Laboratory 15: Rosidae – Part 3

Today we finish looking at the Rosid clade. We will be examining a few remaining families from Rosid I and will look at Rosid II today, as well. The orders and families we will be looking at today are: Cucurbitales (Cucurbitaceae); Fagales (Fagaceae, Juglandaceae, Betulaceae, Myricaceae, Casuarinaceae); Brassicales (Brassicaceae); Malvales (Malvaceae incl. Sterculiaceae); Sapindales (Rutaceae, Anacardiaceae, Sapindaceae s.l.).

Cucurbitaceae – Squash/Melon Family; 120 genera, 825 spp.

Typically herbaceous, many are "climbers"; **leaves alternate and spiral, usually simple, often palmately lobed**; leaves palmately veined and are usually associated with a **tendril (usually branched)**, possibly derived from a modified shoot; stipules lacking; flowers almost always **unisexual, with a hypanthium**; calyx composed of 5 sepals; corolla composed of 5 petals, more or less united at the base; stamens 5, which may be either distinct or fused to varying degrees, adnate to hypanthium; ovary inferior composed of between two and five fused carpels; ovary with (usually) a single locule; fruit generally a berry or **pepo.**

Marah
Ecbalium

Fagaceae – Oak or Beech Family; 9 genera, 900 spp.

Tress and shrubs, deciduous or evergreen; leaves simple but often lobed, alternate, entire to serrate; stipules present but deciduous; flowers generally unisexual, monoecious, **males usually arranged in catkins or small spikes, females in groups of 1-3 inside a scaly cupule**; perianth reduced to a series of bract-like segments; stamens variable; ovary inferior ovary composed of three to six fused carpels; **three to six styles present; fruit is an acorn (or similar)**, **a single-seeded nut usually surrounded by a cupule (involucre).**

Quercus
Lithocarpus

Juglandaceae – Walnut Family; 8 genera, 60 spp.

Trees, deciduous, wind-pollinated**;** leaves generally alternate, **pinnately-compound**; hairs often stellate, peltate glandular scales often present; stipules absent; flowers unisexual, monoecious; male flowers are arranged in catkins, female flowers are arranged on short, stiff spikes; perianth reduced, **usually having four lobes** (sometimes absent); stamens 3-40; **single inferior ovary composed of two fused carpels;** style short with two stigmas; fruit typically a nut.

Juglans
Carya

Betulaceae – Birch/Alder Family; 6 genera, 160 spp.

Trees and shrubs; deciduous; monoecious; wind-pollinated; leaves simple and alternate, **typically with doubly-serrate margins**; stipules present; flowers unisexual; **male flowers are arranged in catkins,** female flowers are arranged on a short, stiff axis; perianth reduced to a variable number of scale-like segments or may be absent altogether; stamens 2-12; **single inferior ovary composed of two fused carpels**; **fruit a single-seeded nut which is typically winged.**

Betula
Alnus
Corylus

Myricaceae – Bayberry Family, 3 genera, 40 spp.

Trees or shrubs, aromatic, **commonly with peltate yellow glands**; leaves alternate and simple, oblanceolate; stipules present or absent; flowers unisexual, generally monoecious, flowers generally aggregated into spikes, axillary; perianth extremely reduced to subtending bractlets; stamens typically 4; **superior ovary composed of two fused carpels, style present with two branches**; fruit a drupe.

Myrica

Casuarinaceae – She-Oak Family, 1 genus, 70 spp.

Trees and shrubs, often superficially resembling Pine trees; jointed branches; wind-pollinated; **leaves very reduced and scale-like, whorled**; flowers reduced, unisexual, monoecios; **perianth highly reduced to two small lobes in male flowers, absent all together in female flowers – female inflorescence resembles a small conifer-like strobilus**; **male flowers contain a single stamen**; small ovary composed of two fused carpels, the style is short but there are two long stigma branches; fruit a samara-like nut.

Casuarina

Brassicaceae (Cruciferae) – Mustard Family (including Capparaceae, the Caper Family); 420 genera, ~4150 spp.

Mostly herbaceous, less often shrubs; leaves generally alternate and simple but may also be once or twice pinnately compound; stipules lacking (present in Capparaceae); flowers bisexual and regular (may be irregular in Capparaceae); calyx composed of 4 sepals, free; **corolla composed of 4 petals, free, with a cruciform (*i.e.* cross-shaped) arrangement**; **stamens 6 , all distinct, two that have short filaments and four that have long filaments**; nectaries often present; ovary superior composed of two fused carpels; ovary appears to have two locules because of a false septum; a single style is present; fruit a **silique** (2 valves breaking away from a ±persistent partition).

Brassica
Arabidopsis
Capsella
Cardamine
Eruca

Malvaceae – Mallow Family (including Sterculiaceae); 200 genera, 2300 spp.

Herbs, trees or shrubs; leaves simple and alternate, often palmately lobed, most have **stellate hairs**; stipules present; flowers regular and bisexual; calyx composed 5 sepals which may be fused or distinct (petaloid in Sterculiaceae), often subtended by an epicalyx; corolla composed of 5 petals, **free** (absent in Sterculiaceae); stamens numerous and **fused at their base to form a typically conspicuous tube** (*i.e.* **monadelphus stamens**); staminodes often present; **nectaries present, typically in the form of glandular hairs on sepals**; ovary superior composed of (usually) five (sometimes more) fused carpels; a single style is present and is **branched**; fruit usually a capsule.

Malva
Hibiscus
Fremontodendron
Theobroma
Lavatera
Sidalcea
Gossypium
Brachychiton

Rutaceae – Citrus Family; 155 genera, 930 spp.

Usually shrubs or trees, some herbs; leaves simple or pinnately-compound, alternate; **leaves are punctate with visible, translucent dots (*i.e.* oil glands) on their surface, usually highly aromatic (at least when crushed)**; petioles often variously winged; stipules absent; flowers are generally regular and bisexual, typically with white petals, also very aromatic; sepals 4-5, fused to varying degrees; petals 4-5, usually distinct; stamens 8-10, all distinct; **nectaries are often present in the form of an intrastaminal disk;** ovary superior composed of 4-5 fused carpels, deeply lobed; ovary with 4-5 locules each containing numerous ovules; a single style is present; fruit: generally a berry (**hesperidium**) but fruit type is variable.

Citrus
Ruta
Choisya

Anacardiaceae – Sumac/Poison Ivy Family, 70 genera, 600 spp.

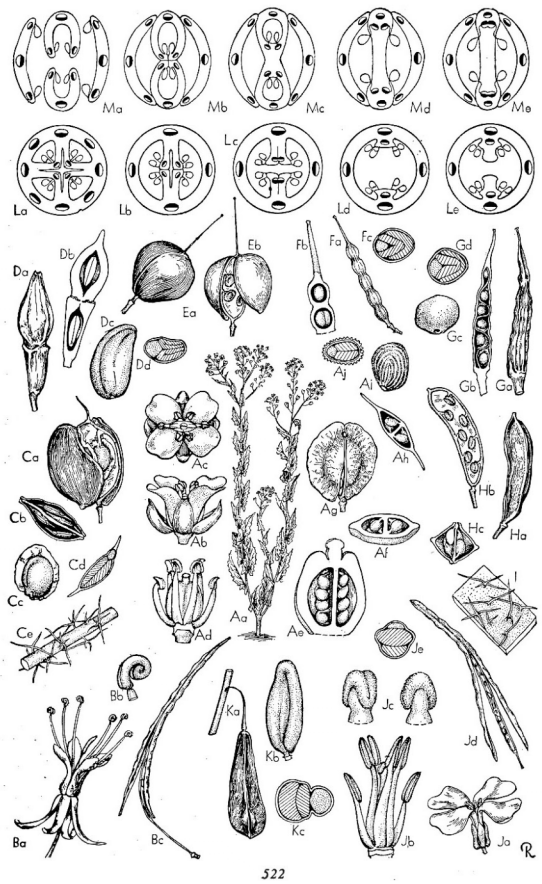
Trees, shrubs or vines; leaves generally alternate (rarely opposite) and pinnately compound; stipules absent; **resinous compounds, some of which may be toxic, are often present**; flowers are regular and typically unisexual, plants usually dioecious; sepals 5 distinct to fused; petals 5, free; stamens 10 or more; **nectaries present as an intrastaminal disk present**; ovary: usually superior and is composed of 1-5 **(most often 3) carpels** (fused if more than one carpel present); ovary with a single locule containing a single ovule; styles generally 1-5 (most often 3), distinct; fruit usually a drupe.

Rhus
Schinus

Sapindaceae – Soapberry Family (including Aceraceae, Maple Family, and Hippocastanaceae, Horse-Chestnut Family); 150 genera, 2200 spp.

Trees, shrubs and vines (*i.e.* lianas), the latter often bearing tendrils; leaves usually alternate simple or compound (opposite in Aceraceae; opposite and palmately compound in Hippocastanaceae); stipules absent; flowers regular or irregular but are almost always unisexual, various combinations of unisexual and bisexual flowers on the plants (esp. in Aceraceae); sepals 4-5, free or fused; petals 4-5 (sometimes 0), distinct, **often clawed and with basal appendages**; **nectaries often present in the form of an extrastaminal disk**; stamens usually 10 in two whorls of five (**2 usually supressed and so there appear to be only 8**); superior ovary composed of 3 fused carpels (2 in Aceraceae); generally a single style which may be variously lobed/branched; fruit type variable (samaras in Aceraceae and a capsule containing one or two very large seeds in Hippocastanaceae).

Acer
Aesculus
Dodonaea



This figure (and all following) taken from Lawrence. 1951. Taxonomy of Vascular Plants

Fig. 152. CRUCIFERAE. A, *Thlaspi arvense*: Aa, habit of plant, × ⅛; Ab, flower, habit, × 4; Ac, flower, top view, × 4; Ad, flower, less perianth, × 5; Ae, pistil, vertical section transverse to replum, × 10; Af, ovary, cross-section, × 10; Ag, silicle, side view, × 1; Ah, silicle, cross-section, × 1½; Ai, seed, × 5; Aj, seed, cross-section (cotyledons accumbent). B, *Stanleya pinnata*: Ba, flower, habit, × 1; Bb, anther, × 4; Bc, silique, × 1. C, *Alyssum saxatile*: Ca, silicle (dehiscing), × 5; Cb, silicle, cross-section, × 5; Cc, seed, winged, × 5; Cd, seed, cross-section, × 8; Ce, stellate hairs, × 2. D, *Cakile maritima*: Da, fruit, habit, × 1½; Db, fruit, vertical section, × 1½; Dc, seed, × 3; Dd, seed, cross-section, × 3. E, *Lesquerella ovalifolia*: Ea, silicle, habit, × 2; Eb, silicle, dehiscing, × 2. F, *Raphanus raphanistrum*: Fa, silique, habit, × 1; Fb, silique, vertical section of distal end, × 2; Fc, seed, cross-section (cotyledons conduplicate), × 4. G, *Brassica arvensis*: Ga, silique, habit, × 1½; Gb, silique, vertical section, × 1½; Gc, seed, × 6; Gd, seed, cross-section, × 6. H, *Descourainia pinnata*: Ha, silique, habit, × 4; Hb, silique, vertical section, × 4; Hc, silique, cross-section, × 8. I, *Draba rupestris*: leaf section with mostly forked hairs, × 4. J, *Hesperis matronalis*: Ja, flower, habit, × 1; Jb, flower, less perianth, × 3; Jc, stigma, side and edgewise views, × 8; Jd, silicle, dehiscing, × ½; Je, seed, cross-section (cotyledons incumbent), × 8. K, *Isatis tinctoria*: Ka, fruit, habit, × 1½; Kb, seed, × 6; Kc, seed, cross-section (cotyledons incumbent), × 12. L, cross-sectional diagrams to illustrate the *Puri theory* (1945) for hypothetical derivation of crucifer type ovary: La, 4-loculed (and -carpelled) presumed ancestral type with axile placentation as in some Moringaceae, note inverted placental strands); Lb, reduction to bilocular and bicarpellate condition, with axile placentation, no ovule reduction; Lc, each axile placenta with components has split and fused to adjacent halves of intermediate (and "lost") carpels, note fusion of inverted placental strands; Ld, carpel margins shortened and placental strands moved peripherally, close to median marginal strand; Le, sterile tissue intruding from each peripheral and parietal placenta toward center producing, on fusion, a "false septum" or replum (as in Af or Cb). M, cross-sectional diagrams to illustrate the *Eames and Wilson theory* (1930) for the derivation of crucifer type ovary: Ma, two whorls of two open fertile carpels; Mb, the two inner carpels closed and connate, with the two outer carpels open and appressed against the inner; Mc, the two outer carpels sterile by loss of ovules, the inner two with smaller locules by contraction, the ventral bundles retreating from their marginal position; Md, the locules of inner carpels lost by compression, the ovules pushed outside into the locules of the sterile carpels, the inverted ventral bundles near the dorsal bundle; Me, same, the replum thinner and ventral bundles fused. (A-K from L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

CUCURBITACEAE. GOURD FAMILY

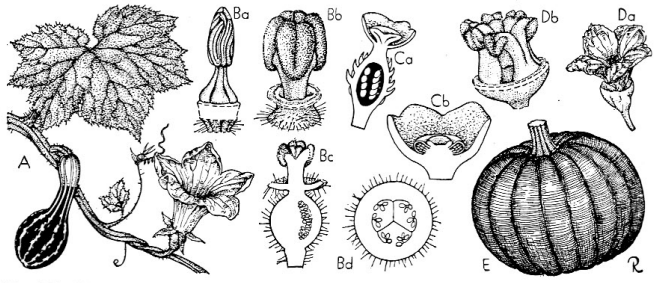


Fig. 292. CUCURBITACEAE. A, *Cucurbita Pepo* var. *ovifera*: branch with fruit and pistillate flower, × ⅛. B, *Cucurbita maxima*: Ba, staminate flower, less perianth, × ½; Bb, pistillate flower less perianth and ovary, × 1; Bc, pistillate flower, vertical section, less perianth, × ½; Bd, ovary, cross-section, × 1. C, *Cyclanthera explodens*: Ca, pistillate flower, vertical section, × 3; Cb, staminate flower, vertical section, × 6. D, *Mormordica Balsamina*: Da, staminate flower, habit, × ½; Db, same, less perianth, × 2; E, *Cucurbita Pepo*: fruit, much reduced. (Adapted in part from L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

FAGACEAE. BEECH FAMILY

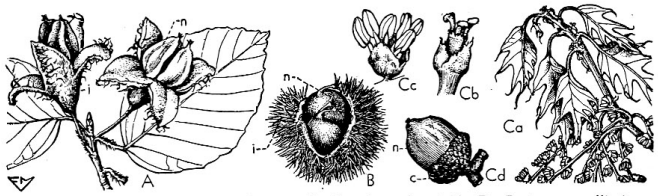


Fig. 110. FAGACEAE. A, *Fagus sylvatica*: fruiting branch, × ½. B, *Castanea mollissima*: fruit, × ½. C, *Quercus borealis*: Ca, twig with staminate catkins, × ½; Cb, pistillate flower, × 3; Cc, staminate flower, × 3; Cd, acorn, × ½. (c cup, i involucre, n nut.) (From L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

JUGLANDACEAE. WALNUT FAMILY

Fig. 107. JUGLANDACEAE. A, *Juglans nigra*: Aa, flowering branch, stem sectioned to show chambered pith, × ½; Ab, fruit and seed, × ½; Ac, pistillate flower, vertical section, × 2; Ad, staminate flower, × 2. B, *Carya*: Ba, staminate catkins, × ½; Bb, staminate flower, × 4; Bc, pistillate flower, vertical section, × 2; Bd, nut, the husk dehiscing, × ½. (From L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright

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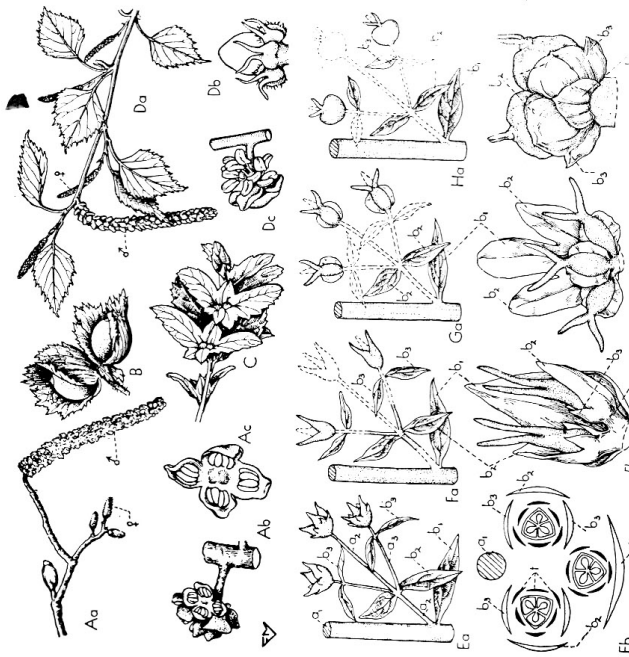

Fig. 109. BETULACEAE. A, *Alnus rugosa*: Aa, twig with catkins, × ½; Ab, staminate flowers, × 3; Ac, single staminate flower, × 5. B, *Corylus Avellana*: fruit, × ½. C, *Carpinus caroliniana*: fruiting branch, × ½. D, *Betula pendula*: Da, twig with catkins, × ½; Db, pistillate flowers, × 10; Dc, staminate flowers, × 3. E, schematic diagram of theoretical 3-flowered pistillate cyme ancestral to modern types. F, *Carpinus japonica*: Fa, schematic diagram of pistillate cymule; Fb, pistillate cymule. G, *Betula Medwediewii*: Ga, schematic diagram of pistillate cymule; Gb, pistillate cymule. H, *Alnus crispa*: Ha, schematic diagram of pistillate cymule; Hb, pistillate cymule. (A, A_1, A_2, primary, secondary, and tertiary axes respectively; B_1, B_2, B_3, primary, secondary, and tertiary bracts respectively; broken lines indicate absence of parts. (A-D from L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey. E-H redrawn from Abbe, 1935, by M. E. Ruff.)

MYRICACEAE. SWEET GALE FAMILY

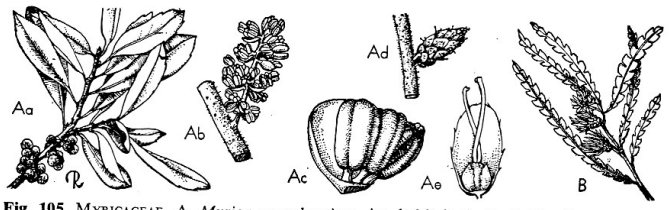

Fig. 105. MYRICACEAE. A, *Myrica pensylvanica*: Aa, habit in fruit, × ⅜; Ab, staminate inflorescence, × 2; Ac, staminate flower, × 8; Ad, pistillate inflorescence, × 2; Ae, pistillate flower, showing bract and 2 bracteoles, × 8. B, *Comptonia peregrina* var. *asplenifolia*, with young fruit, × ⅜. (From L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey)

CASUARINACEAE. CASUARINA FAMILY

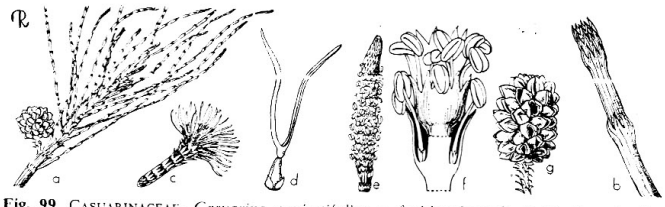

Fig. 99. CASUARINACEAE. *Casuarina equisetifolia*: a, fruiting branch, × ½; b, twig tip, × 3; c, pistillate inflorescence, enlarged; d, pistillate flower, × 15; e, staminate inflorescence, × 1; f, staminate flower, partly excised, × 10; g, fruit, × 1. (From L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

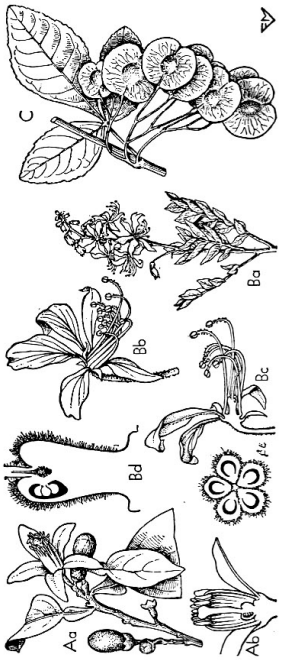

Fig. 174. RUTACEAE. A, *Citrus Aurantium*: Aa, twig in flower, × ½; Ab, flower, vertical section, × 1. B, *Dictamnus albus*: Ba, flowering branch, × ½; Bb, flower, × ½; Bc, same, vertical section, × ½; Bd, ovary, vertical section, × 3; Be, same, cross- n, × 3. C, *Ptelea trifoliata*: fruiting branch, × ½. (From L. H. Bailey, *Manual of* ated *plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. ley.)

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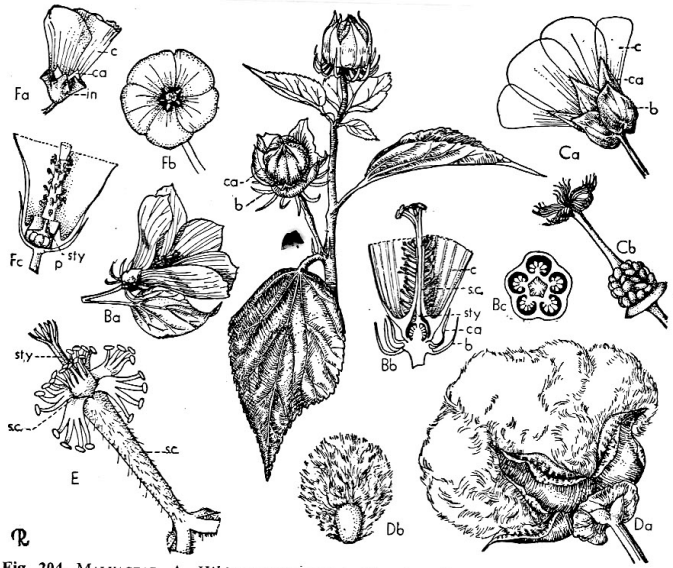

Fig. 204. MALVACEAE. A, *Hibiscus palustris*: fruiting branch, × ⅜. B, *H. Moscheutos*: Ba, flower, × ¼; Bb, same, vertical section, perianth partially excised, × ½; Bc, ovary, cross-section, × 2. C, *Malope trifida*: Ca, flower habit, × ½; Cb, same, gynoecium, × 4. D, *Gossypium hirsutum*: Da, boll, × 1; Db, seed, × ½. E, *Anoda cristata*: Fa, flower, side view, × ½; Fb, same, face view, × ½; Fc, partial vertical section, × 1. (b bract, c corolla, ca calyx, in involucre, p pistil, s.c. staminal column, sty style.) (From L. H. Bailey, *Manual of cultivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

(STERCULIACEAE.[142] STERCULIA FAMILY) Malvaceae

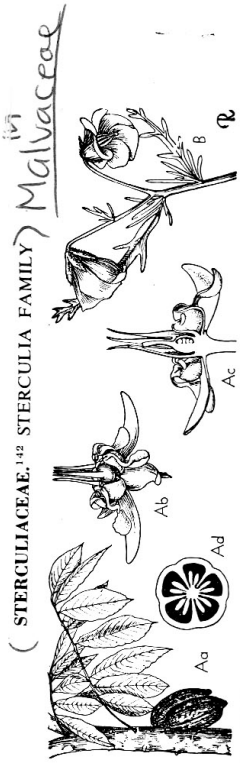

Fig. 206. STERCULIACEAE. A, *Theobroma Cacao*: Aa, trunk with fruits and leafy branches much reduced; Ab, flower, × 2; Ac, same, vertical section, × 2; Ad, ovary, cross-section, × 8. B, *Mahernia verticillata*: flowering branch, × 1. (From L. H. Bailey, *Manual of ivated plants*, The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. v.)

ANACARDIACEAE.[128] CASHEW FAMILY

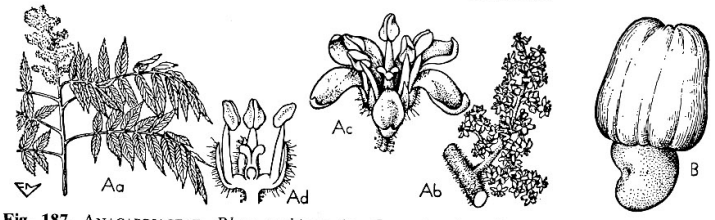

Fig. 187. ANACARDIACEAE. *Rhus typhina*: Aa, flowering branch, × 1/16; Ab, segment of inflorescence, × ½; Ac, perfect flower, × 3; Ad, same, less petals, vertical section, × 4 B, *Anacardium occidentale*: fruit, × ½. (From L. H. Bailey, *Manual of cultivated plants,* The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

SAPINDACEAE.[132] SOAPBERRY FAMILY

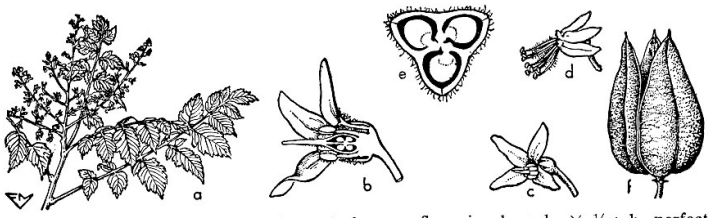

Fig. 196. SAPINDACEAE. *Koelreuteria paniculata*: a, flowering branch, × 1/10; b, perfect flower, vertical section, × 2; c, same, habit, × 1; d, staminate flower, × 1; e, ovary, cross-section, × 10; f, capsule, × ½. (From L. H. Bailey, *Manual of cultivated plants,* The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

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(ACERACEAE. MAPLE FAMILY) in Sapindaceae

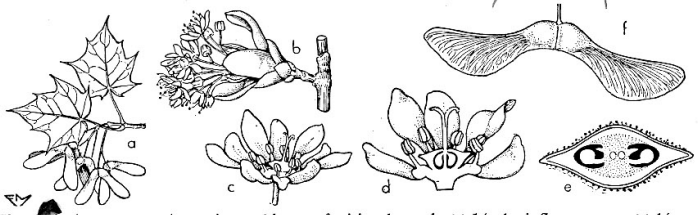

Fig. 194. ACERACEAE *Acer platanoides*: a, fruiting branch, × 1/6; b, inflorescence, × ½; c, flower, habit, × 1½; d, same, vertical section, × 2; e, ovary, cross-section, × 5; f, fruit, × ½. (From L. H. Bailey, *Manual of cultivated plants,* The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)

(HIPPOCASTANACEAE.[131] HORSE-CHESTNUT FAMILY) in Sapindaceae

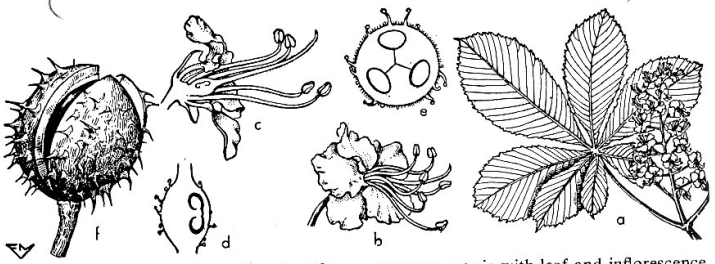

Fig. 195. HIPPOCASTANACEAE. *Aesculus Hippocastanum*: a, twig with leaf and inflorescence, × 1/10; b, flower, × 1; c, same, vertical section, × 1; d, ovary, vertical section, × 2; e, ovary, cross-section, × 4; f, fruit, × ½. (From L. H. Bailey, *Manual of cultivated plants,* The Macmillan Company, 1949. Copyright 1924 and 1949 by Liberty H. Bailey.)