, visible in equatorial view.
- depressed**: a shape of grain in equatorial view, outline near the poles straight.
- echinate, echinus/echini**: with sculpting element like  $>1\mu\text{m}$  spine, the top end pointed.
- ektexine**: outer part of exine.
- elliptic** : shape round without apex, longer diameter  $>1.33$  times of shorter one.

- endexine*: inner layer of exine under the foot layer.
- equator*: a line separating the proximal and distal hemispheres.
- equatorial axis*: the axis perpendicular to the polar axis, but the measurements given for the distance between two farthest points on the equator.
- exine*: outer layer of grain, enclosing intine and cytoplasm, containing sporopollenin and tolerant to acetolysis.
- gemmate, gemma/gemmae*: with sculpting element like  $>1\mu\text{m}$  rod, diameter larger than height and the base constricted.
- glandula*: an object with sticky part at the base of pollinarium, attaching to pollinator.
- heterobrochate*: with brochi different in size.
- heteropolar*: shape of proximal and distal hemispheres different.
- homobrochate*: with brochi uniform in size.
- isopolar*: shape of proximal and distal hemispheres same.
- lalongate*: pore transversely elongate, equatorial diameter  $>1.33$  times of polar diameter.
- lobate*: a shape of grain in polar view, outline between apertures concave, apertures at apex.
- lolongate*: pore longitudinally elongate, equatorial diameter  $>1.33$  times of polar diameter.
- lumen/lumina*: space enclosed by muri in a reticulum.
- margo*: thicker or thinner part along colpus.
- murus/muri*: ridge separating lumen in a reticulum.
- oblate*: with the length of equatorial axis  $>1.33$  times of that of polar axis, P/E ratio  $<0.75$ .
- P/E ratio*: a ratio of the length of polar axis to that of equatorial axis.
- pole*: inner (proximal) and outer (distal) extremities of the grain in the tetrahedral arrangement of microspores.
- polar axis*: axis between proximal and distal poles.
- pollinarium/pollinaria*: consisting of pollinia, associated connectives and structure for fastening to a substrate or pollinator.
- pollinium/pollinia*: sac of agglutinated pollen grains, a part of pollinarium.
- pore/pori*: a round aperture on the surface of exine, the longer axis shorter than twice of the shorter one; sometimes used for an endoaperture of various shapes, of the pollen grains with compound apertures.
- prolate*: with the length of polar axis  $>1.33$  times of that of equatorial axis, P/E ratio  $<1.33$ .
- psilate*: sculpting element absent or surface relatively smooth.
- reticulate*: sculpting with a network of anastomosing ridges, enclosing small, frequently regular spaces.
- rhomboidal*: a shape of grain in equatorial view, outline of lozenge.
- rugulate, rugula/rugular*: with sculpting element like elongate ridges, length at least twice the width, irregularly distributed.
- scabrate*: with minute sculpting elements, no dimension of which reaches  $1\mu\text{m}$ .
- semiangular*: a shape of grain in polar view intermediate between angular and circular, the outline between apertures convex.
- sexine*: outer part of exine containing tectum and columellae, displaying sculpture.
- spherical*: with the length of longer axis  $>1.33$  times of that of shorter axis, P/E ratio  $>0.75$  and  $<1.33$ .
- striate, stria/striae*: with sculpting element like elongate parallel ridges, length  $>2$  times of the width.
- tectum*: a more or less continuous roof formed outer part of ectexine, supported by columellae.
- valla/vallae*: ridges in striate or rugulate sculpting.
- verrucate, verruca/verrucae*: with sculpting element like  $>1\mu\text{m}$  rod, diameter larger than height, not constricted at base.
- vestibulum*: a compartment between endexine and ectexine around pore.



*zonorate*: with series of pori forming a continuous equatorial ring crossing colpi.

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## Appendix

The following species in Watanabe (1970) are not treated in this work.

- Aceraceae**  
*Acer micranthum*  
*Acer nikoense*  
*Acer tenuifolium*
- Asclepiadaceae**  
*Cynanchum caudatum*  
*Cynanchum paniculatum*  
*Metaplexis japonica*  
*Tylophora aristolochioides*
- Boraginaceae**  
*Trigonotis brevipes*
- Caryophyllaceae**  
*Silene firma*  
*Stellaria uchiyamana*
- Celastraceae**  
*Euonymus lanceolatus*
- Compositae**  
*Cacalia peltifolia*  
*Carpesium glossophyllum*  
*Cirsium dipsacolepis*  
*Cirsium longepedunculatum*  
*Cirsium microspicatum*  
*Cirsium yezoense*  
*Pertya rigidula*  
*Rhynchospermum verticillatum*  
*Saussurea pulchella*  
*Senecio pierotii*
- Convolvulaceae**  
*Calystegia sepium*
- Crassulaceae**  
*Hylotelephium sordidum*  
*Sedum aizoon* var. *floribundum*
- Cruciferae**  
*Arabis gemmifera*
- Cyperaceae**  
*Carex blepharicarpa*  
*Carex breviculmis*  
*Carex conica*  
*Carex curvicollis*  
*Carex dolichostachya* var. *glaberrima*  
*Carex fedia* var. *miyabei*  
*Carex incisa*  
*Carex insaniae*  
*Carex insaniae* var. *papillaticulmis*  
*Carex ischnostachya*  
*Carex japonica*  
*Carex kiotensis*  
*Carex maximowiczii*  
*Carex mollicula*  
*Carex morrowii*  
*Carex morrowii* var. *temnolepis*  
*Carex olivacea* var. *angustior*  
*Carex parviflora* var. *macroglossa*  
*Carex persistens*  
*Carex shimidzensis*  
*Carex siderosticta*  
*Carex thunbergii*  
*Cyperus amuricus*  
*Cyperus brevifolius* var. *leirolepis*  
*Cyperus difformis*  
*Cyperus flaccidus*  
*Cyperus iria*  
*Cyperus microiria*  
*Cyperus orthostachyus*  
*Eleocharis congesta*  
*Eleocharis wichurae*  
*Fimbristylis milliacea*  
*Fimbristylis subbispicata*  
*Lipocarpa microcephala*  
*Scirpus juncoides*  
*Scirpus tabernaemontani*  
*Scirpus triangulatus*  
*Scirpus wichurae*
- Eriocaulaceae**  
*Eriocaulon robustius*
- Graminae**  
*Agropyron tsukushiense* var. *transiens*  
*Agrostis alba*  
*Agrostis clavata* var. *nukabo*  
*Alopecurus aequalis*  
*Arthraxon hispidus*  
*Arundinella hirta*  
*Brachypodium sylvaticum*  
*Bromus pauciflorus*  
*Brylkinia caudata*  
*Calamagrostis arundinacea*  
*Calamagrostis epigeios*  
*Calamagrostis hakonensis*  
*Calamagrostis longiseta*  
*Diarrhena japonica*  
*Digitaria ciliaris*  
*Digitaria violascens*  
*Eccoilopus cotulifer*  
*Echinochloa crus-galli* var. *caudata*  
*Eragrostis ferruginea*  
*Eragrostis multicaulis*  
*Festuca parvigluma*  
*Hierochloa odorata* var. *pubescens*  
*Isachne globosa*  
*Leersia sayanuka*  
*Lophatherum gracile*  
*Melica nutans*  
*Microstegium japonicum*  
*Microstegium nudum*

- Microstegium vimineum*  
*Milium effusum*  
*Miscanthus sinensis*  
*Miscanthus tinctorius*  
*Muhlenbergia curviaristata*  
*Muhlenbergia hakonensis*  
*Muhlenbergia longistolon*  
*Oplismenus undulatifolius*  
*Panicum bisulcatum*  
*Paspalum thunbergii*  
*Pennisetum alopecuroides*  
*Phalaris arundinacea*  
*Phragmites japonica*  
*Poa acroleuca*  
*Poa radula*  
*Poa sphondylodes*  
*Sacciolepis indica* var. *oryzorum*  
*Sasa kurilensis*  
*Setaria chondrachne*  
*Setaria glauca*  
*Setaria viridis*  
*Trisetum bifidum*  
*Zoysia japonica*
- Juncaceae**  
*Juncus diastrophanthus*  
*Juncus effusus* var. *decipiens*  
*Juncus leschenaultii*
- Labiatae**  
*Ajuga yezoensis*  
*Clinopodium multicaule*  
*Isodon japonica*
- Lauraceae**  
*Lindera erythrocarpa*  
*Lindera glauca*  
*Lindera obtusiloba*  
*Lindera triloba*  
*Lindera umbellata*  
*Lindera umbellata* var. *membranacea*  
*Neolitsea sericea*
- Leguminosae**  
*Cladrastis platycarpa*  
*Cladrastis sikokiana*  
*Maackia floribunda*
- Lentibulariaceae**  
*Utricularia multispinosa*
- Liliaceae**  
*Hosta longipes*
- Lythraceae**  
*Rotala pusilla*
- Menispermaceae**  
*Menispermum dauricum*
- Oleaceae**  
*Fraxinus longicuspis*
- Orchidaceae**  
*Amitostigma keiskei*  
*Calanthe discolor*  
*Calanthe reflexa*  
*Calanthe tricarinata*  
*Cephalanthera falcata*  
*Cremastra appendiculata*  
*Cremastra unguiculata*  
*Cymbidium goeringii*  
*Epitactis thunbergii*  
*Galeola septentrionalis*  
*Gastrodia elata*  
*Goodyera foliosa*  
*Goodyera pendula*  
*Goodyera schlechtendaliana*  
*Gymnadenia camtschatica*  
*Liparis krameri*  
*Liparis kumokiri*  
*Orchis chidori*  
*Oreorchis patens*  
*Plantanthera minor*  
*Platanthera florenti*  
*Platanthera hologlottis*  
*Platanthera mandarinorum*  
*Platanthera sachalinensis*  
*Pogonia minor*  
*Spiranthes sinensis*  
*Yoania japonica*
- Orobanchaceae**  
*Phacellanthus tubiflorus*
- Polygonaceae**  
*Persicaria sieboldi*  
*Persicaria taquetii*  
*Persicaria viscofera*  
*Persicaria yokusaiana*
- Primuraceae**  
*Lysimachia acroadenia*
- Ranunculaceae**  
*Dichocarpum ohwianum*
- Rhamnaceae**  
*Berchemia pauciflora*
- Rosaceae**  
*Rosa fujisanensis*  
*Rubus pectinellus*  
*Rubus phoenicolasius*  
*Rubus sumatranus*
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*Galium kikumugura*  
*Galium paradoxum*
- Salicaceae**  
*Salix alopoehroa*
- Saxifragaceae**  
*Chrysosplenium fauriei*  
*Chrysosplenium kamtschaticum*  
*Chrysosplenium tosaense*
- Scrophulariaceae**  
*Deinostema violaceum*  
*Dopatrium junceum*  
*Veronica melissaefolia*

- Solanaceae**  
*Physalisstrum savatieri*  
**Ulmaceae**  
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**Umbelliferae**  
*Angelica matsumurae*  
*Hydrocotyle sibthorpioides*  
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