

POLLEN GRAINS OF FORMOSAN PLANTS (2)**

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The pollen grains of Formosan plants, i.e. 66 families, 155 genera, and 263 species were studied. A brief description for each taxon as well as keys for genera and species were prepared for each family.

The pollen grains were extracted from the dry herbarium specimens which are deposited in the Botany Department (TAI) and Forest Department (TAF) of the National Taiwan University, Taiwan Forest Research Institute (TAIF), and Pingtung Agricultural College (PA). In addition, fresh materials were used from the author's collection. The pollen grains of all available taxa were studied from permanent slides prepared by the acetolysis method outlined by Erdtman (1956). The palynological terminology follows that of Erdtman (1966), and Faegri, Iversen, and Waterbolk (1964). When possible, the size is measured randomly on the basis of 30 grains for each collection.

The description of each family is arranged by alphabetical order. Throughout this paper, the signs, A, B, C, D, E, and F in the 72 drawings were designed to indicate:

- A; equatorial view,
- (A); a dorsal segment of equatorial view,
- B; polar view,
- C; exine stratification,
- D; sexine pattern,
- E; grains without definite view,
- F; tetrad grains.

The writer wishes to express his sincere gratitude to chairmen as well as curators of the herbaria who allowed pollen grain extractions from the deposited specimens. I would also like to thank Dr. David B. Dunn, Botany Department, University of Missouri, U.S.A. for his reviewing of this manuscript, and Mrs. L.C. Huang, and Mr. C.Y. Chen for their drawings. Finally, I give thanks to Miss Hope H. Chen for typing the final manuscript.

OBSERVATION

1. ACERACEAE 桦樹科

Pollen grains are characterized by 3-colporate; shape classes of P/E prolate to prolate-spheroidal, or oval, with P axes of 25-34 μ long, and with E axes of 16-25 μ .

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long; amb peritreme to ptychotreme, or circular to intersubangular; colpi crassimarginate, nearly as long as the length of P axes; exine psilate to scabrate, 2μ thick; sexine as thick as nexine, striate-reticulate.

Acer albopurpurascens Hayata 紫蠟子樹

Grains prolate to prolate-spheroidal, with P axes of (25-)28-30(-34) μ long, and with E axes of (16-)19-20(-24) μ long.

The voucher is Hualien, Shimizu et al. II636.

Acer morrisonense Hayata 尖葉槭—Fig. 1.

Grains prolate to subprolate, with P axes of (25-)27-29(-33) μ long, and with E axes of (16-)20-22(-25) μ long.

The voucher is Taipei, Yanming Shan, Liao s.n. Apr. 1963.

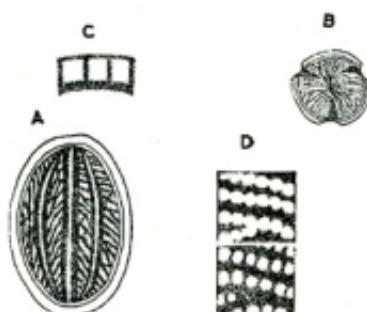


Fig. 1. *Acer morrisonense* Hayata (Liao s.n. Apr. 1963),
equatorial view $\times 1000$, polar view $\times 500$.

2. ACTINIDIACEAE 蘭嶼桃科

Pollen grains are characterized by 3-4-colporate, prolate to prolate-spheroidal, with P axes of 15-21 μ long, and with E axes of 10-19 μ long; exine psilate, 1-2 μ thick; sexine thicker than nexine, granulate, with obscure-pattern.

Key to genera

1. Colpi crassimarginate; ora colpi transversales-equatoriales..... *Actinidia*
1. Colpi uncrassimarginate; ora colpi transversales to colpi transversales-circulares..... *Saurauja*

Actinidia arisanensis Hayata 阿里山蘭嶼桃—Fig. 2-1.

Grains 3-colporate, prolate to prolate-spheroidal, or oval, with P axes of (15-)18-19(-20) μ long, and with E axes of (10-)11-12(-14) μ long; amb peritreme to ptychotreme; colpi crassimarginate, as long as the length of P axes; ora colpi transversales-equatoriales; exine psilate, 1-2 μ thick; sexine as thick as or thicker than nexine, granulate, with obscure-or OL-pattern.

The voucher is Taichung, Mt. Pahsien, Liu et al. 400.

Actinidia latifolia (Gardn. & Champ.) Merr. 絨毛蕪桐

This species differs from the former by having 3(-4)-porate grains, with P axes of (15-)17-19(-21) μ long, and with E axes of (10-)12-13(-16) μ long.

The voucher is Taityu, Rengechi, Yamamoto s. n. July 1930.

Saurauja oldhamii Hemsl. 水冬哥—Fig. 2-2.

Grains 4(-3)-porate; shape classes of P/E prolate-spheroidal, or oval, with P axes of 18-20 μ long, and with E axes of 17-19 μ long; amb peritreme, or circular; colpi long; ora colpi transversales-circulares or colpi transversales; exine psilate, 1 μ thick; sexine thicker than nexine, granulate, with obscure-pattern.

The male gametophyte is dinucleate.

The voucher is Taipei, Huang 4180.

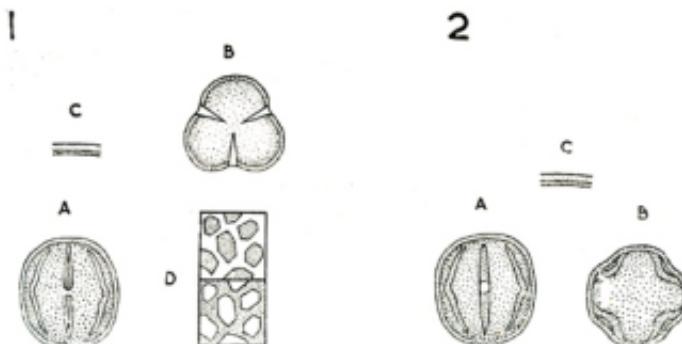


Fig. 2. Actinidiaceae, $\times 1000$. 1. *Actinidia arisanensis* Hayata (Liu et al. 400). 2. *Saurauja oldhamii* Hemsl. (Huang 4180).

3. ALANGIACEAE 八角楓科

Pollen grains are characterized by 3-colporate; shape classes of P/E suboblanceolate, or oval, with P axes of (15-)18-20(-26) μ long, and with E axes of (24-)27-32(-36) μ long; amb goniostreme, or semiangular; colpi crassimarginate, as 2/3 long as the length of P axes; ora costae-circulares; exine verrucate, with prominent infrategillar bacula, 2-3 μ thick; sexine thicker than nexine, coarsely granulate, with OL-pattern.

Alangium chinense (Lour.) Rehd. 華南木—Fig. 3

The vouchers are Mt. Ali, Sasaki s. n. May 1913; Nantou, Musha, Sasaki s. n. August 1929; Pianan ambu, Suzuki S. 5031.

4. ANACARDIACEAE 麝香科

Pollen grains are characterized by 3-colporate or (4-)6-porate; shape classes of P/E prolate to subspheroidal, with P axes of 18-49 μ long, and with E axes of

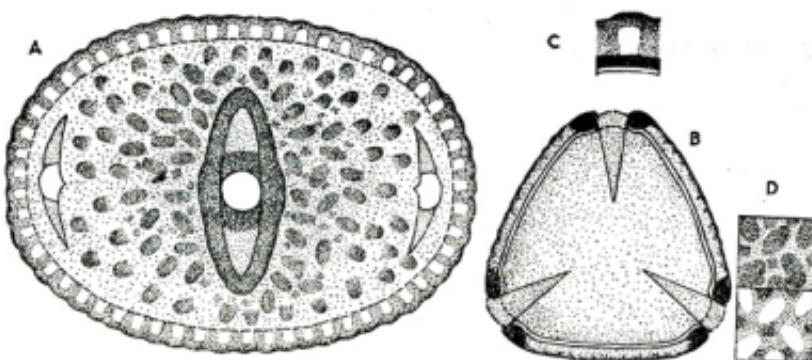


Fig. 3. *Alangium chinense* (Lour.) Rehd. (*Sasaki s.n.* May 1913),
equatorial view $\times 1000$, polar view $\times 500$.

18–41 μ long; amb peritreme to goniotreme; colpi usually as long as the length of P axes; ora frequently long, colpi transversales or colpi transversales-equatoriales; exine scabrate to verrucate, 1–1.5 μ thick; sexine thicker than nexine, striate-reticulate or reticulate, usually with OL-pattern.

Key to genera

1. Grains 4–6-porate *Pistacia*
1. Grains 3-corporate
 2. Sexine with LO-pattern *Mangifera*
 2. Sexine with OL-pattern
 3. Grains large, with P axes of 40–49 μ long *Semecarpus*
 3. Grains small, with P axes of 22–38 μ long
 4. Ora crassimarginata *Buchanania*
 4. Ora uncrassimarginata *Rhus*

Buchanania arborescens Bl. 山橘子—Fig. 4-1

Grains 3-corporate, syncolpate, prolate to subprolate, or oval, with P axes of (26–) 31–33(–36) μ long, and with E axes of (19–)20–22(–27) μ long; amb peritreme, or semicircular; ora costae; transversales; exine scabrate, ca. 1 μ thick; sexine thinner than or as thick as nexine, striate-reticulate, with muri narrower at cross rows and wider at longitudinal rows, with OL-pattern.

The voucher is Taihoku, Tanaka 15144.

Mangifera indica L. 榴果—Fig. 4-2

Grains 3-corporate, subprolate to prolate, or rhomboidal to oval, with P axes of 25–26 μ long, and with E axes of 18–20 μ long; amb peritreme to goniotreme, or circular to angular; colpi long, crassimarginata; ora colpi transversales-equatoriales; exine scabrate, with prominent infrategillar bacular, ca. 1 μ thick; sexine thicker than nexine, reticulate, with LO- or obscure-pattern.

The voucher is Ako, *Matuda s.n.* 1918.

Pistacia chinensis Bunge 黃連木—Fig. 4-3

Grains 4(-8)-porate, oval or spheroidal, with longest diameter (23-)27-28 μ wide; ora slightly crassimarginate; exine scabrate to psilate, ca. 1 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The voucher is Chiayi (Kagi), *Sata s.n.* 1932.

Rhus L. 山漆屬

Grains 3-colporate, spheroidal, subspheroidal, or oval, rhomboidal to depressed oval, with P axes of 22-38 μ long, and with E axes of 18-33 μ long; amb peritreme to goniotreme, or circular to angular; colpi nearly as long as the length of P axes; ora long; colpi transversales or colpi transversales-equatoriales; exine scabrate to verrucate, with prominent infrategillar baculae, 1-1.5 μ thick; sexine striate-reticulate, with OL-pattern.

Key to species of Rhus

1. Grains rhomboidal..... *R. semialata*
1. Grains oval to depressed oval
 2. Amb goniotreme to peritreme; muri equal in thickness; apertures syncolpate..... *R. orientalis*
 2. Amb peritreme; muri narrower at cross rows and wider at longitudinal rows; apertures not syncolpate
 3. Sexine thinner than nexine; infrategillar baculae obscure *R. hypoleuca*
 3. Sexine more or less as thick as nexine; infrategillar baculae prominent..... *R. succedanea*

Rhus hypoleuca Champ. ex Benth. in Hook. 褐白漆—Fig. 4-4

Grains oblate-spheroidal, or oval, with P axes of (25-)27-28(-30) μ long, and with E axes of (23-)25-26(29) μ long; amb peritreme, or circular; ora colpi transversales; exine scabrate, 1 μ thick; sexine thinner than nexine, striate-reticulate, with muri narrower at cross rows and wider at longitudinal rows.

The voucher is Hasenzan, *Kao et al.* 2766.

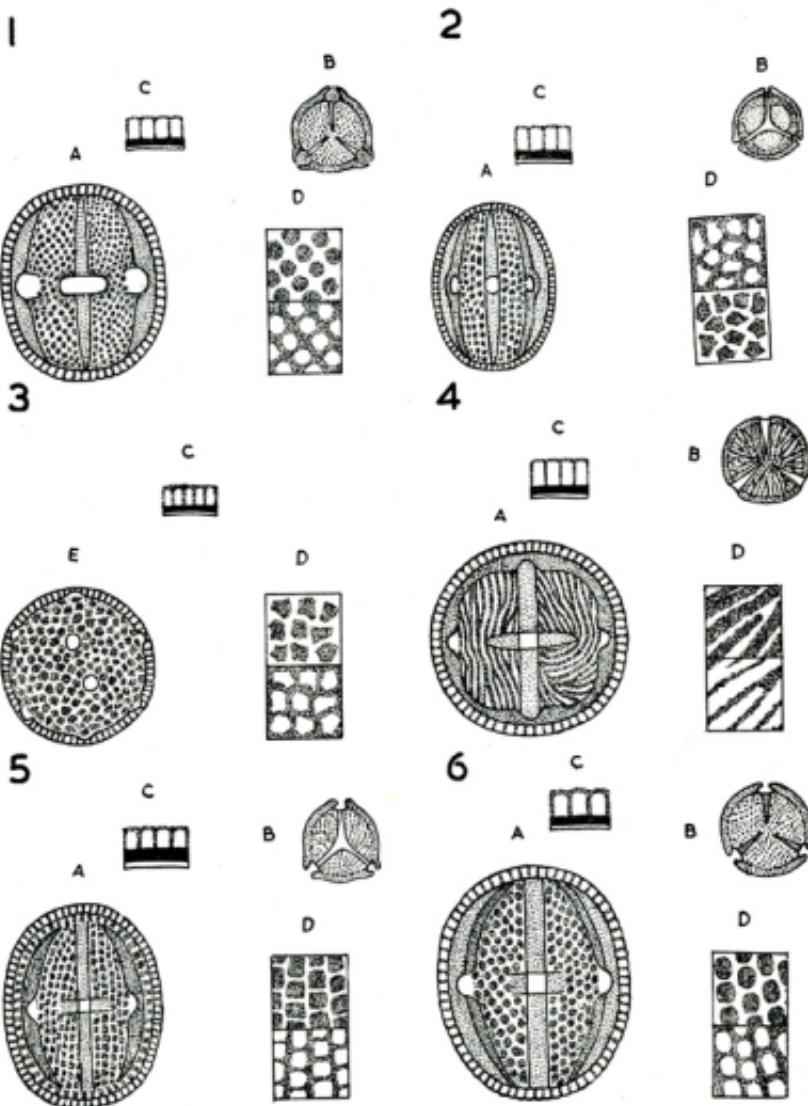
Rhus orientalis (Green) Schneider 野葛—Fig. 4-5

Grains prolate-spheroidal to subprolate, or depressed oval to oval, with P axes of (23-)25-27(-30) μ long, and with E axes of (18-)22-23(-25) μ long; amb goniotreme to peritreme; ora colpi transversales-equatoriales; exine scabrate to verrucate, 1.5 μ thick; sexine thicker than nexine, striate-reticulate, with muri of brochi equal thick.

The voucher is Taipei (Taihoku), *Suzuki* 16499.

Rhus semialata Murr. var. *roxburghiana* DC. 山鹽青—Fig. 4-6

Grains spheroidal to subprolate, or rhomboidal, with P axes of (24-)26-28(-38) μ long, and with E axes of (21-)24-26(-33) μ long; amb goniotreme to peritreme; ora



colpi transversales to colpi transversales-equatoriales; exine scabrate to verrucate, 1.5μ thick; sexine as thick as or thicker than nexine, striate-reticulate, with muri of brochi equal thickness.

The vouchers are Taipei, Mori s.n. May 1931; Sirin, Simada 5458B; Hualien, Shimizu 11919; Taroko, Suzuki 9150.

Rhus succedanea L. 山漆—Fig. 5-1

Grains prolate-spheroidal to oblate-spheroidal, or oval, with P axes of (22)-23-25(-30) μ long, and with E axes of (22)-23-24(-26) μ long; amb peritreme to goniotreme; ora colpi transversales-equatoriales or colpi transversales; exine scabrate, about 1 μ thick; sexine as thick as nexine, striate-reticulate, with muri of brochi narrower at cross rows and wider at longitudinal rows.

The vouchers are Taipei, Matuda s.n. Oct. 1930; Botel Tabago, Hosokawa 9877. **Semecarpus gigantifolia** Vidal. 臺東漆樹—Fig. 5-2

Grains 3-corporate, prolate to prolate-spheroidal, or oval, with P axes of 40-49 μ long, and with E axes of (21)-30-(41) μ long; amb goniotreme; ora colpi transversales-equatoriales; exine scabrate, 1 μ thick; sexine striate, with muri of brochi narrower at cross rows and thicker at longitudinal rows.

The voucher is Sinko, Yamamoto 2106.

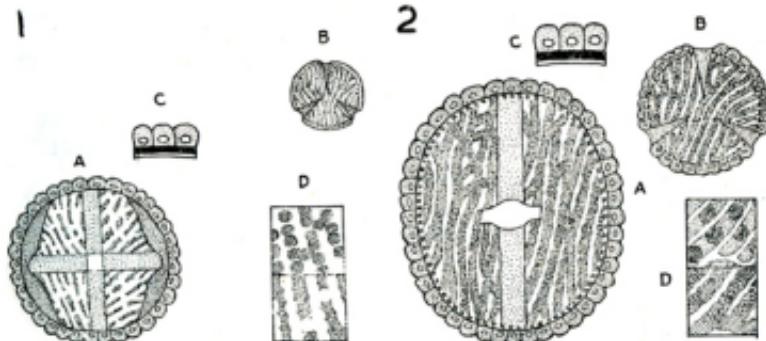


Fig. 5. Anacardiaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Rhus succedanea* L. (Hosokawa 9877). 2. *Semecarpus gigantifolia* Vidal. (Yamamoto 2106).

5. AQUIFOLIACEAE 多角科

Pollen grains are characterized by 3-corporate; shape classes of P/E oblate to prolate, or oval, with P axes of 17-36 μ long, and with E axes of 17-34 μ long;

Fig. 4. Anacardiaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Bachwania arborens* Bl. (Tanaka 15144). 2. *Mangifera indica* L. (Matuda s.n. 1918). 3. *Platocarpus chinensis* Bunge (Sata s.n. 1932). 4. *Rhus hypoleuca* Champ. (Kao et al. 2766). 5. *Rhus orientalis* (Green) Schneider (Suzuki T. 16499). 6. *Rhus semialata* Merr. var. *roxburghiana* DC. (Mori s.n. May 1931).

amb peritreme to ptychotreme, or open circular to inter-subangular; colpi crassimarginate, nearly as long as the length of P axes; ora colpi transversales-circulares, colpi transversales-equatoriales, or colpi transversales; exine gemmate to short baculate, 1-4 μ thick; sexine thicker than or as thick as nexine, coarsely granulate, with LO-pattern.

Key to species of *Ilex*

1. Exine baculate, 3-4 μ thick *I. goshiensis*
1. Exine gemmate to short baculate
 2. Exine gemmate only
 3. Gemmate up to 1 μ long *I. kusanoi*
 3. Gemmate up to 2 μ long *I. formosana*
 2. Exine gemmate, mixed with short baculate
 4. P axes more than 30 μ long *I. warburgii*
 4. P axes less than 30 μ long *I. asprella*, *I. ficoidea*, *I. lonicerifolia*,
I. lonicerifolia hakkuenensis, *I. micrococca*,
I. pubescens, *I. yunnanensis panifolia*.

Ilex asprella (Hook. & Arn.) Champ. ex Benth. in Hook. 煙筒花

Grains suboblate to prolate-spheroidal, with P axes of 23-28 μ long, and with E axes of 23-30 μ long; ora colpi transversales-circulares; exine gemmate, mixed with short baculate, 1-2.5 μ thick.

The vouchers are Taipei, Liu et al. s.n. March 1955, Lee s.n. Apr. 1961.

Ilex ficoidea Hemsl. ex Forb. & Hemsl. 阿里山冬青

Grains suboblate to spheroidal, with P axes of 24-30 μ long, and with E axes of 25-30 μ long; ora colpi transversales-circulares; exine gemmate, 1-2.5 μ thick.

The voucher is Ilan (Giran), Sasaki s.n. March 1918.

Ilex formosana Maxim. 櫛櫟

Grains oblate-spheroidal to prolate-spheroidal, with P axes of 25-30 μ long, and with E axes of 25-30 μ long; ora colpi transversales-circulares; exine gemmate, 1-2 μ thick.

The voucher is Ilan, Sasaki s.n. March 1918.

Ilex goshiensis Hayata 茶葉冬青—Fig. 6-1

Grains spheroidal to prolate-spheroidal, with P axes of 29-31 μ long, and with E axes of 29-30 μ long; ora colpi transversales; exine gemmate, mixed with short baculate, 3-4 μ thick.

The voucher is Taitung, Hsieh & Kao s.n. June 1955.

Ilex kusanoi Hayata 蘭嶼冬青—Fig. 6-2

Grains prolate-spheroidal to oblate-spheroidal, with P axes of 27-30 μ long, and with E axes of 25-30 μ long; ora colpi transversales-equatoriales; exine gemmate, 1 μ thick.

The voucher is Botel Tabago, Hsu & Chuang 2332.

***Ilex lonicerifolia* Hayata** 忽冬葉冬青

Grains oblate-spheroidal to spheroidal, with P axes of $25\text{--}28\ \mu$ long, and with E axes of $25\text{--}34\ \mu$ long; ora colpi transversales-equatoriales; exine gemmate, $2\text{--}2.5\ \mu$ thick.

The voucher is Taichung, Kuo & Kao 551.

***Ilex lonicerifolia* Hayata var. *hakkuensis* (Yamamoto) S. Y. Hu** 白狗冬青

Grains prolate-spheroidal to oblate-spheroidal, with P axes of $28\text{--}32\ \mu$ long, and with E axes of $28\text{--}30\ \mu$ long; ora colpi transversales or colpi transversales equatoriales; exine gemmate, $2.5\ \mu$ thick.

The voucher is Taityu, Sasaki s. n. May 1924.

***Ilex micrococca* Maxim.** 紅朱木

Grains oblate to prolate, with P axes of $17\text{--}26\ \mu$ long, and with E axes of $17\text{--}27\ \mu$ long; ora colpi transversales-circulares or colpi transversales-equatoriales; exine gemmate or clavate, $2\ \mu$ thick.

The voucher is Taipei, Suzuki S. 4371.

***Ilex pubescens* Hook. & Arn.** 密毛冬青

Grains oblate-spheroidal to prolate-spheroidal, with P axes of $21\text{--}23\ \mu$ long, and with E axes of $21\text{--}24\ \mu$ long; ora colpi transversales-equatoriales; exine gemmate, $1.5\text{--}2\ \mu$ thick.

The vouchers are Taipei, Suzuki T. 8923; Taichung, Hsieh & Kao s. n. June 1955.

***Ilex warburgii* Loes.** 臺灣冬青

Grains prolate-spheroidal to subprolate, with P axes of $32\text{--}36\ \mu$ long, and with E axes of $28\text{--}32\ \mu$ long; amb peritreme to pleurotreme, or open circular to intersubangular; ora colpi transversales-equatoriales; exine gemmate, $2\text{--}2.5\ \mu$ thick.

The voucher is Taipei, Kokunisima 430.

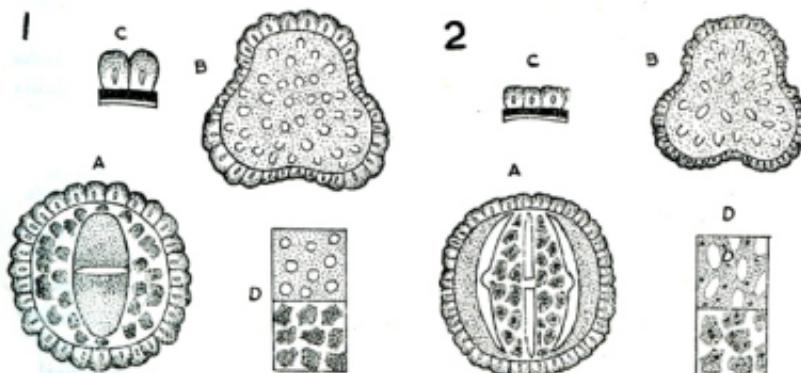


Fig. 6. Aquifoliaceae, $\times 1000$ 1. *Ilex gashiensis* Hayata (Hsieh & Kao s. n. June 1955). 2. *Ilex kusanoi* Hayata (Hsu & Chuang 2332).

***Ilex yunnanensis* Franch. var. *panifolia* (Hayata) S. Y. Hu 高山冬青**

Grains suboblate to prolate-spheroidal, with P axes of 25–26 μ long, and with E axes of 25–31 μ long; ora colpi transversales; exine gemmate, 1–1.5 μ thick.

The voucher is Taichung, Kuo & Kao 519.

6. ARALIACEAE 五加科

Pollen grains are characterized by 3-colporate; shape classes of P/E oblate to prolate, with P axes of 16–48 μ long, and with E axes of 15–36 μ long; amb goniostreme to peritreme; colpi nearly as long as the length of P axes; ora colpi transversales to colpi transversales-equatoriales; exine psilate, scabrate to verrucate, with prominent infrategillar baculae, 1–2 μ thick; sexine usually thicker than nexine, reticulate, usually with OL-pattern.

Key to genera

1. Warts present
 2. Grains 28–37 \times 20–36 μ long; amb often circular; sexine with LO-pattern..... *Fatsia*
 2. Grains 17–25 \times 16–25 μ long; amb often semilobate; sexine with OL-pattern *Boerlagiodendron*
1. Warts absent
 3. Ora crassimarginate..... *Tetrapanax*
 3. Ora uncrassimarginate (The following genera are not easily divided).
 4. Ora usually H-shaped
 5. Infrategillar baculae indistinct..... *Schefflera*
 5. Infrategillar baculae distinct *Acanthopanax*
 4. Ora colpi transversales-equatoriales
 6. Grains oval to rhomboidal
 7. Amb semilobate..... *Dendropanax*
 7. Amb subangular to angular
 8. Grains oblate to prolate..... *Aralia*
 8. Grains spheroidal to prolate..... *Sinopanax*
 6. Grains oval
 7. Length of infrategillar baculae shorter than width;
 grains spheroidal to subprolate..... *Pentapanax*
 7. Length of infrategillar baculae longer than width;
 grains oblate-spheroidal to prolate *Hedera*

***Acanthopanax trifoliatum* (L.) Merr. 三葉五加—Fig. 7-1**

Grains spheroidal to subprolate, or oval to rhomboidal, with P axes of 28–34 μ long, and with E axes of 24–32 μ long; amb peritreme, or circular, flat subangular to semiangular; colpi nearly as long as the length of P axes; ora colpi transversales-equatoriales or H-shaped; exine verrucate, 1 μ thick; sexine thicker than nexine, finely reticulate, with OL-pattern.

The vouchers are Taipei, Kwaningshan (Kannonzan), Simada 773, Feung & Kao 4835; Pingtung, Kenting, Chuang 2398; Taipei, Kawakami & Sasaki s. n. Nov. 1910.

Aralia L. 櫟木屬

Grains oblate to prolate, or oval to rhomboidal, with P axes of 20–30 μ long, and with E axes of 20–30 μ long; amb gonioreme, or subangular to angular; colpi nearly as long as the length of P axes; ora colpi transversales-circulares to colpi transversales-equatoriales; exine scabrate, 2 μ thick; sexine as thick as or thicker than nexine, reticulate, with OL-pattern.

Key to species of Aralia

1. Infrategillar baculae prominent; grains oval, or spheroidal to oblate *A. bipinnata*
1. Infrategillar baculae indistinct; grains rhomboidal to oval, or prolate to subspheroidal *A. decaisneana*

Aralia bipinnata Blanco 真白櫟木—Fig. 7-2

Grains oblate to spheroidal, or oval, with P axes of (20–)24–26(–30) μ long, and with E axes of (24–)26–29(–30) μ long.

The vouchers are Taipei, Sasaki s. n. Nov. 1926; Taichung, Liu et al. s. n. Sept. 1956; Mt. Ali, Sasaki s. n. Oct. 1927.

Aralia decaisneana Hance 刺櫟—Fig. 7-3

Grains prolate to spheroidal, or rhomboidal to oval, with P axes of (23–)24–28(–30) μ long, and with E axes of (20–)23–28(–30) μ long.

The vouchers are Ilan, Kao 5979; Taipei, Sasaki s. n. Oct. 1923; Mt. Pahsien, Suzuki S. s. n. Oct. 1929.

Boerlagiodendron pectinatum Merr. 蘭嶼八角金盤—Fig. 7-4

Grains oblate-spheroidal to subprolate, or rhomboidal to oval, with P axes of (17–)21–24(–25) μ long, and with E axes of (16–)18–20(–25) μ long; amb gonioreme, or semilobate; colpi nearly as long as the length of P axes; ora obscure; exine psilate to scabrate, with warts only at intermediate lobes, about 1 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Kashoto, Kudo & Mori 329; Botel Tabago, Hosokawa 8050.

Dendropanax pellucidopunctata (Hayata) Kanehira & Sasaki 臺灣杞李蔓—Fig. 7-5

Grains prolate to oblate-spheroidal, or rhomboidal to oval, with P axes of (26–)27–31(–38) μ long, and with E axes of (17–)22–26(–33) μ long; amb gonioreme, or semilobate to lobate; colpi nearly as long as the length of P axes; ora colpi transversales; exine psilate, 2 μ thick; sexine as thick as nexine, reticulate, with OL-pattern.

The vouchers are Ilan, Kao 3230; Taipei, Sasaki s. n. Aug. 1931; Taichung, Liu et al. 368; Hualien (Kwarenko), Fukuyama, 16156, Liu et al. 247.

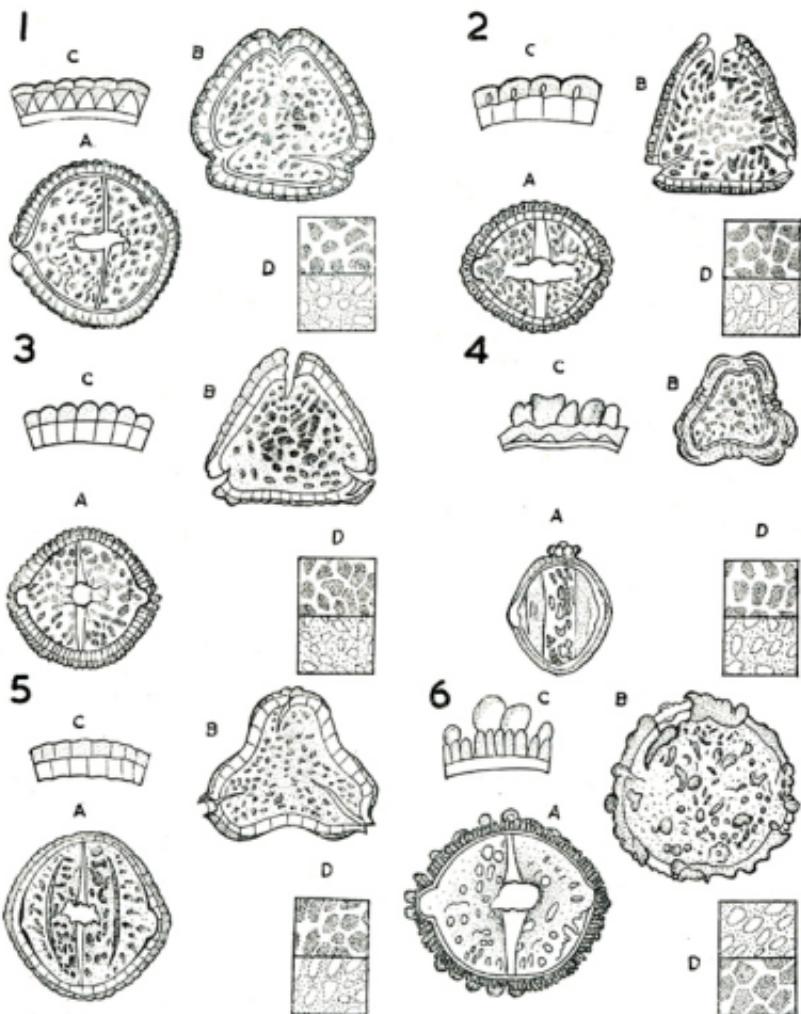


Fig. 7. Araliaceae, ×900. 1. *Acanthopanax trifoliatum* (L.) Merr. (Feung & Kao 4835). 2. *Aralia bipinnata* Blanco (Sasaki s. n. Nov. 1926). 3. *Aralia decaisneana* Hance (Sasaki s. n. Oct. 1923). 4. *Boerlagiodendron pectinatum* Merr. (Kao & Mori 329). 5. *Dendropanax pellucidopunctata* (Hayata) Kanekihira (Kao 3230). 6. *Fatsia polycarpa* Hayata (Shimizu & Kao 10505)

Fatsia polycarpa Hayata 華南八角金盤—Fig. 7-6

Grains prolate to oblate-spheroidal, or oval, with P axes of (28-)33-35(-37) μ long, and with E axes of (20-)32-35(-36) μ long; amb peritreme to goniotreme, or circular to semiangular; colpi nearly as long as the length of P axes; ora colpi transversales or colpi transversales-circulares; exine verrucate to baculate, with prominent warts, 2 μ thick; sexine thicker than nexine, reticulate, with LO-pattern.

The vouchers are Hualien, Shimizu & Kao 10505; Nantou, Huang, 1898; Mt. Ali, Sasaki s. n. Feb. 1918.

Hedera rhombica (Miq.) Bean var. **formosana** (Nakai) Li 常春藤—Fig. 8-1

Grains oblate-spheroidal to prolate, or oval, with P axes of (23-)28-32(-34) μ long, and with E axes of (18-)26-30(-31) μ long; amb goniotreme, or semiangular; colpi nearly as long as the length of P axes; ora colpi transversales; exine verrucate, 2 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Taipei, Mt. Daiton, Suzuki S. s. n. Nov. 1930; Chiayi, Simada 943; Mt. Ali, Yamamoto et al. s. n. Nov. 1832.

Pentaphanax castanopsisicola Hayata 藤五葉蔓—Fig. 8-2

Grains prolate-spheroidal to subprolate, or oval, with P axes of (23-)25-28(-29) μ long, and with E axes of (19-)22-25(-26) μ long; amb goniotreme, or semiangular to circular; colpi nearly as long as the length of P axes; ora colpi transversales-equatoriales; exine scabrate to verrucate, 1.5 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Houshei, Liao 10088; Toyen, Kanekihira & Sasaki s. n. Oct. 1919.

Schefflera J. R. & G. Forster 龍掌柴屬

Grains prolate-spheroidal to prolate, or rhomboidal to oval, with P axes of 16-37 μ long, and with E axes of 15-31 μ long; amb goniotreme to peritreme, or open semiangular, subangular to angular; colpi nearly as long as the length of P axes; ora H-shaped or colpi transversales-equatoriales; exine psilate, scabrate to verrucate, 1-1.5 μ thick; sexine, by enlarge, as thick as nexine, finely reticulate or granulate, with OL-pattern.

Key to species of Schefflera

1. Grains oval; amb peritreme; ora colpi transversales-equatoriales... *S. taiwaniana*
1. Grains rhomboidal; amb goniotreme; ora H-shaped
 2. Grains semilobate to interhexagonal *S. arboricola*
 2. Grains subangular *S. octophylla*

Schefflera arboricola Hayata 龍掌葉—Fig. 8-3

Grains prolate-spheroidal to prolate, or rhomboidal, with P axes of (16-)22-25(-30) μ long, and with E axes of (17-)19-22 μ long; amb goniotreme, or semilobate to interhexagonal; ora H-shaped; exine psilate to scabrate, 1 μ thick.

The vouchers are Taipei, Murakami 159; Rengechi, Sasaki s. n. Nov. 1835.

Schefflera octophylla (Lour.) Harms 鹿掌榮

Grains prolate-spheroidal to subprolate, or rhomboidal, with P axes of (28-)30-34(-37) μ long, and with E axes of (25-)26-30(-31) μ long; amb goniotreme, or subangular; ora H-shaped; exine scabrate to verrucate, 1.5 μ thick.

The vouchers are Sozan, *Sasaki s.n.* Dec. 1932; Nantou, *Shimizu 10329*; Taityu, Baibara, *Sasaki s.n.* Oct. 1924.

Schefflera taiwaniana (Nakai) Kanehira 臺灣鹿掌榮—Fig. 8-4

Grains prolate-spheroidal to prolate, or oval, with P axes of (16-)22-25(-26) μ long, and with E axes of (15-)17-25(26) μ long; amb peritreme, or circular; ora colpi transversales-equatoriales; exine scabrate to verrucate, 1 μ thick.

The vouchers are Chiayi, *Kao 3383*; Hualien, *Liu et al. 53*.

Sinopanax formosana (Hayata) Li 莫白八角金盤—Fig. 8-5

Grains spheroidal to prolate, or oval to rhomboidal, with P axes of (24-)25-29(-34) μ long, and with E axes of (18-)24-26(-28) μ long; amb goniotreme, or open semiangular; colpi nearly as long as the length of P axes; ora colpi transversales; exine verrucate to scabrate, 1-1.5 μ thick; sexine thicker than, or as thick as nexine, reticulate, with OL-pattern.

The vouchers are Buizan, *Sasaki s.n.* Oct. 1933; Nantou, *Huang 2028*; Hualien, Nakamura 5072; Taito, *Sasaki s.n.* March 1920.

Tetrapanax papyriferum (Hook.) C. Koch 通草—Fig. 8-6

Grains prolate to subprolate, or rhomboidal, with P axes of (26-)33-40(-48) μ long, and with E axes of (16-)20-26(-33) μ long; amb goniotreme, or open semiangular; colpi nearly as long as the length of P axes; ora costae transversales; exine scabrate, 1 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Taipei, *Sasaki s.n.* Dec. 1932; Houshei, *Liao 10088*.

7. BALSAMINACEAE 凤仙花科

Pollen grains are characterized by bilateral, subisopolar, 4-colporate; shape classes of P/E oblate, or oval, with P axes of 17-22 μ long, and with E axes of 34-47 μ long; amb goniotreme, or rectangular; colpi short, 8 μ long, 2-2.5 μ wide; exine verrucate, 1 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Impatiens tayemonii Hayata 高山釣船花

The vouchers are Kwangwu, *Huang 4088, 4142*.

Impatiens uniflora Hayata 單花釣船花—Fig. 9

The vouchers are Takao, *Hosokawa 5387*; Mt. Ali, *Huang 1618*; Kwanwu, *Huang 4143, 4161*.

8. BASELLACEAE 落葵科

Pollen grains are characterized by pantocolpate (6-rugate); shape classes of P/E oblate-spheroidal to prolate-spheroidal, or rhomboidal, with P axes of (27-)34-38(-40) μ long, and with E axes of (27-)32-37(40) μ long; colpi short, 7-10 μ long; exine long baculate, 12-14 μ thick, the bacula 10-12 μ long; sexine about 4 times



Fig. 8. Araliaceae, $\times 900$. 1. *Hedera rhombica* (Miq.) Bean, var. *formosana* (Nakai) Li (*Suzuki S.* s. n., Nov. 1930). 2. *Pentaphax castanopsisicola* Hayata (*Kanehira & Sasaki s. n.*, Oct. 1919). 3. *Schefflera arboricola* Hayata (*Makino 159*). 4. *Schefflera taiwaniana* (Nakai) Kanehira (*Kao 3383*). 5. *Sinopanax formosana* (Hayata) Li (*Sasaki s. n.*, March 1920). 6. *Tetrapanax papyriferum* (Hook.) C. Koch (*Liao 10088*)

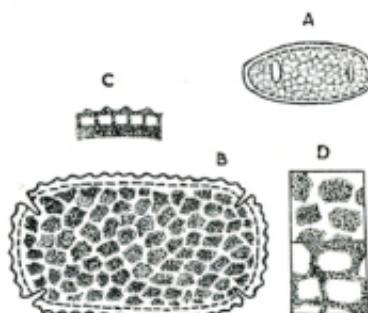


Fig. 9. *Impatiens uniflora* Hayata (Hesokawa 5387), equatorial view $\times 500$, polar view $\times 1000$.

longer than nexine, reticulate at outer parts and granulate toward center, with LO-pattern.

Basella rubra L. 红花落葵—Fig. 10

The vouchers are Suigent, Suzuki S. 12362; Tainan, Moritani 1765.

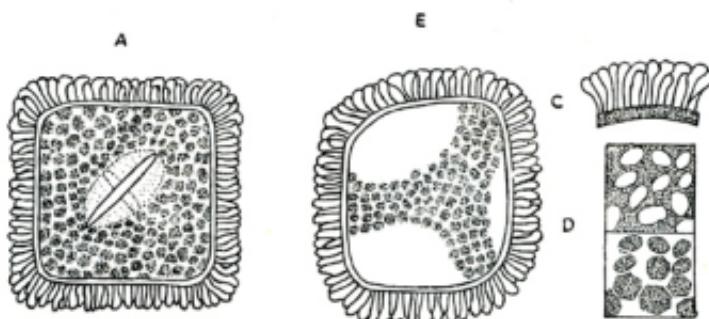


Fig. 10. *Basella rubra* L. (Suzuki S. 12362), $\times 1000$

9. BEGONIACEAE 秋海棠科

Pollen grains are characterized by 3-colporate; shape classes of P/E perprolate to subprolate, or oval, with P axes of (17-)23-25(-27) μ long, and with E axes of (9-)11-14(-16) μ long; amb peritreme, or circular; colpi nearly as long as the length of P axes; ora colpi transversales or colpi transversales-equatoriales; exine psilate, 2 μ thick; sexine as thick as or thicker than nexine, striate, with LO-pattern.

Begonia laciniata Roxb. var. formosana Hayata 圓山秋海棠—Fig. 11

The vouchers are Taipei, Wulai, Chuang 2302; Taito, Yamamoto & Mori 100, 8142.

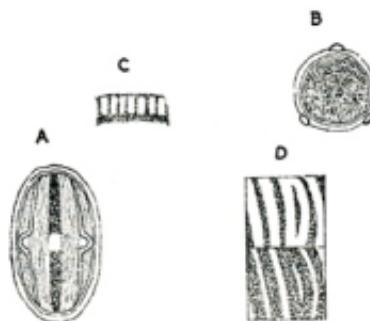


Fig. 11. *Begonia laciniosa* Roxb. var. *formosana* Hayata
(Yamamoto & Mori 100), $\times 1000$.

10. BETULACEAE 榆木科

Pollen grains are characterized by pantoporate; shape classes of P/E oblate to oblate-spheroidal, with P axes of $15\text{--}28 \mu$ long, and with E axes of $25\text{--}33 \mu$ long; amb. goniotreme; ora crassimarginate; exine psilate or scabrate, 1-2 μ thick; sexine as thick as or thicker than nexine, striate-reticulate, with LO- or indistinct-pattern.

Key to genera

1. Pores connected with thickened streaks of sexine..... *Alnus*
1. Pores unconnected with thickened streaks of sexine..... *Carpinus*

Alnus japonica (Thunb.) Steud. 槲櫟赤楊—Fig. 12-1

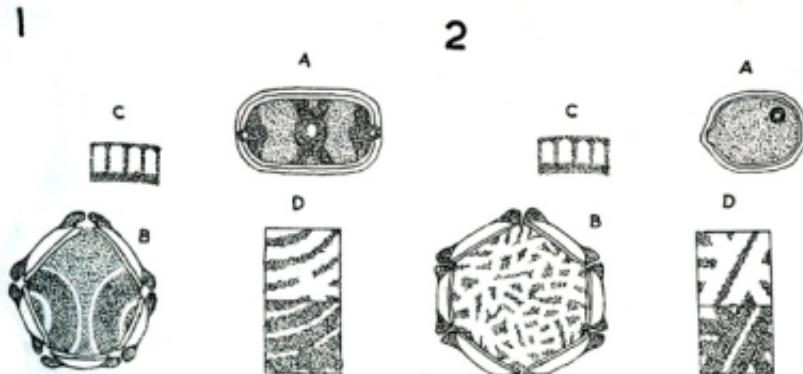


Fig. 12. Betulaceae, $\times 1000$. 1. *Alnus japonica* (Thunb.) Steud. (Polar view, Huang 1944; equatorial view and others, Yamamoto s.n. Oct. 1929.) 2. *Carpinus rankanensis* Hayata (equatorial view, Fukuyama 4423; polar view and others, Suzuki 89613)

Grains 4-5-porate, oblate, with P axes of 15μ long, and with E axes of 25μ long; amb goniotreme; equatorial diameter $(14-)18-20(-23)\mu$ wide in polar view; pores connected with thicker streaks of sexine; exine scabrate.

The vouchers are Taipei, NTU, Huang 1944; Taityu, Yamamoto s.n. Oct. 1929. *Carpinus rankanensis* Hayata 蘭那千金榆—Fig. 12-2

Grains 3-6-porate, suboblate to oblate-spheroidal, with P axes of $23-28\mu$ long, and with E axes of $25-33\mu$ long; amb goniotreme, equatorial diameter $25-28(-30)\mu$ wide in 3 porate grains, $25-28\mu$ wide in 4 porate grains, $26-28\mu$ wide in 5 porate grains, and 28μ wide in 6 porate grains; ora crassimarginate; exine psilate.

The vouchers are Taipei, Suzuki T. 18183, 859613; Hualien (Kwarenko), Fukuyama 4423.

11. BIGNONIACEAE 柿蔴科

Pollen grains are characterized by 3-colpate: shape classes of P/E prolate to oblate-spheroidal, or oval, with P axes of $12-38\mu$ long, and with E axes of $11-35\mu$ long; colpi nearly as long as the length of P axes, crassimarginate; exine scabrate, $2-2.5\mu$ thick; sexine thicker than nexine, with OL-pattern.

Key to genera

- 1. Grains small, $12-18\times 11-17\mu$ long; sexine reticulate..... *Tecoma*
- 1. Grains large, $28-38\times 25-35\mu$ long; sexine granulate..... *Radermachia*

Radermachia sinica (Hance) Hemsl. 山茶豆—Fig. 13-1

Grains with P axes of $28-38\mu$ long, and with E axes of $25-35\mu$ long; amb peritreme, or circular; exine 2.5μ thick; sexine granulate.

The voucher is Taipei, Sasaki s.n. Aug. 1923.

Tecoma jasminoides Lindl. 得克馬樹—Fig. 13-2

Grains with P axes of $(12-)17-18\mu$ long, and with E axes of $11-17\mu$ long; amb

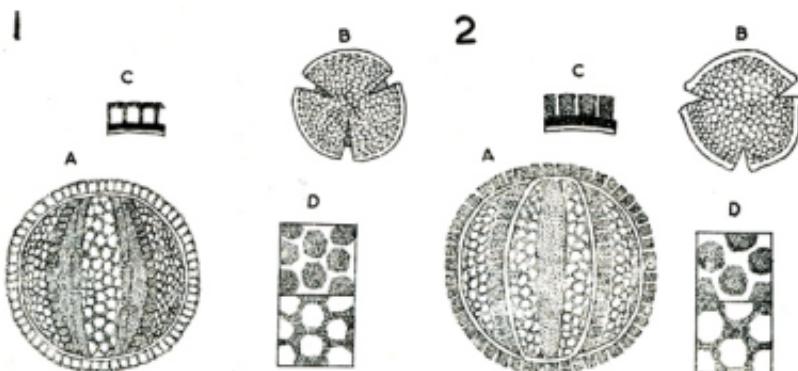


Fig. 13. Bignoniaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Radermachia sinica* (Hance) Hemsl. (Sasaki s.n. Aug. 1923). 2. *Tecoma jasminoides* Lindl. (Km s.n. Feb. 1945)

peritreme to ptychotreme, or intersubangular; exine $2\ \mu$ thick, reticulate.

The voucher is Taipei, Kao s.n. Feb. 1945.

12. BOMBACACEAE 木棉科

Pollen grains are characterized by 3-colporate; shape class of P/E prolate to oblate, or oval, with P axes of $23\text{--}42\ \mu$ long, and with E axes of $48\text{--}60\ \mu$ long; amb pleurotreme, or intersubangular; colpi crassimarginate; ora longolobate, colpi transversales-equatoriales; exine semitectate, gemmate, $1\text{--}2\ \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Bombax malabaricum DC. 木棉樹—Fig. 14

The vouchers are Ban Shi Ryo, Kawakami 16550; Taipei Bot. Gard. Sasaki 16552.

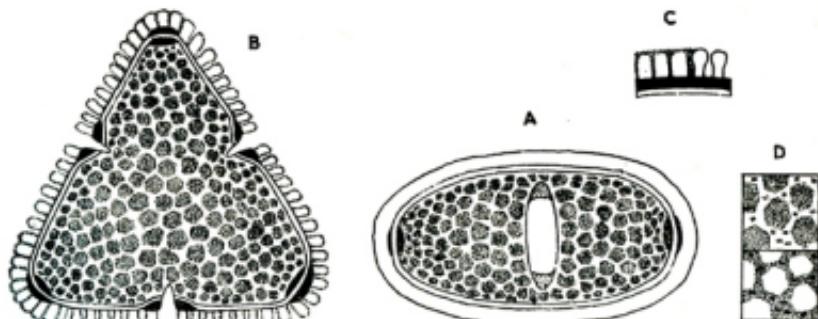


Fig. 14. *Bombax malabaricum* DC. (Kawakami 16550), $\times 1000$

13. BUXACEAE 黃楊科

Pollen grains are characterized by pantoporate; shape classes of P/E spheroidal, or ellipsoidal to oval, with longest diameter $20\text{--}51\ \mu$ wide; exine scabrate to clavate, $1\text{--}3.5\ \mu$ thick; sexine thicker than nexine, reticulate or crotonoid, with OL-pattern.

Key to genera

1. Grains large, usually $38\text{--}40\ \mu$ long in diameter; exine clavate;
sexine crotonoid *Pachysandra*
 1. Grains small, usually $26\text{--}30\ \mu$ long in diameter; exine scabrate;
sexine reticulate *Buxus*
- Buxus microphylla* Sieb. & Zucc. var. *intermedia* (Kanehira) Li 黃楊—Fig. 15-1
Grains with longest diameter (20--) $26\text{--}30\text{--}(37)\ \mu$ long; exine scabrate, $1\text{--}2\ \mu$ thick;
sexine as thick as or thicker than nexine, reticulate.
The vouchers are Taipei, NTU, Huang 1945, Lin s.n. 1939, s.n. 1940; Yanming-shan, Kao s.n. Feb. 1955; Mt. Ali, Sasaki s.n. Jan. 1911.
- Pachysandra axillaris* Franch. var. *tricarpa* Hayata 臺灣富貴草—Fig. 15-2

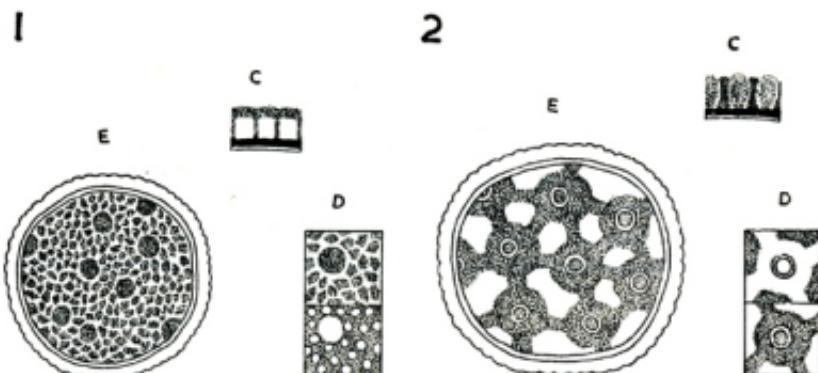


Fig. 15. Buxaceae, $\times 1000$. 1. *Buxus microphylla* Sieb. & Zucc. var. *intermedia* (Kanchira) Li (Lin & n. 1939). 2. *Pachysandra axillaris* Franch. var. *tricarpa* Hayata (Mori 15006).

Grains with longest diameter (31-)38-40(-51) μ wide; exine clavate, 3-3.5 μ thick, the pila 2-2.5 μ long; sexine thicker than nexine, crotonoid.

The voucher is Tonkarankei, Mori 15006.

14. CAMPANULACEAE 紫草科

Pollen grains are characterized by 3-colporate, pantoporate or pantocolpate; shape classes of P/E oblate to subprolate, with P axes of 13-45 μ long, and with E axes of 15-47 μ long, or 33-50 μ wide in equatorial diameter; amb peritreme to goniotreme; ora colpi transversales-circulares; exine echinate or psilate, 1-2 μ thick; sexine thicker than nexine, granulate, with LO-pattern.

Key to genera

1. Grains pantoporate or pantocolpate
 2. Apertures 6-7-furrows..... *Codonopsis*
 2. Apertures 4-6-pores
 3. Exine psilate or with caducous spines..... *Peracarpa*
 3. Exine echinate
 4. Pores 4-6 μ wide in diameter..... *Adenophora*
 4. Pores 3-4 μ wide in diameter..... *Wahlenbergia*
 1. Grains 3-colporate
 5. Grains small, 13-19 μ long in P axes and 15-19 μ long in E axes.. *Sphenoclea*
 5. Grains large, 20-36 μ long in P axes and 18-42 μ long in E axes.. *Campanumoea*

Adenophora Fisch. 沙參屬

Grains 4(-5)-porate, oblate or spheroidal, with longest equatorial diameter 33-50 μ wide in polar view; amb peritreme; pores 2-3 μ wide, crassimarginate, the annulus 4-6 μ wide in diameter; exine echinate, 1.5-2 μ thick; sexine thicker than nexine, punctate, with LO-pattern.

Adenophora morrisonensis Hayata 玉山沙參—Fig. 16-3

Grains 4(-5)-porate, with longest equatorial diameter (34-)38-40(-42) μ long.

The vouchers are Taityu, Sasaki s. n. 1923; Niitaka, Simada 920, Sasaki 380588,

Adenophora triphylla A. DC. 三出葉沙參

Grains 4-porate, with longest equatorial diameter (35-)40-45(-50) μ wide.

The vouchers are Ilan, Suzuki 5090; Taityu, Suzuki T. 18485; Noko, Sasaki s. n. Aug. 1929; Nantou, Kao 5738; Kwarenko, Suzuki T. 16245.

Adenophora uehatae Yamamoto 臺灣沙參

Grains 4-porate, with longest equatorial diameter (33-)35-40(-43) μ wide.

The voucher is Noko, Suzuki T. 2200.

Campanumoea lanceifolia Merr. 臺灣金錢豹—Fig. 16-6

Grains 3-colporate, oblate to suboblate, with P axes of 25-30 μ long, and with E axes of (32-)34-36(-40) μ long; amb peritreme to goniotreme, or circular to semiangular; colpi short; ora colpi transversales-circulares; exine echinate, 2 μ thick, the spinules 1.5-2 μ long; sexine as thick as or thinner than nexine, granulate, with LO-pattern.

The vouchers are Nankotaizan, Sasaki s. n. July 1922; Hualien, Liu et al. s. n. Aug. 1956.

Codonopsis kawakamii Hayata 臺灣黨參—Fig. 16-1

Grains 6-7-colporate, oblate to prolate-spheroidal, with P axes of 28-45 μ long, and with E axes of 35-47 μ long; amb goniotreme to peritreme; colpi long; exine minutely echinate, 1.5-2 μ thick; sexine as thick as or thinner than nexine, granulate, with LO-pattern.

The vouchers are Taichun (Taityu), Sasaki s. n. Aug. 1929; Noko, Sasaki s. n. Aug. 1929; Mt. Niitaka, Sasaki s. n. Aug. 1935.

Peracarpa carnosa Hook. f. & Thoms. 蓼狀果草—Fig. 16-2

Grains 4-6-porate, suboblate, with longest equatorial diameter 30-36 μ wide in polar view; amb peritreme, or circular; pores 1.5 μ wide, crassimarginate, the annulus 4 μ wide in diameter; exine psilate, 1-2 μ thick or with caducous spines; sexine thicker than nexine, granulate, with LO-pattern.

The vouchers are Taiheizan, Sasaki s. n. Apr. 1930; Kwarenko, Tarokotaizan, Sasaki s. n. June 1933.

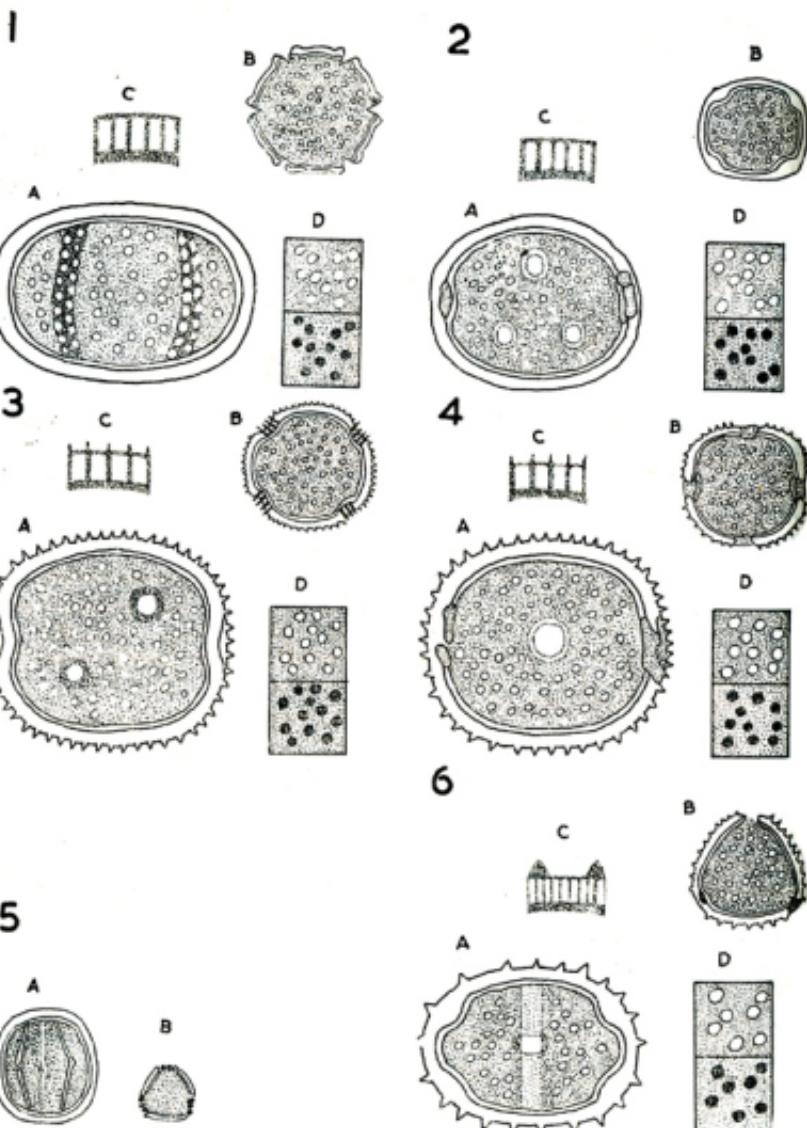
Sphenoclea zeylanica Gaertn. 橢狀果草—Fig. 16-5

Grains 3-colporate, subprolate to suboblate, with P axes of 13-19 μ long, and with E axes of 15-19 μ long; amb peritreme to goniotreme, or circular to semiangular; colpi long; ora colpi transversales-circulares; exine psilate, 1 μ thick; sexine thicker than nexine, very finely granulate, with obscure-pattern.

The vouchers are Chiayi, Yamamoto 317; Tainan, Morimoto 460.

Wahlenbergia gracilis Schrad. 細葉沙參—Fig. 16-4

Grains 4-porate, oblate to spheroidal, with longest equatorial diameter (35-)38-



$40(-43)\mu$ wide in polar view; amb peritreme; pores $2-3\mu$ wide, crassimarginate, the annulus $3-4\mu$ wide in diameter; exine echinate, 2μ thick, the spinulose 2μ long; sexine thicker than nexine, granulate, with LO-pattern.

The vouchers are Taiheizan, Huang 3948; Taipei, Sasaki s.n. Apr. 1918; Taityu, Suzuki S. 6324; Yaeyama, Masamune 1754.

15. CAPRIFOLIACEAE 蔷薇科

Pollen grains are characterized by 3(-4)-porate; shape classes of P/E oblate to subprolate, with P axes of $16-63\mu$ long, and with E axes of $10-80\mu$ long; amb goniortreme, peritreme to ptychotreme; ora usually colpi transversales-equatoriales; exine scabrate, gemmate, baculate to echinate, $1-5\mu$ thick; sexine thicker than nexine, granulate to reticulate, usually with LO-pattern.

Key to genera

1. Apertures brevicolpate
 2. Exine with infrategilliar bacular..... *Lonicera*
 2. Exine without infrategilliar bacular..... *Abelia*
1. Apertures longicolpate
 2. Amb goniortreme..... *Sambucus*
 2. Amb ptychotreme..... *Viburnum*

Abelia ionandra Hayata 鹽櫛榧木條—Fig. 17-1

Grains 3(-4)-porate, spheroidal to oblate, with P axes of $40-52\mu$ long, and with E axes of $47-57\mu$ long; amb peritreme, or circular; colpi very short; ora colpi transversales-equatoriales to colpi transversales; exine echinate, $4-5\mu$ thick; sexine thicker than nexine, granulate, with LO-pattern.

The vouchers are Hualien, Sasaki s.n. Aug. 1929, Nakamura 3654; Kiirun, Masamune et al. 118.

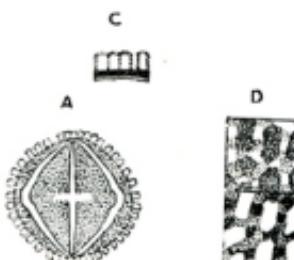
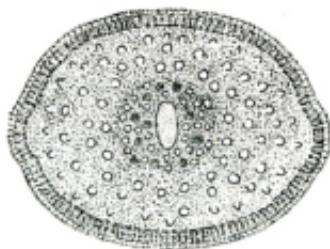
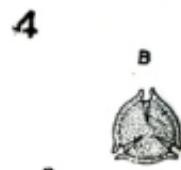
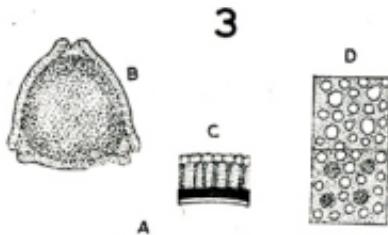
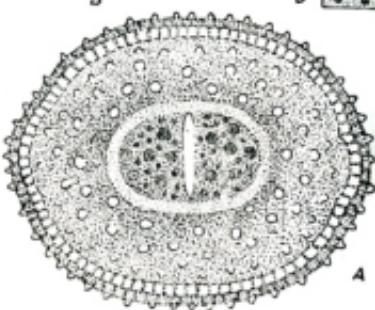
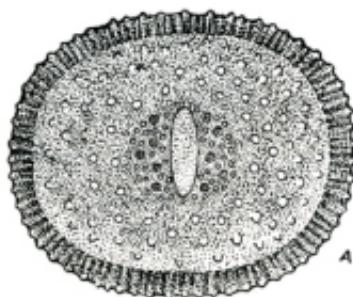
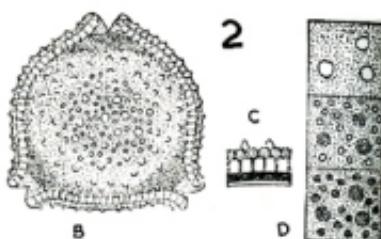
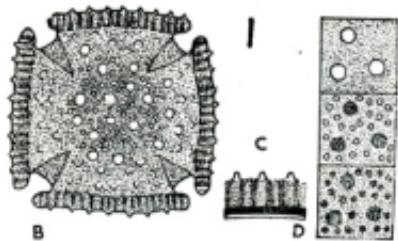
Lonicera L. 金銀花屬

Grains 3-colporate, oblate to spheroidal, with P axes of $33-63\mu$ long, and with E axes of $40-80\mu$ long; amb goniortreme, or semiangular to subangular; apertures brevicolpate, as long as the width of ora; exine echinate to scabrate, $2-3\mu$ thick; sexine thicker than nexine, granulate, with LO-pattern.

Key to species of *Lonicera*

1. Exine scabrate..... *L. kawakamii*
1. Exine baculate to echinate
 2. Ora colpi transversales..... *L. japonica*
 2. Ora colpi transversales equatoriales..... *L. acuminata*, *L. hypoglauca*

Fig. 16. Campanulaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Codonopsis kawakamii* Hayata (Sasaki s.n. Aug. 1935). 2. *Peracarpa carnosissima* Hk. f. & Thoms. (Sasaki s.n. Apr. 1930). 3. *Adenophora morrisonensis* Hayata (Sasaki s.n. Dec. 1923). 4. *Wahlenbergia gracilis* Schrad. (Huang 9948). 5. *Sphenocephala zeylanica* Gaertn. (Yamasita 317). 6. *Campanumoea lancifolia* Merr. (Sasaki s.n. July 1922).



Lonicera acuminata Wall. 銳葉金銀花

Grains spheroidal to oblate, with P axes of 48–63 μ long, and with E axes of 50–67 μ long; ora colpi transversales-equatoriales; exine echinate to baculate, 3 μ thick.

The vouchers are Mt. Taiheizan, Liu s.n. June 1955; Suzuki 917; Mt. Ali, Chuan & Kao s.n. July 1957.

Lonicera hypoglauca Miq. 紅星金銀花

Grains oblate-spheroidal to oblate, with P axes of (33–)40–42(–50) μ long, and with E axes of (50–)54–60(–62) μ long; ora colpi transversales-equatoriales; exine baculate, 3 μ thick.

The vouchers are Taipei, Tanaka et al. 11005; Sozan, Kudo et al. 3324.

Lonicera japonica Thunb. 毛金銀花—Fig. 17-2

This species differs from the former by having P axes of (40–)50–52(–55) μ long, and with E axes of (55–)63–65(–80) μ long, and ora colpi transversales.

The vouchers are Taipei, Simizu 64, Masamune 2767; Sintikusyu, Simizu s.n. Oct. 1934.

Lonicera kawakamii (Hayata) Masamune 川上氏忍冬—Fig. 17-3

Grains oblate-spheroidal to oblate, with P axes of 35–40 μ long, and with E axes of 42–50 μ long; ora colpi transversales-circulares; exine scabrate, 2 μ thick.

The voucher is Taipei, Suzuki T. 17399.

Sambucus formosana Nakai 有骨清—Fig. 17-4

Grains 3-colporate, subprolate to oblate-spheroidal, with P axes of (20–)23–26 μ long, and with E axes of (14–)15–20(–23) μ long; amb peritreme to ptychotreme; apertures long, nearly as long as the length of P axes; ora colpi transversales-equatoriales; exine intectate, gemmate, 1–1.5 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Shoka, Morimoto 51; Tamsui, Ku 426, Huang 3371.

Viburnum L. 茄蒼屬

Grains 3-colporate, prolate to oblate-spheroidal, with P axes of 16–30 μ long, and with E axes of 10–30 μ long; amb usually ptychotreme; colpi long, nearly as long as the length of P axes; exine gemmate to scabrate, 1–3 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Key to species of Viburnum

1. Ora colpi transversales-circulares..... *V. taiwanianum*
1. Ora colpi transversales-equatoriales..... *V. foetidum rectangulatum*, *V. lacovicum formosanum*, *V. odoratissimum*, *V. propinquum*.

Viburnum foetidum Wall. var. **rectangulatum** (Graebner) Rehder 玉山櫻米樹

Grains subprolate to oblate-spheroidal, with P axes of (16–)20–21(25) μ long,

Fig. 17. Caprifoliaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Abelia ionandra* Hayata (Sasaki s.n. Aug. 1929). 2. *Lonicera japonica* Thunb. (Masamune 2767). 3. *Lonicera kawakamii* (Hayata) Masamune (Suzuki T. 17399). 4. *Sambucus formosana* Nakai (Morimoto 511).

and with E axes of (10-)17-20(-22) μ long; amb peritreme, or circular; ora colpi transversales-equatoriales; exine gemmate, 2 μ thick.

The vouchers are Taipei, Suzuki T. 7016; Chiayi, Mt. Ali, Jan. & Kao s.n. July 1957; Niitakayama, Suzuki T. 19349.

Viburnum luzonicum Rolfe var. **formosanum** (Hance) Rehder 紅子仔

Grains prolate to prolate-spheroidal, with P axes of (17-)20-22(-28) μ long, and with E axes of (11-)15-20(-22) μ long; amb peritreme to ptychotreme; ora colpi transversales-equatoriales; exine scabrate to gemmate, 1-1.5 μ thick.

The vouchers are Ilan, Chuang et al. 2447; Taipei, Shimizu 2081, Kao 45, Chuang et al. s.n. Apr. 1961, Keng 1006, Simada 356; Taichung, Chuang 2487; Hualien, Shimizu et al. 11988; Subon, Matsuda s.n. Jan. 1916.

Viburnum odoratissimum Ker-Gawl. 烏頭樹—Fig. 18-1

Grains spheroidal, with P axes of 25-30 μ long, and with E axes of 25-30 μ long; amb peritreme, pleurotreme to ptychotreme, or circular, intersemicircular to intersubangular; exine scabrate, 3 μ thick.

The sporoderm of the two collections is quite different.

The vouchers are Taipei, Suzuki T. 7007; Nantou, Huang et al. 799.

Viburnum parvifolium Hayata 小葉莢蒾

Grains prolate-spheroidal, with P axes of 22-28 μ long, and with E axes of 20-22 μ long; amb peritreme, or circular; ora colpi transversales-equatoriales; exine gemmate, 2 μ thick.

The voucher is Nantou, Soon Kan, Huang 4634.

Viburnum propinquum Hemsl. in Forb. & Hemsl. 高山莢蒾

Grains subprolate to spheroidal, with P axes of (20-)22-24(-30) μ long, and with E axes of (14-)16-19(-27) μ long; amb peritreme to ptychotreme, or circular to

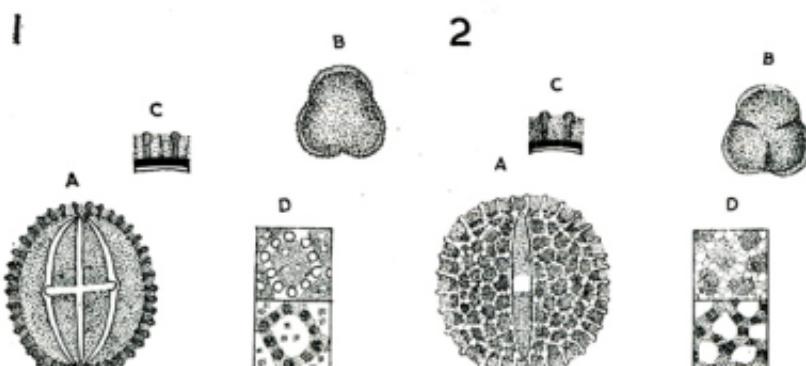


Fig. 18. Caprifoliaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Viburnum odoratissimum* Ker-Gawl. (Huang et al. 799). 2. *Viburnum taiwanianum* Hayata (Chuang 2503).

intersubangular; ora colpi transversales-equatoriales; exine scabrate to gemmate, $2\text{--}3\ \mu$ thick.

The vouchers are Taitun, Shimizu 3848; Chikutou, Suzuki T. 20312; Hualien, Shimizu et al. 11746.

Viburnum taiwanianum Hayata 臺灣美連—Fig. 18-2

Grains subprolate to spheroidal, with P axes of $(22)\text{--}27\text{--}28(\text{--}30)\ \mu$ long, and with E axes of $19\text{--}26(\text{--}28)\ \mu$ long; amb peritreme to ptychotreme, or circular to intersubangular; ora colpi transversales-circulares; exine scabrate to gemmate, $2\text{--}3\ \mu$ thick.

The vouchers are Ilan, Chuang et al. 2469; Taichung, Chuang 2503, Chuang et al. 2743.

16. CASUARINACEAE 木麻黃科

Pollen grains are characterized by 3-porate; shape classes of P/E oblate to spheroidal, with P axes of $19\text{--}30\ \mu$ long, and with E axes of $21\text{--}35\ \mu$ long; amb goniotreme, or angular; ora crassimarginate; exine psilate, $1\text{--}2\ \mu$ thick; sexine thicker than nexine, granulate, with LO-pattern.

Casuarina equisetifolia L. 木麻黃

Grains with P axes of $(19)\text{--}22\text{--}26(\text{--}30)\ \mu$ long, and with E axes of $(21)\text{--}24\text{--}31(\text{--}35)\ \mu$ long.

The voucher is Tainan, Mori 3216.

Casuarina huuegeliana Miq. in Lehm. 虎氏木麻黃—Fig. 19

Grains with P axes of $21\text{--}25\ \mu$ long, and with E axes of $22\text{--}30\ \mu$ long.

The voucher is Peikan, Keng 72.

17. COMBRETACEAE 使君子科

Pollen grains are characterized by 3- or 6-colporate; shape classes of P/E

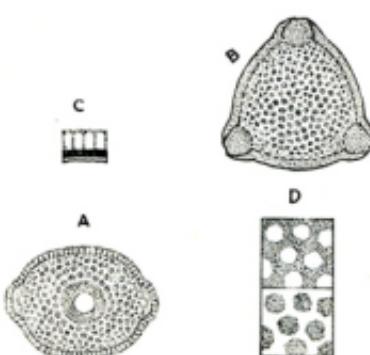


Fig. 19. *Casuarina huuegeliana* Miq. in Lehm. (Keng 72), $\times 1000$.

subprolate to suboblate, with P axes of 19–47 μ long, and with E axes of 16–49 μ long; amb rounded hexagonal, or pleurotreme ?; colpi long; exine psilate, 1–1.5 μ thick; sexine thicker than nexine, reticulate to granulate, with OL-pattern.

Key to genera

1. Grains 6-colporate; ora colpi transversales-equatoriales *Lumnitzera*
1. Grains 3-colporate; ora colpi transversales to colpi transversales-circulares
 2. Ora crassimarginata; grains large, 38–47 \times 42–49 μ long *Quisqualis*
 2. Ora uncrassimarginata; grains small, 19–25 \times 16–24 μ long *Terminalia*

***Lumnitzera racemosa* Willd.** 檳榔—Fig. 20-1

Grains 6-colporate, prolate-spheroidal to subprolate, with P axes of 20–25 μ

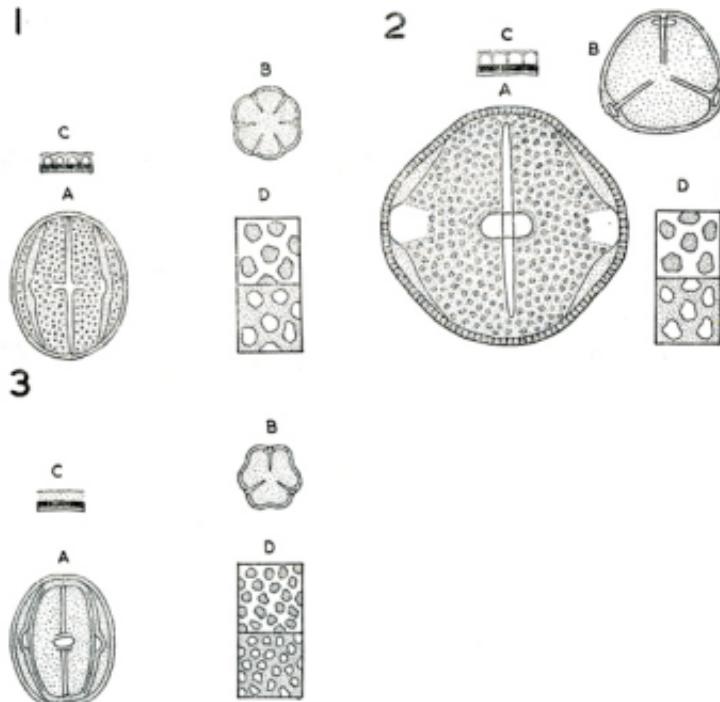


Fig. 20. Combretaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Lumnitzera racemosa* Willd. (Chang 2228). 2. *Quisqualis indica* L. (Sasaki s. n. Aug. 1928). 3. *Terminalia catappa* L. (Matsuda 1373).

long, and with E axes of $17-22\ \mu$ long; amb pleurotreme?, or rounded hexagonal; ora colpi transversales-equatoriales; exine $1-1.5\ \mu$ thick; sexine reticulate.

The voucher is Kaoshiung, Chang 2228.

Quisqualis indica L. 使君子—Fig. 20-2

Grains 3-colporate, prolate-spheroidal to suboblate, with P axes of $38-47\ \mu$ long, and with E axes of $42-49\ \mu$ long; amb peritreme, or semiangular; ora costae transversales to costae circulares, crassimarginate; exine $1\ \mu$ thick; sexine reticulate.

The vouchers are Taipei, Sasaki s.n. Aug. 1928, Masamune 2597.

Terminalia catappa L. 櫟仁—Fig. 20-3

Grains 3-colporate, subprolate to oblate-spheroidal, with P axes of $19-25\ \mu$ long, and with E axes of $16-24\ \mu$ long; amb peritreme, or circular to rounded hexagonal; ora colpi transversales to colpi transversales-circulares; exine $1\ \mu$ thick; sexine reticulate to granulate.

The vouchers are Takao, Matuda 1373, Sasaki s.n. March 1932.

18. CONNARACEAE 牛拳藤科

Pollen grains are characterized by 3-colporoidate; shape classes of P/E prolate to prolate-spheroidal, or oval, with P axes of $20-25\ \mu$ long, and with E axes of $16-22\ \mu$ long; amb peritreme to goniotreme, or circular to semiangular; ora colpi transversales-circulares; exine scabrate, $1\ \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Rourea minor (Gaertner) Leenhouts 牛拳藤—Fig. 21

The vouchers are Lu-tao, Chuang 4034; Botel Tabago, Chuang 2371, 3056.

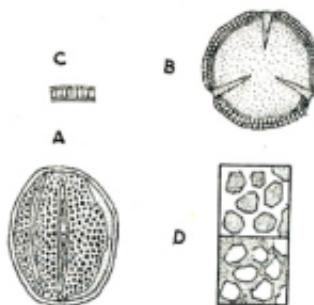


Fig. 21. *Rourea minor* (Gaertner) Leenhouts
(Chuang 4034), $\times 1000$

19. CORIARIACEAE 馬桑科

Pollen grains are characterized by 3-porate; shape classes of P/E suboblate to oblate-spheroidal, with P axes of $20-25\ \mu$ long, and with E axes of $25-27\ \mu$ long; amb peritreme, or circular; ora crassimarginate, $3\ \mu$ wide in diameter; exine psilate,

$1\ \mu$ thick; sexine thicker than nexine, granulate, with obscure pattern.

Coriaria intermedia Matsumura 臺灣馬桑—Fig. 22

The voucher is Buizan, Matuda 1200.

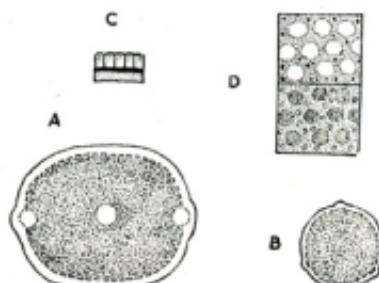


Fig. 22. *Coriaria intermedia* Matsumura (Matuda 1200), equatorial view $\times 1000$, polar view $\times 500$.

20. CORNACEAE 山茱萸科

Pollen grains are characterized by 3-colporiate, or 3-colporoidate; shape classes of P/E oblate-spheroidal to prolate, with P axes of $18\text{--}56\ \mu$ long, and with E axes of $15\text{--}44\ \mu$ long; amb peritreme, goniotreme or ptychotreme; colpi usually as long as the length of P axes; exine psilate or gemmate; sexine granulate, with obscure-or LO-pattern.

Key to genera

1. Grains 3-colporoidate or 3-colporate..... *Helwingia*
1. Grains 3-colporate
 2. Exine gemmate; colpi and ora uncrassimarginate; sexine reticulate to very coarsely granulate *Aucuba*
 2. Exine psilate; colpi and ora crassimarginate; sexine very finely granulate or obscure..... *Cornus*

Aucuba chinensis Benth. 桃葉珊瑚—Fig. 23-1

Grains 3-colporate or 3-colporoidate; shape classes of P/E oblate spheroidal to subprolate, with P axes of $35\text{--}45\ \mu$ long, and with E axes of $31\text{--}42\ \mu$ long; amb peritreme, or open circular to semiangular; colpi nearly as long as the length of P axes; ora transversales-circulares; exine semitectate, gemmate, $3\ \mu$ thick; sexine as thick as or thinner than nexine, very coarsely granulate to reticulate, with LO-pattern.

The voucher is Taichung, Liu et al. s.n. Oct. 1957.

Cornus L. 紫莖樹屬

Grains 3-colporate, oblate-spheroidal to prolate, or oval to rhomboidal, with P

axes of $22-56\ \mu$ long, and with E axes of $22-44\ \mu$ long; amb goniotreme, ptychotreme to peritreme, or open circular, subangular, semiangular to semilobate; colpi crassimarginate, a little shorter than the length of P axes; ora costae-equatoriales, or pseudo-H-shaped; exine psilate, $1-1.5\ \mu$ thick; sexine as thick as or thicker than nexine, costae-circulares, transparent to obscurely granulate, with indistinct-or obscure LO-pattern.

Key to species of *Cornus*

1. Grains large, $37-56\times 38-44\ \mu$ long; ora costae-circulares.....*C. macrophylla*
1. Grains small, $22-27\times 22-24\ \mu$ long; ora costae-equatoriales

***Cornus kousa* Buerger ex Miq.** 小葉潤臺灣—Fig. 23-2

Grains oblate-spheroidal to subprolate, with P axes of $22-27\ \mu$ long, and with E axes of $22-24\ \mu$ long.

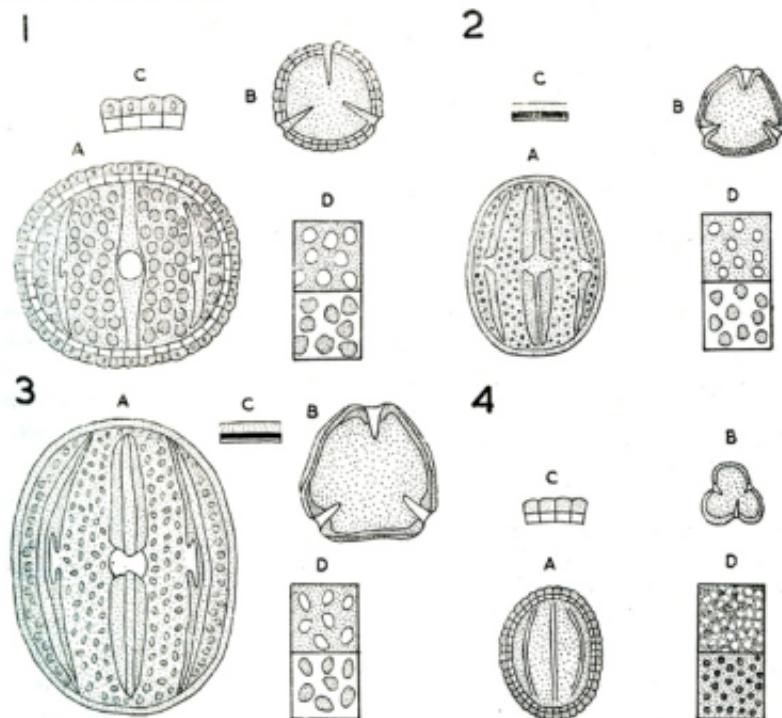


Fig. 23. Cornaceae, $\times 1000$. 1. *Ancuba chinensis* Benth. (*Sasaki s. n.*, Dec. 1930). 2. *Cornus kousa* Buerger ex Miq. (*Nakamura 6175*). 3. *Cornus macrophylla* Wall. (*Kanehira s. n.*, May 1923). 4. *Helwingia chinensis* Batal. (*Sasaki s. n.*, March 1931).

The voucher is Kwarenko, Nakamura 6175.

Cornus macrophylla Wall. 大葉糙臺樹—Fig. 23-3

Grains oblate-spheroidal to prolate-spheroidal, with P axes of $37\text{--}56\ \mu$ long, and with E axes of $38\text{--}44\ \mu$ long.

The vouchers are Kwarenko, Sasaki s. n. May 1919; Tabiras, Kanekura s. n. May 1923.

Helwingia chinensis Batal. 臺灣青黃葉—Fig. 23-4

Grains 3-colporoidate or 3-colporate, prolate-spheroidal, or oval, with P axes of $18\text{--}22\ \mu$ long, and with E axes of $15\text{--}17\ \mu$ long; amb peritreme to ptychotreme, or open circular; colpi $2/3$ long as the length of P axes; exine psilate, $2\ \mu$ thick; sexine nearly as thick as nexine, granulate, LO- or obscure-pattern.

It is near to *Cornus kousa* except colporate or colporoidate aperture and uncrassimarginate colpi.

The voucher is Taiheizan, Sasaki s. n. March 1931.

21. CRASSULACEAE 景天科

Pollen grains are characterized by 3(-4)-colporate, with P axes of $16\text{--}32\ \mu$ long, and with E axes of $13\text{--}28\ \mu$ long; exine psilate, $1\ \mu$ thick or less than $1\ \mu$ thick; sexine thicker than nexine, granulate, with OL- or indistinct-pattern.

Key to genera

1. Amb ptychotreme; ora colpi transversales-equatoriales.....*Bryophyllum*
1. Amb peritreme to goniotreme; ora colpi transversales-circulares to colpi transversales
 2. Grains small, $16\text{--}25\times 13\text{--}20\ \mu$ long.....*Sedum*
 2. Grains large, $27\text{--}32\times 24\text{--}28\ \mu$ long.....*Kalanchoe*

***Bryophyllum calycinum* Salisb.** 落地生根—Fig. 24-1

Grains 3-colporate; shape classes of P/E subprolate, with P axes of $20\text{--}25\ \mu$ long, and with E axes of $16\text{--}20\ \mu$ long; amb ptychotreme; ora colpi transversales-equatoriales.

The voucher is Ilan, Kawakami 11138.

***Kalanchoe spathulata* DC.** 小燈籠草—Fig. 24-2

Grains 3-colporate; shape classes of P/E subprolate to prolate-spheroidal, with P axes of $27\text{--}32\ \mu$ long, and with E axes of $24\text{--}28\ \mu$ long; amb peritreme to goniotreme; colpi transversales to colpi transversales-circulares.

The vouchers are Buizan, Matuda 904; Chiayi, Feung & Kao 4950.

***Sedum* Tourn. ex L.** 佛甲草屬

Grains 3(-4)-colporate; shape classes of P/E subprolate to suboblate, with P axes of $16\text{--}25\ \mu$ long, and with E axes of $13\text{--}20\ \mu$ long; amb peritreme to goniotreme; ora colpi transversales-circulares to colpi transversales.

***Sedum arisanensis* Yamamoto** 阿里山佛甲草

Grains 3-colporate, subprolate to spheroidal, with P axes of $18\text{--}25\mu$ long, and with E axes of $16\text{--}19\mu$ long; amb peritreme; ora colpi transversales to colpi transversales-circulares; sexine striate-granulate.

The vouchers are Taihokusyu, Suzuki T. 7526; Mt. Taihasenzan, Hosokawa 2490. *Sedum formosanum* N. E. Br. 臺灣佛甲草—Fig. 24-3

Grains 3-colporate, subprolate to suboblate, with P axes of $16\text{--}22\mu$ long, and with E axes of $13\text{--}20\mu$ long; amb goniotreme to peritreme; ora colpi transversales to colpi transversales-circulares; sexine reticulate-granulate.

The vouchers are Taipei, Simada 1218, Suzuki T. 19329.

Sedum morrisonense Hayata 玉山佛甲草—Fig. 24-4

Grains 3(-4)-colporate, subprolate to prolate-spheroidal, with P axes of $17\text{--}22\mu$ long, and with E axes of $14\text{--}20\mu$ long; amb peritreme to goniotreme; ora colpi trans-

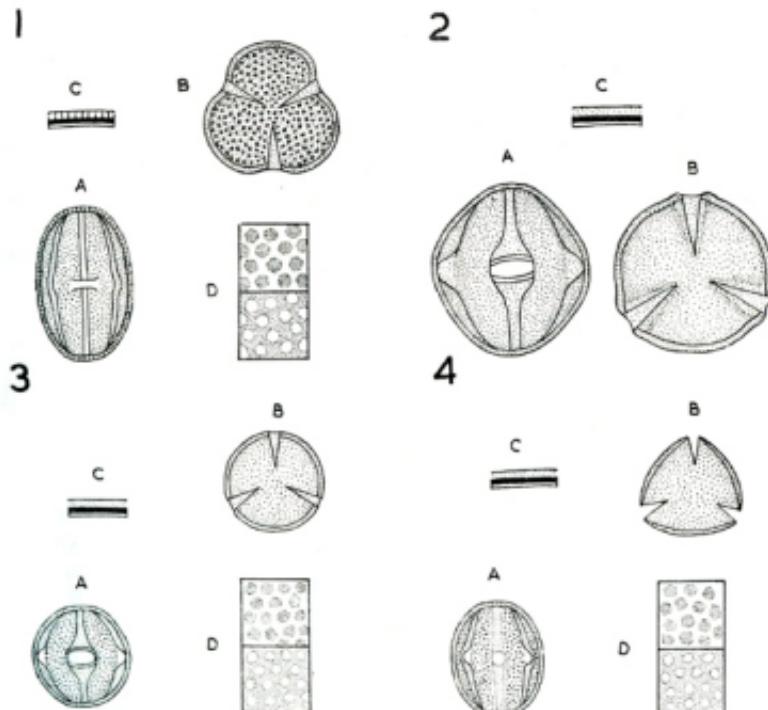


Fig. 24. Crassulaceae, $\times 1000$. 1. *Bryophyllum calycinum* Salisb. (Kuwakami 11138). 2. *Kalanchoe spathulata* DC. (Matuda 904). 3. *Sedum formosanum* N. E. Br. (Simoda 1218). 4. *Sedum morrisonense* Hayata (Huang 4559).

versales-circulares; sexine granulate.

The vouchers are Mt. Noko, *Kudo s.n.*; Mt. Pahsien, *Huang 1314*; Chiayi, Mt. Ali, *Huang 1779*, between Tung Pu to Pai Yun Shan Chuan, *Huang 4557, 4559*.

Sedum parvisepalum Yamamoto 小瓣花佛甲草

Grains 3-colporate, subprolate to spheroidal, with P axes of 17-21 μ long; and with E axes of 15-18 μ long; amb goniotreme to peritreme; colpi transversales to colpi transversales-circulares; sexine granulate.

The voucher is Taito, *Yamamoto 346*.

22. DAPHNIPHYLACEAE 交葉木科

Pollen grains are characterized by 3-colp(or)ate; shape classes of P/E perprolate to peroblate, or oval, with P axes of 10-24 μ long, and with E axes of 7-25 μ long; amb usually peritreme to goniotreme; ora usually obscure; exine psilate, 1 μ thick; sexine thicker than nexine, granulate, with OL-? or obscure-pattern.

The male gametophyte is dinucleate.

Daphniphyllum glaucescens Bl. subsp. **oldhamii** (Hemsl.) Huang 奧氏虎皮楠—Fig. 25-1

Grains subprolate to suboblate, with P axes of 18-24 μ long, and with E axes of 16-20 μ long; amb usually peritreme, rarely ptychotreme.

The vouchers are Koko, *Simada 1730B*; Ensorei, *Suzuki S. s.n.* Apr. 1929; Toyen, *Tanaka & Simada 1353I*; precise locality unknown, *Sasaki 1459I, Wilson 10207*.

Daphniphyllum himalaense (Benth.) Muell.-Arg. subsp. **macropodium** (Miq.) Huang 肉質虎皮楠—Fig. 25-2

Grains prolate to oblate, with P axes of 12-23 μ long, and with E axes of 15-25 μ long; amb usually goniotreme.

The vouchers are Mt. Ali, *Keng 1118*; Taihokusyu, *Suzuki T. 8806*.

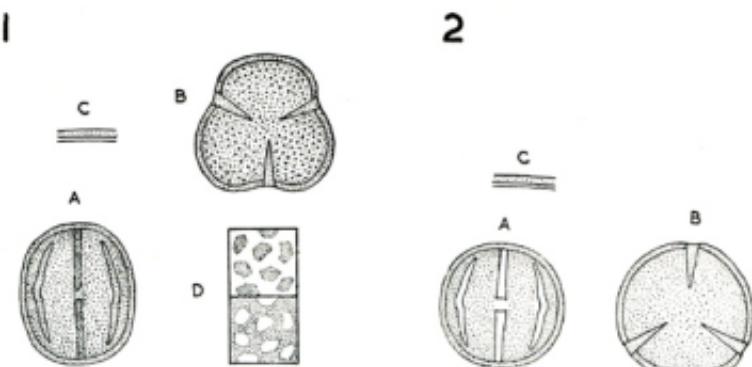


Fig. 25. Daphniphyllaceae, $\times 1000$. 1. *Daphniphyllum glaucescens* Bl. subsp. *oldhamii* (Hemsl.) Huang. (*Suzuki S. s.n.* Apr. 1929). 2. *Daphniphyllum himalaense* (Benth.) Muell.-Arg. subsp. *macropodium* (Miq.) Huang. (*Suzuki T. 8806*).

23. DIAPENSIACEAE 裂鱗花科

Pollen grains are characterized by 3-colporate; shape classes of P/E oblate to prolate, with P axes of 20–30 μ long, and with E axes of 15–30 μ long; amb peritreme, or circular; ora colpi transversales-circulares; exine psilate, 2 μ thick; sexine thicker than nexine, very finely reticulate, with LO-pattern.

Shortia exappendiculata Hayata 裂鱗花

Grains oblate to prolate, with P axes of (20–)22–24(–28) μ long, and with E axes of (15–)27–29(–30) μ long.

The vouchers are Taiheizan, Sasaki s. n. Sept. 1925; Kwarenko, Sasaki s. n. June 1933. *Shortia transalpina* Hayata 玉山裂鱗花—Fig. 26

Grains prolate to spheroidal, with P axes of (24–)27–28(–30) μ long, and with E axes of (15–)19–20(–28) μ long.

The vouchers are Mt. Tugitaka, Sasaki s. n. July 1932; Mt. Niitaka, Sasaki s. n. Sept. 1924.

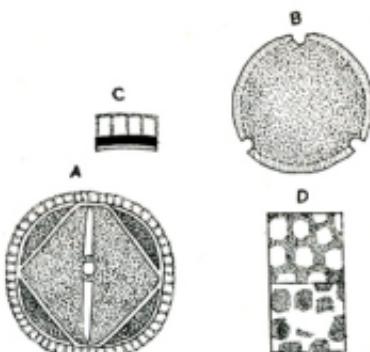


Fig. 25. *Shortia transalpina* Hayata
(Sasaki s. n. July 1932), $\times 1000$

24. DIPSACACEAE 蒜金花科

Pollen grains are characterized by 3-colporate; shape classes of P/E subprolate to oblate-spheroidal, or oval, with P axes of (65–)70–73(–74) μ long, and with E axes of (56–)60–61(–65) μ long; amb peritreme, or circular; exine echinate, 7–10 μ thick; sexine 2–3 times thicker than nexine, reticulate, with LO-pattern.

Scabiosa lacerafolia Hayata 裂葉襯被—Fig. 27

The voucher is Mt. Ali, Koushi s. n. July 1940.

25. DROSERACEAE 級斷科

Pollen grains are characterized by tetrad in tetrahedral or rhomboidal arrangement; tetrad diameter 30–57 μ wide; exine echinate to baculate, or verrucate, 2 μ

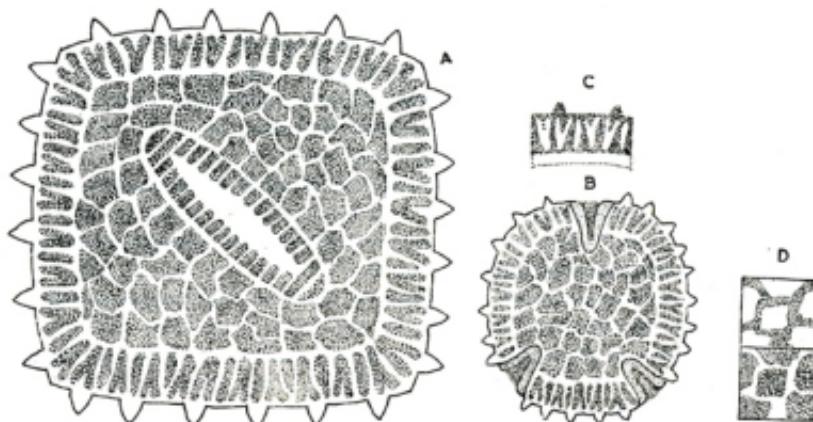


Fig. 27. *Scabiosa lacerifolia* Hayata (Koushi s. n. July 1940), equatorial view $\times 1000$, polar view $\times 500$.

thick, the spines 1-2 μ long; sexine thicker than nexine, with LO-pattern.

Drosera indica L. 長葉茅膏菜—Fig. 28

Grains 38-57 μ wide in tetrad diameter; exine echinate.

The vouchers are Toyen, Sasaki s. n. Nov. 1923, Simada 48; Sintikusyu, Kudo & Suzuki 164.

Drosera peltata Smith ex Willd. var. *lunata* Clarke 茅膏菜

Grains 30-40 μ wide in tetrad diameter; exine verrucate to baculate.

The vouchers are Toyen, Simada 1153; Sintikusyu, Suzuki T. 16436.

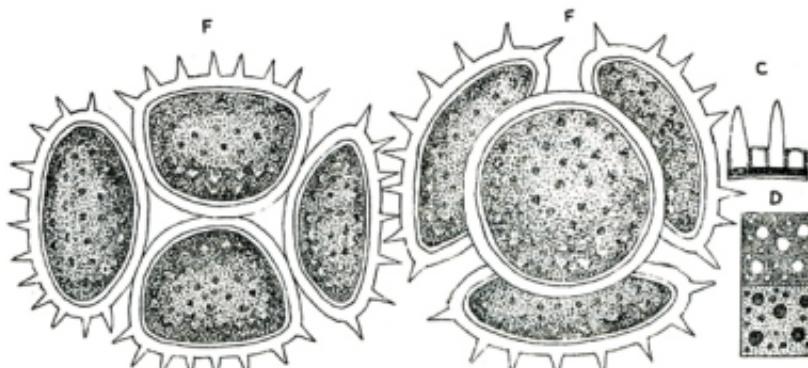


Fig. 28. *Drosera indica* L. (Sasaki s. n. Nov. 1923), $\times 1000$.

26. ELAEAGNACEAE 胡蘿子科

Pollen grains are characterized by 3-colporate; shape classes of P/E oblate, with P axes of 20-32 μ long, and with E axes of 33-46 μ long; amb goniostreme, or angular; ora costae circulares; exine psilate, 2 μ thick; sexine thicker than nexine, granulate, with OL-pattern.

Elaeagnus formosana Nakai 臺灣胡蘿子

Grains with P axes of 30 μ long, and with E axes of 33 μ long.

The voucher is Taipei, Sasaki s.n. Oct. 1923.

Elaeagnus glabra Thunb. 葵胡蘿子

Grains with P axes of 30-31 μ long, and with E axes of 40-45 μ long.

The vouchers are Taipei, Suzuki S. s.n. Dec. 1929, Shimizu 384.

Elaeagnus oldhami Maxim. 檳榔—Fig. 29

Grains with P axes of 20-32 μ long, and with E axes of 35-46 μ long.

The vouchers are Hsinchu, Chuang 3264; Taityu, Suzuki T. 21585, Sasaki s.n. Nov. 1922.

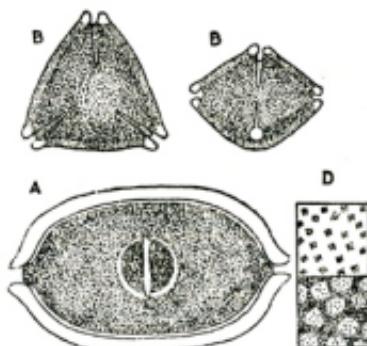


Fig. 29. *Elaeagnus oldhami* Maxim. (Chuang 3064, except 4-colporate, Sasaki s.n. Nov. 1922), equatorial view $\times 1000$, polar view $\times 500$.

27. ELAEOCARPACEAE 膨八樹科

Pollen grains are characterized by 3-colporate, or 3-colporoidate; shape classes of P/E prolate to oblate-spheroidal, with P axes of 8-15 μ long, and with E axes of 5-15 μ long; amb peritreme to ptychotreme, or circular to intersubangular; ora colpi transversales-equatoriales; exine psilate, 1 μ thick; sexine thicker than nexine, very finely granulate, with obscure OL-or indistinct-pattern.

Elaeocarpus arthropus Ohwi 節枝杜英—Fig. 30-1

Grains subprolate to oblate-spheroidal, with P axes of 10-11 μ long, and with E axes of 8-11 μ long.

The voucher is Botel Tabago, Liu et al. 92.

Elaeocarpus decipiens Hemsl. ex Forbes & Hemsl. 鹽八樹

Grains prolate to oblate-spheroidal, with P axes of (8-)10(-12) μ long, and with E axes of (5-)7-8(-11) μ long.

The vouchers are Taipei, Huang 2398, Sizangan, Sasaki s. n. July 1909; Hiiranzen, Matuda 1264; Kwarenkotyo, Suzuki 16368.

Elaeocarpus japonicus Sieb. & Zucc. 薤豆

Grains prolate to prolate-spheroidal, with P axes of (10-)13(-15) μ long, and with E axes of (8-)9-10(-15) μ long.

The voucher is Taipei, Keng et al. s. n. Apr. 1955.

Sloanea formosana Li, Woody Flora of Taiwan, Livingston Publishing Company, 538, 1963 蘭嶼喜—Fig. 30-2

Grains prolate to prolate-spheroidal, with P axes of (10-)13-14 μ long, and with E axes of (7-)9(-12) μ long; sexine with obscure OL- or indistinct-pattern.

The voucher is Takao, Yamamoto et al. 685.



Fig. 30. Elaeocarpaceae, $\times 1000$. 1. *Elaeocarpus aristropus* Ohwi, (Liu et al. 92). 2. *Sloanea formosana* Li (Yamamoto et al. 685).

28. ELLISIOPHYLLACEAE 蔊菊科

Pollen grains are characterized by 3-colporate; shape classes of P/E perprolate to subprolate, or oval, with P axes of (25-)19-31(-33) μ long, and with E axes of (17-)20-21(-25) μ long; amb peritreme to ptychotreme, or circular; colpi long; exine psilate, 1.5-2 μ thick; sexine thicker than or as thick as nexine, reticulate, with OL-pattern.

Ellisiophyllum pinnatum Makino 蔊菊—Fig. 31

The vouchers are Taiheizan, Suzuki S. 691; Taipei, Suzuki T. 18353; Mt. Ali, Chuan & Kao s. n. July 1957.

29. FAGACEAE 櫟斗科

Pollen grains are characterized by 3-colporate, rarely 3-colporoidate; shape classes of P/E prolate to suboblate, with P axes of 11-35 μ long, and with E axes of 8-37 μ long; amb peritreme, sometimes ptychotreme; colpi usually long; ora colpi transversales-equatoriales to colpi transversales-circulares; exine psilate to scabrate, from less than 1 μ thick to 1.5 μ thick; sexine thicker than nexine, granulate, with LO- or obscure-pattern.

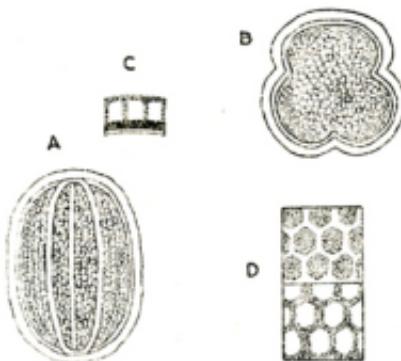


Fig. 31. *Ellisiophyllum pinnatum* Makino
(Chien & Kao s. n., July 1957), $\times 1000$.

Key to genera

1. Colpi very short..... *Fagus*
1. Colpi long, nearly as long as the length of P axes
 2. Apertures 3-colporoidate..... *Quercus*
 2. Apertures 3-colporate
 3. Sexine with LO- or indistinct-pattern; ora colpi transversales-equatoriales
 4. Colpi crassimarginate..... *Lithocarpus*
 4. Colpi uncrassimarginate..... *Pasania*
 3. Sexine with OL-pattern; ora colpi transversales-circulares..... *Castanopsis*, *Cyclobalanopsis*

Castanopsis carlesii (Hemsl.) Hayata 長尾柯—Fig. 32-1

Grains prolate to suboblate, with P axes of (15-)18-22(27) μ long, and with E axes of (15-)18-22(-25) μ long; amb peritreme to ptychotreme; ora colpi transversales-circulares; exine psilate, less than 1 μ thick; sexine with OL-pattern.

The vouchers are Ilan, Mt. Oobi, *Masamune* 3245; Taipei, Kabosan, *Suzuki* T. 18130.

Castanopsis formosana (Skan) Hayata 臺灣柯—Fig. 32-2

Grains prolate to prolate-spheroidal, with P axes of (16-)17-19(-22) μ long, and with E axes of (9-)11-15 μ long; amb ptychotreme; ora colpi transversales to colpi transversales-equatoriales; exine psilates, less than 1 μ thick; sexine OL-pattern.

The vouchers are Kusukusu, *Kudo & Suzuki* 16019; Buizan, *Matuda* 320; Synsuiel, *Kudo & Mori* 2653.

Cyclobalanopsis glauca (Thunb.) Oerst. 青剛櫟—Fig. 32-3

Grains prolate to oblate-spheroidal, with P axes of (13-)17-24(27) μ long, and with E axes of (10-)13-22(-25) μ long; amb peritreme; ora colpi transversales-circulares to colpi transversales; exine psilate, 1 μ thick; sexine thicker than or as thick as nexine, with OL-pattern.

The vouchers are Taipei, Chu Shan Yen, Huang 2253; Sintiku, Simada s. n. April 1918; Taityu, Hokuko, Tamiya 2604.

Cyclobalanopsis paucidentata (Franch.) Kudo & Masamune 複子櫟—Fig. 32-4

Grains suboblate to spheroidal, with P axes of 22-26(-27) μ long, and with E axes of (25-)26-28(-30) μ long; amb peritreme to ptychotreme; ora colpi transversales-circulares; exine psilate to scabrate, 1-1.5 μ thick; sexine with OL-pattern.

The voucher is Mt. Tatung, Lee 3935.

Fagus hayatae Palib. ex Hayata 臺灣山毛櫟—Fig. 31-5

Grains suboblate to oblate spheroidal, with P axes of 30-35 μ long, and with E axes of 33-37 μ long; amb peritreme; colpi very short; ora colpi transversales-circulares; exine psilate, 1.5-2 μ thick; sexine with LO-pattern.

The voucher is Taihoku, Sansyo, Suzuki T. 8658.

Lithocarpus amygdalifolia (Skan) Hayata 桂力—Fig. 32-6

Grains prolate to prolate spheroidal, with P axes of 12-15 μ long, and with E axes of 8-11 μ long; amb peritreme to ptychotreme; colpi crassimarginate; ora colpi transversales-equatoriales; exine psilate, less than 1 μ thick; sexine with obscure-or LO-pattern.

The vouchers are Takao, Simizu 3914; Mt. Paohsienshan, Chuang et al. 2757.

Pasania brevicaudata (Skan) Schottky 油葉杜—Fig. 32-7

Grains prolate to subprolate, with P axes of 15-19 μ long, and with E axes of 10-14 μ long; amb peritreme; ora colpi transversales-equatoriales to colpi transversales-circulares; exine psilate, less than 1 μ thick; sexine as thick as or thicker than nexine, with LO? or obscure-pattern.

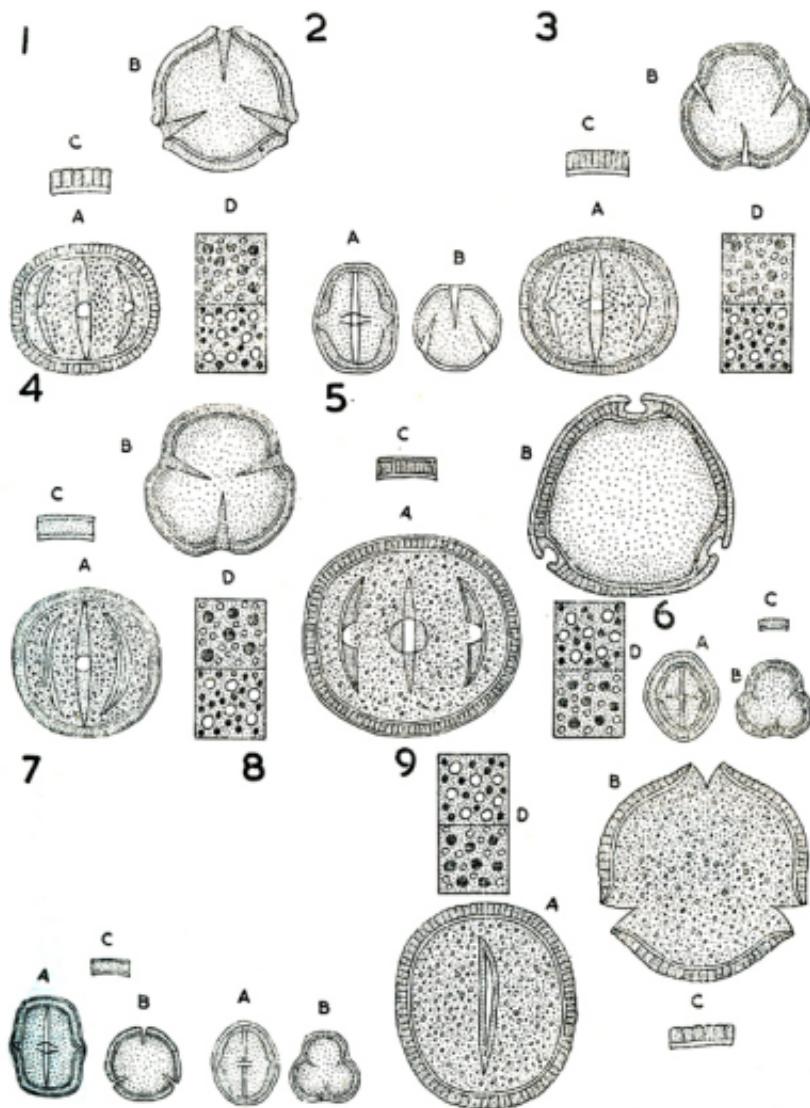
The vouchers are Taipei Bot. Gard., Ku s. n. 1937; Taityu, Saito s. n. May 1924; Paipansyuer, Matuda s. n. Oct. 1917.

Pasania kodaihoensis (Hayata) Li 后大埔石櫟—Fig. 32-8.

Grains prolate to rarely oblate-spheroidal, with P axes of 11-16 μ long, and with E axes of 10-13 μ long; amb peritreme to ptychotreme; ora colpi transversales-equatoriales; exine psilate, less than 1 μ thick; sexine with obscure pattern.

The vouchers are Taito, Simizu 3762; Mokazan (Mukua Shan), Tamiya 49.

Fig. 32. Fagaceae, $\times 1000$. 1. *Castanopsis carlesii* (Hemsl.) Hayata (Masamune 3245). 2. *Castanopsis formosana* (Skan) Hayata (Kudo & Suzuki 16019). 3. *Cyclobalanopsis glauca* (Thunb.) Oerst. (Huang 2253). 4. *Cyclobalanopsis paucidentata* (Franch.) Kudo & Masamune (Lee & Kao 3935). 5. *F. g. hayatae* Palib. (Suzuki T. 8658). 6. *Lithocarpus amygdalifolia* (Skan) Hayata (Simizu 3914). 7. *Pasania brevicaudata* (Skan) Schottky (Matuda s. n. Oct. 1917). 8. *Pasania kodaihoensis* (Hayata) Li (Simizu 3762). 9. *Quercus variabilis* Bl. (Lin s. n. Feb. 1942).



Pasania uraiana (Hayata) Schottky 島來柯

Grains prolate to prolate-spheroidal, with P axes of 17-21(-25) μ long, and with E axes of 12-15(-20) μ long; amb ptychotreme; ora colpi transversales-equatoriales to colpi transversales-circulares; exine psilate, 1 μ thick; sexine with LO-? or obscure-pattern.

The vouchers are Taipei, Kabosan, Suzuki T. 18130, Agyoku, Suzuki T. 14513; Buizan, Matuda 653.

Quercus variabilis Bl. 檫皮櫟—Fig. 32-9

Grains 3-colporoidate, subprolate to spheroidal, with P axes of 26-34 μ long, and with E axes of (20)-25-30 μ long; amb Peritreme; ora obscure or colpi transversales-equatoriales; exine psilate to scabrate, 1-1.5 μ thick; sexine with LO-pattern.

The voucher is Taipei Bot. Gard., Lin s.n. Feb. 1942.

30. GERANIACEAE 雞牛兒科

Pollen grains are characterized by 3-colp(or)ate; shape classes of P/E suboblate to spheroidal, with P axes of 50-95 μ long, and with E axes of 55-95 μ long; amb peritreme; apertures brevicolpate, as long as or slightly longer than the length of ora; ora longolate, colpi transversales; exine clavate, 5-12 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Geranium hayatum Ohwi 早田鴉牛兒

Grains with P axes of 75-95 μ long, and with E axes of 85-95 μ long; exine 10-12 μ thick.

The vouchers are Rato, Nankotaizan, Suzuki T. 17510; Taipasenzan, Sasaki 420273.

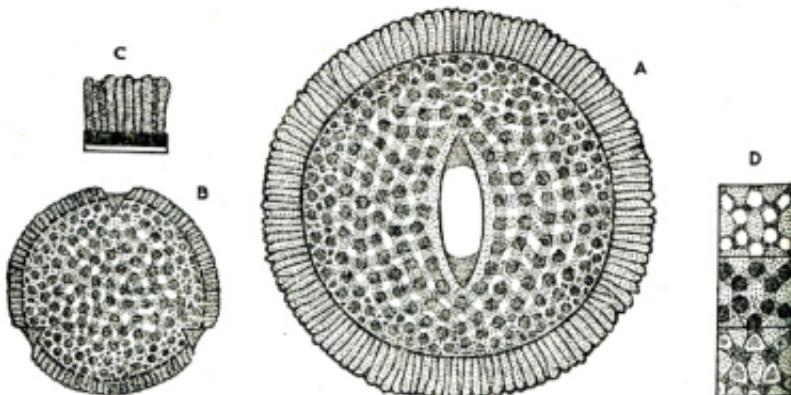


Fig. 33. *Geranium robertianum* L. (Shimizu 12498), equatorial view $\times 1000$, polar view $\times 500$.

Geranium robertianum L. 漢紅魚腥草—Fig. 33

Grains with P axes of $57\text{--}70\ \mu$ long, and with E axes of $63\text{--}75\ \mu$ long; exine $5\text{--}8\ \mu$ thick.

The vouchers are Hienanzan, Sikano s. n.; Taichung, Feung & Kao 4584; Shimizu 12498.

31. GOODENIACEAE 草海桐科

Pollen grains are characterized by 3-colporate; shape classes of P/E suboblate to prolate-spheroidal, or oval, with P axes of $(38\text{--})48\text{--}50\text{--}(55)\ \mu$ long, and with E axes of $(43\text{--})48\text{--}50\text{--}(55)\ \mu$ long; amb peritreme to goniotreme, or circular; colpi as long as the length of P axes; ora colpi transversales-equatoriales; exine psilate, $2\text{--}3\ \mu$ thick; sexine thicker than nexine, reticulate, with LO-pattern.

Scaevola sericea Vahl. 草海桐—Fig. 34

The vouchers are Kiirun, Suzuki S. 4713; Kashoto, Kudo & Mori 164; Pingtung, Shimizu 12142.

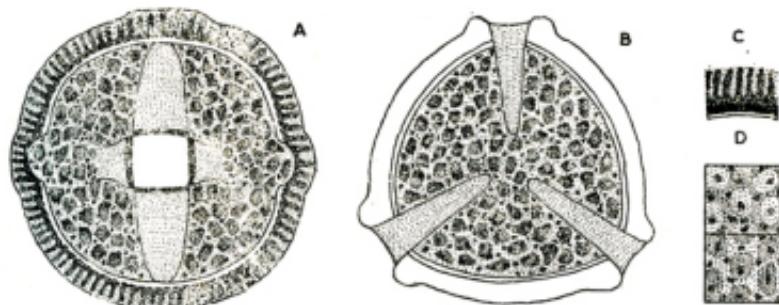


Fig. 34. *Scaevola sericea* Vahl. (Suzuki S. 4713), $\times 1000$.

32. GUTTIFERAE 檻木科

Pollen grains are characterized by 3-colporate, pantoporate, pantocolporate; shape classes of P/E prolate to suboblate, with P axes of $18\text{--}39\ \mu$ long, and with E axes of $16\text{--}45\ \mu$ long; amb peritreme to ptychotreme; ora various; exine psilate, $1\text{--}2\ \mu$ thick; sexine thicker than nexine, reticulate to granulate, usually with OL-pattern.

Key to genera and species

1. Grains porate *Garcinia linii*
1. Grains colporate
 2. Grains pantocolporate *Garcinia spicata*
 2. Grains 3-colporate
 3. Grains suboblate to spheroidal *Calophyllum inophyllum*

3. Grains prolate to spheroidal
4. E axes usually more than $22\ \mu$ long.....*Garcinia multiflora*,
Hypericum simplicistylum
4. E axes usually less than $22\ \mu$ long..*Hypericum japonicum*, *H. nagasawai*,
H. patulum, *H. randaiense*,
Takasagoya formosana

Calophyllum inophyllum L. 瓜崖海棠—Fig. 35-1

Grains 3-colporate, suboblate to spheroidal, with P axes of $35\text{--}39\ \mu$ long, and with E axes of $35\text{--}45\ \mu$ long; amb peritreme; ora colpi transversales-equatoriales; exine psilate, $2\ \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Taipei, Sasaki s. n. May, 1929; Kuaru, Yamamoto 1330.

Garcinia linii Chang, Forest Journ. Taiwan Provincial Institute of Agriculture, Pingtung, 6:1, 1964 蘭嶼海棠—Fig. 35-2

Grains 4-5-porate, subprolate, with P axes of $32\text{--}37\ \mu$ long, and with E axes of $27\text{--}31\ \mu$ long; ora costae cirulares, crassimarginate, connected with each other by thick exine; exine psilate, $2\ \mu$ thick; sexine thicker than nexine, granulate, with LO-pattern.

The voucher is Botel Tabago, Chang 3641.

Garcinia multiflora Champ. 山桔子—Fig. 35-3

Grains 3-colporate, prolate to spheroidal, with P axes of $23\text{--}31\ \mu$ long, and with E axes of $20\text{--}26\ \mu$ long; amb peritreme to ptychotreme; ora colpi transversales to colpi transversales-equatoriales; exine psilate, $1\ \mu$ thick; sexine thicker than nexine, granulate, with OL-pattern.

The vouchers are Pingtung, Meitan, Chang 4758; Kosyun, Fukuyama 4654.

Garcinia spicata Hook. f. 頭木—35-4

Grains 5-7-colporate, oblate-spheroidal, with P axes of $30\ \mu$ long, and with E axes of $34\ \mu$ long, or with longest diameter of $27\text{--}38\ \mu$ wide in polar view; ora crassimarginate; colpi transversales-circulares; exine psilate, $1.5\ \mu$ thick; sexine thicker than nexine, granulate, with OL-pattern.

The voucher is Kosyun, Kuaruru, Sasaki s. n. May, 1932.

Hypericum japonicum Thunb. 地耳草鐵釘草

Grains 3-colporate, subprolate to prolate-spheroidal, with P axes of $21\text{--}23\ \mu$ long, and with E axes of $17\text{--}20\ \mu$ long; amb peritreme to ptychotreme; ora colpi transversales-circulares; exine psilate, less than $1\ \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The voucher is Rato, Suzuki S. 3692.

Hypericum nagasawai Hayata 高山鐵釘草—Fig. 35-5

Grains 3-colporate, prolate to prolate-spheroidal, with P axes of $20\text{--}25\ \mu$ long, and with E axes of $15\text{--}20\ \mu$ long; amb ptychotreme; ora colpi transversales-equatoriales; exine psilate, less than $1\ \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

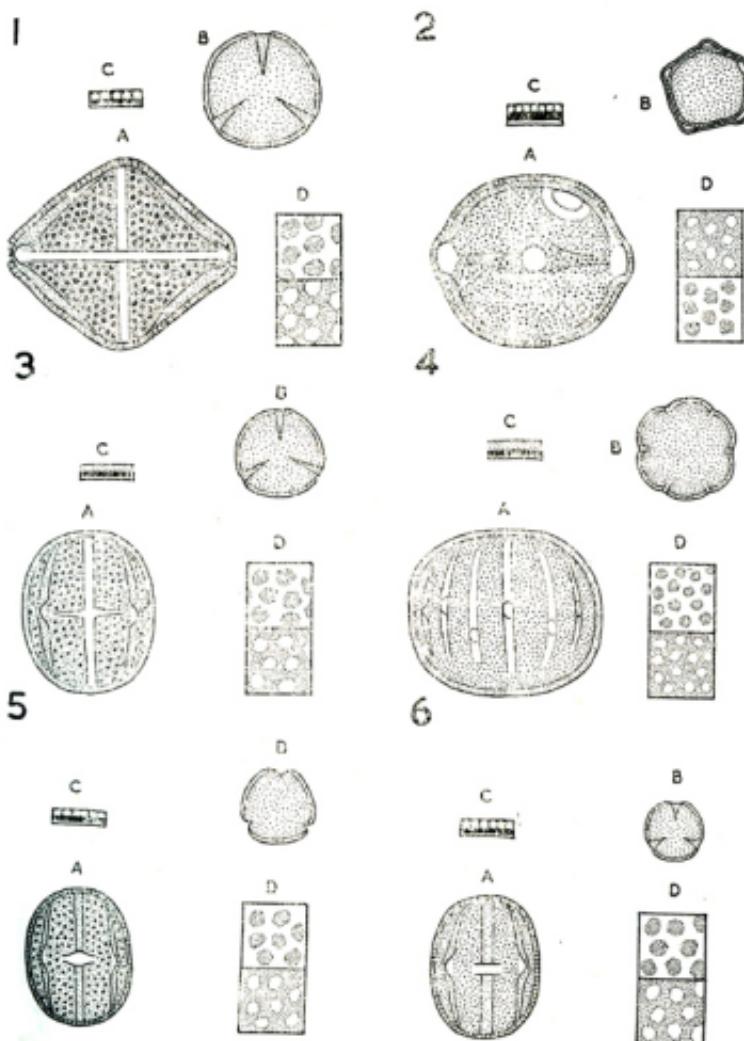


Fig. 35. Guttiferae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Calophyllum inophyllum* L. (Sasaki s. n. May 1929) 2. *Garcinia linii* Chang (Chang 3641) 3. *Garcinia multiflora* Chang (Chang & n. Aug. 1929) 4. *Garcinia spicata* Hook. f. (Sasaki s. n. May 1932) 5. *Hypericum nagasawae* Hayata (Sasaki s. n. Apr. 1911) 6. *Hypericum japonicum* Thunb. (Sasaki s. n. Apr. 1911)

The voucher is east Noko to Noko, Sasaki s.n. Aug. 1929.

Hypericum patulum Thunb. 金絲梅—Fig. 35-6

Grains 3-corporate, prolate, with P axes of $25-27 \mu$ long, and with E axes of $18-21 \mu$ long; amb ptychotreme; ora colpi transversales; exine psilate, less than 1μ thick; sexine thicker than nexine, granulate, with obscure-pattern.

The voucher is Keelung, Sasaki s.n. Aug. 1911.

Hypericum randaiense Hayata 帶大鐵鈎草—Fig. 36-1

Grains 3-corporate, prolate, with P axes of $22-25 \mu$ long, and with E axes of $13-18 \mu$ long; amb ptychotreme; ora colpi transversales-circulares; exine psilate, 1μ thick; sexine thicker than nexine, granulate, with OL-pattern.

The voucher is Mt. Ali, Suzuki S. 18000.

Hypericum simplicistylum Hayata 素桂花鐵

Grains 3-corporate, prolate to spheroidal, with P axes of $21-23 \mu$ long, and with E axes of $17-22(-26) \mu$ long; amb peritreme; ora colpi transversales-circulares; exine psilate, 1μ thick; sexine thicker than nexine, granulate, with obscure-pattern.

The voucher is Neng-Kao, Kao 5744.

Takasagoya formosana (Makino) Kimura 臺灣金絲統—Fig. 36-2

Grains 3-corporate, subprolate to prolate-spheroidal, with P axes of $18-22(-26) \mu$ long, and with E axes of $16-20 \mu$ long; amb peritreme to ptychotreme; ora various; exine psilate, 1μ thick; sexine thicker than nexine, granulate, with OL-pattern.

The vouchers are Miaoli, Liao & Kuo, 1581; Mt. Ali, Creech, 1465.

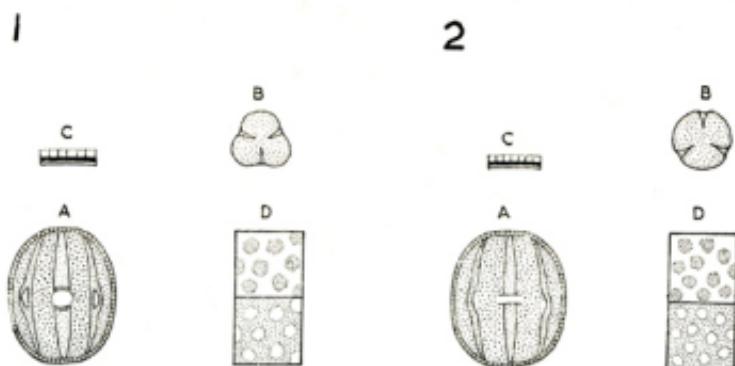


Fig. 36. Guttiferae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Hypericum randaiense* Hayata (Suzuki T. 18000). 2. *Takasagoya formosana* (Makino) Kimura (Creech 1465).

33. HALORAGACEAE 小二仙草科

Pollen grains are characterized by 3(-1)-porate; shape classes of P/E oblate

to spheroidal, with P axes of $17\text{--}27\ \mu$ long, and with E axes of $25\text{--}35\ \mu$ long; amb goniotreme, or angular; ora costae circulares, crassimarginate; exine psilate to scabrate, $1\text{--}3\ \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Key to genera

1. Exine $2\text{--}3\ \mu$ thick, scabrate; grains 4-5-porate.....*Haloragis*
2. Exine $1\text{--}1.5\ \mu$ thick, psilate; grains 3(-4)-porate.....*Myriophyllum*
***Haloragis micrantha* R. Br.** 小二仙草—Fig. 37-1

Grains 4-5-porate, suboblate to spheroidal, with P axes of $17\text{--}25\ \mu$ long, and with E axes of $25\text{--}30\ \mu$ long; exine psilate, $2\text{--}3\ \mu$ thick; perispore? present.

The vouchers are Taipei, *Sasaki s. n.* May 1932, *Kao 3310*; Toyen, *Sasaki s. n.* June 1923.

***Myriophyllum ussuriense* Maxim.** 三葉狐尾藻—Fig. 37-2

Grains 3(-4)-porate, oblate to spheroidal, with P axes of $19\text{--}27\ \mu$ long, and with E axes of $25\text{--}35\ \mu$ long; exine scabrate, $1\text{--}1.5\ \mu$ thick.

The vouchers are Toyen, *Kudo 578*, *Sasaki s. n.* Apr. 1929.

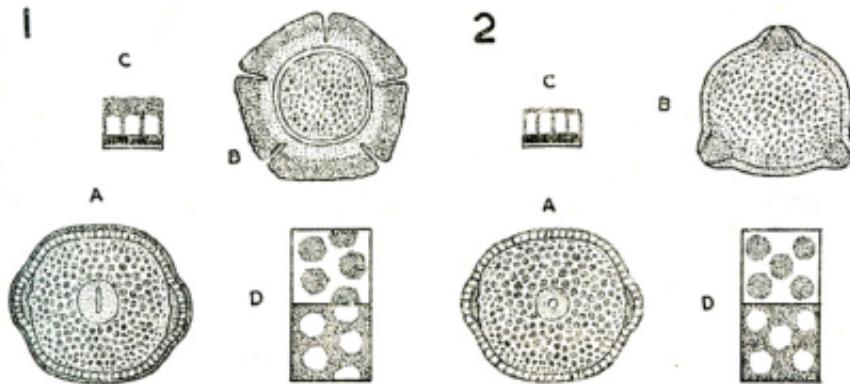


Fig. 37. Haloragaceae, $\times 1000$. 1. *Haloragis micrantha* R. Br. (*Sasaki s. n.* June 1923) 2. *Myriophyllum ussuriense* Maxim. (*Sasaki s. n.* Apr. 1927)

24. ICACINACEAE 茶茱萸科

Pollen grains are characterized by inaperturate or 4-colporate, with longest equatorial diameter $25\text{--}60\ \mu$ long; shape classes of P/E spheroidal; amb peritreme; exine baculate or echinate, $2.5\text{--}3\ \mu$ thick; sexine thicker than nexine, reticulate.

Key to genera

1. Grains inaperturate; exine intectate, baculate.....*Gonocaryum*
1. Grains 4-colporate; exine tectate, echinate.....*Nothopodytes*
***Gonocaryum calleryanum* (Baill.) Becc.** 柚葉茶茱萸—Fig. 38-1

Grains inaperturate, spheroidal or subspheroidal, with longest equatorial diameter

(25-) 27-30 (-33) μ long; exine baculate, 3 μ thick; sexine twice thicker than nexine, reticulate, the brochi with duplibaculate muri and multigranulate lumina, with OL-pattern.

Sexine pattern of this species is similar to that of *Polygonum* except without ora.

The voucher is Pingtung, Shimizu 12088.

Nothapodytes foetida (Wight) Sleum. 茶茱萸—Fig. 38-2

Grains 4-colporate, spheroidal, with longest diameter 50-60 μ long in polar view; amb peritreme, or circular; exine echinate, 2.5 μ thick; sexine thicker than nexine, finely reticulate, the brochi with wider muri and narrower lumina, with LO-pattern.

The voucher is Botel Tabago, Mori s. n. Apr. 1907.

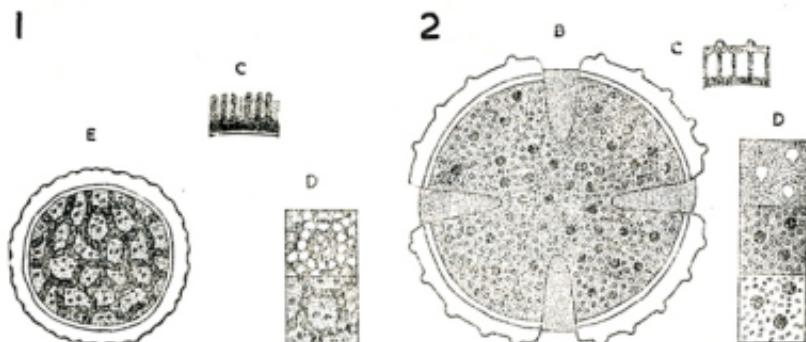


Fig. 38. Icacinaceae, $\times 1000$. 1. *Gonocaryum calleryanum* (Baill.) Becc. ((Shimizu 12088). 2. *Nothapodytes foetida* (Wight) Sleum. (Mori s. n. Apr. 1907).

38. ILLICIACEAE 商香科

Pollen grains are characterized by 3-colporate, syncolporate bipolar convergent; shape classes of P/E peroblate to spheroidal, with P axes of 20-30 μ long, and with E axes of 25-45 μ long; amb peritreme; exine psilate, 1-2 μ thick; sexine thicker than nexine, reticulate, the brochi with dupli-baculate muri, with obscure OL-pattern.

Key to species of *Illicium*

1. Exine tectate to intectate; amb peritreme *I. arborescens*
1. Exine tectate; amb ptychotreme *I. philippinense*

Illicium arborescens Hayata 紅花八角—Fig. 39-1

Grains suboblate, with P axes of 29 μ long, and with E axes of 34 μ long; amb peritreme.

The voucher is Nantou, Ching Shiu Kou tract, Hwang et al. 1001.

***Ilicium philippinense* Merr.** 白花八角—Fig. 39-2

Grains prolate to spheroidal, with P axes of (20-)22-25(-30) μ long, and with E axes of 25-27(-45) μ long; apertures, usually monopolar convergent; amb ptychotreme to peritreme.

The vouchers are Mt. Taihei, Sasaki s. n. Apr. 1932; Mt. Amma, Liu et al. 0188; Taitung, Lin et al. 342.

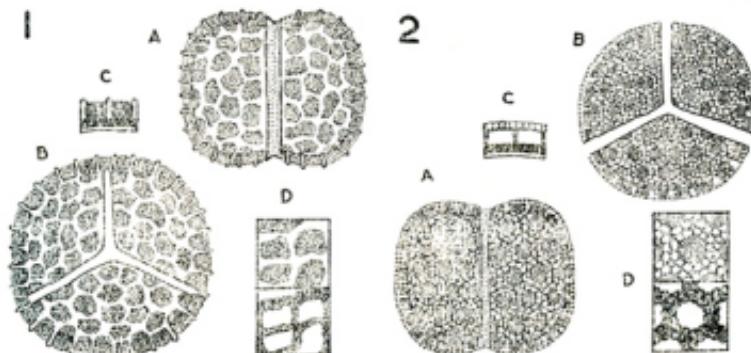


Fig. 39. Iliciaceae, $\times 1000$. 1. *Ilicium arborescens* Hayata (Huang et al. 1001) 2. *Ilicium philippinense* Merr. (Liu et al. 0188)

36. LARDIZABALACEAE 野木瓜科

Pollen grains are characterized by 3-colp(oroide)ate; shape classes of P/E prolate to suboblate, with P axes of 17-27 μ long, and with E axes of 14-25 μ long; amb peritreme to ptychotreme, or circular to intersubangular; colpi long; ora indistinct; exine psilate, 1-2.5 μ thick; sexine thicker than nexine, granulate to finely reticulate, with OL-pattern.

Key to genera

1. Exine 2-2.5 μ thick.....*Akebia*
1. Exine about 1 μ thick*Stauntonia*

***Akebia chingshuiensis* Shimizu 清水野木瓜**

Grains spheroidal to subprolate, with P axes of (17-)20-22(-23) μ long, and with E axes of (12-)15-18(-20) μ long; exine 2 μ thick.

The voucher is Hualien, Shimizu 12545.

***Akebia longeracemosa* Matsumura 長萼野木瓜—Fig. 40-1**

Grains suboblate to spheroidal, rarely prolate-spheroidal, with P axes of (18-)20-22(-23) μ long, and with E axes of (20-)21-22(-25) μ long; exine 2-2.5 μ thick.

The vouchers are Taichung, Feung et al. 4572; Hualien, Shimizu 11559; Naiwan, Simaza s. n. Apr. 1918.

Stauntonia hexaphylla (Thunb.) Decne 野木瓜—Fig. 40-2

Grains prolate to spheroidal, with P axes of (17-)20-25(-27) μ long, and with E axes of (14-)15-17(-19) μ long; exine 1 μ thick.

The voucher is Taipei, Kou & Kao s. n. March 1952.

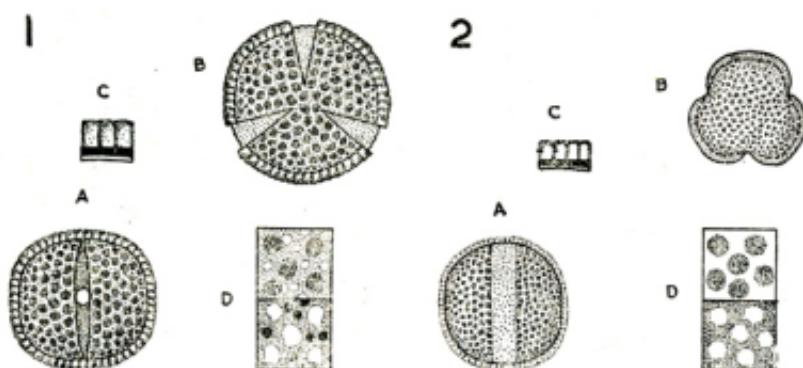


Fig. 40. Lardizabalaceae, $\times 1000$. 1. *Akelia longercepsis* Matsumura (Feung et al. 4572) 2. *Stauntonia hexaphylla* (Thunb.) Decne (Kou & Kao s. n. March 1952)

37. LECYTHIDACEAE 玉蕊科

Pollen grains are characterized by 3-colp(or)ate; shape classes of P/E spheroidal to subprolate, with P axes of 45-62 μ long, and with E axes of 43-51 μ long; amb peritreme, or circular; colpi crassimarginate, nearly as long as the length of P axes; ora longoligate, colpi transversales-equatoriales; exine psilate, 1.5-2 μ thick; sexine thicker than nexine, prominently reticulate, with OL-pattern.

Barringtonia asiatica (L.) Kurz 菲律脚樹

Grains prolate-spheroidal to spheroidal, with P axes of 50-55 μ long, and with E axes of 48-50 μ long.

The voucher is South Cape, Lee et al. s. n. Sept. 1955.

Barringtonia racemosa (L.) Bl. ex DC. 玉蕊—Fig. 41.

Grains spheroidal to subprolate, with P axes of (45-)47-52(-62) μ long, and with E axes of (43-)45(-51) μ long.

The vouchers are Keelung, Matuda 1365; Taipei, Suzuki S. 5858.

38. LOBELIACEAE 山梗菜科

Pollen grains are characterized by 3-colporate, prolate to suboblate, with P axes of 20-40 μ long, and with E axes of 14-42 μ long; amb peritreme to goniotreme; colpi long; ora colpi transversales-circulares; exine psilate, 1-1.5 μ thick; sexine thicker than nexine, very finely granulate, with indistinct-or OL-pattern.

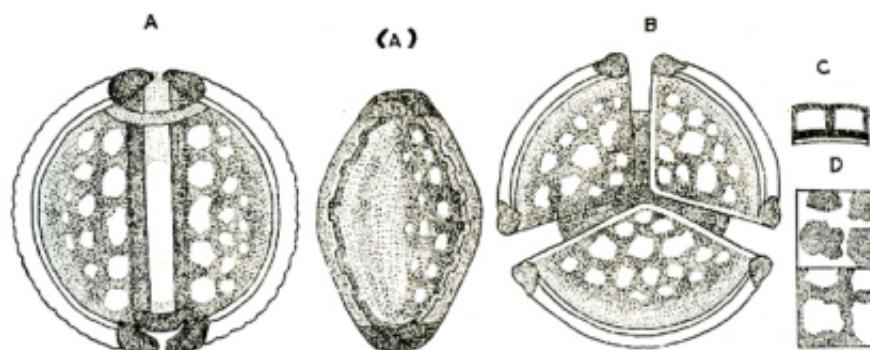


Fig. 41. *Barringtonia racemosa* (L.) Bl. ex DC. (Matuda 1365), $\times 1000$.

Pollen grains of two genera in this family are similar. They differ from those of *Campanumoea* by having long colpi only.

Lobelia L. 牛邊草屬

Grains prolate to suboblate, with P axes of (22-)27-35(-40) μ long, and with E axes of (14-)18-20(-42) μ long; amb circular to semiangular; exine psilate to minutely scabrate, 1-1.5 μ thick.

Lobelia chinensis Lour. 中國牛邊草

Grains prolate to spheroidal, with P axes of (25-)32-33 μ long, and with E axes of (14-)18-19(-25) μ long.

The voucher is Miaoli, Kao 5686.

Lobelia pyramidalis Wall. 角錐牛邊草—Fig. 42-1.

Grains suboblate to subprolate, with P axes of (28-)31-35(-40) μ long, and with E axes of 20-25(-42) μ long.

The vouchers are Taichung, Liu et al. 122; Kwarenko, Sasaki s. n. March 1923.

Lobelia radicans Thunb. 牛邊草

Grains prolate, with P axes of (26-)34 μ long, and with E axes of (17-)20(-24) μ long.

The voucher is Mukaiyama-Sinrynn, Sasaki s. n. Sept. 1929.

Lobelia trigona Roxb. 三角牛邊草

Grains oblate-spheroidal, with P axes of (22-)25-27(-30) μ long, and with E axes of (15-)20(-28) μ long.

The voucher is Toyen, Suzuki T. 5826.

Pratia nummularia A. Br. & Archers 普利特草—Fig. 42-2.

Grains prolate-spheroidal to suboblate, with P axes of 20-27 μ long, and with E axes of 23-27 μ long; amb circular to subangular; exine psilate, 1 μ thick.

The vouchers are Wulai, Yamamoto s. n. May 1929; Chiayi, Morimoto 463.

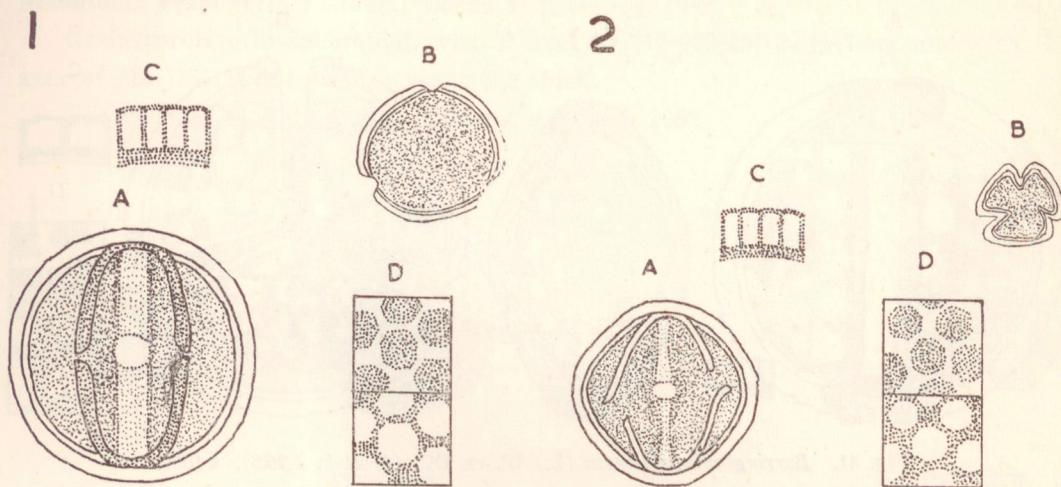


Fig. 42. Lobeliaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Lobelia pyramidalis* Wall. (Liu et al. 122) 2. *Pratia nummularia* A. Br. & Archers (Morimoto 463)

39. MAGNOLIACEAE 木蘭科

Pollen grains are characterized by monocolpate, 21–83 μ long, and 12–47 μ wide; colpi long; exine psilate, 1 μ thick; sexine thicker than nexine, granulate, usually with LO-pattern.

Key to genera

1. Sexine with OL-pattern *Magnolia*
1. Sexine with LO-pattern
 2. Grains small, 21–30 \times 12–23 μ long *Michelia*
 2. Grains large, 50–65 \times 25–33 μ long *Micheliopsis*

***Magnolia coco* DC.** 夜香木蘭—Fig. 43-1.

Grains (52–)60–70(–83) μ long, (30–)40(–47) μ wide, and 25 μ thick; sexine with OL-pattern.

The vouchers are Kaoshiung, Ho & Kao s. n. Sept. 1956; Taipei, Ku s. n. May 1936.

***Michelia formosana* (Kanehira) Masamune** 烏心石

Grains (21–)23–26(–30) μ long, and (12–)16–17(–23) μ wide; sexine with LO-pattern.

The vouchers are Taipei Bot. Gard., Keng 1048, NTU, Kao s. n. Feb. 1955; Nantou, Kanehira & Sasaki s. n. March, 1918.

***Micheliopsis kachirachirai* (Kanehira & Yamamoto) H. Keng** 烏心石舅—Fig. 43-2.

Grains 50–65 μ long, and 25–33 μ wide; sexine with LO-pattern.

The voucher is Pingtung, Wang. s. n. March 1966.

40. MYOPORACEAE 苦檻藍科

Pollen grains are characterized by 3-colporate; shape classes of P/E oblate to spheroidal, with P axes of 20–30 μ long, and with E axes of 27–38 μ long; amb ptycho-

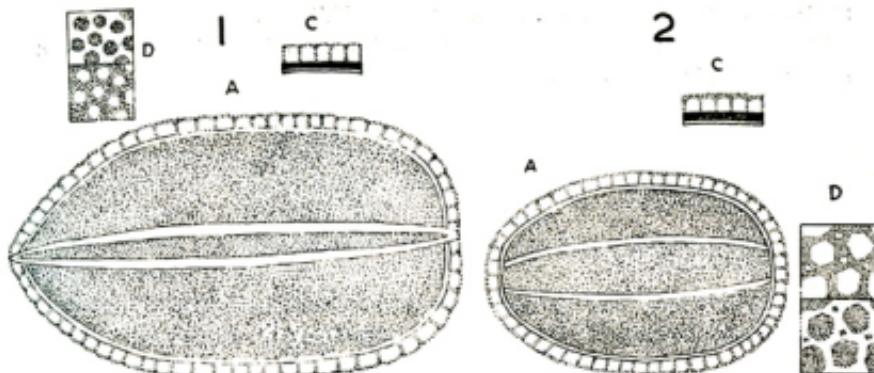


Fig. 43. Magnoliaceae, $\times 1000$. 1. *Magnolia coco* DC. (Ho & Kao s. n. 1956) 2. *Micheliopsis kachirochirai* (Kaneh. & Yamamoto) Keng (Wang s. n. March 1966)

treme; colpi long; ora lalongate, diorate, colpi transversales; exine psilate, $2-3 \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Myoporum bontioides A. Gray 苦櫟藍—Fig. 44.

The vouchers are Goto, Matuda 2859; Kagi, Sasaki s. n. Jan. 1924.

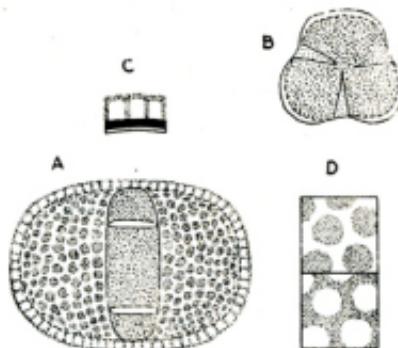


Fig. 44. *Myoporum bontioides* A. Gray (Matuda 2859), equatorial view $\times 1000$, polar view $\times 500$.

41. MYRICACEAE 楊柳科

Pollen grains are characterized by 3-colporate; shape classes of P/E oblate to oblate-spheroidal, or apiculate, with P axes of $17-20 \mu$ long, and with E axes of $20-26 \mu$ long; amb. goniotreme, or semiangular; ora costae transversales, crassimarginata; exine psilate, 1μ thick; sexine thicker than nexine, reticulate, with LO-pattern.

***Myrica rubra* Sieb. & Zucc. var. *acuminata* Nakai 楊梅—Fig. 45.**

The vouchers are Taipei, Kao & Kou s. n. Apr. 1957, Suzuki S. s. n. Feb. 1930; Kanonzan, Mori s. n. Feb. 1931.

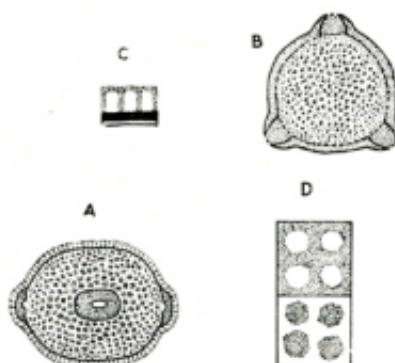


Fig. 45. *Myrica rubra* Sieb. & Zucc. var. *acuminata* Nakai
(Kao & Kou s. n. Apr. 1957), $\times 1000$

42. MYRISTICACEAE 肉豆蔻科

Pollen grains are characterized by inaperturate, spheroidal to elliptic, rarely quadrangular, with diameter of 30–38 μ long; exine scabrate, 2–3 μ thick; sexine thicker than nexine, reticulate, with obscure OL-pattern.

***Myristica cagayanensis* Merr. 紫肉桂肉豆蔻—Fig. 46.**

The voucher is Mt. Clararai, Sata 1269.

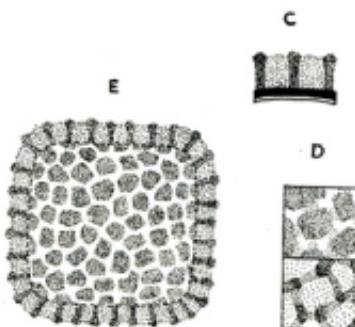


Fig. 46. *Myristica cagayanensis* Merr. (Sata 1269), $\times 1000$.

43. NYCTAGINACEAE 紫茉莉科

Pollen grains are characterized by pantoporate or 3-colpate; shape classes of P/E suboblate to spheroidal.

Key to genera

1. Grains pantoporate; exine echinate.....*Boerhaavia*
1. Grains 3-colporate; exine psilate.....*Pisonia*
Boerhaavia diffusa L. 黃細心草—Fig. 47-1.

Grains pantoporate, spheroidal to ellipsoidal, with longest diameter $57\text{--}77 \mu$ long; exine echinate, 5μ thick, the spines 2μ long; sexine thicker than nexine, granulate, with LO-pattern.

The voucher is Tainan, Moritani 1997; Insula Liukiusyo, Hosokawa 1689.

Pisonia aculeata L. 皮孫木—Fig. 47-2.

Grains 3-colporate, suboblate to oblate-spheroidal, or oval, with P axes of 25μ long, and with E axes of $28\text{--}30 \mu$ long; amb peritreme, or circular; exine psilate, 1μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The voucher is Insula Liukiusyo, Hosokawa 1696.

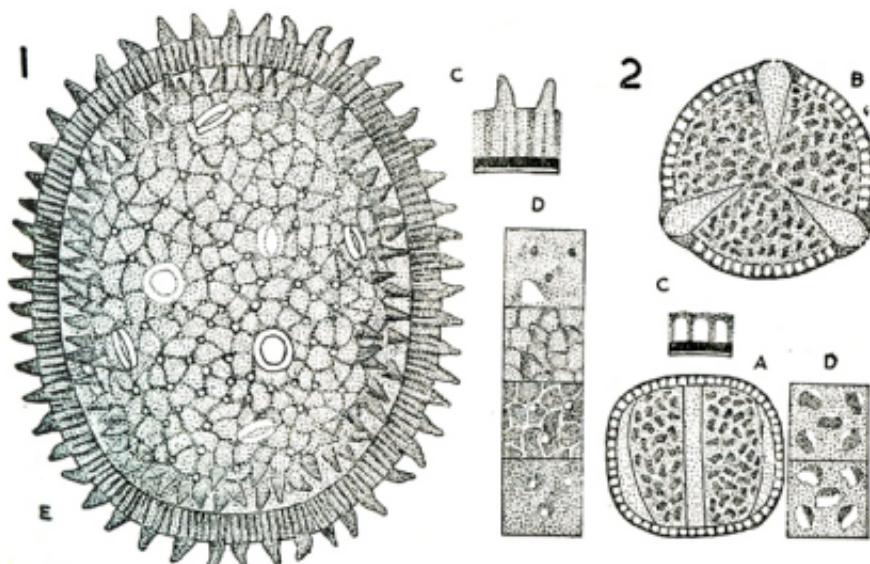


Fig. 47. Nyctanginaceae, $\times 1000$. 1. *Boerhaavia diffusa* L. (Moritani 1997) 2. *Pisonia aculeata* L. (Hosokawa 1696)

44. OXALIDACEAE 醉鈴草科

Pollen grains are characterized by 3-colporate to 3-colporate; shape classes of P/E prolate to oblate, with P axes of $20\text{--}48 \mu$ long, and with E axes of $15\text{--}45 \mu$ long; amb usually peritreme; ora colpi transversales-circulares; exine psilate to scabrate, $1\text{--}2 \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Key to genera

1. Grains 3-colporate..... *Averrhoa*
1. Grains 3-colpate
 2. Amb. goniotreme; P axes usually $38\text{--}48\ \mu$ long..... *Biophytum*
 2. Amb. peritreme; P axes usually $27\text{--}37\ \mu$ long..... *Oxalis*

Averrhoa carambola L. 五敛子—Fig. 48-1.

Grains 3-colporate; shape classes of P/E prolate to prolate-spheroidal, with P axes of $20\text{--}24\ \mu$ long, and with E axes of $15\text{--}20\ \mu$ long; amb peritreme to ptychotreme; ora colpi transversales-circulares; exine psilate, ca. $1\ \mu$ thick.

The voucher is kali, Morimoto 374.

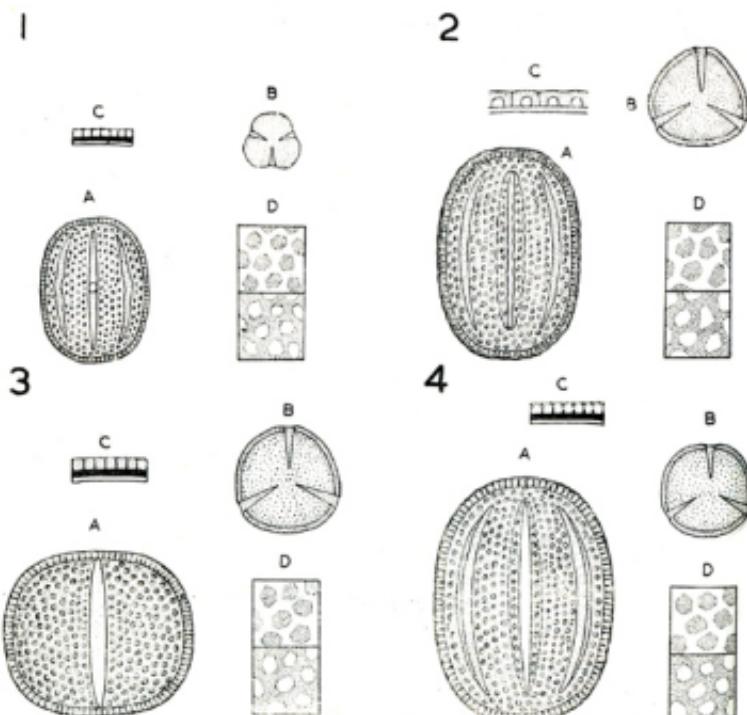


Fig. 48. Oxalidaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Averrhoa carambola* L. (Morimoto 374) 2. *Biophytum sensitivum* A. P. DC. (Simeda s. n.) 3. *Oxalis corniculata* L. (Suzuki S. n. Sept. 1928) 4. *Oxalis violacea* L. (Nonaka & Mori s. n. Apr. 1933)

Biophytum sensitivum A. P. DC. 感應草—Fig. 48-2.

Grains 3-colpate; shape classes of P/E prolate, with P axes of 38-48 μ long, and with E axes of 28-36 μ long; amb goniotreme; exine scabrate, 1-2 μ thick.

The voucher is Akoten, *Simada s. n.*

Oxalis L. 酢醬草屬

Grains 3-colp(or?)ate, oblate to prolate, with P axes of 27-37 μ long, and with E axes of 24-45 μ long; amb peritreme; exine psilate to scabrate, 1-1.5 μ thick.

Oxalis corniculata L. 肝臟草—Fig. 48-3.

Grains 3-colpate, suboblate, with P axes of 30-32 μ long, and with E axes of 35-39 μ long; exine scabrate, 1.5 μ thick.

The vouchers are Toyen, *Suzuki S. s. n.* Sept. 1928; Takao, *Hosokawa 5384.*

Oxalis griffithii Edgew. & Hook. f. 阿里山酢醬草

Grains 3-colp(or?)ate, oblate to suboblate, with P axes of 27-32 μ long, and with E axes of 32-42 μ long; ora colpi transversales; exine scabrate, 1.5 μ thick.

The vouchers are Mt. Taiheizan, *Suzuki S. 3942.*; Taipei, *Suzuki T. 14505.*

Oxalis taimonii Yamamoto 高山酢醬草

Grains 3-colpate, oblate to suboblate, with P axes of 33-37 μ long, and with E axes of 38-45 μ long; exine psilate, 1.5 μ thick.

The vouchers are Tugitakayama, *Sikano s. n.* July 1931; Arisan, *Suzuki T. 18001.*

Oxalis violacea L. 紫酢醬草—Fig. 48-4

Grains 3-colpate, prolate to subprolate, with P axes of 30-37(-42) μ long, and with E axes of 24-30 μ long; exine scabrate, 1 μ thick.

The voucher is Sizangan, *Nonaka & Mori s. n.* Apr. 1933.

45. PHYTOLACCACEAE 商陸科

Pollen grains are characterized by 3-colpate; shape classes of P/E prolate to prolate-spheroidal, with P axes of 27-32 μ long, and with E axes of (17-)20(-27) μ long; amb peritreme, or circular; colpi nearly as long as the length of P axes; exine psilate, 2 μ thick; sexine as thick as nexine, reticulate, with OL-pattern.

Phytolacca acinosa Roxb. 商陸—Fig. 49.

The vouchers are Tashieshan, *Kou & Kao 486.*; Hasenzan, *Suzuki S. s. n.* Oct. 1929.

46. PITTOSPORACEAE 海桐科

Pollen grains are characterized by 3(-4)-colp(or)ate; shape classes of P/E suboblate to prolate, with P axes of 19-40 μ long, and with E axes of 15-32 μ long; amb peritreme to ptychotreme, or circular to intersubangular; colpi long; ora colpi transversales-circulares; exine psilate, 1-2 μ thick; sexine thicker than nexine, granulate, with OL-pattern.

Pittosporum illinooides Makino 疏果海桐—Fig. 50-1

Grains 3-colp(or)ate, suboblate to prolate, with P axes of (19-)25-27 μ long, and with E axes of (15-)18-30(-32) μ long; amb peritreme to ptychotreme.

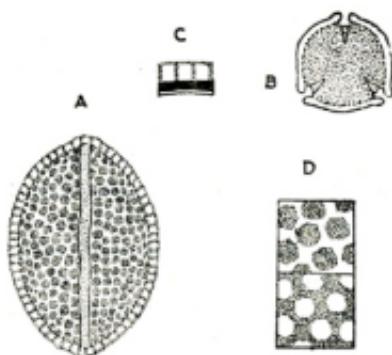


Fig. 49. *Phytolacca acinosa* Roxb. (Kou & Kao 486), equatorial view $\times 1000$, polar view $\times 500$.

The vouchers are Hualien, Shimizu & Kao 11951; Taichung, Mt. Boatshaped, Chen s. n. May 1961.

The pollen grains of the two collections are quite different, for grains of Chen's collection are 3-colporate, oblate, and peritreme, those of Shimizu and Kao's collection are 3-colporate, prolate and pleurotreme.

Pittosporum tobira Ait. 海桐花—Fig. 50-2

Grains 3(-4)-colporate, prolate to oblate-spheroidal, with P axes of $25-40\mu$ long, and with E axes of $20-30\mu$ long; amb peritreme.

The vouchers are Taipei, Kingshan, Huang 2282, 2283, 3325; Hualien, Shimizu & Kao 11561.

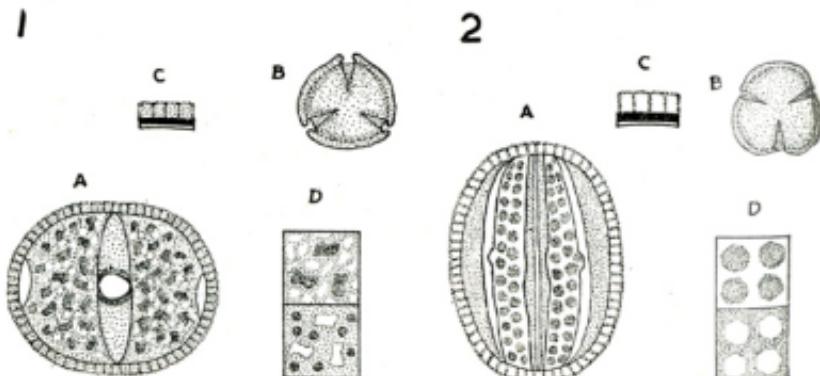


Fig. 50. Pittosporaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Pittosporum illicioides* Makino (Shimizu & Kao 11951) 2. *Pittosporum tobira* Ait. (Huang 2283)

The sizes of different collections vary greatly, for grains of Huang's collection 2282, and 2283 were measured to be $30-40 \times 20-26 \mu$ long, those of Shimizu & Kao, and Huang's 3325 were measured to be $25-27 \times 25-30 \mu$ long.

47. PLANTAGINACEAE 車前科

Pollen grains are characterized by 4-5-porate, spheroidal, or ellipsoidal, with longest diameter $20-27 \mu$ long; exine psilate, 1μ thick; sexine thicker than nexine, reticulate to granulate, with LO-pattern.

Plantago formosana Tateishi 車前草

The voucher is Sasaki s. n. March 1921.

Plantago major L. var. *Kimurae* Yamamoto 大葉車前

The vouchers are Taiheizan, Suzuki, S. 3748, 4108.

Plantago sawadai Yamamoto 車前—Fig. 51.

The voucher is Taiheizan, Yamamoto s. n. May 1931.

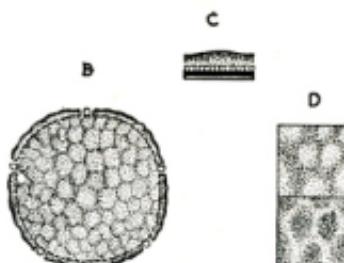


Fig. 51. *Plantago sawadai* (Yamamoto s. n. May 1931), $\times 1000$.

48. PLUMBAGINACEAE 藜科

Pollen grains are characterized by 3(-4)-colporate; shape classes of P/E oblate to subprolate, with P axes of $52-65 \mu$ long, and with E axes of $50-75 \mu$ long; amb peritreme, to ptychotreme; exine scabrate or baculate, $4-8 \mu$ thick; sexine thicker than nexine, reticulate.

Key to genera

1. Colpi long; exine intectate; amb peritreme..... *Plumbago*
1. Colpi short; exine tectate; amb ptychotreme..... *Statice*

Plumbago Tourn. ex L. 藜

Grains 3-4-colporate, subprolate to oblate, with P axes of $52-62 \mu$ long, and with E axes of $50-75 \mu$ long; exine scabrate, $4-5 \mu$ thick; sexine with LO-pattern.

Plumbago auriculata Lam. 耳狀藜

The voucher is Taipei, Suzuki S. s. n. Oct. 1922.

Plumbago zeylanica L. 錫倫藜—Fig. 52-1

The vouchers are Ilan, Chaoshe, Huang 3998; Taipei, Suzuki, S. s. n. Nov. 1928, Simoda s. n. Oct. 1914; Chiayi, Matuda 1464.

Statice Tourn. 硬松屬

Grains 3-colporate, prolate-spheroidal to oblate-spheroidal, with P axes of 57–65 μ long, and with E axes of 55–65 μ long; exine scabrate or echinate, 5–8 μ thick; sexine with OL-pattern.

Statice arbuscula Maxim. 硬松

The vouchers are Kasyoto, Mori s. n. Aug. 1907; Botel Tabago. Chuang et al. 1339.

Statice sinensis Girard. 中國硬松—Fig. 52-2

The vouchers are Taipei, Huang 1126; Taityu, Sasaki s. n. July 1922; Takao, Liukiusyo, Hosokawa 1735.

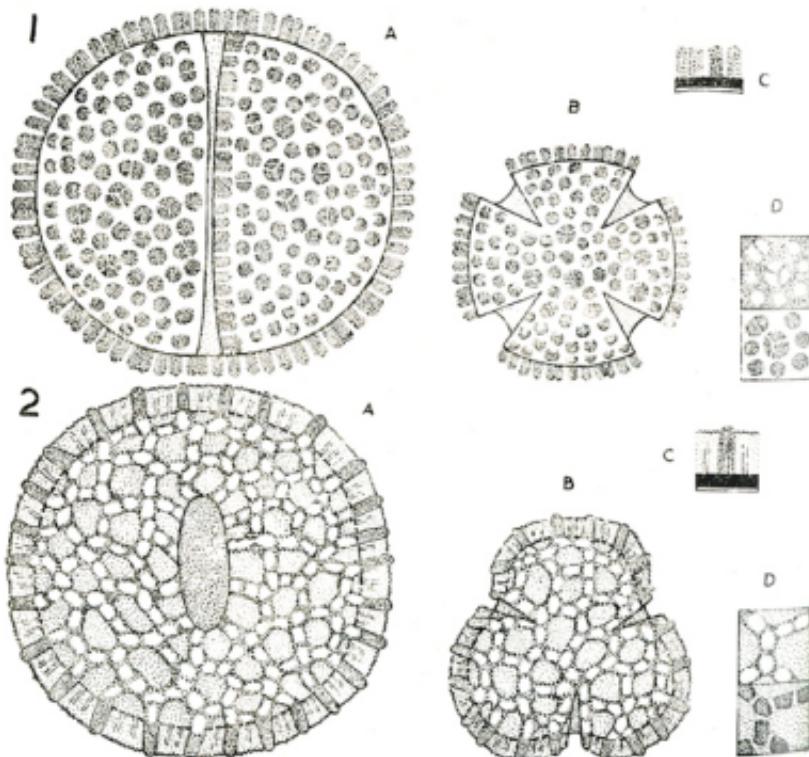


Fig. 52. ■Plumbaginaceae. 1. equatorial view $\times 1000$, polar view $\times 500$. 1. *Plumbago zeylanica* L. (Huang 3998). 2. *Statice sinensis* Girard. (Hosokawa 1735)

49. PORTULACACEAE 馬齒莧科

Pollen grains are characterized by pantocolpate, with diameter ca. $31-65\mu$ long; sexine thicker than nexine, granulate to small reticulate, with LO-pattern.

Key to genera

1. Grains large; exine thicker, echinate *Portulaca*
1. Grains small; exine thinner, psilate *Talinum*

Portulaca pilosa L. 馬齒莧—Fig. 53-1.

Grains with longest diameter $56-65\mu$ long; exine echinate, $2-2.5\mu$ thick, the spinulose ca. 1μ long.

The vouchers are Taipei, Huang 4036, 4087.

Talinum triangulare Will. var. *crassifolium* Hort. 假人參—Fig. 52-2.

Grains with longest diameter $31-45\mu$ long; exine $1-1.5\mu$ thick, psilate.

The vouchers are Sintiku, Kawakami & Simoda s. n. Oct. 1907; Kozan, Nakasima s. n. May 1926.

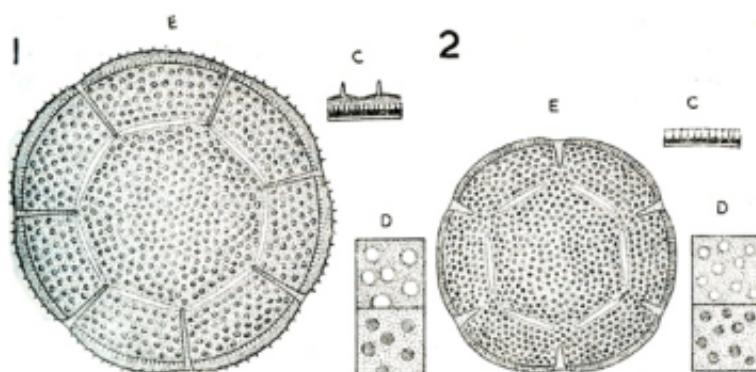


Fig. 53. Portulacaceae, $\times 1000$. 1. *Portulaca pilosa* L. (Huang 4087) 2. *Talinum triangulare* Will. var. *crassifolium* Hort. (Simoda S. s. n. Oct. 1907)

50. PRIMULACEAE 報春花科

Pollen grains are characterized by 3-colporate; shape classes of P/E prolate to spheroidal, or oval, with P axes of $11-35\mu$ long, and with E axes of $10-32\mu$ long; amb peritreme, goniotremes to pleurotreme; colpi long; ora various; exine usually psilate, $1-1.5\mu$ thick; sexine usually thicker than nexine, granulate or reticulate.

Key to genera

1. Grains small, $11-18 \times 10-15\mu$ long; LO- or indistinct-pattern *Androsace*, *Stimpsonia*, *Lysimachia*

1. Grains large, $17-35 \times 12-32 \mu$ long, usually OL-pattern
2. Ora colpi transversales-circulares.....*Primula*
2. Ora various except colpi transversales-circulares.....*Anagallis*, *Lysimachia*

Anagallis arvensis L. 玻璃繁縷—Fig. 54-1

Grains subprolate to spheroidal, with P axes of $17-22 \mu$ long, and with E axes of $16-22 \mu$ long; amb peritreme, or circular; ora colpi transversales-equatoriales; exine psilate, $1-1.5 \mu$ thick; sexine as thick as or thicker than nexine, reticulate, with OL-pattern.

The vouchers are Tamshui, Huang 3341; Taipei, Chuang 2096.

Androsace umbellata Merr. 繖形花銅錢草—Fig. 54-2

Grains subprolate to prolate-spheroidal, with P axes of $11-13 \mu$ long, and with E axes of $10-11 \mu$ long; amb peritreme, or circular; ora colpi transversales-equatoriales; exine psilate, 1μ thick; sexine thicker than nexine, with indistinct pattern.

The voucher is Taipei, Suzuki S. s. n. Jan. 1930.

Lysimachia L. 珍珠菜

Grains prolate to spheroidal, with P axes of $13-35 \mu$ long, and with E axes of $12-32 \mu$ long; ora usually colpi transversales-equatoriales.

The male gametophyte is dinucleate.

Key to species of *Lysimachia*

1. Grains small, $13-18 \times 12-15 \mu$ long; sexine LO-pattern..*L. ardisioides*, *L. sikokiana*
1. Grains large, $20-35 \times 17-32 \mu$ long
 2. Sexine LO-pattern.....*L. fortunei*
 2. Sexine OL-pattern
 3. Sexine thinner than nexine; exine psilate, scabrate to gemmate*L. decurrens*
 3. Sexine thicker than nexine; exine psilate
 4. Sexine granulate.....*L. formosana*
 4. Sexine finely reticulate
 5. Amb pleurotreme to peritreme.....*L. japonica*
 5. Amb peritreme.....*L. maritima*

Lysimachia ardisioides Masamune 榆杞珍珠—Fig. 54-4

Grains prolate to spheroidal, or oval, with P axes of $13-17 \mu$ long, and with E axes of $12-15 \mu$ long; amb peritreme, or circular; colpi nearly as long as the length of P axes; ora colpi transversales-equatoriales; exine psilate, 1μ thick; sexine thicker than nexine, granulate, with indistinct- or LO-pattern.

The vouchers are Taipei, Fukuyama 19244; Rahao-rimogan, Kudo 207; Paiwan, Matuda 1917.

Lysimachia decurrens Forst. 珍珠菜—Fig. 54-3

Grains prolate to prolate-spheroidal, with P axes of $25\text{--}35\ \mu$ long, and with E axes of $20\text{--}27\ \mu$ long; amb peritreme, or circular; ora colpi transversales; exine psilate, scabrate or gemmate, $2\ \mu$ thick; sexine thinner than nexine, reticulate, with OL-pattern.

The vouchers are Taipei, Chuang 2174, Sinten, Yamamoto s. n. Apr. 1929; Hualien, Shimizu et al. 11600.

Lysimachia formosana Honda 臺灣珍珠菜—Fig. 54-5

Grains subprolate to spheroidal, with P axes of $25\text{--}32\ \mu$ long, and with E axes of $23\text{--}28\ \mu$ long; amb peritreme to pleurotreme, or circular to intersubangular; exine psilate, $1.5\ \mu$ thick; sexine thicker than nexine, granulate, with OL-pattern.

The voucher is Sintiku, Simada 3993.

Lysimachia fortunei Maxim. 星宿菜—Fig. 54-6

Grains prolate to prolate-spheroidal, with P axes of $20\text{--}27\ \mu$ long, and with E axes of $17\text{--}22\ \mu$ long; amb pleurotreme to peritreme; exine psilate, $1\ \mu$ thick; sexine thicker than nexine, granulate, with LO-pattern.

The vouchers are Taipei, Huang 2353, Wen Shan, Liu & Shen s. n. May 1933; Sintiku, Kawakami 5964.

Lysimachia japonica Thunb. 小茄 Fig. 54-7

Grains prolate to spheroidal, with P axes of $25\text{--}35\ \mu$ long, and with E axes of $20\text{--}32\ \mu$ long; amb pleurotreme to peritreme, or intersubangular to circular; ora connected with each other; exine psilate, $1.5\ \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Taipei, Sasaki s. n. March 1924, Yamamoto & Suzuki s. n. Feb. 1929; Chiu-reki, Kawakami & Simada s. n. March 1909; central Mt. Suzuki S. 2056.

Lysimachia mauritiana Lam. 海濱珍珠草

Grains prolate to subprolate, with P axes of $27\text{--}35\ \mu$ long, and with E axes of $20\text{--}27\ \mu$ long; amb peritreme, or circular; exine psilate, $1\ \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Taipei, Kao 3958; Kiirun, Suzuki S. 4861; Botel Tabago, Hosokawa 9878.

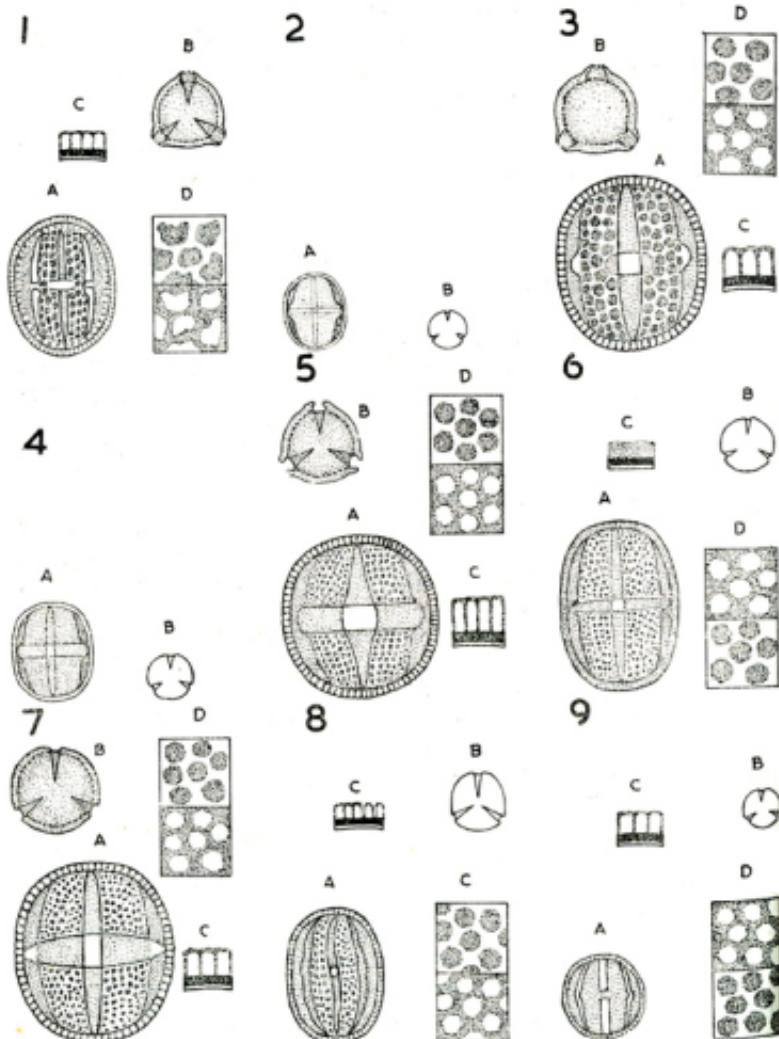
Lysimachia sikokiana Miq. 排草

Grains prolate to prolate-spheroidal, with P axes of $13\text{--}18\ \mu$ long, and with E axes of $12\text{--}13\ \mu$ long; amb peritreme, or circular; ora various, such as colpi transversales-equatoriales or colpi transversales and connected together; exine psilate, $1\ \mu$ thick; sexine thicker than nexine, granulate, with LO-pattern.

The vouchers are Taipei, Suzuki S. s. n. May 1929; Taito, Yamamoto & Mori 265, Nankotaizan, Suzuki S. s. n. July 1937.

Primula miyabeana Ito & Kawakami 玉山九輪草 Fig. 54-8

Grains prolate to subprolate, with P axes of $20\text{--}22\ \mu$ long, and with E axes of $12\text{--}18\ \mu$ long; amb peritreme, or circular; ora colpi transversales-circulares; exine



verrucate, $1\ \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The voucher is Tsugitakayama, Masamune 1237.

Stimpsonia chamaedryoides Wright ex Gray 施丁草—Fig. 54-9

Grains subprolate to suboblate, with P axes of $12\text{--}15\ \mu$ long, and with E axes of $12\text{--}15\ \mu$ long; amb peritreme, or circular to semiangular; ora colpi transversales-equatoriales; exine psilate, $1\ \mu$ thick; sexine thicker than nexine, granulate, with indistinct- or obscure LO-pattern.

The vouchers are Taipei, Suzuki S. 10240, Simada 960, Sasaki s. n. Apr. 1931; Toyen, Simada 1148.

51. PROTEACEAE 山龍眼科

Pollen grains are characterized by 3-porate; shape classes of P/E oblate to suboblate, or apiculate, with P axes of $15\text{--}17\ \mu$ long, and with E axes of $20\text{--}25(27)\ \mu$ long; amb goniotreme, or angular; ora crassimarginata; exine psilate, $1\text{--}1.5\ \mu$ thick; sexine thicker than or as thick as nexine, granulate, with indistinct- or obscure LO-pattern.

Helicia formosana Hemsl. 山龍眼—Fig. 55

The vouchers are wulai, Suzuki S. s. n. June 1928, Sendam Yama, Suzuki T. 7449; Taitung, Liu & keng 2885.

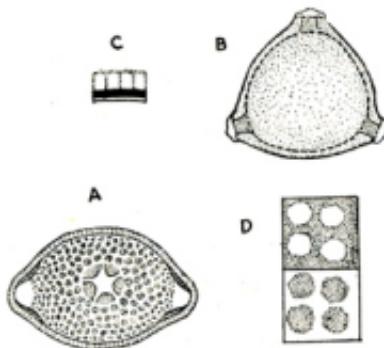


Fig. 55. *Helicia formosana* Hemsl.
(Suzuki S. s. n. June 1928), $\times 1000$.

52. SALICACEAE 楊柳科

Pollen grains are characterized by 3-colporate; shape classes of P/E prolate

Fig. 54. Primulaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Anagallis arvensis* L. (Huang 3341). 2. *Androsace umbellata* Merr. (Suzuki S. s. n. Jan. 1930) 3. *Lysimachia decurrens* Forst. (Yamamoto s. n. Apr. 1929) 4. *Lysimachia ardisioides* Masamune (Fukuyama 19244) 5. *Lysimachia formosana* Honda (Simada 3993) 6. *Lysimachia fortunei* Maxim. (Kawakami 5964) 7. *Lysimachia japonica* Thunb. (Kawakami & Simada s. n. March 1909) 8. *Primula miyabeana* Ito & Kawakami (Masamune 1237) 9. *Stimpsonia chamaedryoides* Wright (Simada 960)

to prolate-spheroidal, with P axes of 17-22 μ long, and with E axes of 12-18 μ long; amb peritreme to ptychotreme; colpi long; ora colpi transversales-circulares or colpi transversales-equatoriales; exine scabrate, 1 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Salix warburgii O. Seem. 水柳—Fig. 56.

The voucher is Taipei. Suzuki S. 4176.

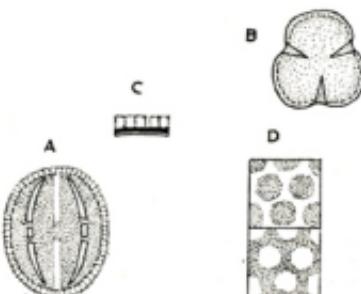


Fig. 56. *Salix warburgii* O. Seem. (Suzuki S. 4176), $\times 1000$

53. SAPOTACEAE 山櫻科

Pollen grains are characterized by 3-colporate; shape classes of P/E prolate to subprolate, with P axes of 17-33 μ long, and with E axes of 12-22 μ long; amb peritreme to pleurotreme, or circular to intersubangular; exine psilate, 2 μ thick; perispore? present; sexine thicker than nexine, granulate, with indistinct-or obscure OL-pattern.

Key to genera

1. Grains large, usually 27-30 \times 17-20 μ long; ora colpi transversales or colpi transversales-circulares *Pouteria*
1. Grains small, usually 20-25 \times 15-18 μ long; ora colpi transversales-equatoriales *Palaquium*

Palaquium formosanum Hayata 臺灣膠木—Fig. 57-1

Grains prolate to prolate-spheroidal, with P axes of (17-)20-30 μ long, and with E axes of (12-)15-20 μ long; ora colpi transversales-equatoriales to colpi transversales.

The vouchers are Kotosyo, Kawakami et al. 1326; Lutau Isl. Chuang et al. 2317. *Pouteria obovata* (R. Br.) Baehni 山櫻—Fig. 51-2.

Grains prolate to subprolate, with P axes of (25-)27-30(-33) μ long, and with E axes of 17-20(-22) μ long; ora colpi transversales or colpi transversales-circulares.

The voucher is Kotosyo, Sasaki s. n. Nov. 1934.

2

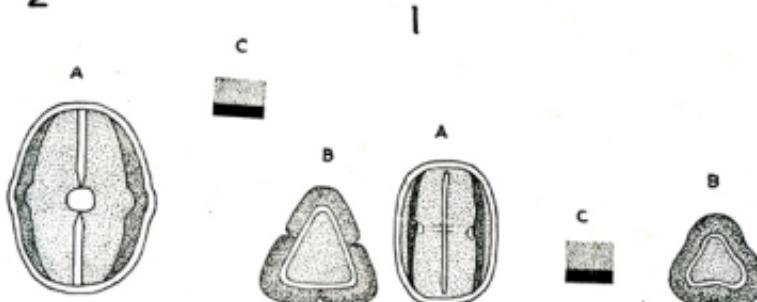


Fig. 57. Sapotaceae. $\times 1000$. 1. *Pouteria obovata* (R. Br.) Baehni, (Sasaki s. n. Nov. 1934)
2. *Palaquium formosanum* Hayata (Kawakami et al. 1326)

54. SCHIZANDRACEAE 五味子科

Pollen grains are characterized by 6-colporate; shape classes of P/E oblate to oblate-spheroidal, or oval, with P axes of 15-25 μ long, and with E axes of 23-30 μ long; amb peritreme; apertures 6 furrows, monopolar convergent, 3 furrows long and meeting at one pole, and other 3 furrows short, not meeting at either pole; exine scabrate to gemmate, 1-2 μ thick; sexine thicker than nexine, reticulate, the brochi with simplibaculate muri, with obscure OL-pattern.

Pollen grains of two genera in this family are very similar.

Kadsura japonica (L.) Dunal. 南五味子—Fig. 58-1.

Grains oblate to oblate-spheroidal, with P axes of 20-25 μ long, and with E axes of 27-30 μ long; apertures 6; exine 1-2 μ thick.

The voucher is Leeshan, Feung et al. 4574.

Schizandra arisanensis Hayata 阿里山北五味子—Fig. 57-2.

Grains oblate, or oval, with P axes of 15-22 μ long, and with E axes of 23-30 μ long; colpi long; exine with sparingly prominent bacula, 1 μ thick.

The voucher is Kwarenko, Fukuyama 4443.

55. STACHYURACEAE 旋花科

Pollen grains are characterized by 3-colporate; shape classes of P/E prolate-spheroidal to oblate-spheroidal, or oval, with P axes of (18-)20-23(-25) μ long, and with E axes of (17-)19-22(-24) μ long; amb peritreme, or circular to inter-subangular; ora colpi transversales-equatoriales; exine tectate, psilate, 1 μ thick; sexine thicker than nexine, granulate, with OL-pattern.

Stachyurus himalaicus HK. f. & Thoms. 通紫樹—Fig. 59

The vouchers are Hsitou, Lin & Kou s. n. Feb. 1957, Kou s. n. Feb. 1956; Nantou, Huang 4060.

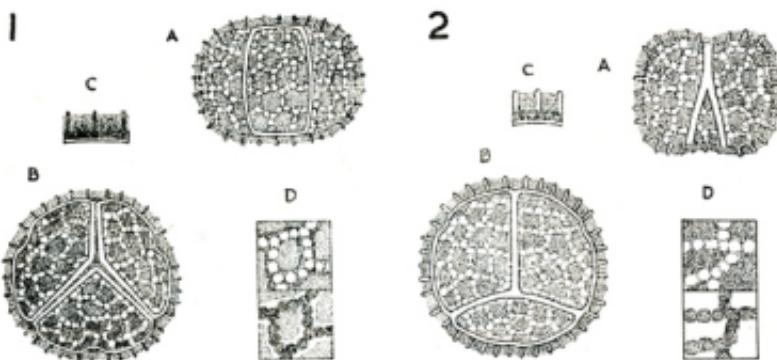


Fig. 58. Schizandraceae, $\times 1000$. 1. *Kodura japonica* (L.) Dunal. (Feung et al. 4574) 2. *Schizandra arisanensis* Hayata (Fukuyama 4443)

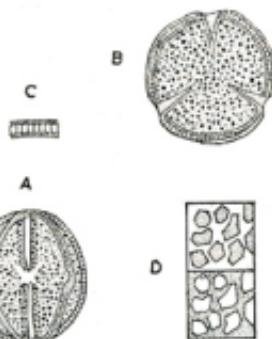


Fig. 59. *Stachyurus himalaicus* HK. f. & Thoms.
(Liu & Kou s. n., Feb. 1967)

56. STAPHYLEACEAE 省沽油科

Pollen grains are characterized by 3-colporate; shape classes of P/E oblate to subprolate, with P axes of $22\text{--}35 \mu$ long, and with E axes of $25\text{--}37 \mu$ long; amb goniofreme to peritreme, or angular, subangular, circular, semiangular to subangular; colpi long; ora colpi transversales-circulares; exine psilate, 2μ thick; sexine thicker than or nearly as thick as nexine, reticulate, with OL-pattern.

Key to genera

1. Colpi crassimarginate..... *Euscapheis*
1. Colpi uncrassimarginate *Turpinia*

***Euscaphis japonica* (Thunb.) Kanitz 野鴨情—Fig. 60-1**

Grains oblate to subprolate, or oval, with P axes of 22–27 μ long, and with E axes of 25–32 μ long; sexine with crassimurate brochi; colpi long, crassimarginate at equator.

The vouchers are Mt. Dalton, *Sasaki s. n.* Apr. 1932; Yanming Shan, *Huang* 3332, *Kao & Kou s. n.* Apr. 1957.

***Turpinia formosana* Nakai 山香圓—Fig. 60-2**

Grains suboblate to subprolate, or oval to rhomboidal, with P axes of 25–35 μ long, and with E axes of 25–37 μ long; colpi long, uncrassimarginate; sexine without crassimurate brochi.

The vouchers are Taipei, *Shimizu 2116*, *Kudo et al. s. n.* Apr. 1929; Taityu, *Sasaki s. n.* March 1924; Mt. Taihei, *Suzuki S. 3925*.

***Turpinia ternata* Nakai 三葉山香圓**

The voucher is Taito, *Sasaki s. n.* March 1932.

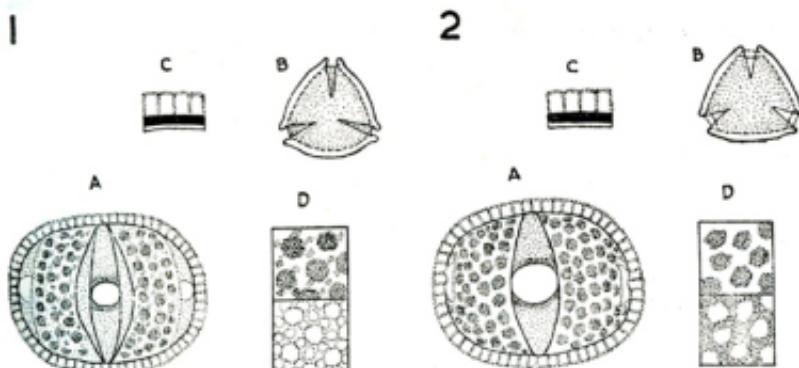


Fig. 60. Staphyleaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Euscaphis japonica* (Thunb.) Kanitz (*Sasaki s. n.* Apr. 1932) 2. *Turpinia formosana* Nakai (*Suzuki S. 3925*)

57. STERCULIACEAE 梧桐科

Pollen grains are characterized by 3(-4)-porate, pantoporate or panto-colporate; shape classes of P/E peroblate to prolate, with P axes of 16–52 μ long, and with E axes of 15–46 μ long, or with longest diameter of 40–67 μ long; ambigoniote to peritreme; exine usually psilate, sometimes echinate and scabrate, 1–2.5 μ thick; sexine reticulate, echinate to granulate.

Key to genera and species

1. Grains pantoporate or panto-colporate
2. Grains 5–8-porate; exine echinate *Waltheria*
2. Grains 3–6-porate; exine scabrate to psilate *Pterospermum*

1. Grains 3(-4)-porate
2. Grains peroblate to oblate-spheroidal, with small size of $12-19 \times 19-30 \mu$ long
 3. Sexine with LO-pattern..... *Helicteres*
 3. Sexine with OL-pattern
 4. Amb. goniotreme..... *Kleinhovia*
 4. Amb. peritreme..... *Reevesia*
 2. Grains prolate to oblate-spheroidal
 3. Sexine with LO-pattern
 4. Exine echinate..... *Sterculia ceramica*
 4. Exine psilate..... *Heritiera*
 3. Sexine with OL-pattern
 4. Grains small, $23-28 \times 24-28 \mu$ long *Sterculia nobilis*
 4. Grains large, $33-52 \times 33-46 \mu$ long
 5. Grains prolate-spheroidal to oblate..... *Melochia*
 5. Grains prolate to prolate-spheroidal *Firmiana*

Firmiana simplex Wright 楠桐—Fig. 61-1.

Grains 3-colporate, prolate to prolate-spheroidal, with P axes of $38-52 \mu$ long, and with E axes of $34-46 \mu$ long; amb. peritreme; ora lalongate, rarely lolongate; colpi transversales to colpi transversales-equatoriales; exine tectate and psilate, sometimes semitectate and short baculate, $1.5-2 \mu$ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Pingtung, Arikou, *Matuda s. n.*, July, 1919; San Chi Mon, *Matuda 1299*.

Helicteres angustifolia L. 山芝蔴—Fig. 61-2

Grains 3-porate, peroblate to oblate, with P axes of $13-19 \mu$ long, and with E axes of $23-30 \mu$ long; amb. goniotreme; ora crassimarginata; exine psilate, 1μ thick; sexine thicker than nexine, granulate, with LO-pattern.

The vouchers are Sintiku, *Kawakami 16578*; Miaoli, *Hayata & Kawakami 16581*; Nantou, *Mori 16582*.

Heritiera littoralis Dryand in Ait. 銀葉樹—Fig. 61-3

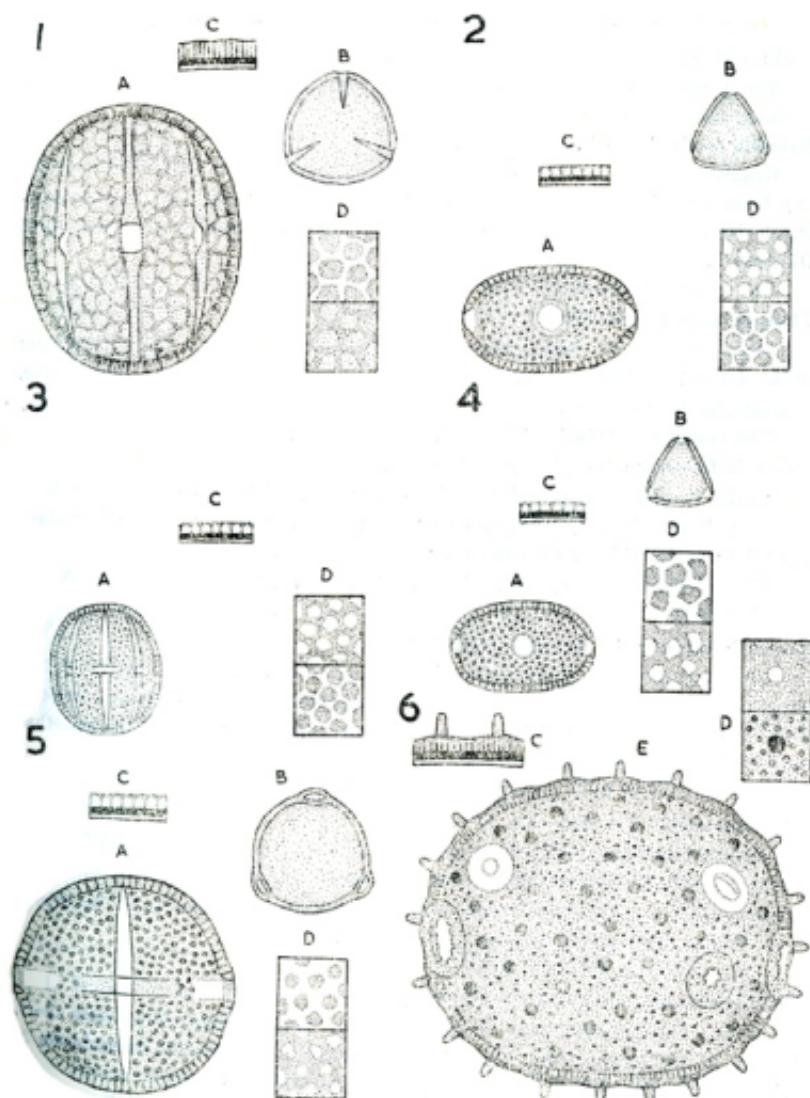
Grains 3-colporate, prolate-spheroidal to subprolate, with P axes of $19-22 \mu$ long, and with E axes of $18-21 \mu$ long; ora colpi transversales-equatoriales; exine psilate, 1μ thick; sexine thicker than nexine, granulate, with LO-pattern.

The voucher is Pingtung, *Chang 1572*.

Kleinhovia hospita L. 克蘭樹—Fig. 61-4

Grains 3-porate, peroblate to oblate, with P axes of $12-16 \mu$ long, and with E

Fig. 61. Sterculiaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Firmiana simplex* Wight (*Matuda s. n.*, July 1919) 2. *Helicteres angustifolia* L. (*Mori 16582*) 3. *Heritiera littoralis* Dryand in Ait. (*Chang 1572*) 4. *Kleinhovia hospita* L. (*Chang 1748*) 5. *Melochia corchorifolia* L. (*Sasaki s. n.*, Sept. 1938) 6. *Pterospermum cicerifolium* Willd. (*s. col. s. n.*, Apr. 1966)



axes of 21-26 μ long; amb goniotreme; ora uncrassimarginate; exine psilate, 1 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are pingtung, Kengting, Chang 1381, Liu Kuei, Chang 1748; Taitung, Liu & Keng 2821.

Melochia corehorifolia L. 野薺—Fig. 61-5.

Grains 3-colporate, prolate-spheroidal to oblate-spheroidal, with P axes of 33-38 μ long, and with E axes of 33-37 μ long; amb peritreme; ora colpi transversales-equatoriales; exine psilate, 2 μ thick; sexine thicker than nexine, granulate, with OL-pattern.

The voucher is Keelung, Sasaki s. n. Sept. 1908.

Pterospermum acerifolium Willd. 翅子木—61-6

Grains 3-6-porate, with longest diameter 55-67 μ wide; ora crassimarginate; exine echinate, 2-2.5 μ thick, the spines 2.5 μ long; sexine thicker than nexine, echinate, with LO-pattern.

The voucher is Taipei, NTU, s. col. s. n. Apr. 1966.

Reevesia formosana Hayata 台灣接羅樹—Fig. 62-1

Grains 3(-4)-porate, oblate to oblate-spheroidal, with P axes of 15-20 μ long, and with E axes of 19-23 μ long; amb peritreme; ora uncrassimarginate; exine psilate, 1 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Pingtung, Chang 4899, Meitan, Chang 4846; Kosyun, Noboru s. n. Apr. 1923.

Sterculia ceramica Br. 蘭嶼頭婆—Fig. 62-2

Grains 3-colporate, prolate-spheroidal to spheroidal, with P axes of 16-20 μ long, and with E axes of 15-18 μ long; amb peritreme; ora colpi transversales to colpi transversales-equatoriales; exine echinate, 1 μ thick; sexine thicker than nexine, granulate, with LO-pattern.

The voucher is Botel Tabago, Hosokawa 9833a.

Sterculia nobilis Sm. 頭婆—Fig. 61-3.

Grains 3-colporate, subprolate to oblate-spheroidal, with P axes of 23-28 μ long, and with E axes of 24-28 μ long; amb peritreme, or semiangular; ora colpi transversales to colpi transversales-circulares; exine psilate, 2 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The voucher is Sin Kwa, Suzuki S. s. n. Apr. 1921.

Waltheria americana L. 草梧桐—Fig. 62-4.

Grains 5-8-colporate, with longest diameter 40-54 μ wide; colpi very short, as long as the length of ora; ora colpi transversales; exine psilate to scabrate, 2-2.5 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

The vouchers are Takao, Hosokawa 1716; s. loc. Sasaki s. n. Feb. 1935.

58. STYRACACEAE 安息香科

Pollen grains are characterized by 3-colporate; shape classes of P/E oblate

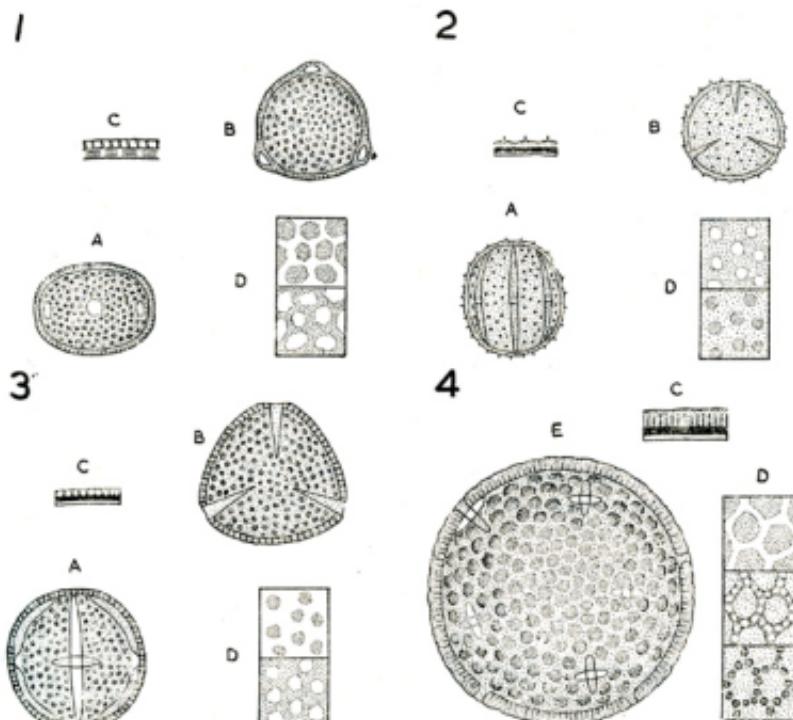


Fig. 62. Sterculiaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Reevesia formosana* Hayata (Chang 4846) 2. *Sterculia ceramica* Br. (Hosokawa 9833a) 3. *Sterculia nobilis* Sm. (Suzuki S. n. Apr. 1921) 4. *Waltheria americana* L. (Suzuki s. n. Feb. 1935)

to subprolate, with P axes of 20–42 μ long, and with E axes of 22–50 μ long; amb peritreme to goniotreme, or circular, semiangular, subangular to angular; ora various; exine psilate, 1–2.5 μ thick; sexine reticulate.

Key to genera

1. Sexine thicker than nexine, with LO-pattern *Alniphyllum*
1. Sexine thinner than nexine, with OL-pattern *Styrax*
***Alniphyllum pterospermum* Matsumura 假赤楊—Fig. 63-1**

Grains oblate to subprolate, with P axes of 20–27 μ long, and with E axes of 22–30 μ long; ora colpi transversales to colpi transversales-circulares; exine 1–2 μ thick; sexine thicker than nexine, with LO-pattern.

The vouchers are Taipei, Nakamura 4349, Liu & Shen s. n. Sept. 1933.

Styrax formosanum Matsumura 烏皮九芎

Grains oblate to oblate-spheroidal, with P axes of (30-)32-35(-42) μ long, and with E axes of (37-)42-45(-47) μ long; ora colpi transversales-circulares or rarely colpi transversales-equatoriales; exine 2-2.5 μ thick; sexine as thick as or thinner than nexine, with OL-pattern.

The vouchers are Taipei, Sasaki s. n. March 1918; Sintiku, Sasaki s. n. March 1916; Naibuntoge, Kudo & Mori 1628; Kuawarusu, Matuda s. n. March 1918.

Styrax japonicum Sieb. & Zucc. var. **kotoensis** (Hayata) Masamune & Suzuki 蘭香
安息香—Fig. 60-2.

This species differs from *S. formosana* by its grains with P axes of 35-40 μ long and with E axes of 42-60 μ long; and exine 2 μ thick.

The voucher is Botel Tabago, Sasaki s. n. Feb. 1920.

Styrax suberifolium Hook. & Arn. 紅皮

This species differs from *S. formosana* by its grains suboblate to subprolate, with P axes of 30-42 μ long, and with E axes of 32-42 μ long; ora colpi transversales-circulares or colpi transversales; exine 1-2 μ thick.

The vouchers are Kiirun, Sasaki s. n. Apr. 1911, Yanming Shan, Huang 3383, Hsieh 420180; Taito, Sasaki s. n. May 1924; Hualien, Shimizu et al. 11585.

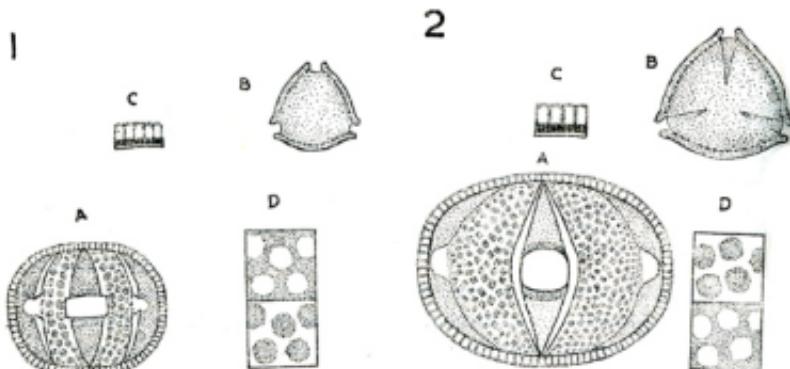


Fig. 63. Styracaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Aluiphyllo pterospermum* Matsumura (Nakamura 4349) 2. *Styrax japonica* Sieb. & Zucc. var. *kotoensis* (Hayata) Masamune & Suzuki. (Sasaki s. n. Feb. 1920)

59. SYMPLOCACEAE 灰木科

Pollen grains are characterized by 3(-4)-colporate; shape classes of P/E oblate-spheroidal to oblate, with P axes of 17-40 μ long, and with E axes of 20-42 μ long; amb gonioreme to peritreme, or semiangular, subangular, semilobate to circular; apertures brevicolpate, 5-15 μ long; ora 5-15 μ in diameter, costae circulares;

exine psilate, 1.5-3 μ thick; sexine as thick as nexine, granulate, with majority of LO-pattern.

The distinction among species is rather difficult, size and shape of ora and colpi, shape of grains and sexine pattern may be important characteristics for identification of taxa in the genus.

Key to species of *Symplocos*

1. Sexine with OL-pattern
 2. Amb semiangular to circular, with P axes of 32-40 μ long;
 - colpi as wide as ora..... *S. confusa*
 2. Amb subangular to semilobate, with P axes of 20-25 μ long;
 - colpi narrow, as 1/3 wide as ora..... *S. paniculata*
1. Sexine with LO-pattern
 2. Apertures pores or mixed with composite structure
 3. Grains pores, circular shaped in polar view..... *S. theophrastaeifolia*
 3. Some grains mixed with composite aperture
 4. Amb sometimes semilobate..... *S. morrisonicola*
 4. Amb all subangular..... *S. caudata*
 4. Amb semiangular to circular
 2. Apertures all composite structure
 3. Colpi as long as ora..... *S. heishanensis*
 3. Colpi twice longer than ora.
 4. Amb semiangular to circular.....
..... *S. konishi*, *S. kotoensis*, *S. taiheizanensis*
 4. Amb semiangular to subangular..... *S. lancifolia*
 4. Amb semiangular..... *S. cochinchinensis*, *S. formosana*.
 4. Amb semiangular, subangular to semilobate..... *S. modesta*

***Symplocos caudata* Wall.** 尾狀葉灰木—Fig. 64-1

Grains 3(-4)-porate, oblate to oblate-spheroidal, with P axes of (17-)21-22 (-26) μ long, and with E axes of (20-)28(-38) μ long; amb goniotreme, or sub angular to rarely suboblate; colpi including margo about twice as long as the width of ora; ora 6-7 μ in diameter; exine 1.5-2 μ thick; sexine with LO-pattern.

The vouchers are Taipei, Nakamura 764; Sotenzan, Kanehira et al. s. n. Oct. 1919; Sintiku, Sasaki s. n. March 1916.

***Symplocos cochinchinensis* (Lour.) Moore 銅葉山欒**

Grains 3-porate, suboblate, with P axes of 22.5 μ long, and with E axes of 27.5 μ long; amb goniotreme, or semiangular; colpi including margo about twice as long as the width of ora; ora 6-7 μ in diameter; exine 1.5-2 μ thick; sexine with LO-pattern.

The voucher is Taipei, Kanehira s. n. Oct. 1929.

Symplocos confusa Brand. 南瀛山櫟—Fig. 64-2

Grains 3-corporate, oblate-spheroidal to oblate, with P axes of $(32.5\text{--})35(\text{--}40)\mu$ long, and with E axes of $(40\text{--})42.5(\text{--}50)\mu$ long; amb goniotreme to peritreme, or circular to semiangular; ora $10\text{--}13\mu$ in diameter, margo cleft, 3μ thick; exine $2\text{--}3\mu$ thick; sexine thinner than nexine, pseudo-reticulate, with obscurely LO-pattern.

The vouchers are Tipontoge, Suzuki 11088; Taitun, Shimizu 3781.

Symplocos congesta Zoll. 灰木—Fig. 64-3

Grains 3(-4)-corporate, oblate to oblate-spheroidal, with P axes of $(22.5\text{--})27\text{--}30(\text{--}32.5)\mu$ long, and with E axes of $(25\text{--})32\text{--}38(\text{--}40)\mu$ long; amb goniotreme to peritreme, or circular to semiangular; ora including the width of margo, $10\text{--}13\mu$ in diameter; exine $2\text{--}3\mu$ thick; sexine thinner than nexine, with LO-pattern.

The vouchers are Takao, Matuda s. n. July 1919; Mt. Daizyurin, Sasaki s. n. July 1919; Taito, Shimizu 3737.

Symplocos formosana Brand 臺灣灰木

Grains 4(-3)-corporate, oblate, with P axes of $(25\text{--})27.5(\text{--}30)\mu$ long, and with E axes of $32\text{--}42.5\mu$ long; amb goniotreme, or semiangular; apertures brevicolpate, 10μ long; ora without the width of margo 5μ in diameter; exine 2.5μ thick; sexine as thick as nexine, with LO-pattern.

The voucher is Nantou, Huang 2087.

Symplocos heishanensis Hayata 平遠那灰木—Fig. 64-4

Grains 3-4-corporate, oblate, with P axes of $20\text{--}26\mu$ long, and with E axes of $30\text{--}40\mu$ long; amb goniotreme, or semiangular; apertures brevicolpate, 10μ long; ora without the width of margo 5μ in diameter, costae transversales; exine $1.5\text{--}2\mu$ thick; sexine as thick as nexine, with LO-pattern.

The vouchers are Taipei, Suzuki T. 17926, Liu et al. s. n. Feb. 1955; Buizan, Matuda s. n. March 1917; Hsinchu, Liu et al. 1448.

Symplocos konishii Hayata 小西氏灰木

Grains 3(-4)-corporate, oblate to oblate-spheroidal, with P axes of $17\text{--}28\mu$ long, and with E axes of $27\text{--}35\mu$ long; amb goniotreme to peritreme, or semiangular to circular; apertures brevicolpate, 10μ long; ora 10μ in diameter; costae circulares; exine 2μ thick; sexine as thick as nexine, with LO-pattern.

The voucher is Taipei, Suzuki T. 18911.

Symplocos kotoensis Hayata 蘭嶼山櫟

Grains 3(-4)-corporate, oblate to oblate-spheroidal, with P axes of 17.5μ long, and with E axes of 25μ long; amb peritreme to goniotreme, or semiangular to circular; apertures brevicolpate, 7.5μ long; ora 7.5μ in diameter, costae circulares; exine 1μ thick; sexine as thick as nexine, with LO-pattern.

The voucher is Botel Tabago, Chuang 2413.

Symplocos lancifolia Sieb. & Zucc. 光葉山鱉

Grains 3(-4)-porate, oblate to suboblate, with P axes of (25-)28(-32) μ long, and with E axes of (33-)38(-42) μ long; amb goniotreme, or semiangular to subangular; apertures brevicolpate, 10-15 μ long; ora 7.5-15 μ in diameter; exine 2 μ thick; sexine as thick as nexine or thinner than nexine, with LO-pattern.

The vouchers are Taiheizan, Suzuki S. 3817; Mt. Ali, Sasaki s. n. Jan. 1912; Taipei, Suzuki T. 8622; Nantou, Liu et al. s. n. Feb. 1954.

Symplocos modesta Brand. 小葉灰木

Grains 3(-4)-porate, oblate to suboblate, with P axes of 24-28 μ long, and with E axes of 28-42 μ long; amb goniotreme, or semiangular, subangular to semilobate; apertures brevicolpate, 10-15 μ long; ora 10-15 μ in diameter; exine 2 μ thick; sexine as thick as nexine, with LO-pattern.

The vouchers are Taiheizan, Suzuki S. 3819; Taichung, Liu et al. 89; Taitotyo, Suzuki T. 19514; Hosokawa 5301; Kosyun, Suzuki T. 6182.

Symplocos morrisonicola Hayata 玉山灰木

Grains 3-corporate, oblate to suboblate, with P axes of 20-29 μ long, and with E axes of 27-38 μ long; amb goniotreme, or semiangular, subangular to semilobate; apertures brevicolpate, 10-12 μ long; ora 10-12 μ in diameter, costae circulares; exine 2 μ thick; sexine as thick as nexine, with LO-pattern.

The vouchers are Nantou, Huang 461; Taichung, Liu et al. 10200.

Symplocos paniculata Wall. 圓錐花灰木—Fig. 64-5.

Grains 3(-4)-porate, oblate to suboblate, with P axes of 20-25 μ long, and with E axes of 33-40 μ long; amb goniotreme, or semiangular, subangular to semilobate; apertures brevicolpate, 10-15 μ long; ora 10 μ in diameter, H-shaped or costae equatoriales; exine 2 μ thick; sexine as thick as nexine, with OL-pattern.

The vouchers are Taipei, Huang 2258, Shimizu 2176, Masamune 2924, Kao et al. s. n. Apr. 1957.

Symplocos taiheizanensis (Mori) Mori 太平山灰木

Grains 3-corporate, oblate to suboblate, with P axes of 21-28 μ long, and with E axes of 28-33 μ long; amb goniotreme to peritreme, or semiangular to circular; apertures brevicolpate, 10 μ long; ora 10 μ in diameter; exine 2 μ thick; sexine as thick as nexine, with LO-pattern.

The vouchers are Hualien, Fukuyama 4680; Taiheizan, Suzuki 3830.

Symplocos theophrastaeefolia Sieb. & Zucc. 山鱉肝—Fig. 64-6

Grains 3(-4)-porate, oblate to suboblate, with P axes of 18-25 μ long, and with E axes of 20-27 μ long; amb peritreme to goniotreme, or circular to semiangular; apertures brevicolpate, 5 μ long; ora 5 μ in diameter; exine 2 μ thick; sexine as thick as nexine, with LO-pattern.

The vouchers are Ilan, Kao 5996; Taipei, Kao 30158; Sintiku, Suzuki T. 20535.

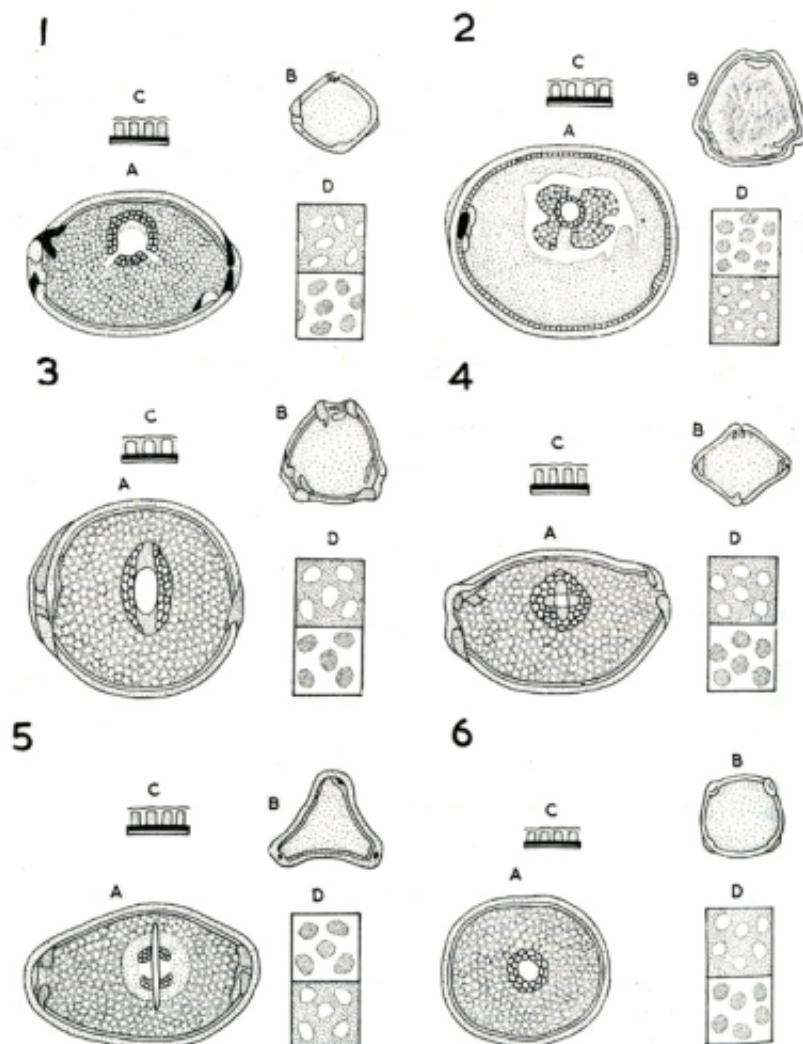


Fig. 64. Symplocaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Symplocos caudata* Wall. (Kanekira et al. s.n. Oct. 1919) 2. *Symplocos confusa* Brand (Shimizu 37810) 3. *Symplocos congesta* Benth. (Sasaki s.n. July 1919) 4. *Symplocos heishanensis* Hayata (Sezaki T. 17926) 5. *Symplocos paniculata* Wall. (Masamune 2824) 6. *Symplocos theophrastaefolia* Sieb. & Zucc. (Kao 30158)

60. THYMELLACEAE 瑞香科

Pollen grains are characterized by pantoporate or inaperturate (?), spheroidal to subspheroidal; longest diameter 20–37 μ wide; ora very small, nearly as large as brochi; exine about scabrate, 2 μ thick; sexine thicker than nexine, reticulate, with OL-pattern.

Daphne arisanensis Hayata 白瑞香

Grains (25–)30–33(–35) μ wide in the longer diameter; ora relatively larger than brochi.

The vouchers are Mt. Taihei, *Sasaki s. n.* Apr. 1931; Chitou, *Kao* 222.

Daphne genkwa Sieb. & Zucc. 茜花

Grains (21–)22–25(–27) μ wide in the longer diameter; ora relatively larger than brochi.

The voucher is Taityu Ensyurin, *Keyama* 72.

Daphne odora Thunb. var. *atrocaulis* Rehder 白花瑞香—Fig. 65–1

Grains (27–)30–35(–37) μ wide in the longer diameter; ora almost as large as brochi.

The vouchers are Syokei, *Sasaki s. n.* Jan. 1914; Taipei, *Shimizu* 680.

Wikstroemia indica C. A. Meyer 南嶺莢花

Grains about 32 μ wide in diameter.

The voucher is Taipei, *Suzuki S. 55153*.

Wikstroemia mononectaria Hayata 長葉南嶺莢花—Fig. 65–2

Grains (20–)22–25(–27) μ wide in the longer diameter; ora relatively larger than brochi.

The vouchers are Taipei, *Mori* 222, Wulai, *Hsieh s. n.* Sept. 1953, *Chuang* 229.

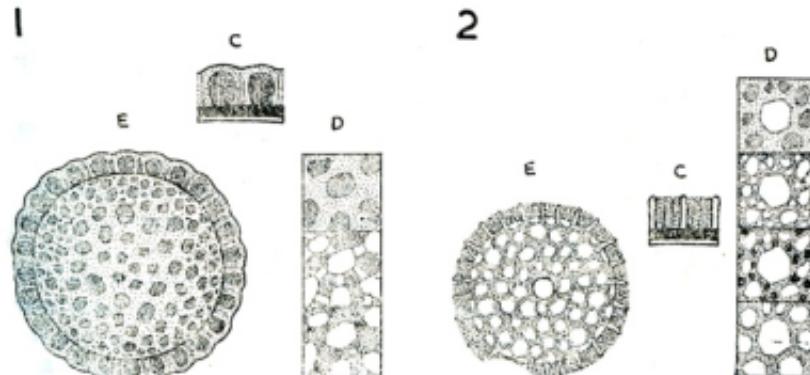


Fig. 65. Thymellaceae, $\times 1000$. 1. *Daphne* (var. *atrocaulis* Rehder) 2. *Wikstroemia mononectaria* Hayata (var. *atrocaulis* Rehder).

(*Shimizu* 680) (var. *atrocaulis* Rehder. (*Shimizu*

61. TILIACEAE 田麻科

Pollen grains are characterized by 3-colporate; shape classes of P/E prolate to spheroidal, with P axes of 30-55 μ long, and with E axes of 22-42 μ long; amb peritreme, ptychotreme to pleurotreme, or circular to intersubangular; colpi nearly as long as the length of P axes; ora colpi transversales-circulares or colpi transversales-equatoriales; exine psilate to scabrate, 2-3 μ thick; sexine reticulate, with OL-pattern.

Corchorus capsularis L. 黃麻—Fig. 66-1

Grains prolate to subprolate, with P axes of 30-32 μ long, and with E axes of 22-25 μ long; amb peritreme; ora colpi transversales-equatoriales; exine psilate, 2 μ thick; sexine as thick as or thinner than nexine.

The voucher is Suigentii, *Umiyani* s. n. Sept. 1928.

Grewia L. 田麻屬

Grains oval to rhomboidal, or prolate to prolate-spheroidal; exine psilate to scabrate, 2-3 μ thick; sexine thicker than nexine.

Grewia asiatica L. 田麻

Grains oval, with P axes of 48-55 μ long, and with E axes of 35-42 μ long; ora colpi transversales-circulares.

The voucher is Taipei, *Sasaki* s. n. June 1929.

Grewia biloba Wall. 雙裂葉田麻—Fig. 66-2

Grains oval to rhomboidal, with P axes of 37-48 μ long, and with E axes of 25-30 μ long; ora colpi transversales-equatoriales.

The voucher is Takao, *Sasaki* s. n. July 1918.

Grewia piscatorum Hance 小葉捕魚木

Grains oval, with P axes of (32-)40-45(-50) μ long, and with E axes of (25-)30-35(-37) μ long; ora colpi transversales-equatoriales.

The voucher is Taipei, *Sasaki* s. n. May 1932.

Grewia rhombifolia Kaneh. & Sasaki 菱葉捕魚木

Grains oval to rhomboidal, with P axes of (35-)38-42(-50) μ long, and with E axes of 25-32 μ long; ora colpi transversales-equatoriales.

The voucher is Ilan, *Huang* 3997; Taipei, *Sasaki* 380350.

Triumfetta Plum. ex L. 蝶施草屬

Grains with P axes of 32-45 μ long, and with E axes of 17-35 μ long; ora colpi transversales-equatoriales; exine 2 μ thick; sexine thicker than nexine.

Triumfetta bartramia L. 菱葉垂按木

Grains oval to rhomboidal, or prolate to spheroidal, with P axes of 32-45 μ long, and with E axes of 27-35 μ long; amb peritreme, or circular; ora colpi transversales-equatoriales; exine psilate.

The voucher is Taipei, *Sasaki* s. n. March 1950.

Triumfetta pilosa Roth. 密毛螺旋草—Fig. 66-3

Grains oval or prolate, with P axes of 32-40 μ long, and with E axes of 17-22

(-25) μ long; amb peritreme to pleurotreme, or circular to intersubangular; exine psilate to scabrate.

The vouchers are Taipei, Suzuki S. 6130; Inter Aderu et Budai, Suzuki S. 11212.

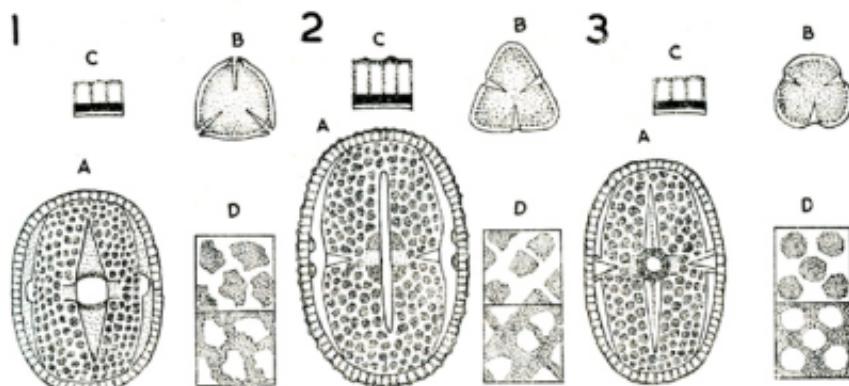


Fig. 66. Tiliaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Corchorus capsularis* L. (Umetani & n. Sept. 1928) 2. *Grewia biloba* Wall. (Suzuki s. n. July 1918) 3. *Triumfetta pilosa* Roth. (Suzuki S. 11212)

62. TROCHODENDRACEAE 星櫛樹科

Pollen grains are characterized by 3-colporate; shape classes of P/E prolate to spheroidal, with P axes of 18-25 μ long, and with E axes of 15-23 μ long; amb peritreme to ptychotreme, or circular, intersubangular, semiangular to intersemianangular; colpi long, nearly as long as the length of P axes; exine scabrate to psilate, 1.5-2 μ thick; sexine as thick as or thicker than nexine, reticulate, with OL-pattern.

Trochodendron aralioides Sieb. & Zucc. 星櫛樹—Fig. 67

The vouchers are Taipei, Kao & Liu s. n. Apr. 1957, Huang, 2308, 2317; Hualien, Shimizu 12544.

63. UMBELLIFERAE 紫草科

This is a stenopalynous family, which is characterized by 3-colporate grains. The shape of pollen grains varies from elliptic, oblong-elliptic, rhomboidal to constricted oblong-oval in equatorial view and triangular in polar view. In this family, the shape classes of P/E ranges from oblate-spheroidal to perprolate, and varies with P axes of 14-48 μ long, and with E axes of 7-27 μ long. The amb which belongs to pleurotreme, less frequently goniotreme and ptychotreme, has a diagnostic value for distinguishing grains into 3 major groups. The aperture is 3 pores with 3 long furrows with the width varying greatly. Syncolporate grains are rarely found in members of *Centella* and *Bupleurum*. The lalongate ora are of taxonomic value. These characteristics are: ora crassimarginate versus uncras-

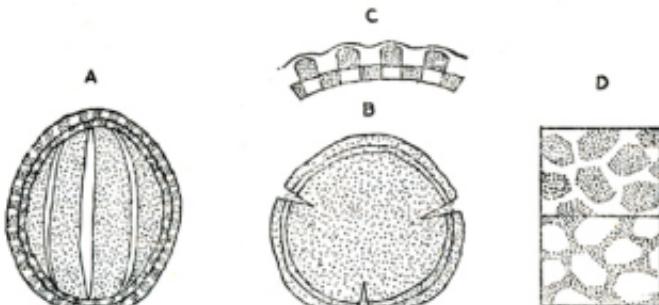


Fig. 66. *Trochodendron aralioides* Sieb. & Zucc. (Kao & Liu s. n. Apr. 1957), $\times 1500$.

simarginate; shape of ora circular vs. elliptic vs. parallel; and size of ora vs. colpi. The exine is 1-2 μ thick, sometimes, it is thickened at the equator, Z section or pole. The sexine is reticulate or finely reticulate, usually as thick as nexine, with LO-pattern throughout the family.

34 species in 18 genera were examined.

Key to genera

1. Amb ptychotreme to peritreme
2. Shape classes of P/E perprolate
 3. Colpi as long as P axes..... *Sanicula*
 3. Colpi as 2/3 long as P axes..... *Conioselinum*
2. Shape classes of P/E prolate
 4. Grains syncolpate *Centella*
 4. Grains not syncolpate *Apium*
1. Amb goniotreme to peritreme
 5. Grains rhomboidal; exine thickened at equator..... *Hydrocotyle*
 5. Grains oblong-oval; exine even in thickness..... *Bupleurum*
1. Amb pleurotreme to peritreme
 6. Ora crassimarginate
 7. Sexine nearly as thick as nexine
 8. Grains constricted at equator *Pimpinella*
 8. Grains not constricted at equator
 9. Infrategilliar baculae distinct *Glehnia*
 9. Infrategilliar baculae obscure..... *Cnidium*
 7. Sexine thicker than nexine
 10. Infrategilliar baculae usually obscure..... *Peucedanum*
 10. Infrategilliar baculae distinct..... *Coriandrum, Foeniculum*
 6. Ora uncrassimarginate

11. Grains usually constricted at equator.....*Angelica, Torilis*
11. Grains not constricted at equator
 12. Sexine usually thickened at pole
 13. Shape classes of P/E perprolate.....*Eryngium*
 13. Shape classes of P/E prolate to perprolate
 13. Shape classes of P/E prolate to subprolate
 12. Sexine usually thickened at equator.....*Oenanthe, Angelica*

***Angelica* L. 美活**

Grains constricted oblong-oval, oblong, oblong with one side bulged and elliptic-oval or perprolate to prolate, with P axes of from 19μ to 33μ , and with E axes of from 8μ to 15μ ; ora as wide as or wider than the width of colpi, colpi transversal; sexine as thick as nexine.

Five species were examined.

Key to species of *Angelica*

1. Ora as wide as the width of colpi; grains constricted oblong-oval.....*A. dahurica, A. tarokoensis*
1. Ora wider than the width of colpi
 2. Grains asymmetric oblong-oval with one side bulged.....*A. morii*
 2. Grains symmetric oblong-oval.....*A. hirsutiflora, A. morrisonicola*

***Angelica dahurica* Maxim. 臺灣羌活—Fig. 68-1**

Grains constricted oblong-oval or perprolate to prolate, with P axes of (23-) 26-29(-33) μ long, and with E axes of (9-)10-12(-14) μ long; distance between two colpi (9-)10-12(-13) μ long; colpi as wide as the width of ora, discontinuous at cross with ora.

The vouchers are Taipei, Yen 1-1, Kao 3616, Huang 3328; Sintiku, Simada 1411. *Angelica hirsutiflora* Liu, Chao & Chuang, Umbelliferae of Taiwan, Experimental Forest of National Taiwan University, Technical Bulletin 26: 4, 1961. 毛葉羌活

Grains oblong-oval or perprolate to prolate, with P axes of (21-)23-24(-28) μ long, and with E axes of (9-)10-11(-12) μ long; distance between two colpi 9-11 (-13) μ long; colpi narrower than the width of ora.

The vouchers are Taipei, Chuang 3979, Chuang & Kao 3346.

***Angelica morii* Hayata 森氏羌活**

Grains oblong-oval with one side bulged or perprolate, with P axes of (25-) 29-30(-33) μ long, and with E axes of (9-)10-11(-14) μ long; distance between two colpi (7-)8-10(-14) μ long; colpi narrower than the width of ora.

The vouchers are Takao, Fukuyama 4473; Kwarenko, Fukuyama & Suzuki 15171, 16296.

***Angelica morrisonicola* Hayata 玉山羌活**

Grains oblong-oval or perprolate, with P axes of (22-)23-25(-31) μ long, and

with E axes of (8-)10(-14) μ long; colpi narrower than the width of ora.

The voucher is Hualien, Nokogoe, Kudo & Mori 28.

Angelica tarokoensis Hayata 太魯閣羌活

Grains elliptic-oval or prolate to perprolate, with P axes of (19-)21-24(-25) μ long, and with E axes of (10-)11-13(-15) μ long; distance between two colpi 8-14 μ long; colpi as wide as the width of ora.

The voucher is Kwarenko, Matuda 548.

Apium graveolens L. 芥菜—Fig. 68-2

Grains elliptic-oval or prolate to perprolate, with P axes of 18-22 (-29) μ long, and with E axes of (8-)10-12(-15) μ long; amb ptychotreme; distance between two colpi from (7-)10(-14) μ long; ora colpi transversales, as wide as the width of colpi, broadened at cross with colpi; sexine as thick as nexine, with obscure LO-pattern.

The vouchers are Ako, Matuda 126; Taitung, Liu et al. 315.

Bupleurum Kaoli Liu, Chao & Chuang, Umbelliferae of Taiwan, Experimental Forest of National Taiwan University, Technical Bulletin 26: 8, 1961 紫欒—Fig. 68-3

Grains ellipsoidal, or prolate, with P axes of (16-)20-21(-23) μ long, and with E axes of (9-)11-13(-14) μ long; amb goniotreme; distance between two colpi 10-14 μ long; apertures syncolpate; ora wider than the width of colpi, colpi transversales; sexine as thick as nexine.

The vouchers are Miaoli, Chuang & Kao 2807, Kao 3746.

Centella asiatica (L.) Urban 雷公根—Fig. 68-4

Grains elliptic-oval or prolate, with P axes of (20-)22-23(-26) μ long, and with E axes of (10-)13-15(-17) μ long; amb ptychotreme; distance between two colpi (9.5-)11-13(-17) μ long; syncolpate; ora wider than the width of colpi, colpi transversales equatoriales to colpi transversales; sexine as thick as nexine.

The vouchers are Kao 3573, s. n. July 1958.

Cnidium formosanum Yabe 臺灣蕁荑—Fig. 68-5

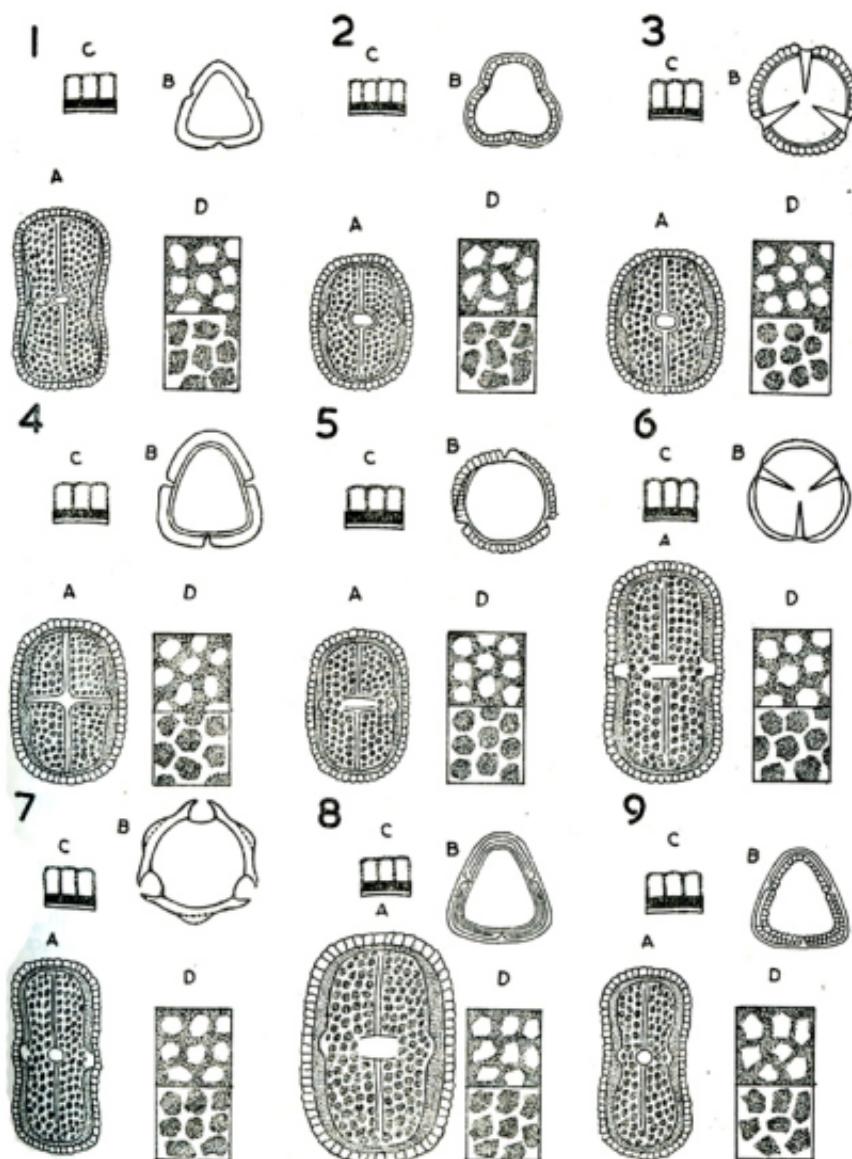
Grains elliptic-oval, with one equatorial side bulged, or perprolate to subprolate, with P axes of (16-)20-21(-28) μ long, and with E axes of 8-13 μ long; amb pleurotreme; distance between two colpi (5-)7-12(-13) μ long; ora crassimarginata, as wide as or wider than the width of colpi, costae equatoriales; sexine as thick as nexine.

The vouchers are Tainan, Morimoto 343, Sasaki s. n. Apr. 1925; Ako, Matuda 237.

Conioselinum morrisonense Hayata 玉山蕁荑—Fig. 68-6

Grains oblong-oval, or perprolate, with P axes of (28-)31-33(-35) μ long, and

Fig. 68. Umbelliferae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Angelica dahurica* Maxim. (Yen 1-1) 2. *Apium graveolens* L. (Matuda 126) 3. *Bupleurum Kaoli* Liu, Chao & Chuang (Kao 2807) 4. *Centella asiatica* (L.) Urban (Kao s. n. July 1958) 5. *Cnidium formosanum* Yabe (Morimoto 343) 6. *Conioselinum morrisonense* Hayata (Moriba s. n. Oct. 1936) 7. *Coriandrum sativum* L. (Konchira & Sasaki s. n. July 1918) 8. *Eryngium foetidum* L. (Kao 4082) 9. *Foeniculum vulgare* Mill. (Matuda 896)



with E axes of (10-)12-14(-16) μ long; amb ptychotreme; distance between two colpi 10-11 μ long; ora wider than the width of colpi, colpi transversales-equatoriales; sexine as thick as nexine.

The voucher is Taichung, Mt. Tugitata, Mori s. n. Oct. 1936.

Coriandrum sativum L. 胡荽—Fig. 68-7.

Grains oblong-oval, constricted at the equator, perprolate, with P axes of (24-)29-32(-33) μ long, and with E axes of (8-)9-10(-12) μ long; amb pleurotreme; distance between two colpi (8-)10(-17) μ long; ora wider than the width of colpi; costae transversales-circulares; sexine as thick as nexine.

The vouchers are Tainan, Morimoto s. n. March 1943; Nantou, Kanekira & Sasaki s. n. July 1918; Taipei, Mune s. n. July 1933.

Eryngium foetidum L. 易芥僅草—Fig. 68-8

Grains oblong-oval, or perprolate, with P axes of (26-)29-33(-34) μ long, and with E axes of 12-15(-16) μ long; amb pleurotreme; distance between two colpi 9 μ long; ora wider than the width of colpi, colpi transversales-equatoriales; sexine as thick as nexine.

The voucher is Nantou, Kao 4082.

Foeniculum vulgare Mill. 茴香—Fig. 68-9

Grains oblong-oval, or perprolate, with P axes of (25-)27-28(-30) μ long, and with E axes of (8-)9-10(-11) μ long; amb pleurotreme; distance between two colpi 7-13 μ long; ora as wide as or wider than the width of colpi, colpi transversales-circulares; exine thickened at equator, as thick as nexine.

The voucher is Ako, Matuda 896.

Glehnia littoralis Schmidt in Miq. 規雷那草—Fig. 69-1

Grains 3(-4) corporate, oblong-oval, or perprolate, very rarely prolate, with P axes of (26-)28-32(-33) μ long, and with E axes of 11-14(-16) μ long; amb pleurotreme; distance between two colpi 7-14 μ long; ora wider than the width of colpi, colpi transversales; sexine as thick as nexine.

The voucher is Taipei, Chuang 3975, Sasaki s. n. March 1924.

Hydrocotyle L. 胡荽

Grains 3(-4)-corporate, rhomboidal, or oblate-spheroidal to perprolate, with P axes of 14-30 μ long, and with E axes of 12-22 μ long; amb goniotreme; distance between two colpi from 11-18 μ long; colpi continuous; ora as wide as or wider than the width of colpi, colpi transversales to colpi transversales-equatoriales; exine thickened at equator and pole; sexine as thick as nexine.

Key to species of Hydrocotyle

1. Colpi broadened at equator *H. setulosa*
1. Colpi not broadened at equator *H. formosana*, *H. javanica*,
H. keelungensis, *H. sibthoroides*

Hydrocotyle formosana Masamune 臺灣胡荽

Grains subprolate to perprolate, with P axes of (19-)22-28(-30) μ long, and with

E axes of (12-)19-20(-21) μ long; distance between two colpi 14-16(-18) μ long; ora as wide as or wider than the width of colpi, colpi transversales-equatoriales.

The vouchers are Taipei, Kao 3455, 3994.

Hydrocotyle javanica Thunb. 紅骨頭草—Fig. 69-2

Grains prolate to spheroidal, with P axes of (18-)20-22(-25) μ long, and with E axes of (14-)17-18(-19) μ long; distance between two colpi (13.5)15-17 μ long; ora as wide or wider than the width of colpi, colpi transversales-equatoriales.

The vouchers are Kiirun, Suzuki s. n. Apr. 1929, Taipei, Kao 3045.

Hydrocotyle keelungensis Liu, Chao & Chuang, Umbelliferae of Taiwan, Experimental Forest of National Taiwan University, Technical Bulletin 26: 15, 1961 基隆胡荽

Grains oblate-spheroidal to prolate, with P axes of (15-)16-18(-20) μ long, and with E axes of (12-)15-16(-17) μ long; distance between two colpi (11-)12-13(-15) μ long; ora wider than colpi, colpi transversales-equatoriales.

The voucher is Keelung, Chuang 3980.

Hydrocotyle setulosa Hayata 毛胡荽

Grains prolate to subprolate, with P axes of (18-)22-23(-26) μ long, and with E axes of 14-17(-18.5) μ long; distance between two colpi (14-)15(-18) μ long; ora wider than the width of colpi, colpi transversales-equatoriales, continuous at cross with colpi.

The vouchers are Taipei, Hsu & Kao 3454, Kao 4004.

Hydrocotyle sibthoroides Lam. 變地錦

Grains subprolate to prolate-spheroidal, with P axes of (14-)16-17(-21) μ long, and with E axes of (12-)14-15(-19) μ long; distance between two colpi 12(-13) μ long; ora wider than the width of colpi, colpi transversales-equatoriales, continuous at the cross with colpi.

The voucher is Hualien, Kao 4097.

Oenanthe (Tourn.) L. 山芹菜屬 Fig. 69-3

Grains elliptic-oval or prolate to perprolate, with P axes of 18-30 μ long, and with E axes of 9-17 μ long; amb pleurotreme; distance between two colpi from 12 μ to 15 μ long; colpi continuous; ora wider than the width of colpi, colpi transversales to colpi transversales-equatoriales; sexine thinner than nexine.

Key to species of Oenanthe

1. Ora colpi transversales.....*O. pterocaulon*
1. Ora colpi transversales-equatoriales.....*O. javanica*

Oenanthe javanica (Bl.) DC. 爪哇山芹菜

Grains prolate to perprolate, with P axes of (23-)27-28(-30) μ long, and with E axes of (11-)13(-17) μ long; distance between two colpi 12-15 μ long; ora transversales-equatoriales.

The vouchers are Rato, Yamamoto 2609; Taityu, Yamamoto & Suzuki 381; Hualien, Yamamoto 3560.

Oenanthe pterocaulon Liu, Chao & Chuang, Umbelliferae of Taiwan, Experimental Forest of National University, Technical Bulletin 26: 17, 1961 福建山芹菜

Grains perprolate to prolate, with P axes of (18-)24-27(-30) μ long, and with E axes of (9-)12-13(-17) μ long; distance between two colpi 12.5 μ long; ora colpi transversales.

The voucher is Taipei, Liu et al. 3645.

Oreomyrrhis involucrata Hayata 魚雷附馬拉斯草—Fig. 69-4

Grains oblong-oval, or prolate to subprolate, with P axes of (16-)19-20(-24) μ long, and with E axes of (10-)11-13(-14) μ long; amb pleurotreme; distance between two colpi 9-13 μ long; ora wider than the width of colpi, colpi transversales or colpi transversales-equatoriales; exine uniform in thickness; sexine thinner than nexine.

The vouchers are Taipei, Fukuyama 17445; Chiayi, Suzuki 13225.

Peucedanum (Tourn.) L. 防風

Grains oblong-oval, or perprolate, rarely prolate, with P axes of 20-32 μ long, and with E axes of 7-15 μ long; amb pleurotreme; distance between two colpi 8-12 μ long; ora wider than the width of colpi, colpi transversales-equatoriales; exine thickened at equator; sexine as thick as nexine.

Peucedanum formosanum Hayata 臺灣防風—Fig. 69-5

Grains perprolate, with P axes of (24-)26-28(-32) μ long, and with E axes of (10-)11-12(-15) μ long; distance between two colpi 8-11 μ long.

The vouchers are Nantou, Kao 5737; Pianan, Suzuki S. s. n. Oct. 1928; Taityu, Suzuki T. 13228.

Peucedanum japonicum Thunb. 防風

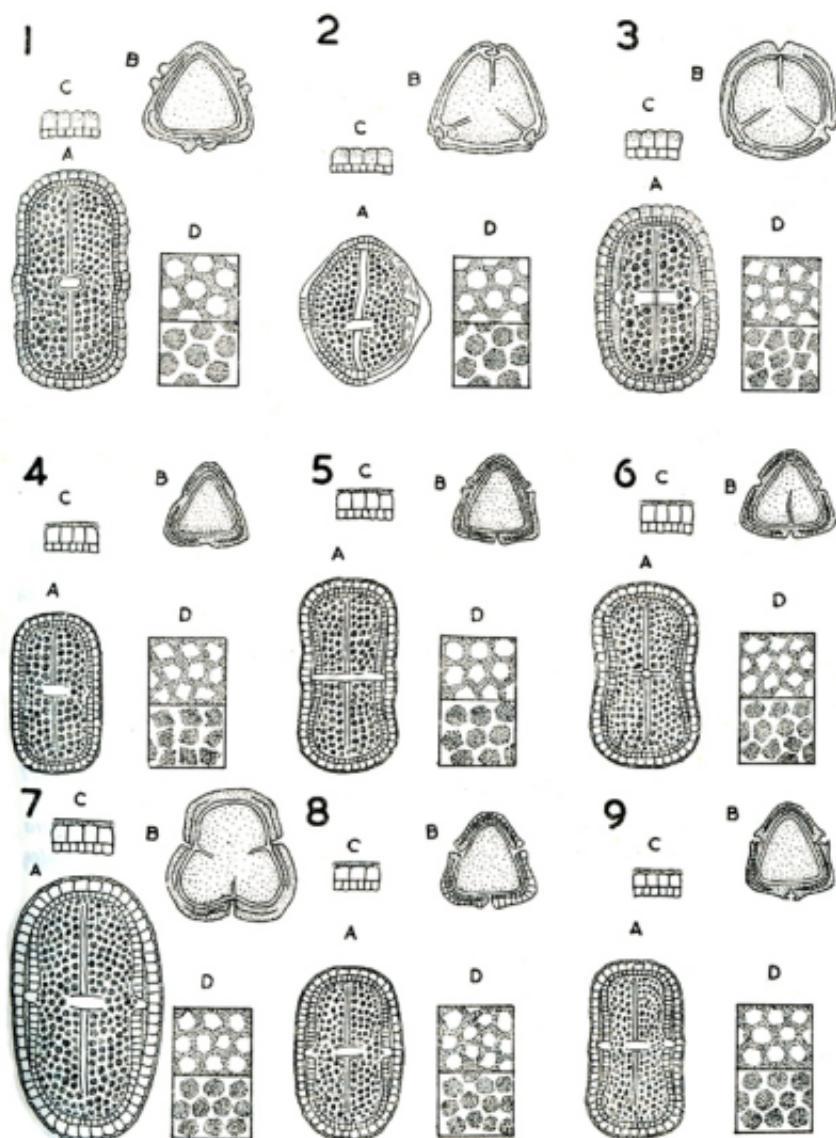
Grains perprolate to prolate, with P axes of (20-)21-28(-31) μ long, and with E axes of (7-)10-12(-14) μ long; distance between two colpi 8-12 μ long.

The vouchers are Kiirun, Matuda 1420, Suzuki S. 10343; Taipei, Kao 3597, Kingshan, Huang 3316.

Pimpinella (Riv.) L. 野芹屬

Grains oblong-oval with bulged part at equator, or perprolate to prolate, with P axes of 19-32 μ long, and with E axes of 8-16 μ long; amb pleurotreme; distance between two colpi from 6 μ to 17 μ long; ora wider than the width of colpi, colpi

Fig. 69. Umbelliferae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Glechoma littoralis* Schmidt & Miquel (Chuang 3978) 2. *Hydrocotyle javanica* Thunb. (Suzuki S. s. n. Apr. 1929) 3. *Oenanthe javanica* (Bl.) DC. (equatorial view, Yamamoto 3560, polar view and others Yamamoto & Suzuki 381) 4. *Oreomyrrhis involucrata* Hayata (Suzuki S. 13225) 5. *Peucedanum formosanum* Hayata (Suzuki T. 13228) 6. *Pimpinella mitakayamensis* Hayata (Faurie 8148) 7. *Sanicula lamelligera* Hance (Lee & Kao 3936) 8. *Sium suave* Walt. (Yen s. n. June 1963) 9. *Torilis japonica* (Houtt.) DC. (Suzuki T. 8931)



transversales to colpi transversales-equatoriales; exine thickened at equator; sexine thinner than nexine.

Key to species of *Pimpinella*

1. Ora colpi transversales-equatoriales *P. diversifolia*
1. Ora colpi transversales *P. niitakayamensis*

Pimpinella diversifolia DC. 煙葉野芹

Grains perprolate to prolate, with P axes of (20-)25-28(-32) μ long, and with E axes of (9-)10-14(-16) μ long; distance between two colpi 8-11(-16) μ long; ora wider than the width of colpi, colpi transversales-equatoriales; exine thickened at equator.

The vouchers are Taipei, Kao 3598; Chiayi, Morimoto 514.

Pimpinella niitakayamensis Hayata 玉山野芹—Fig. 69-6

Grains perprolate to prolate, with P axes of (19-)25-28(-30) μ long, and with E axes of (8-)10-13(-15) μ long; distance between two colpi (6-)12(-14) μ long; ora as wide as or wider than the width of colpi, colpi transversales-equatoriales; exine sometimes, thickened at equator.

The vouchers are Taipei, Suzuki et al. 17359; Hualien, Kao 4197; Rato, Mt. Nanko, Suzuki et al. 18054; s. loc. Faurie 8148.

Sanicula (Tourn.) L. 煙豆菜屬

Grains oblong-oval to elliptic-oval, or perprolate to prolate, with P axes of 25-48 μ long, and with E axes of 11-27 μ long; amb ptychotreme; distance between two colpi 14-20 μ long; colpi continuous; ora wider than the width of colpi, colpi transversales-equatoriales; sexine thinner than nexine.

Key to species of *Sanicula*

1. Grains not syncolpate; exine uniform in thickness *S. lamelligera*
1. Grains syncolpate; sexine thicker than nexine *S. petagnoides*

Sanicula lamelligera Hance 小山芹—Fig. 69-7

Grains oblong-oval, or perprolate, with P axes of (28-)34-36(-48) μ long, and with E axes of (13-)16-19(-27) μ long; distance between two colpi (15-)19(-20) μ long; colpi broadened at center; ora as wide or wider than the width of colpi.

The vouchers are Taipei, Simada 991, Lee & Kao 3936.

Sanicula petagnoides Hayata 玉山煙豆菜

Grains elliptic-oval, or prolate to perprolate, with P axes of (25-)29-30(-38) μ long, and with E axes of (11-)17-18(-20) μ long; distance between two colpi (14-)17-18 μ long, syncolpate; ora wider than the width of colpi; sexine thinner than nexine.

The vouchers are Chiayi, Mt. Ali, Tseng et al. 4103; Noko, Kudo & Mori 87; Taipei, Suzuki 866-B.

Sium suave Walt. 漚岸—Fig. 69-8

Grains elliptic-oval, or prolate to perprolate, with P axes of (23-)25-26(-28) μ long, and with E axes of (11-)12-15 μ long; amb pleurotreme; distance between two colpi (9-)11-12(-13) μ long; ora wider than the width of colpi, colpi transversales-equatoriales; sexine as thick as nexine.

The voucher is Taichung, Yene s.n. June 1963.

Torilis Adans. 痞衣屬

Grains oblong-oval with bulged part at the equator, or perprolate, with P axes of 19-28 μ long, and with E axes of 7-12 μ long; colpi long; ora wider than the width of colpi, colpi transversales-equatoriales; exine thickened at equator; sexine as thick as or thinner than nexine.

Torilis japonica (Houtt.) DC. 痞衣—Fig. 69-9

Grains with P axes of (19-)21-25(-28) μ long, and with E axes of (7-)8-10(-12) μ long; distance between two colpi 9-14 μ long.

The vouchers are Hualien, Shimizu 12664; Taipei, Chuang 3981, Suzuki T. 8931.

Torilis scabra (Thunb.) DC. 鱗毛蘿蔴

Grains with P axes of (19-)21-23(-24) μ long, and with E axes of (7-)9-10(-12) μ long; distance between two colpi 10-13 μ long.

The voucher is Nantou, Shimizu et al. 11055.

64. VIOLACEAE 蕃菜科

Pollen grains are characterized by 3-corporate; shape classes of P/E suboblate to subprolate, with P axes of 22-37 μ long, and with E axes of 25-36 μ long; amb peritreme to ptychotreme; colpi nearly as long as the length of P axes; ora colpi transversales-circulares; exine psilate, 1 μ thick; sexine thicker than nexine, granulate, with LO-pattern.

Viola mandshurica W. Beck. var. **ciliata** Nakai 紫花地丁

Grains with P axes of 30 μ long, and with E axes of 27 μ long.

The voucher is Noko, Fukuyama 4402.

Viola oblongo-sagitta Nakai 姜菜黃

Grains with P axes of 37 μ long, and with E axes of 36 μ long.

The voucher is Taipei, Simada 1206.

Viola stenocentra Hayata 臺灣如意草

Grains with P axes of 30-32 μ long, and with E axes of 30-32 μ long.

The vouchers are Taipei, Suzuki 4028, 16777.

Viola verecunda A. Gray var. **verecunda** 嘉董菜—Fig. 70

Grains with P axes of 22-35 μ long, and with E axes of 25-30 μ long.

The vouchers are Taipei, Sasaki s.n. March 1929, Mt. Daiton, Suzuki S. 10229.

65. VITACEAE 葡萄科

Pollen grains are characterized by 3-corporate; shape classes of P/E prolate-spheroidal to prolate, with P axes of 19-53 μ long, and with E axes of 18-51 μ long;

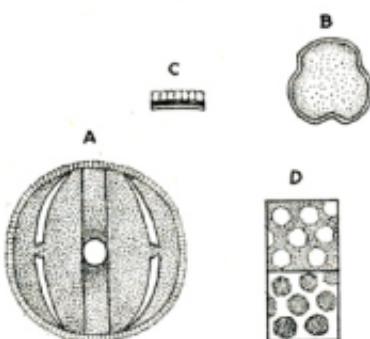


Fig. 70. *Viola verecunda* A. Gray., var. *verecunda*,
(Sasaki s. n. March 1929), equatorial view $\times 1000$, polar view $\times 500$.

amb goniotreme, ptychotreme to peritreme; colpi long; ora colpi transversales to colpi transversales-circulares; exine scabrate to psilate, from $0.5\text{--}2 \mu$ thick; sexine thicker than or as thick as nexine, reticulate to granulate, with OL-pattern.

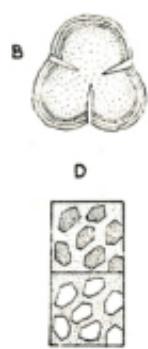
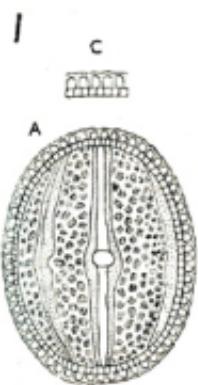
Key to genera

1. Amb ptychotreme to peritreme
2. Exine scabrate *Ampelopsis*
2. Exine psilate *Cissus*
1. Amb goniotreme to peritreme
2. Exine less than 1μ thick
 3. Amb goniotreme *Tetrastigma*
 3. Amb ptychotreme *Vitis*
2. Exine more than 1.5μ thick
 4. Colpi short; grains rhomboidal *Leea*
 4. Colpi long; grains oval
 5. Exine scabrate *Parthenocissus*
 5. Exine psilate *Cayratia*

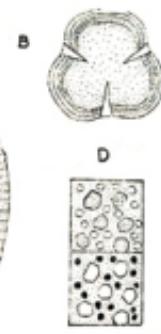
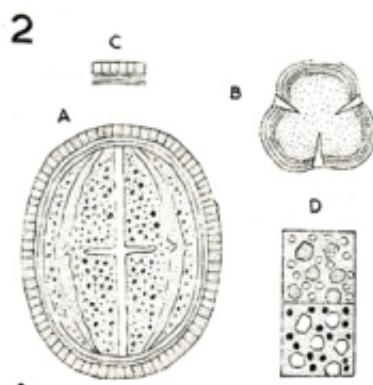
Ampelopsis heterophylla Sieb. & Zucc. 蛇葡萄—Fig. 71-1

Grains prolate to prolate-spheroidal, with P axes of $(35\text{--})37\text{--}40\text{--}41 \mu$ long, and with E axes of $(27\text{--})30\text{--}34\text{--}36 \mu$ long; amb peritreme to ptychotreme, or circular to intersubangular; colpi nearly as long as the length of P axes; ora colpi trans-

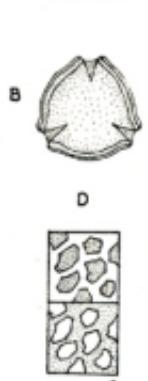
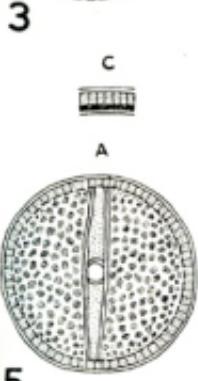
Fig. 71. Vitaceae, equatorial view $\times 1000$, polar view $\times 500$. 1. *Ampelopsis heterophylla* Sieb. & Zucc. (Sawada s. n. July 1930) 2. *Cissus repens* Low (Chang 2191) 3. *Cayratia japonica* (Thunb.) Gagnep. (Sikano s. n. July 1935) 4. *Leea manilensis* Walp. (Sikano s. n. July 1935) 5. *Parthenocissus thunbergii* Nakai (Chang 4) 6. *Tetrastigma umbellata* Nakai (Sasaki s. n. March 1932) 7. *Vitis rotundifolia* Hance (Sasaki s. n. March 1910)



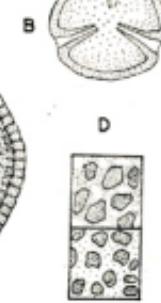
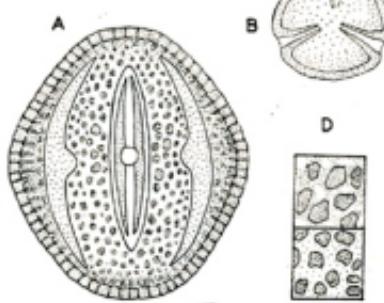
1 A, Longitudinal section; B, polar view; C, apertural margin; D, surface detail.



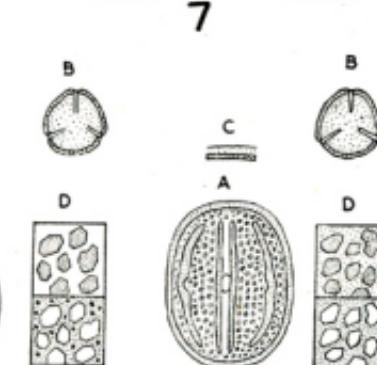
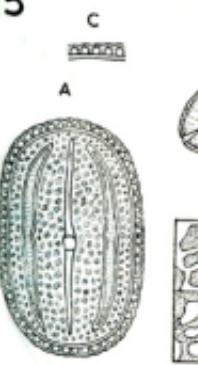
2 A, Longitudinal section; B, polar view; C, apertural margin; D, surface detail.



3 A, Longitudinal section; B, polar view; C, apertural margin; D, surface detail.



4 A, Longitudinal section; B, polar view; C, apertural margin; D, surface detail.



5 A, Longitudinal section; B, polar view; C, apertural margin; D, surface detail.

6 A, Longitudinal section; B, polar view; C, apertural margin; D, surface detail.

7 A, Longitudinal section; B, polar view; C, apertural margin; D, surface detail.

versales; exine scabrate, $2\ \mu$ thick; sexine thicker than or as thick as nexine, reticulate.

The vouchers are Taipei, *Shimizu* 134; Takaо, Insular Liukiusyo, *Hasokawa* 1874; Kashos, *Kado & Suzuki* 15958; Sintiku, *Sawada* s. n. July 1930; Ako, *Matuda* 1252; Insl. Kizan, *Masamune & Suzuki* s. n. July 1932.

Cissus repens Lam. 虎葛—Fig. 71-2

Grains prolate to subprolate, with P axes of (37-)40-45(-48) μ long, and with E axes of (26-)31-36(-39) μ long; amb ptychotreme, or intersubangular; colpi nearly as long as the length of P axes; ora colpi transversales; exine psilate to scabrate, $2\ \mu$ thick; sexine thicker than or as thick as nexine, reticulate.

The vouchers are Nantou, *Huang* 4039; Botel Tabago, *Chuang* 2191; Ako, *Matuda* 16108.

Cayratia japonica (Thunb.) Gagnep. 五葉藤—Fig. 71-3

Grains prolate to oblate-spheroidal, with P axes of (31-)33-35(-37) μ long, and with E axes of (22-)25-33(-35) μ long; amb peritreme, or circular; colpi nearly as long as the length of P axes; ora colpi transversales-circulares; exine psilate, 1.5-2 μ thick; sexine thicker than nexine, reticulate.

The vouchers are Kiirun, *Masamune et al.* 88; Botel Tabago, *Sikano* s. n. July 1935; Pai Sa Wan, *Huang* 3351.

Leea manilensis Walp. 火筒樹—Fig. 71-4

Grains prolate-spheroidal to subprolate, with P axes of (40-)47-52(-53) μ long, and with E axes of (36-)44-48(-51) μ long; amb goniostreme, or semiangular to semilobate; colpi nearly as long as the length of P axes; ora colpi transversales-circulares; exine scabrate, $2\ \mu$ thick; sexine thicker than nexine, reticulate.

The vouchers are Kotosyo, *Sata* 1493, 1495; *Sikano* s. n. July, 1935.

Parthenocissus thunbergii Nakai 紅葡萄藤—Fig. 71-5

Grains prolate, with P axes of (32-)39-40(-41) μ long, and with E axes of (22-)24-26 μ long; amb goniostreme, or semiangular; colpi nearly as long as the length of P axes; ora colpi transversales-circulares; exine scabrate, $1.5\ \mu$ thick; sexine thicker than nexine, reticulate.

The voucher is Taipei, NTU, *Chang* 4.

Tetrastigma umbellata Nakai 臺灣崖爬藤—Fig. 71-6

Grains prolate-spheroidal to subprolate, with P axes of 19-23 μ long, and with E axes of 18-21 μ long; amb goniostreme to peritreme, or semiangular to circular; colpi nearly as long as the length of P axes; ora colpi transversales-circulares; exine psilate, $1\ \mu$ thick; sexine thicker than nexine, reticulate.

The voucher is Kosyun, *Sasaki* s. n. March 1932.

Vitis L. 葡萄屬

Grains prolate-spheroidal to subprolate, with P axes of 19-24 μ long, and with E axes of 18-23 μ long; amb goniostreme; colpi nearly as long as the length of P

axes; ora colpi transversales-circulares; exine psilate, $0.5\ \mu$ thick; sexine thicker than nexine, granulate.

Vitis adstricta Hance. 緣本山葡萄—Fig. 71-7

The voucher is Nantou, *Sasaki s. n.* March 1910.

Vitis lanata Roxb. 棉狀山葡萄

The vouchers are Taipei, *Simizu 2026*; *s. loc. Faure 8368*.

61. ZYGOPHYLLACEAE 瓜藤科

Pollen grains are characterized by pantoporate, circular, or spheroidal to elliptic, with longest diameter of (47-)52-56(-63) μ wide; exine scabrate, 4 μ thick; sexine thicker than nexine, reticulate, with OL-pattern, the muri simplibaculate, the lumina 5-6-hedra, funnel-like, consisting of ora at center.

Tribulus terrestris L. 瓜藤—Fig. 72

The vouchers are Tainan, *s. coll. s. n.* Aug. 1940; Penhu island, *Tseng s. n.* Aug. 1933; Makou, *Horikawa s. n.* July, 1929.

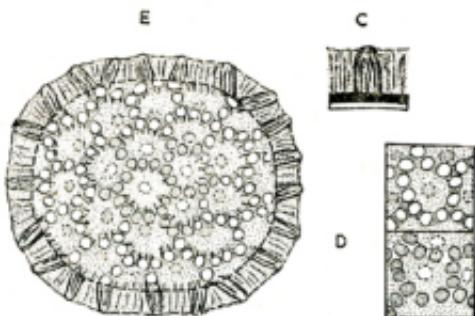


Fig. 72. *Tribulus terrestris* L. (*Horikawa s. n.* July 1929)

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