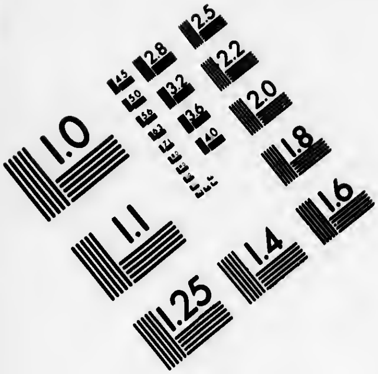

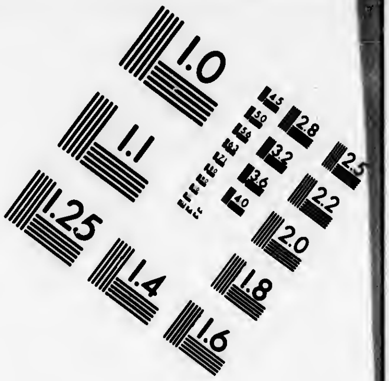

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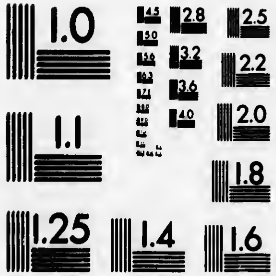

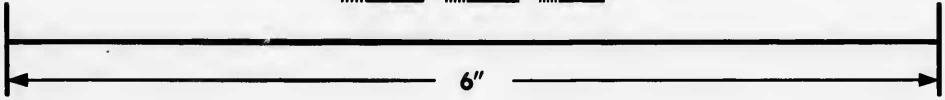

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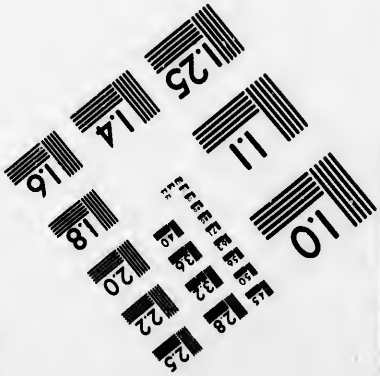

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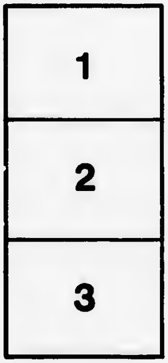
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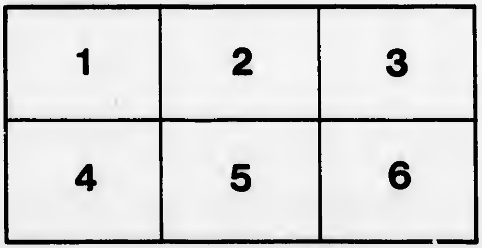
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THE

SILVA OF NORTH AMERICA

A DESCRIPTION OF THE TREES WHICH GROW NATURALLY IN NORTH AMERICA EXCLUSIVE OF MEXICO

BY

CHARLES SPRAGUE SARGENT

DIRECTOR OF THE ARNOLD ARBORETUM
OF HARVARD UNIVERSITY

Illustrated with Figures and Analyses drawn from Nature

BY

CHARLES EDWARD FAXON

VOLUME VI

EBENACEÆ—POLYGONACEÆ

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To
FREDERICK LOTHROP AMES,
A PATRON OF HORTICULTURE AND BOTANY,
THIS SIXTH VOLUME OF
THE SILVA OF NORTH AMERICA
IS DEDICATED
IN AFFECTIONATE MEMORY

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SYNOPSIS OF THE ORDERS OF PLANTS CONTAINED IN VOLUME VI. OF THE SILVA OF NORTH AMERICA.

CLASS I. **DICOTYLEDONOUS or EXOGENOUS PLANTS.**

Stems increasing in diameter by the annual addition of a layer of wood inside the bark. Leaves netted-veined. Embryo with a pair of opposite cotyledons.

SUB-CLASS I. **Angiospermæ.** Pistil, a closed ovary containing the ovules and developing into the fruit.

DIVISION II. **Gamopetalæ.** Petals usually united. Stamens inserted on the corolla alternate with or opposite its lobes, or free from the corolla. Ovary inferior or superior.

36. **Ebenaceæ.** Flowers diœcious or rarely perfect, regular. Stamens usually free from the corolla, as many as its lobes, or twice as many, or indefinite. Ovary superior, 2 to 8-celled. Ovule solitary, anatropous. Seeds albuminous. Leaves alternate or rarely opposite, exstipulate.

37. **Styraceæ.** Flowers perfect or rarely polygamo-diœcious, regular. Stamens inserted on the corolla and twice as many as its lobes, or indefinite. Ovary usually inferior or partly inferior, 2 to 5-celled. Ovule usually solitary, anatropous. Seeds albuminous. Leaves alternate, exstipulate.

38. **Oleaceæ.** Flowers perfect or rarely diœcious, or polygamo-diœcious, regular. Stamens usually 2, inserted on the corolla, or hypogynous. Ovary superior, 2-celled. Ovules usually in pairs, rarely solitary or 4 to 8, anatropous or amphitropous. Seeds albuminous or exalbuminous. Leaves opposite, rarely alternate or verticillate, exstipulate.

39. **Borraginaceæ.** Flowers perfect or rarely polygamous, regular. Stamens as many as the lobes of the corolla, inserted on it. Ovary superior, 2-celled or imperfectly 4-celled. Ovules in pairs or solitary in each cell. Seeds albuminous. Leaves alternate or rarely opposite or verticillate, exstipulate.

40. **Bignoniaceæ.** Flowers perfect, bilabiate. Stamens 4, rarely 2. Ovary superior, 2 or rarely 1-celled. Ovules numerous, anatropous. Seeds exalbuminous. Leaves opposite, exstipulate.

41. **Verbenaceæ.** Flowers perfect or rarely polygamous, irregular or regular. Stamens 4 or rarely 2, inserted on the corolla. Ovary superior, imperfectly 4-celled. Ovules solitary or in pairs, usually amphitropous.

DIVISION III. **Apetalæ.** Corolla 0. Stamens inserted on the petaloid calyx, or hypogynous.

42. **Nyctaginaceæ.** Flowers perfect or rarely unisexual, regular. Stamens 1 or many, hypogynous. Ovary 1-celled. Ovule basal, solitary, erect. Seeds albuminous. Leaves opposite or alternate, exstipulate.

43. **Polygonaceæ.** Flowers perfect or rarely unisexual. Stamens 6 to 9, rarely fewer or many, inserted on the calyx. Ovary superior, 1-celled. Ovule erect, solitary, orthotropous. Leaves alternate or rarely opposite, stipulate, the stipules sheathing the stem.

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SILVA OF NORTH AMERICA.

DIOSPYROS.

FLOWERS diœcious or rarely polygamous; calyx usually 4-lobed, accrescent under the fruit; corolla gamopetalous, usually 4-lobed, the lobes sinistrorsely contorted or rarely irregularly imbricated in æstivation; stamens usually 16; disk 0; ovary superior, 4 or rarely 8-celled; ovules suspended. Fruit baccate, juicy, 1 to 10-seeded. Leaves alternate or rarely subopposite, entire, destitute of stipules.

Diospyros, Linnæus, *Gen.* 143 (1737). — Adanson, *Fam. Pl.* ii. 165. — A. L. de Jussieu, *Gen.* 156. — Meisner, *Gen.* 250. — Endlicher, *Gen.* 742. — Bentham & Hooker, *Gen.* ii. 665. — Gürke, *Engler & Prantl Pflanzenfam.* iv. pt. i. 161. — Baillon, *Hist. Pl.* xi. 227.

Paralea, Aublet, *Pl. Guian.* i. 576 (1775). — Meisner, *Gen.* 250.

Dactylus, Forskål, *Fl. Ægypt.-Arab.* p. xxxvi. (1775).

Embryopteris, Gærtner, *Fruct.* i. 145 (1788).

Cavanillea, Desrousseaux, *Lam. Dict.* iii. 663 (1789).

Cargillia, R. Brown, *Prodr. Fl. Nov. Holl.* 526 (1810). — Meisner, *Gen.* 250. — Endlicher, *Gen.* 742.

Leucoxylum, Blume, *Bijdr. Fl. Ned. Ind.* 1169 (1826). — Meisner, *Gen.* 250.

Noltia, Schumacher, *Dansk. Vidensk. Selsk. Skrift.* iii. 189 (*Guian. Pl.*) (1828). — Meisner, *Gen.* 158. — Endlicher, *Gen.* 1330.

Mabola, Rafinesque, *Sylva Tellur.* 11 (1838).

Persimon, Rafinesque, *Sylva Tellur.* 164 (1838).

Gunisanthus, A. de Candolle, *Prodr.* viii. 219 (1844).

Rospidios, A. de Candolle, *Prodr.* viii. 220 (1844).

Trees or shrubs, with terete branchlets, scaly buds, hard heavy dark heartwood, and fibrous roots. Leaves alternate or rarely subopposite, entire, deciduous or persistent, destitute of stipules. Flowers articulate with the bibracteolate pedicels, in short few or many-flowered bracted cymes, or solitary from the axils of leaves of the year, or lateral on older branches. Calyx three to seven, usually four-lobed, rarely truncate or slightly divided at the apex, generally pubescent on the outer surface, closed or open in the bud, accrescent under the fruit. Corolla urceolate, campanulate, tubular, or salver-formed, more or less contracted in the throat, three to seven, usually four-lobed, the lobes spreading or recurved, rarely erect, obtuse, or occasionally acute. Sterile flowers smaller than the fertile, usually cymose. Stamens varying from four to an indefinite number, usually about sixteen, inserted on the bottom of the corolla, or hypogynous; filaments slender, sometimes nearly obsolete, rarely geniculate, glabrous or hairy, free or connate at the base, often anteposed in pairs, the interior then usually shorter than the exterior; anthers oblong, linear, or lanceolate, often apiculate by the prolongation of the connective, introrse, two-celled, the cells opening laterally by longitudinal slits or rarely by apical pores; pollen ellipsoidal or globose. Ovary rudimentary or wanting. Fertile flowers often solitary. Stamens rudimentary or sometimes more or less polliniferous, usually less numerous than those of the sterile flower, sometimes wanting. Ovary conical or globose, hirsute or glabrous, usually four or sometimes eight-celled, each cell more or less completely divided by the development of a false longitudinal partition from its exterior face; styles one to four, distinct or partially united, or obsolete; stigmas two-parted or lobed; ovules solitary in the divisions of the cells, attached to their interior angle, pendulous, anatropous; raphe dorsal; micropyle superior. Fruit globose, oblong, or conical, glabrous, glabrate, pubescent, or tomentose, often pulpy, one to ten-seeded, the enlarged persistent calyx often dilated at the base, its lobes spreading or reflexed, sometimes plicate, coriaceous, or foliaceous. Seeds pendulous, oblong, compressed; testa thin, or thick and bony, dark, more or less lustrous. Embryo axile in copious ruminate or uniform albumen, straight or somewhat curved; cotyledons foliaceous, ovate, or lanceolate; radicle superior, cylindrical, turned towards the small hilum.[1]

About one hundred and sixty species of Diospyros are now known;[2] they abound in tropical Asia and Malaya, where the largest number are collected, in tropical Africa and Natal, Madagascar, Brazil, the region bordering the Caribbean Sea, and Mexico. They occur in New Caledonia, on the Mascarene and Seychelles Islands, in tropical Australia, China, the West Indies, and eastern North America, where two species are found. The genus is not represented in western North America, the Andean region, and extratropical South America, southern Australia, New Zealand, or in Europe and northern Africa, where, however, *Diospyros Lotus*,[3] a native probably of the Orient, northern India, and China, has become naturalized in the countries bordering the Mediterranean. In Japan, where two or three species have been cultivated from very early times and are now occasionally naturalized, the genus was probably introduced by man from the neighboring continent. Fossil remains found in the miocene rocks of Greenland,[4] central and southern Europe,[5] and Alaska,[6] and in the cretaceous formation of Nebraska,[7] indicate that Diospyros or some closely related genus once inhabited regions from which the family to which it belongs has now disappeared.

Diospyros produces hard close-grained valuable wood with small pores, often in radial lines, and numerous thin equidistant uniform medullary rays, very thick pale usually soft sapwood, and dark often black heartwood, which is formed only in old individuals. The ebony of commerce is partly derived from different tropical species of Diospyros,[8] especially from *Diospyros Ebenum*[9] and *Diospyros*

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[1] By Hiern (*Trans. Camb. Phil. Soc.* xii. pt. i. 146) the species of Diospyros are grouped in fifteen sections, principally distinguished by the ruminate or uniform albumen of the seeds, by the form of the calyx, the insertion of the stamens, and the shape of the fruit.

[2] Aublet, *Pl. Guian.* i. 576 (*Paralea*). — Blume, *Bijdr. Fl. Ned. Ind.* 668. — A. de Candolle, *Prodr.* viii. 222. — Miquel, *Fl. Ind. Bat.* ii. 1044; *Martius Fl. Brasil.* vii. 3. — Thwaites, *Enum. Pl. Zeylan.* 178, 423. — Grisebach, *Fl. Brit. W. Ind.* 401; *Cat. Pl. Cub.* 168. — Bentham, *Fl. Austral.* iv. 286. — Hiern, *l. c.* 144; *Oliver Fl. Trop. Afr.* iii. 517. — Baker, *Fl. Maur. and Seych.* 196. — Hemsley, *Bot. Biol. Am. Cent.* ii. 300. — C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iii. 553. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 69.

[3] Linnæus, *Spec.* 1057 (1753). — Pallas, *Fl. Ross.* i. pt. ii. 20, t. 58, 59. — *Nouveau Duhamel*, vi. 83, t. 26. — A. de Candolle, *l. c.* 228. — Hiern, *l. c.* 223. — Hance, *Jour. Linn. Soc.* xiii. 83. — C. B. Clarke, *l. c.* 555. — Franchet & Savatier, *Enum. Pl. Jap.* i. 303. — Naudin, *Nouv. Arch. Mus.* sér. 2, iii. 220. — Caruel, *Parlatore Fl. Ital.* viii. 680. — Forbes & Hemsley, *l. c.* 70.

Dactylus Trapezuntinus, Forskâl, *Fl. Ægypt.-Arab.* p. xxxvi. (1775).

Diospyros Kaki, var. β, Thunberg, *Fl. Jap.* 158 (1784).

Diospyros microcarpa, Siebold, *Ann. Soc. Hort. Pays Bas*, 1844, 28.

Diospyros Japonica, Siebold & Zuccarini, *Abhand. Akad. Munch.* iv. pt. iii. 136 (1846).

Diospyros Pseudo-Lotus, Naudin, *l. c.* (1880).

Diospyros Lotus is believed to be a native of northern Persia and Anatolia, whence it was carried by the ancients into the countries bordering the Mediterranean; it is probably indigenous in some parts of northern India, where it has also long been cultivated, in Afghanistan, and northern China, where this tree is said to be common in the mountain forests near Peking. It is often cultivated in Japan, where it appears to have been introduced from China in early times. The small fruit, when fully ripe, has a sweetish flavor, and is consumed in large quantities fresh and dried by some native tribes of India (Brandis, *Forest Fl. Brit. Ind.* 298)

[4] Heer, *Fl. Foss. Arct.* 118, t. 7, f. 7, b, c, f. 8; t. 47, f. 8.

[5] Saporta, *Origine Paléontologique des Arbres*, 241. — Zittel, *Handb. Palæontolog.* ii. 715, f. 384–386.

[6] Schimper, *Paléontolog. Vég.* ii. 949.

[7] Heer, *Phyll. Cret. Nebr.* 19, t. 1, f. 6, 7.

[8] Charropin, *Étude sur le Plaqueminier*, 13. — Spons, *Encyclopædia of the Industrial Arts, Manufactures, and Raw Commercial Products*, ii. 2015.

[9] Koenig, *Phys. Salsk. Handl.* i. 176 (1776). — Linnæus f. *Suppl.* 440. — A. de Candolle, *l. c.* 231. — Thwaites, *l. c.* 180. — Beddome, *Fl. Sylv. S. Ind.* i. t. 65. — Hiern, *l. c.* 208 (in part). — C. B. Clarke, *l. c.* 558.

Diospyros glaberrima, Rottboell, *Act. Hafn.* ii. 540, t. 5 (1783).

Diospyros melanoxylon, Willdenow, *Spec.* iv. 1109 (not Roxburgh) (1805).

Diospyros Ebenaster, Roxburgh, *Fl. Ind.* ed. 2, ii. 529 (not Retzius) (1832). — Spach, *Hist. Vég.* ix. 407, t. 135.

melanoxylon[1] of India, *Diospyros Dendo*[2] of western tropical Africa, *Diospyros Ebenaster*[3] of Malaya, and *Diospyros tessellaria*[4] of Mauritius. The beautifully variegated and valuable calamander or coromandel wood is produced by *Diospyros quæsita*[5] and *Diospyros oppositifolia*[6] of Ceylon. In the Phillipine Islands the leaves and fruit of *Diospyros Canalon*[7] are used to dye cloth black.[8] A decoction of the bark of *Diospyros Paralea*[9] is used as a febrifuge in French Guiana,[10] and that of the North American *Diospyros Virginiana* has been found efficacious for the same purpose. The bark of *Diospyros melanoxylon* is astringent and tonic, and is employed in India in decoction, in the treatment of diarrhœa and diseases of debility.[11] The fruit of *Diospyros toxicaria*[12] is said to poison birds in Madagascar, and the unripe fruits of several species are used in the tropics to kill fish.[13] In India the glutinous pulp of *Diospyros peregrina*,[14] which is rich in tannic acid, is employed in filling the seams of fishing boats, for preserving fishing nets and lines, and in book-binding;[15] and the oil obtained by boiling the seeds, bark, and leaves is used in native medicines.[16] The fruit of several species is edible.

Diospyros nigricans, Dalzell, *Hooker Jour. Bot. and Kew Gard. Misc.* iv. 110 (not A. de Candolle) (1852).

The best Indian ebony is produced by this tree, which is common in the mountain forests of southern India and of Ceylon, and ranges eastward to Sumatra and the Molucca Islands. The heartwood is black, sometimes streaked with yellow or brown, and is very heavy and close-grained. The sapwood, which is white or gray, is hard and strong, although not durable (Brandis, *Forest Fl. Brit. Ind.* 296. — Gamble, *Man. Indian Timbers*, 251).

[1] Roxburgh, *Pl. Corom.* i. 36, t. 46 (1795); *Fl. Ind.* ed. 2, ii. 530. — Willdenow, *Spec.* iv. 1109. — A. de Candolle, *Prodr.* viii. 224. — Hiern, *Trans. Camb. Phil. Soc.* xii. pt. i. 159 (in part). — Brandis, *l. c.* 294 (in part). — C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iii. 564.

Diospyros Wightiana, A. de Candolle, *l. c.* 223 (1844). — Beddome, *Fl. Sylv. S. Ind.* i. t. 67.

Diospyros dubia, A. de Candolle, *l. c.* (1844).

Diospyros melanoxylon is common in the forests of the Deccan peninsula and of Ceylon, where it sometimes attains the height of eighty feet. The heartwood is black, sometimes streaked with purple, and is hard and heavy. The thick sapwood is light pink, soft, and soon decays; but it is used in building and for many domestic purposes (Gamble, *l. c.* 249).

[2] Hiern, *l. c.* 195, t. 10; *Oliver Fl. Trop. Afr.* iii. 523.

[3] Retzius, *Obs. Bot.* v. 31 (1798). — A. de Candolle, *l. c.* 235. — Hiern, *l. c.* 244.

Diospyros digyna, Jacquin, *Hort. Schœnbr.* iii. 35, t. 313 (1789). — A. de Candolle, *l. c.* 238.

Diospyros revoluta, Poiret, *Lam. Dict.* v. 435 (1804). — A. de Candolle, *l. c.* 234.

Diospyros obtusifolia, Willdenow, *Spec.* iv. 1112 (1805). — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 253, t. 247. — A. de Candolle, *l. c.* 227.

Diospyros Sapota, Roxburgh, *Fl. Ind.* ed. 2, ii. 535 (1832). — *Bot. Mag.* lxix. t. 3988. — A. de Candolle, *l. c.* 228.

Diospyros decandra, Bojer, *Hort. Maurit.* 200 (not Loureiro) (1837).

Sapota nigra, Blanco, *Fl. Filip.* 409 (1837).

Diospyros membranacea, A. de Candolle, *l. c.* 227 (1844).

Diospyros nigra, Blanco, *l. c.* ed. 2, 211 (1845).

Diospyros laurifolia, A. Richard, *Fl. Cub.* iii. 86, t. 55 (1845).

Diospyros Brasiliensis, Miquel, *Martius Fl. Brasil.* vii. 5, t. 2, f. 2 (1856).

Diospyros Ebenaster is carefully cultivated in the Phillipine Islands as a timber-tree, and appears to have been early introduced into tropical America, where it has now become occasionally naturalized. The fruit, although of poor quality, is eaten, and is said to be used before it is ripe to poison fish. The leaves possess caustic properties (Blanco, *l. c.*).

[4] Poiret, *Lam. Dict.* v. 430 (1804). — A. de Candolle, *l. c.* 225. — Hiern, *l. c.* 176.

Diospyros Ebenum, Poiret, *l. c.* 429 (not Koenig) (1804).

Diospyros reticulata, Willdenow, *l. c.* 1109 (1805). — A. de Candolle, *l. c.* (excl. var. *Timoriana*).

[5] Thwaites, *Enum. Pl. Zeylan.* 179 (1860). — Hiern, *l. c.* 174. — C. B. Clarke, *l. c.* 560.

[6] Thwaites, *l. c.* 181 (1860). — Hiern, *l. c.* 157. — C. B. Clarke, *l. c.* 565.

[7] A. de Candolle, *l. c.* 237 (1844). — Hiern, *l. c.* 197.

[8] Blanco, *l. c.* 304.

[9] Steudel, *Nomen. Bot.* ed. 2, i. 514 (1840). — A. de Candolle, *l. c.* 224. — Miquel, *l. c.* 6, t. 3. — Hiern, *l. c.* 240.

Paralea Guianensis, Aublet, *Pl. Guian.* i. 576, t. 231 (1775).

Diospyros ferruginea, Splitgerber, *Vriese Ned. Kruidk. Arch.* 327 (1848).

Diospyros longifolia, Spruce, *Jour. Linn. Soc.* v. 7 (1861).

[10] Miquel, *l. c.* 10.

[11] Warming, *Pharmacopœa of India*, 132.

[12] Hiern, *l. c.* 175.

[13] Hiern, *l. c.* 30.

[14] *Diospyros peregrina.*

Embryopteris peregrina, Gærtner, *Fruct.* i. 145, t. 29 (1788).

Garcinia Malabarica, Desrousseaux, *Lam. Dict.* iii. 701 (1789).

Embryopteris glutinifera, Roxburgh, *Pl. Corom.* i. 49, t. 70 (1795). — Wight, *Icon. Pl. Ind. Orient.* t. 843, 844.

Diospyros Embryopteris, Persoon, *Syn.* ii. 624 (1807). — A. de Candolle, *l. c.* 235. — Miquel, *Fl. Ned. Ind. Bat.* ii. 1048. — Thwaites, *l. c.* 178. — Beddome, *l. c.* t. 69. — C. B. Clarke, *l. c.* 556.

Diospyros glutinosa, Roxburgh, *Fl. Ind.* ed. 2, ii. 533 (1837).

Diospyros Malabarica, Kosteletzky, *Med. Pharm. Fl.* iii. 1099 (1834).

Embryopteris gelatinifera, Don, *Gen. Syst.* iv. 41 (1837).

[15] Brandis, *l. c.* 298. — Balfour, *Cyclopædia of India*, ed. 3, i. 954.

[16] *Bengal Dispens.* 1842, 428. — Flückiger & Hanbury, *Pharmacopœa*, 360.

The most valuable is that of *Diospyros Kaki*,[1] which is cultivated as a fruit-tree in some parts of China and Japan, in California,[2] the southern United States,[3] and in southern Europe.[4]

In the United States Diospyros is not seriously injured by insects[5] or fungal diseases.[6]

The generic name, from Διός and πυρός, in allusion to the life-giving properties of the fruit, was established by Linnæus, who discarded the Guaiacana of Tournefort.[7]

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[1] Linnæus f. *Suppl.* 439 (1781). — Thunberg, *Fl. Jap.* 157 (excl. var. β). — Blume, *Bijdr. Fl. Ned. Ind.* 669. — Wight, *Icon. Pl. Ind. Orient.* t. 415. — A. de Candolle, *Prodr.* viii. 229 (excl. var. *glabra*). — C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iii. 555. — Hiern, *Trans. Camb. Phil. Soc.* xii. pt. i. 227, f. — *Rev. Hort.* 1887, 348, t. — Franchet & Savatier, *Enum. Pl. Jap.* i. 306. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 69.

? *Diospyros Chinensis*, Blume, *Cat. Hort. Buitenz.* 110 (1823).

? *Diospyros Schi-Tse*, Bunge, *Mém. Sav. Étr. St. Pétersbourg*, ii. 116 (*Enum. Pl. Chin. Bor.*) (1834). — Naudin, *Nouv. Arch. Mus.* sér. 2, iii. 222.

Embryopteris Kaki, Don, *Gen. Syst.* iv. 41 (1837).

? *Diospyros costata*, Carrière, *Rev. Hort.* 1870, 134, f.

? *Diospyros Kaki*, var. *costata*, André, *Ill. Hort.* xviii. 176, t. 78 (1871).

Diospyros Roxburghii, Carrière, *l. c.* 1872, 253, f. 28, 29.

Diospyros Mazeli, Carrière, *l. c.* 1874, 70, t.

? *Diospyros Sinensis*, Naudin, *l. c.* 221 (1880).

? *Diospyros Kæmpferi*, Naudin, *l. c.* 226 (1880).

The origin of the cultivated Kakis is uncertain, and the home of the wild types from which they have been developed is not well established. Naudin's view, based upon plants introduced from Japan into the gardens of southern Europe (*l. c.* 226), that three species are cultivated under the general name of Kaki, is perhaps the correct one; and the varieties which are chiefly cultivated by the Japanese, and which have been introduced in considerable numbers into the temperate parts of the United States, are perhaps derived not from *Diospyros Kaki* but from *Diospyros Schi-Tse*, a native, it is supposed, of northern China. The Diospyros commonly cultivated in central and northern Japan produces large thick-skinned orange-colored fruits which vary somewhat in shape and size, but are usually broadly ovate, pointed, and from two to three inches in diameter; they are produced by a tree thirty or sometimes forty feet high, with a short trunk, wide-spreading rather pendulous branches, and large leathery oval more or less cordate dark green lustrous leaves which, having turned to shades of orange and scarlet, fall before the fruit is fully ripe. The severity of the climate in which this tree flourishes in the mountain regions of Japan clearly indicates that it is derived from a northern species. The varieties with large red thin-skinned fruits are much less hardy and are cultivated in the southern provinces of Japan and in southern China (Burbidge, *Gard. Chron.* n. ser. xiii. 106), only flourishing in regions suitable to the cultivation of the Orange-tree. It is possible that these two distinct forms are derived from a single species of wide continental range, although until the Chinese species can be studied in their original forms it is impossible to determine the origin and relationship of varieties which have been perfected by centuries of cultivation and selection.

In Japan the Diospyros is the universally cultivated fruit-tree; it is found in every garden and by every cottage, and in the early autumn, when the trees are covered with their lustrous leaves and brilliant fruit they form the most striking feature of the rural landscape, and are not equaled in beauty by any fruit-tree of cold temperate climates. More than a hundred varieties are distinguished by Japanese horticulturists, who propagate them by grafting (Kaempfer, *Amœn.* 805, t. — Dupont, *Notes relatives aux Kakis cultivés Japonais*). The fruit, which is an important article of food, is gathered before it is fully ripe, and is eaten while it is still hard and astringent, or, carefully packed in old saké tubs, it is allowed to mellow gradually and to collect the flavor and perfume of the saké. It is also dried in the sun, pressed flat, and packed in boxes for export or winter use. From the green fruit, shibu, an astringent fluid rich in tannin and employed in several industries, is pressed. It is made in early summer by pounding the young fruit in iron mortars into pulp, which is covered with water in wooden tubs and allowed to soak for five or six hours, when it is put into bags made of straw rope and made to yield by pressure a milky juice, which soon becomes darker on exposure to the air. This juice is shibu of the best quality; a second quality is obtained by resoaking and repressing the refuse pulp. Shibu, as it appears in commerce, is a light gray fluid containing numerous fine hard particles; it is employed to toughen wood, paper, and fishing nets, and is used in one of the processes of lacquering, in the preparation of saké, and in dyeing (Rein, *Industries of Japan*, 88, 179, 181, 354). In central China oil obtained from the unripe fruit is used to make hats and umbrellas impervious to water (Forbes & Hemsley, *l. c.* 70); and the fruit is used in medicine (Smith, *Chinese Mat. Med.* 87).

The wood of the Diospyros cultivated in central Japan is heavy and hard, but not particularly strong, with a thick dark gray sapwood more or less marked with dark lines towards the interior, and thin black heartwood, which is valued by the Japanese, who use it in turnery and in the manufacture of small boxes.

[2] Wickson, *California Fruits and How to Grow Them*, ed. 2, 484.

[3] *Am. Agric.* xxxvi. 222, f. — *Proc. Am. Pomol. Soc.* 17th Session, 1880, 40; 19th Session, 1884, 146; 22d Session, 1889, 104. — *U. S. Dept. Agric. Div. Pomol. Bull.* No. 1, 6, t. 2, 3.

[4] Naudin, *Manuel de l'Acclimateur*, 248.

[5] Few insects are reported as feeding upon Diospyros in America, although little is known of the wood-borers which attack it. The leaves of *Diospyros Virginiana* are occasionally injured by a number of general foliage-eating lepidopterous larvæ, and a leaf-miner, *Aspidisca diospyriella*, Chambers, lives within their parenchyma. On this tree were first detected *Aphis Diospyri*, Thomas (*8th Rep. Insects of Illinois*, 95), and *Psylla Diospyri*, Ashmead (*Canadian Entomologist*, 1881, 222).

[6] *Botryosphæria Persimmons*, Saccardo, and *Valsaria Diospyri*, De Notaris, are peculiar to *Diospyros Virginiana*, producing small swellings on the bark, which, so far as is known, are not followed by any serious disease of the tree. On the leaves of this tree, *Cercospora Diospyri*, Cooke, and *Cercospora fuliginosa*, Ellis & Kellerman, cause spots, from which a white growth protrudes on their lower surface. A third species of Cercospora, *C. Kaki*, Ellis & Evans, has been found in Louisiana on the leaves of the cultivated Japanese Diospyros.

[7] *Inst.* 600, t. 371.

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CONSPECTUS OF THE NORTH AMERICAN SPECIES OF DIOSPYROS.

Staminate flowers in 3-flowered fascicles; anthers opening longitudinally nearly throughout their entire length; filaments pubescent; pistillate flowers with 8 staminodia; ovary nearly glabrous; leaves oval . . . . 1. D. VIRGINIANA.

Staminate flowers in 1 to 3-flowered fascicles; anthers opening only near the apex; filaments glabrous; pistillate flowers without staminodia; ovary pubescent; leaves cuneate-oblong or obovate 2. D. TEXANA.

DIOSPYROS VIRGINIANA.

Persimmon.

Staminate flowers in 3-flowered fascicles; anthers opening longitudinally almost throughout their entire length; pistillate flowers with 8 staminodia; ovary nearly glabrous. Leaves oval.

Diospyros Virginiana, Linnæus, *Spec.* 1057 (1753). — Miller, *Dict.* ed. 8, No. 2. — Moench, *Bäume Weiss.* 39. — Wangenheim, *Beschr. Nordam. Holz.* 129; *Nordam. Holz.* 84, t. 28, f. 58. — Marshall, *Arbust. Am.* 40. — Castiglioni, *Viag. negli Stati Uniti*, ii. 233. — Walter, *Fl. Car.* 253. — Aiton, *Hort. Kew.* iii. 446. — Willdenow. *Berl. Baumz.* 101; *Spec.* iv. 1107; *Enum.* 1061. — Abbot, *Insects of Georgia*, ii. t. 61, 74. — Michaux. *Fl. Bor.-Am.* ii. 258. — Borkhausen, *Handb. Forstbot.* ii. 1863. — Gærtner, f. *Fruct.* iii. 158, t. 207. — Poiret, *Lam. Dict.* v. 428. — Persoon, *Syn.* ii. 624. — Duhamel, *Traité des Arbres Fruitiers*, nouv. éd. i. t. 37. — Desfontaines, *Hist. Arb.* i. 208. — Du Mont de Courset, *Bot. Cult.* ed. 2, iii. 312. — Titford, *Hort. Bot. Am.* 106. — Michaux f. *Hist. Arb. Am.* ii. 195, t. 12. — Pursh, *Fl. Am. Sept.* ii. 265. — *Nouveau Duhamel*, vi. 84. — Nuttall, *Gen.* ii. 240. — Hayne, *Dendr. Fl.* 228. — Elliott, *Sk.* ii. 712. — Collin, *Förslag af nagra Nord-Americas Träd*, 23. — Audubon, *Birds*, t. 87. — Sprengel, *Syst.* ii. 202. — Watson, *Dendr. Brit.* ii. 146, t. 146. — Don, *Gen. Syst.* iv. 39. — Loudon, *Arb. Brit.* ii. 1195, t. 200, 201. — Spach, *Hist. Vég.* ix. 405. — A. de Candolle, *Prodr.* iv. 228. — Dietrich, *Syn.* v. 437. — *Belg. Hort.* iv. 118, t. — Darlington, *Fl. Cestr.* ed. 3, 176. — Chapman, *Fl.* 273. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 70. — Koch, *Dendr.* ii. 204. — Hiern, *Trans. Camb. Phil. Soc.* xii. pt. i. 224. — Charropin, *Étude sur le Plaqueminier*, 26. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 69. — Lauche, *Deutsche Dendr.* ed. 2, 215. — Sargent, *Forest Trees, N. Am. 10th Census, U. S.* ix. 104. — Diez, *Regensburg Flora*, 1887, 535. — Watson & Coulter, *Gray's Man.* ed. 6, 333. — Gürke, *Engler & Prantl Pflanzenfam.* iv. pt. i. f. 86, F. — Baillon, *Hist. Pl.* xi. f. 218–222. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 257 (*Man. Pl. W. Texas*). — Koehne, *Deutsche Dendr.* 483, f. 79, A–J.

Diospyros Guajacana, Romans, *Nat. Hist. Florida*, 20 (1775). — Robin, *Voyages*, iii. 417.

Diospyros concolor, Moench, *Meth.* 471 (1794).

Diospyros pubescens, Pursh, *Fl. Am. Sept.* i. 265 (not Persoon) (1814). — Rafinesque, *Fl. Ludovic.* 139. — Don, *Gen. Syst.* iv. 38. — Loudon, *Arb. Brit.* ii. 1196.

Diospyros Caroliniana, Rafinesque, *Fl. Ludovic.* 139 (1817).

Diospyros Virginiana, var. puoescens, Nuttall, *Gen.* ii. 240 (1818). — Elliott, *Sk.* ii. 713.

Diospyros Virginiana, var. microcarpa, Rafinesque, *Med. Fl.* i. 155 (1828).

Diospyros Virginiana, var. concolor. Rafinesque, *Med. Fl.* i. 155 (1828).

Diospyros Virginiana, var. macrocarpa, Rafinesque, *Med. Fl.* i. 155 (1828).

Diospyros Persimon. Wikström, *Jahr. Schwed.* 1830, 92 (1834).

Diospyros ciliata, Rafinesque, *New Fl.* iii. 25 (not A. de Candolle) (1836).

A tree, with thick fleshy black stoloniferous roots, usually thirty to fifty feet in height, with a short trunk rarely more than twelve inches in diameter, and spreading often pendulous branches which form a broad or narrow round-topped head; or, when growing in the primeval forest under the most favorable conditions, sometimes a hundred to a hundred and fifteen feet high, with a long slender trunk free from branches for seventy or eighty feet, and rarely exceeding two feet in diameter. The bark of the trunk is three quarters of an inch to an inch in thickness, dark brown tinged with red, or dark gray, and deeply divided into thick square plates, their surface being broken into thin persistent scales. The branchlets are terete, slender, with a thick pith, or pith cavity,[1] slightly zigzag by the death of the tip during the summer,[2] light reddish brown and more or less coated, when they first appear, with pale

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[1] The branchlets of *Diospyros Virginiana* sometimes contain no pith and are then hollow (Foerste, *Bot. Gazette*, xvii. 186).

[2] The ends of the branchlets of *Diospyros Virginiana* die and shrivel up in early summer before the formation of the terminal buds, and during the winter appear as small dark-colored stubs immediately below the upper axillary buds which the following spring prolong the branches (Henry, *Nov. Act. Nat. Cur.* xxii. 239, t. 21, f. 7. — Brendel, *Illinois Mus. Nat. Hist.* Bull. No. 1, t. 3, f. 26. — Foerste, *l. c.* 184; *Bull. Torrey Bot. Club*, xix. 268, t. 132, f. 9; xx. 162).

pubescence. During their first winter they are pubescent or glabrous, light brown to ashy gray, and marked with occasional small orange-colored lenticels and elevated semicircular leaf-scars with deep horizontal lunate depressions in which appear the ends of the crowded fibro-vascular bundles; later they are reddish brown and are covered with thin bark often somewhat broken by longitudinal fissures. The winter-buds are broadly ovate, acute, an eighth of an inch long, and covered with thick imbricated dark red-brown or purple lustrous scales which often remain at the base of the young branchlets during the season. The leaves are alternate, revolute in vernation, oval, shortly acuminate at the apex, and abruptly or gradually narrowed, or rounded or often cordate at the base; when they unfold they are thin, light green or red, pubescent on the lower surface, puberulous on the upper surface, and ciliate on the margins with long soft white hairs; at maturity they are coriaceous, dark green and lustrous above, pale and often pubescent below, four to six inches long, and two to three inches wide, with broad flat midribs, about six pairs of conspicuous primary veins arcuate near the margins, and reticulate veinlets; they are borne on stout pubescent petioles which vary from half an inch to an inch in length, and fall early in the autumn without changing color, or sometimes turn orange or scarlet. The flowers appear from April in Texas to the end of June in New England, when the leaves are more than half grown, on shoots of the year, the males in two to three-flowered pubescent pedunculate cymes, their pedicels in the axils of minute lanceolate acute caducous bracts, and furnished near the middle with two minute caducous bractlets, the females solitary, on separate trees, their short recurved pedicels covered by two conspicuous acute bractlets ciliate on the margins, and often a quarter of an inch long. The corolla of the staminate flower is tubular, a third of an inch long, slightly contracted below the short acute reflexed lobes which before expansion form a pointed four-angled bud not inclosed in and rather longer than the broadly ovate acute foliaceous ciliate calyx-lobes with inflexed margins. There are sixteen stamens with short slightly hairy free filaments inserted in the bottom of the corolla in two rows and in pairs, those of the outer row being rather longer and opposite those of the inner row, and linear lanceolate anthers opening throughout their length. The ovary is rudimentary or wanting. The pistillate flower is three quarters of an inch long, with a greenish yellow or creamy white corolla nearly half an inch broad when fully expanded; in this, below the middle, are inserted in one row eight small stamens with short filaments and sagittate abortive or sometimes fertile anthers.[1] The ovary is conical, pilose toward the apex, ultimately eight-celled by the development of a false partition from the face of each of the original four cells, with a solitary ovule in each cell, and gradually narrowed into the four slender spreading styles which are slightly two-lobed at the apex and hairy at the base. The fruit, which contains one to eight seeds or is sometimes seedless, is borne on a short thick woody stem often persistent on the branches during the winter, and ripens at midsummer at the south and late in the autumn at the north, where it hangs on the leafless branches until the beginning of winter; it is crowned with the remnants of the style, and is usually depressed-globose or slightly obovate-oblong, and an inch to an inch and a half in diameter, although it varies in different parts of the country and on different individuals in size, shape, and quality; it is pale orange-color, often with a bright red cheek, covered with a slight glaucous bloom, and turns yellowish brown when partly decayed by freezing; the flesh, which is exceedingly austere while green, is yellowish brown, sweet, and luscious when fully ripe, although, except in the extreme southern parts of the country, it requires the action of frost to make it edible; the fruiting calyx is spreading, an inch to an inch and a half across, with broadly ovate pointed or rounded spreading lobes recurved on the margins. The seeds are oblong, much flattened, half an inch long, a third of an inch broad, with a thick hard lustrous brown pitted testa, a conspicuous truncate hilum, and a slender raphe.

The most northern place where *Diospyros Virginiana* is known to grow naturally is Lighthouse Point in New Haven, Connecticut. It is not uncommon on Long Island, and is abundant in all the

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[1] It is not unusual to find abundant crops of fruit on isolated pistillate trees, and such fruits often contain seeds with well-developed embryos, although they appear to be more often seedless.

region east of the Alleghany Mountains from southern New York to the banks of the Caloosa River and the shores of Bay Biscayne in Florida, and southern Alabama and Mississippi; west of the Alleghany Mountains it is distributed from southern Ohio to southeastern Iowa, southern Missouri, Arkansas, Louisiana, eastern Kansas, the Indian Territory, and the valley of the Colorado River in Texas. The Persimmon usually grows in light sandy well-drained soil, although in the basin of the Mississippi, where it attains its largest size, it is sometimes found in the primeval forests which clothe the deep rich bottom-lands of river valleys.[1] It is exceedingly common in the south Atlantic and Gulf states, often covering with a shrubby growth, by means of its stoloniferous roots, abandoned fields exhausted by agriculture, and springing up by the sides of roads and fences.

The wood of *Diospyros Virginiana* is heavy, hard, strong, and very close-grained, with numerous conspicuous medullary rays and bands of one or two rows of open ducts marking the layers of annual growth. The heartwood, which is often not developed until the tree is over a hundred years old, is dark brown or sometimes nearly black, and is rarely seen. The specific gravity of the sapwood, which is light brown and often marked with darker spots, when absolutely dry is 0.7908, a cubic foot weighing 49.28 pounds. It is employed in turnery, for shoe-lasts, plane-stocks, and many small articles of domestic use; for shuttles it is preferred to other American woods.

The fruit contains tannin similar to that of cinchona, to which it owes its astringent qualities, pectin, sugar, and lignin, but neither vegetable albumen, starch, nor resin;[2] it is eaten in great quantities in the southern states and is sometimes to be found in the markets of northern cities, where, however, it is not much appreciated. By the Indians of the south bread was made of the dried fruit, which is still occasionally used in the same manner in the western and southern states, where persimmons are also fermented with hops, corn meal, or wheat bran, into a sort of beer which is used domestically, or are manufactured into brandy.[3] It is a favorite food of hogs and many other animals. The inner bark, which is astringent and bitter, and the unripe fruit are sometimes used in the treatment of fevers, diarrhœa, and hæmorrhage, and with alum as a gargle.[4] Indelible ink is made from the fruit, and the dried, roasted, and ground seeds have been used as a substitute for coffee.[5]

In the autumn of 1539 the companions of De Soto learned from the Indians in Florida the value of the fruit of the Persimmon, which helped them to eke out their scanty fare. The earliest mention of it appears in the narrative of his expedition published at Evora in 1557;[6] and in the next century the fruit was admirably described by Jan de Laet in his account of Virginia,[7] and by William Strachey.[8] The date of the first introduction of the tree into European gardens is uncertain; it was carried,

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[1] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 68.

[2] Rafinesque, *Med. Fl.* i. 153, t. 32. — B. R. Smith, *Am. Jour. Pharm.* xviii. 161. — J. E. Bryan, *Am. Jour. Pharm.* xxxii. 215.

[3] Porcher, *Resources of Southern Fields and Forests*, 385.

[4] Woodhouse, *On the Chemical and Medical Properties of the Persimmon Tree and the Analysis of Astringent Vegetables.* — Barton, *Coll.* ed. 2, i. 11, 45; ii. 52. — Griffith, *Med. Bot.* 435, f. 196. — Rosenthal, *Syn. Pl. Diaphor.* 512. — Mettauer, *Boston Med. and Surg. Jour.* lxxvii. 188. — *Nat. Dispens.* ed. 2, 514. — Baillon, *Traité Bot. Méd.* 1311. — Johnson, *Man. Med. Bot. N. Am.* 199. — *U. S. Dispens.* ed. 16, 1783.

[5] *Med. and Surg. Reporter*, 1873, 437.

[6] "There were many mulberrie trees and plum trees, which bare red plums like those of Spaine, and other gray, somewhat differing, but farre better." (*The Discovery and Conquest of Florida*, by Don Fernando de Soto, ed. Rye, chap. xxiii. 94.)

"They travelled seven daies journie through a desert, and returned verie wearie, eating greene plums and stalkes of mais." (Chap. xxiv. 102.)

"Canoes loden with maiz, French beanes, prunes, and many loaves made of the substance of prunes." (Chap. xxix. 119.)

"The plummes are of two kindes, red and gray, of the making and bignesse of nuts, and have three or foure stones in them." (Chap. xliv. 169.)

[7] "Prunorum species hic tres observatæ, quarum duæ quæ rubra atque alba Pruna ferunt, arbutis similes: tertiæ vero fructus appellant barbari *Putchamins*, hæc in Palmæ altitudinem adolescit, & fructum fert mespilo non absimilem primo viridem, deinde subflavum, ubi plene maturuerit, rubicundam: immaturus austerior est & si masticetur, os cum exquisito dolore astringit, maturus gratissimi est saporis & præcocibus omnino similis." (*Nov. Orb.* 80.)

[8] "They have a plomb which they call pessemmins, like to a medler, in England, but of a deeper tawnie cullour; they grow on a most high tree. When they are not fully ripe, they are harsh and choakie, and furre in a man's mouth like allam, howbeit, being taken fully ripe, yt is a reasonable pleasant fruict, somewhat lushious. I have seene our people put them into their baked and sodden puddings; there be whose tast allowes them to be as pretious as the English apricock; I confesse it is a good kind of horse plomb." (*The Historie of Travaile into Virginia Britannia*, ed. Major, 118.)

however, to England before 1629, when an account of a cultivated tree appeared in Parkinson's *Paradisi in sole Paradisus terrestris*,[1] published in that year.

As an ornamental tree *Diospyros Virginiana* is made valuable by its hardiness, its power of adapting itself to a great variety of soils and climates, its good habit, its large and lustrous leaves, its abundant crops of handsome fruit, and by its immunity from disease and the serious attacks of disfiguring insects. The excellent quality and flavor of the fruit of some uncultivated trees, and its tendency to vary,[2] indicate that it could be greatly improved by careful selection and cultivation, and that in time it might be made to equal the best Chinese and Japanese varieties in size and flavor.[3]

Diospyros Virginiana is easily raised from seed; it can also be increased by stolons, which are often produced in great numbers; and varieties are readily increased by grafting.

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[1] *Lotus. The Virginia Pishamin*, 570, t. f. 6.

Pishamin Virginianum. The Virginia Date Plumme or Pishamin, Parkinson, *Theatr.* 1523, f.

Guaiacana Virginiana Pishamin dicta, Ray, *Hist. Pl.* ii. 1918.

Guaiacana Loto arboris Guaiaco Patavino affinis Virginiana, Plukenet, *Phyt.* t. 241, f. 5.

Guaiacana, Plukenet, *Alm. Bot.* 180. — Miller, *Dict.* No. 3. — Catesby, *Nat. Hist. Car.* ii. 76, t. 76.

Guajacana? Pishamin Virginianum, Boerhaave, *Ind. Alt.* ii. 220.

Diospyros foliis utrinque concoloribus, Linnæus, *Hort. Cliff.* 149. — Clayton, *Fl. Virgin.* 43. — Royen, *Fl. Leyd. Prodr.* 442.

[2] In size the fruit of *Diospyros Virginiana* varies from that of a small cherry to that of a large plum. On some trees it becomes so soft when fully ripe that in falling to the ground it is crushed by its own weight, while on other trees growing under identical conditions it remains nearly as hard as stone after severe freezing. Some trees in the south produce fruit which is sweet and luscious without the action of frost, and on adjoining trees it preserves its acidity when nearly rotten, never becoming edible.

[3] *Garden and Forest*, i. 544.

EXPLANATION OF THE PLATES.

PLATE CCLII. DIOSPYROS VIRGINIANA.

1. A flowering branch of a staminate tree, natural size.
2. A flowering branch of a pistillate tree, natural size.
3. Diagram of a staminate flower.
4. Diagram of a pistillate flower.
5. Vertical section of a staminate flower, enlarged.
6. A pair of stamens, enlarged.
7. Vertical section of a pistillate flower, enlarged.
8. Cross section of an ovary, enlarged.
9. An ovule, much magnified.
10. A winter branchlet, natural size.

PLATE CCLIII. DIOSPYROS VIRGINIANA.

1. A fruiting branch, natural size.
2. An oblong fruit, natural size.
3. Vertical section of a fruit, natural size.
4. Cross section of a fruit, natural size.
5. A seed, natural size.
6. An embryo, enlarged.

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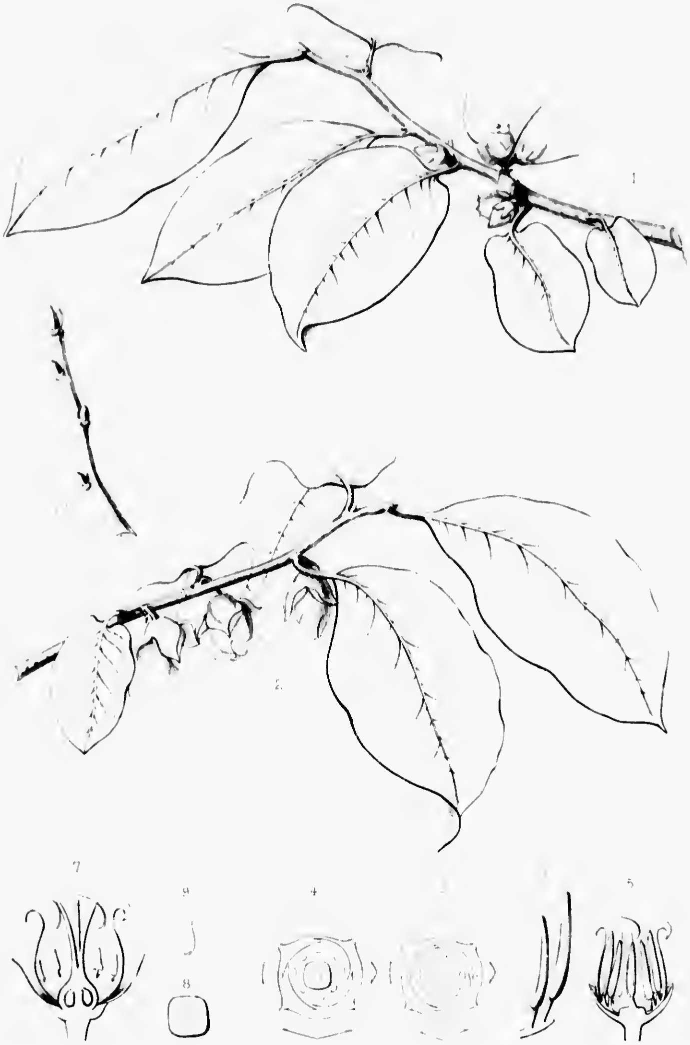

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DIOSPYROS VIRGINIANA L.

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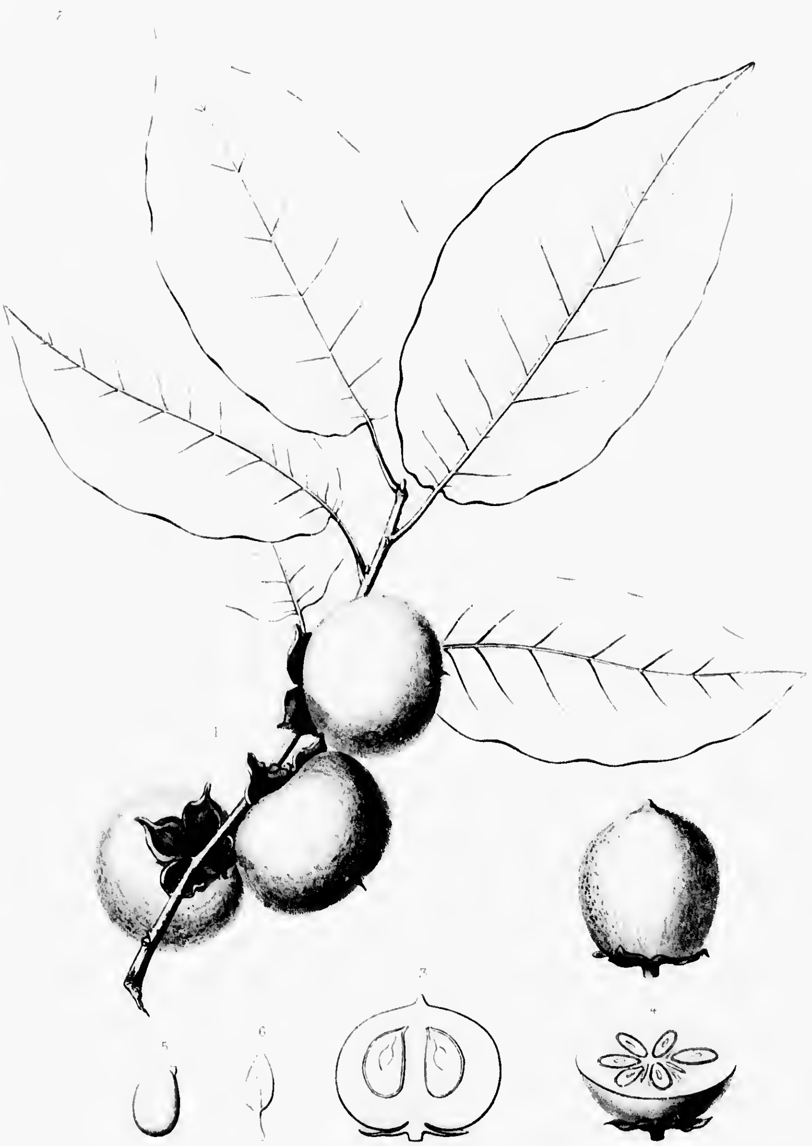

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DIOSPYROS TEXANA.

Black Persimmon. Chapote.

STAMINATE flowers in 1 to 3-flowered fascicles; anthers opening only near the apex; pistillate flowers without staminodia; ovary pubescent. Leaves cuneate-oblong or obovate.

Diospyros Texana, Scheele, *Linnæa*, xxii. 145 (1849). — Walpers, *Ann.* iii. 14. — Torrey, *Bot. Mex. Bound. Surv.* 109. — Hiern, *Trans. Camb. Phil. Soc.* xii. pt. i. 238. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 70. — Hemsley, *Bot. Biol. Am. Cent.* ii. 300. — Sargent, *Forest Trees, N. Am. 10th Census, U. S.* ix. 105. — C. G. Pringle, *Garden and Forest*, ii. 394. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 257 (*Man. Pl. W. Texas*).

An intricately branched twiggy tree, occasionally forty to fifty feet in height, with a trunk eighteen to twenty inches in diameter, dividing at some distance above the ground into a number of stout upright branches which form a narrow round-topped head; often much smaller, and toward the northern and western limits of its range reduced to a low many-stemmed shrub. The bark of the trunk is smooth, thin, light gray, slightly tinged with red, the outer layer falling away in large irregularly shaped patches displaying the smooth gray inner bark. The branchlets are slender, terete, rigid, and slightly zigzag by the death of the tips before the terminal buds are formed; when they first appear they are coated with pale or rufous tomentum, and in their first winter they are ashy gray, glabrous or puberulous, later becoming brown, and marked by minute pale lenticels and by the small elevated semicircular leaf-scars in which appear lunate rows of fibro-vascular bundle-scars. The winter-buds are obtuse, barely more than a sixteenth of an inch long, and protected by broadly ovate scales rounded at the apex, and coated with rufous tomentum. The leaves are cuneate-oblong to obovate, revolute in vernation, rounded and often retuse at the apex, and wedge-shaped at the base; when they unfold they are covered on the lower surface with thick pale tomentum, and on the upper with scattered long white hairs; at maturity they are thick and coriaceous, dark green and lustrous, glabrous or puberulous above, paler and pubescent below, three quarters of an inch to an inch and a half long, and a third of an inch wide, with short thick hairy petioles, broad midribs, and about four pairs of arcuate primary veins which, like the reticulate veinlets, are inconspicuous on the upper side of the leaf. The leaves unfold in February and March, and fall during the following winter without changing color. The flowers appear in early spring, when the leaves are about one third grown, on branches of the previous year, the staminate in one to three-flowered crowded pubescent fascicles, on slender drooping pedicels furnished near the middle with minute caducous bractlets, the pistillate solitary or rarely in pairs on separate plants, and borne on stouter club-shaped bibracteolate pedicels. In the sterile flower the calyx is an eighth of an inch long and deeply divided into five ovate or lanceolate lobes, silky-tomentose on both surfaces, recurved after the opening of the flower, and much shorter than the corolla, which is an eighth of an inch long, creamy white, and slightly contracted below the five short spreading rounded lobes ciliate on their margins. There are sixteen stamens, which are distinct, glabrous, shorter than the corolla, and inserted on it in two rows and in pairs, those of the outer row being rather longer than those of the inner row; the anthers are linear-lanceolate and open at the apex by short slits. The pistillate flowers, which have no staminodia, are a third of an inch long, with oblong acute silky-tomentose calyx-lobes half the length of the pubescent corolla, which, when expanded, is nearly half an inch across the short spreading lobes. The ovary is ovate and gradually contracted into four spreading styles two-lobed at the apex; it is pubescent like the young fruit, and is ultimately eight-celled with a single ovule in each cell. The fruit, which ripens in August, is subglobose, half an inch to an inch in diameter, pilose, tipped with the remnants of the style, and surrounded at the base by the large thickened leathery calyx sometimes an inch across, with oblong pubescent reflexed lobes; it is covered with a thick tough black skin which incloses the thin sweet insipid dark flesh, and contains three to eight triangular seeds rounded on the back, narrowed and flattened at the pointed apex, a third of an inch long, about an eighth of an inch thick, and covered with a thick bony lustrous light red pitted coat.

Diospyros Texana is distributed from the valleys of the Colorado and Concho Rivers in Texas to Nuevo Leon. It is abundant in western and southern Texas, inhabiting, near the coast, the borders of prairies, where it flourishes in rich moist soil, growing on the bottom-lands of the Guadaloupe more vigorously than in other parts of the state; farther west it is found on dry rocky mesas and in isolated cañons. In the region between the Sierra Madre and the coast of the Gulf of Mexico in Nuevo Leon, where it is exceedingly common, the Chapote grows to its largest size.

The wood of *Diospyros Texana* is heavy, hard, and very close-grained, with a satiny surface susceptible of receiving a beautiful polish. It contains a few minute scattered open ducts and many thin medullary rays. The heartwood, which appears only in old individuals, is black, often streaked with yellow; the sapwood is clear bright yellow. The specific gravity of the absolutely dry wood is 0.8460, a cubic foot weighing 52.72 pounds. It is used in turnery for the handles of tools, etc., and has been recommended as a substitute for boxwood for engraving-blocks.[1] The fruit, which is exceedingly austere until it is fully ripe, stains black, and probably possesses valuable tinctorial properties; it is sometimes used by Mexicans inhabiting the valley of the Rio Grande to dye sheepskins.[2]

Diospyros Texana was discovered in Nuevo Leon in February, 1828,[3] by the Belgian botanist Berlandier;[4] in Texas it was first noticed by Lindheimer[5] in 1845 growing on the bottom-lands west of the Colorado River.

Diospyros Texana is not known to be an inhabitant of gardens, where it might well find a place for the beauty of its dark lustrous foliage and abundant black fruit, which no doubt could be improved in size and quality by cultivation.[6]

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[1] Jackson, *Commercial Botany of the Nineteenth Century*, 156.

[2] Havard, *Proc. U. S. Nat. Mus.* viii. 523.

[3] *Teste* Hiern, *Trans. Camb. Phil. Soc.* xii. pt. i. 238.

[4] See i. 82.

[5] See i. 74.

[6] The black coloring matter is so abundant in the fruit of the Chapote that it discolors the hands, lips, and teeth of a person eating it, and so lessens its value for the table.

EXPLANATION OF THE PLATE.

Plate CCLIV. Diospyros Texana.

1. A flowering branch of a staminate tree, natural size.
2. A flowering branch of a pistillate tree, natural size.
3. A staminate flower, enlarged.
4. Vertical section of a staminate flower, enlarged.
5. A stamen, enlarged.
6. A pistillate flower, enlarged.
7. Vertical section of a pistillate flower, enlarged.
8. A pistil cut transversely, enlarged.
9. A fruiting branch, natural size.
10. Cross section of a fruit, natural size.
11. A seed, natural size.
12. Vertical section of a seed, natural size.
13. An embryo, enlarged.

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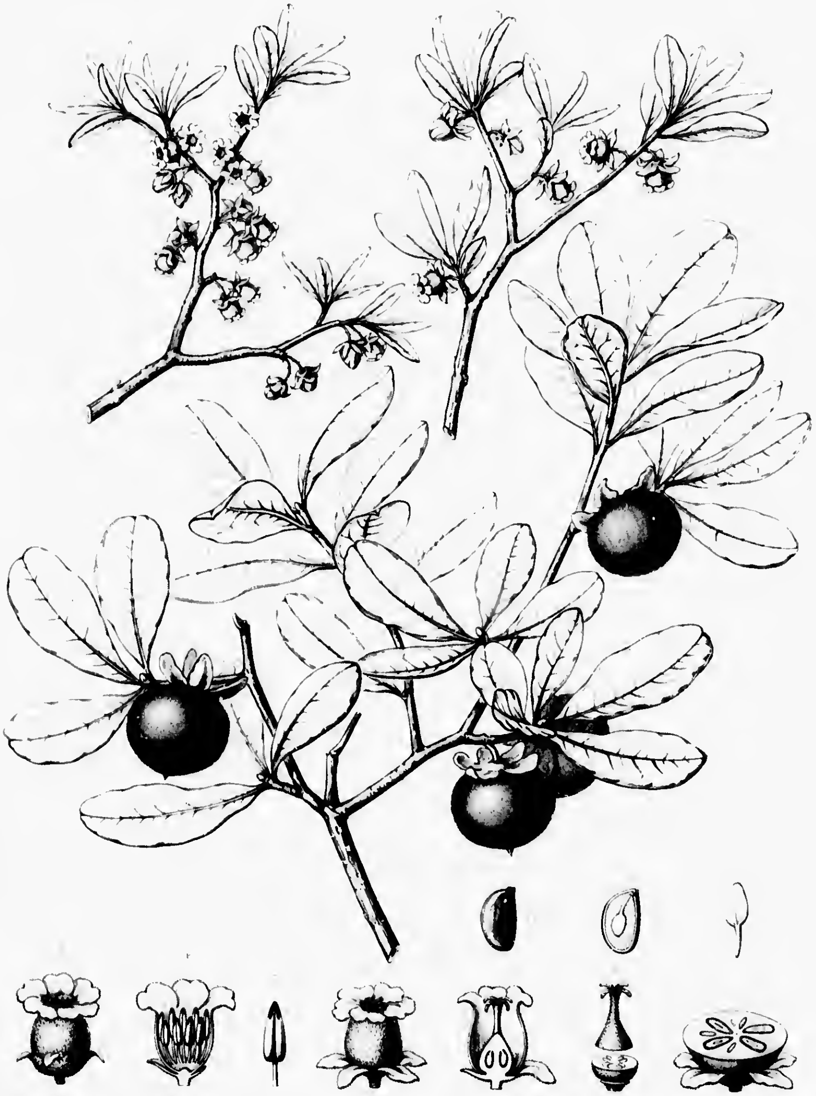

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SYMPLOCOS.

Flowers regular, perfect, or rarely polygamous; calyx 5-lobed, the lobes imbricated in æstivation; corolla gamopetalous, the lobes imbricated in æstivation; stamens indefinite, in several series; anthers innate; disk 0; ovary inferior or partly superior, 2 to 5-celled; ovules 2 or rarely 4 in each cell. Fruit drupaceous or baccate. Leaves alternate, simple, destitute of stipules.

Symplocos, L'Héritier, *Trans. Linn. Soc.* i. 174 (1791). — Bentham, *Trans. Linn. Soc.* xviii. 225. — Meisner, *Gen.* 250. — Endlicher, *Gen.* 744. — Bentham & Hooker, *Gen.* ii. 668. — Engler & Prantl, *Pflanzenfam.* iv. pt. i. 168. — Baillon, *Hist. Pl.* xi. 461.

Eugenioides, Linnæus, *Fl. Zeylan.* 192 (1747).

Symplocos, Jacquin, *Hist. Stirp. Am.* 166 (1763). — Linnæus, *Gen.* ed. 6, 272. — A. L. de Jussieu, *Gen.* 157.

Bobu, Adanson, *Fam. Pl.* ii. 88 (1763).

Hopea, Linnæus, *Mant.* 14 (1767). — A. L. de Jussieu, *Gen.* 157. — Meisner, *Gen.* 250.

Ciponima, Aublet, *Pl. Guian.* i. 566 (1775). — A. L. de Jussieu, *Gen.* 157. — Miers, *Jour. Linn. Soc.* xvii. 288.

Alstonia, Linnæus, f. *Suppl.* 39 (1781). — A. L. de Jussieu, *Gen.* 157.

? **Drupatris**, Loureiro, *Fl. Cochin.* 314 (1790).

? **Decadia**, Loureiro, *Fl. Cochin.* 314 (1790). — Miers, *Jour. Linn. Soc.* xvii. 295.

Dicalyx, Loureiro, *Fl. Cochin.* 663 (1790). — Meisner, *Gen.* 250. — Endlicher, *Gen.* 1018. — Miers, *Jour. Linn. Soc.* xvii. 296.

Pladera, Roxburgh, *Fl. Ind.* i. 416 (1820).

Sariava, Reinwardt, *Syll. Ratisb.* ii. 12 (1825).

Mongezia, Vellozo, *Fl. Flum.* 229; *Icon.* v. t. 105, 106 (1825).

Barberina, Vellozo, *Fl. Flum.* 235; *Icon.* v. t. 117 (1825). — Endlicher, *Gen.* 1334. — Miers, *Jour. Linn. Soc.* xvii. 292.

Bobua, De Candolle, *Prodr.* iii. 23 (1828). — Meisner, *Gen.* 110. — Endlicher, *Gen.* 1183. — Miers, *Jour. Linn. Soc.* xvii. 302.

Stemmatosiphum, Pohl, *Pl. Brasil. Icon.* ii. 86 (1831). — Meisner, *Gen.* 250.

Lodhra, Decaisne, *Jacquemont Voy.* iv. 103 (1847). — Miers, *Jour. Linn. Soc.* xvii. 297.

Cordyloblaste, Henschel, *Bot. Zeit.* 1848, 604.

Carlea, Presl, *Epimel. Bot.* 216 (1850).

Hypopogon, Turczaninow, *Bull. Mosc.* xxxi. pt. i. 246 (1858).

Chasseloupia, Vieillard, *Bull. Soc. Linn. Normandie*, x. 101 (1866).

Protohopea, Miers, *Jour. Linn. Soc.* xvii. 289 (1879).

Præalstonia, Miers, *Jour. Linn. Soc.* xvii. 290 (1879).

Palura, Miers, *Jour. Linn. Soc.* xvii. 297 (1879).

Trees or shrubs, with scaly buds and fibrous roots. Leaves alternate, coriaceous or membranaceous, entire or dentate, usually becoming yellow in drying, and often possessing tinctorial properties. Flowers yellow, white, or rarely rose-color, in dense or lax axillary spikes or racemes, sometimes reduced to few-flowered fascicles or to a single flower, the pedicels ebracteolate. Bracts usually small, caducous. Calyx campanulate, five-lobed, open in the bud, the tube adnate to the ovary, enlarging after anthesis. Corolla divided nearly or quite to the base, or with the divisions sometimes more or less united into a tube. Stamens numerous, in many series, inserted on the base of the corolla, or adnate to its tube; filaments filiform or flattened towards the base, free, or more or less united below into clusters or rarely into a tube projected above the corolla-tube; anthers oblong, innate, two-celled, the cells lateral, opening longitudinally. Ovary two to five-celled, contracted into a slender simple style tipped with an entire or slightly lobed stigma; ovules two or rarely four in each cell, suspended from its inner angle, anatropous; raphe ventral; micropyle superior. Fruit crowned with the persistent lobes of the calyx, indehiscent, oblong, ovoid, or globose, drupaceous, with a dry or fleshy endocarp and a bony putamen, or sometimes baccate, usually one-seeded or with a solitary seed in each cell. Seed oblong, suspended;

testa membranaceous or crustaceous. Embryo terete, erect in conspicuous fleshy albumen, the cotyledons much shorter than the long slender radicle turned towards the broad conspicuous hilum.

In Symplocos, as the genus is here characterized, more than a hundred and fifty species are recognized,[1] inhabitants of the warmer parts of Asia, Australia, and America, one species occurring in the southern United States. It is not known in Africa, western North America, extratropical South America, or in Europe, where, however, the traces of one or two species have been found in the rocks of the tertiary epoch.[2]

Symplocos contains coloring matter in the bark and leaves; and some of the species have medical properties. In New Granada an infusion of the astringent leaves of *Symplocos theæformis*[3] is used as a stimulating beverage; and the bitter astringent mucilaginous bark of some Brazilian species is employed in the treatment of fevers.[4] In British India, where sixty to seventy species are now recognized, the fruits of *Symplocos spicata*[5] are strung into necklaces and placed on children to ward off evil, and the leaves are used in dyeing;[6] the bark of *Symplocos racemosa*[7] yields a red dye and a powder used by the Hindoos in the festival of the Holi;[8] a yellow dye[9] is extracted from the bark and leaves of *Symplocos cratægoides*,[10] a small tree or shrub distributed from the Himalayas to Japan, and the leaves of *Symplocos phyllocalyx*[11] are gathered by the inhabitants of the Sikkim Himalaya and sent to Thibet, where they are used to dye yellow.[12]

The North American species of Symplocos is not seriously injured by insects or fungal diseases.[13]

The generic name, from Σύμπλοκος, relates to the union of the filaments of some of the species.

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[1] Humboldt & Bonpland, *Pl. Æquin.* i. 181. — Kunth, *Syn. Pl. Æquin.* ii. 315. — Blume, *Bijdr. Fl. Ned. Ind.* 1116 (Dicalyx). — A. de Candolle, *Prodr.* viii. 246, 673. — Miquel, *Fl. Ind. Bat.* i. pt. ii. 465; *Ann. Mus. Lugd. Bat.* iii. 101; *Martius Fl. Brasil.* vii. 23. — Grisebach, *Fl. Brit. W. Ind.* 403; *Cat. Pl. Cub.* 167. — Bentham, *Fl. Austral.* iv. 292. — Franchet & Savatier, *Enum. Pl. Jap.* i. 307. — Kurz, *Forest Fl. Brit. Burm.* ii. 142. — C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iii. 572. — Hemsley, *Bot. Biol. Am. Cent.* ii. 301. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 72. — Urban, *Bot. Jahrb.* xv. 328.

[2] Zittel, *Handb. Palæontolog.* ii. 751, f. 387, 1–19.

[3] *Symplocos theæformis.*

Alstonia theæformis, Linnæus f. *Suppl.* 264 (1781). — Lamarck, *Dict.* i. 95.

Symplocos Alstonia, L'Héritier, *Trans. Linn. Soc.* i. 176 (1791). — Willdenow, *Spec.* iii. 1436. — Humboldt & Bonpland, *l. c.* 181, t. 151. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 257. — Kunth, *l. c.* — A. de Candolle, *l. c.* 247.

Proalstonia theæformis, Miers, *Jour. Linn. Soc.* xvii. 291 (1880).

[4] Martius, *Mat. Med. Brasil.* 18; *Fl. Brasil.* vii. 35.

[5] Roxburgh, *Fl. Ind.* ed. 2, ii. 541 (1832). — Kurz, *l. c.* 146. — C. B. Clarke, *l. c.* 573.

Symplocos Loha, D. Don, *Prodr. Fl. Nepal.* 144 (1825). — A. de Candolle, *l. c.*

Symplocos polycarpa, A. de Candolle, *l. c.* 255 (1844). — Kurz, *l. c.*

[6] Brandis, *Forest Fl. Brit. Ind.* 300. — Gamble, *Man. Indian Timbers*, 253.

[7] Roxburgh, *l. c.* 539 (1832). — Kurz, *l. c.* 144. — C. B. Clarke, *l. c.* 576. — Forbes & Hemsley, *l. c.* 74.

Symplocos Hamiltoniana, A. de Candolle, *l. c.* 254 (1844). — Brandis, *l. c.* 301.

Symplocos nervosa, A. de Candolle, *l. c.* 256 (not Wight), (1844).

Symplocos propinqua, Hance, *Jour. Bot.* vi. 329 (1868).

[8] Balfour, *Cyclopædia of India*, ed. 3, iii. 794.

[9] Brandis, *l. c.* 299.

[10] D. Don, *l. c.* 145 (1825). — A. de Candolle, *l. c.* 258. — Franchet & Savatier, *l. c.* 308. — Kurz, *l. c.* 147. — C. B. Clarke, *l. c.* 573. — Forbes & Hemsley, *l. c.* 72.

Lodhra cratægoides, Decaisne, *Jacquemont Voy.* iv. 103, t. 110 (1844).

In Japan *Symplocos cratægoides* is one of the common shrubs of the mountain regions of Hondo; and in our gardens the Japanese form is a distinct and valuable ornamental plant, conspicuous in the autumn, when it is covered with its bright blue fleshy fruits (*Garden and Forest*, iii. 529; v. 90, f. 15).

[11] C. B. Clarke, *l. c.* 575 (1882).

[12] Hooker f. *Himalayan Journals*, ii. 63.

[13] A deformity of the leaves of *Symplocos tinctoria* is caused by the growth of *Exobasidium Symploci*, Ellis & Martin, a genus usually found on Andromeda, Rhododendron, and other members of the Heath family. A few small and insignificant fungi, like *Sacidium Symploci*, Cooke, and *Septoria Symploci*, Ellis & Martin, form small spots on the leaves.

SYMPLOCOS TINCTORIA.

Sweet Leaf. Horse Sugar.

FLOWERS in many-flowered axillary fascicles; corolla divided nearly to the base; stamens united in five clusters: ovary 3-celled, with a pair of ovules in each cell. Fruit drupaceous, 1-seeded.

Symplocos tinctoria, L'Héritier, *Trans. Linn. Soc.* i. 176 (1791). — Willdenow, *Spec.* iii. 1436. — Sprengel, *Syst.* iii. 339. — Don, *Gen. Syst.* iv. 2. — A. de Candolle, *Prodr.* viii. 254. — Chapman, *Fl.* 272. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 65. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 70. — Sargent, *Forest Trees, N. Am. 10th Census, U. S.* ix. 105. — Watson & Coulter, *Gray's Man.* ed. 6, 335.

Hopea tinctoria, Linnæus, *Mant.* 105 (1767). — Walter, *Fl. Car.* 189. — Michaux, *Fl. Bor.-Am.* ii. 42. — Persoon, *Syn.* ii. 72. — Desfontaines, *Hist. Arb.* i. 217. — Du Mont de Courset, *Bot. Cult.* ed. 2, iii. 320. — Gærtner f. *Fruct.* iii. 140, t. 209. — Robin, *Voyages*, iii. 419. — Michaux f. *Hist. Arb. Am.* iii. 61, t. 9. — Pursh, *Fl. Am. Sept.* ii. 451. — Nuttall, *Gen.* ii. 83. — Elliott, *Sk.* ii. 173. — Spach, *Hist. Vég.* ix. 420.

Protohopea tinctoria, Miers, *Jour. Linn. Soc.* xvii. 290 (1879).

Eugenioides tinctorium, Otto Kunze, *Rev. Gen. Pl.* ii. 976 (1891).

A tree, occasionally thirty to thirty-five feet in height, with a short trunk rarely exceeding six or eight inches in diameter, and slender upright branches which form an open head; or more often a shrub. The bark of the trunk varies from a third to half an inch in thickness, and is ashy gray, slightly tinged with red, divided by occasional narrow fissures, and roughened with wart-like excrescences. The branchlets are terete, stout, and pithy, and when they first appear are light green, and coated with rufous or pale tomentum, or are sometimes glabrous or covered with scattered white hairs; they are reddish brown to ashy gray, tinged with red, and usually more or less pubescent, or often covered with a glaucous bloom during their first and second years, later growing darker, and becoming roughened with occasional small elevated lenticels. The winter-buds are ovate, acute, and covered with broadly ovate, nearly triangular acute scales; those of the inner rows are accrescent on the young shoots, and at maturity are oblong, obovate, rounded, and often apiculate at the apex, light green, glabrous or pilose, ciliate on the margins, and often half an inch long. The leaves are revolute in vernation, oblong, acute or acuminate at the apex, gradually narrowed at the base, obscurely crenulate-serrate with remote teeth, or sometimes nearly entire; when they unfold they are coated with pale tomentum on the lower surface, glabrous or tomentose on the upper, and furnished on the margins with minute dark caducous glands; at maturity they are subcoriaceous, dark green and lustrous above, paler and pubescent below, five or six inches long, one to two inches wide, with broad midribs rounded and sometimes puberulous on the upper side, inconspicuous arcuate veins and reticulate veinlets; they are borne on stout slightly winged petioles from a third to half an inch long, and late in the autumn fall from plants growing in the northern part of the region occupied by this species and at high elevations above the level of the ocean, or in the southern Atlantic and Gulf states remaining on the branches until after the flowers of the following spring have opened and the branchlets have begun to grow. The fragrant flowers, which appear from the first of March at the south to the middle of May on the mountains of the Carolinas, are produced in nearly sessile many-flowered clusters in the axils of leaves of the previous year, on short pedicels enlarged into thick hemispherical receptacles covered with long white hairs. The flower-clusters are inclosed in the bud by ovate acute orange-colored scales brown and ciliate on the margins, and each of the globose flower-buds is surrounded by three imbricated oblong bracts rounded or pointed at the apex and ciliate on the margins, the longest being as long as the calyx and a third longer than the two lateral bracts. The calyx is oblong, cup-shaped, dark green and puberulous, with minute ovate scarious lobes rounded at the apex. The corolla is creamy white, a quarter of an inch long, and divided nearly to the base into five lobes rounded at the apex. The stamens with slender filiform filaments united at the base into five clusters, and orange-colored anthers, are exserted. The three-celled ovary is furnished on the top with five dark nectariferous glands placed opposite the lobes of the calyx, and is abruptly contracted into a slender style, gradually thickened towards the apex, and longer than the corolla. The fruit ripens in the summer or early autumn, and is an ovate nut-like drupe, a third of an inch long, dark orange-colored or brown, tipped with the persistent calyx-lobes and the remnants of the style, and consists of a thin dry outer covering and a thick-walled bony stone containing a single ovate pointed seed covered with a thin papery chestnut-brown coat.

On the Atlantic seaboard *Symplocos tinctoria* is found from the Delaware peninsula to northern Florida, and from the coast to the Blue Ridge, on which it ascends, in the Carolinas, to an elevation of nearly three thousand feet; and through the Gulf states ranges west to western Louisiana and southern Arkansas. It is an inhabitant of moist rich soil in the shade of dense forests, or in the Gulf states often occupies the borders of Cypress swamps.

The wood of *Symplocos tinctoria* is light, soft, and close-grained, and contains numerous thin medullary rays; it is light red or brown, with thick lighter colored, often nearly white sapwood, composed of eighteen or twenty layers of annual growth. The specific gravity of the absolutely dry wood is 0.5325, a cubic foot weighing 33.19 pounds.

The leaves, which are sweet to the taste, are devoured in the autumn by cattle and horses, and, like the bark, yield a yellow dye, occasionally used domestically.[1] The bitter and aromatic roots have been used as a tonic.[2]

Symplocos tinctoria appears to have been discovered by Mark Catesby[3] in the coast region of South Carolina, and the first description and figure of this plant is found in his *Natural History of Carolina*,[4] published in 1731. In England the Sweet Leaf was cultivated before 1780 by Dr. Fothergill[5] in his garden at Upton House, near Stratford in Essex.[6] It is probably no longer cultivated except in a few botanic gardens.

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[1] Porcher, *Resources of Southern Fields and Forests*, 388.

[2] Griffith, *Med. Bot.* 437.

[3] Mark Catesby (1679 or 1680–1749), a native of Sudworth in Suffolk, appears to have developed early in life a love of natural history, which induced him in 1712 to visit Virginia, where some of his family had settled, and where he remained for seven years studying the natural resources of the country, and collecting specimens of animals and plants. After returning to England he became known, through his collections, to Sir Hans Sloane and other English naturalists, who encouraged him to revisit America for the purpose of describing the curious and interesting objects of nature. He left England in 1722 and established himself in Charleston, South Carolina, where he devoted some time to exploring the coast region, probably penetrating to the eastern base of the Blue Ridge, and afterwards extending his travels through Georgia into northern Florida. Having spent nearly three years on the continent, Catesby sailed for the Bahama Islands, which he was the first botanist to visit, and where he remained for a year, finally returning to England in 1726. Having learned the art of etching, Catesby devoted himself to the preparation of his *Natural History of Carolina, Florida, and the Bahama Islands*, containing figures of birds, beasts, fishes, serpents, insects, and plants, and illustrated with two hundred and twenty plates representing animals and plants, usually of life size, and drawn and engraved with his own hands. The first volume was completed in 1731 and the second in 1743, an appendix appearing in 1748. At the time of its publication the *Natural History of Carolina* was the most sumptuous work on natural history which had appeared in England. To the student of American botany it is still indispensable, as it contains the earliest descriptions and figures of a number of important plants, with many curious and interesting notes upon their properties and uses.

In 1763 was published Catesby's *Hortus Britanno-Americanus*, a description of a number of American trees and shrubs adapted to the soil and climate of England, with illustrations printed from copper plates. *Catesbæa*, a genus of tropical American shrubs, was dedicated to him by Gronovius.

[4] *Arbor lauri folio, floribus ex foliorum alis, pentapetalis, pluribus staminibus donatis*, i. 54, t. 54.

[5] John Fothergill (1712–1780), a native of Wensleydale in Yorkshire, and a distinguished physician in London, where he lived from 1740 till his death. In 1762 Dr. Fothergill planted on his estate in Essex a collection of trees and shrubs which was at that time considered one of the most important in England. A correspondence with Humphrey Marshall, the Pennsylvania botanist and the author of the *Arbustum Americanum*, whose acquaintance he made through his friend Benjamin Franklin, enabled Dr. Fothergill to introduce a number of American trees and shrubs into England. (See Darlington, *Memorial of Bartram and Marshall*, 495.) *Fothergilla*, a monotypic shrub of the south Atlantic coast region of North America dedicated to him by Linnæus, associates Fothergill's name with American botany.

[6] Lettsom, *Hort. Upton.* 30. — Aiton, *Hort. Kew.* ed. 2, iv. 419.

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n, *Hort. Kew.* ed. 2, iv. 419.

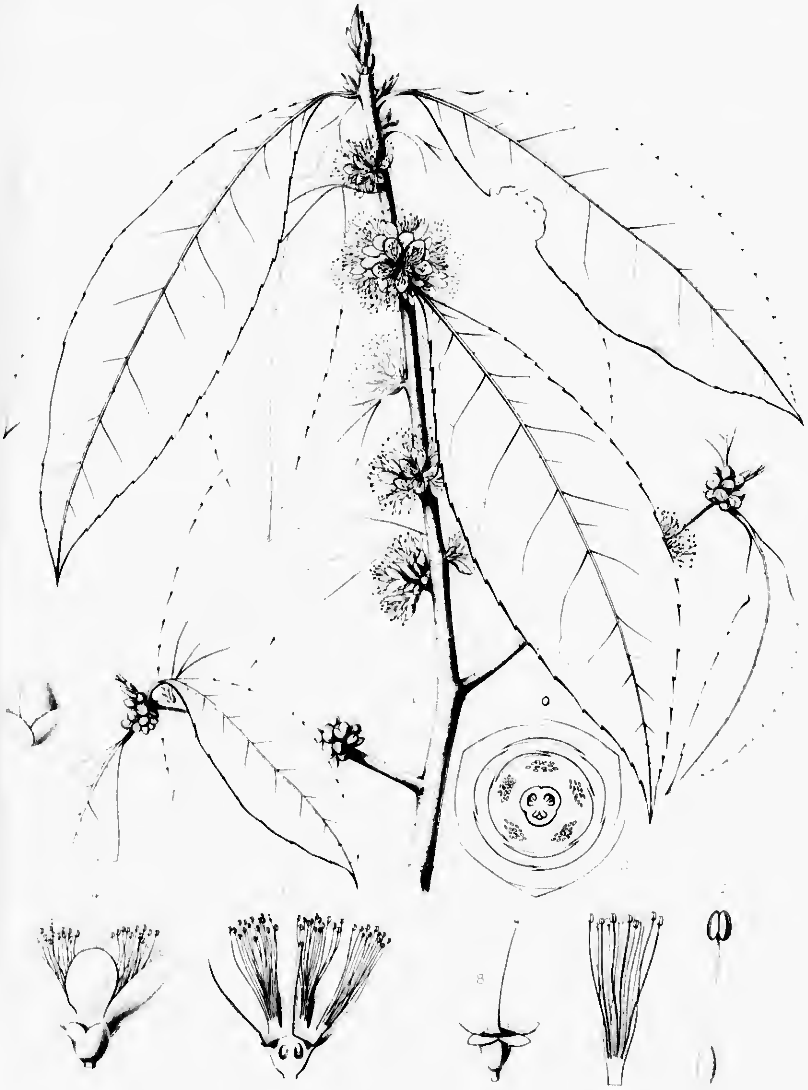
EXPLANATION OF THE PLATES.

PLATE CCLV. SYMPLOCOS TINCTORIA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower-bud with bracts, enlarged.
4. A flower, enlarged.
5. Vertical section of a flower, enlarged.
6. A cluster of stamens, enlarged.
7. An anther, enlarged.
8. A flower, the corolla removed, enlarged.
9. An ovule, much magnified.

PLATE CCLVI. SYMPLOCOS TINCTORIA.

1. A fruiting branch, natural size.
2. A fruit, enlarged.
3. Cross section of a fruit, enlarged.
4. Vertical section of a fruit, enlarged.
5. An embryo, enlarged.



C. E. Faxon del. E. Taillé sc.

SYMPLOCOS TINCTORIA, L'Hér.

A. Riocreux direx. Imp. R. Taneur, Paris.

SYMPLOCOS TINCTORIA

A. Riocreux direx.

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MOHRODENDRON.

FLOWERS regular, perfect; calyx 4-toothed, the teeth not closed in æstivation; corolla gamopetalous, 4-lobed or divided nearly to the base, the lobes convolute or imbricated in æstivation; stamens definite, in a single series; anthers adnate; disk 0; ovary mostly inferior, 2 to 4-celled; ovules 4 in each cell. Fruit drupaceous, 2 to 4-winged. Leaves alternate, membranaceous, denticulate, destitute of stipules.

Mohrodendron, Britton, *Garden and Forest*, vi. 463 (1893).

Halesia, Linnæus, *Syst. Nat.* ed. 10, 1044 (not Browne) (1759): *Gen.* ed. 6, 237. — Adanson, *Fam. Pl.* ii. 158. — A. L. de Jussieu, *Gen.* 156. — Meisner, *Gen.* 250. — Endlicher, *Gen.* 744. — Bentham & Hooker, *Gen.* ii. 669 (excl. *Pterostyrax*). — Engler & Prantl, *Pflanzenfam.* iv. pt. i. 177 (excl. *Pterostyrax*). — Baillon, *Hist. Pl.* xi. 460 (excl. *Pterostyrax*).

Mohria, Britton, *Garden and Forest*, vi. 434 (not Swartz) (1893).

Carlomohria, Greene, *Erythea*, i. 246 (1893).

Trees or shrubs, with slender terete pithy branchlets, buds covered with imbricated accrescent scales, and fibrous roots, the young branchlets and leaves clothed with soft stellate pubescence. Leaves involute in vernation, membranaceous, ovate-oblong, acute, denticulate, penniveined, deciduous, destitute of stipules. Flowers appearing in early spring with the unfolding of the leaves in fascicles or short racemes produced in the axils of leaves of the previous year. Pedicels slender, elongated, drooping, pubescent, developed in the axils of foliaceous obovate or acute caducous bracts, ebracteolate. Calyx-tube obconical or obpyramidal, four-ribbed, adnate to the ovary, coated with thick pale tomentum, the limb short, four-toothed, the teeth open in the bud. Corolla campanulate, epigynous, four-lobed or divided nearly to the base, thin and white, sometimes puberulous on the outer surface. Stamens eight to sixteen; filaments inserted on and slightly attached to the base of the corolla or sometimes free, flattened below, glabrous or tomentose; anthers oblong, adnate or free at the very base, introrse, two-celled, the cells opening longitudinally. Ovary two to four-celled, gradually contracted into an elongated glabrous or tomentose simple style stigmatic at the apex; ovules four in each cell, attached by elongated funiculi at the middle of the axis, the two upper ascending, the two lower pendulous, anatropous; raphe dorsal; micropyle inferior and superior. Fruit drupaceous, indehiscent, elongated, obovate, gradually narrowed at the base, crowned with the calyx-limb and the thickened persistent style; epicarp tough, separable, light green and lustrous, turning reddish brown late in the autumn; endocarp thick and fleshy, becoming dry and corky at maturity, produced into two or four broad thin wings wedge-shaped at the base and rounded at the apex; putamen thick and bony, obovate, gradually narrowed at the base into an elongated slender stipe inclosed in the wings, tipped with the bony remnants of the style, usually irregularly eight-angled or sulcate, one to four-celled. Seed solitary in each cell, elongated, cylindrical; testa thin, light brown, lustrous, adherent to the walls of the stone, the delicate inner coat attached to the copious fleshy albumen. Embryo terete, axile, erect; cotyledons oblong, as long as the elongated radicle turned towards the minute hilum.

Mohrodendron is confined to the southern Atlantic region of North America, where three species occur; of these two are trees and the third, *Mohrodendron parviflorum*,[1] is a shrub of southern Georgia and northern Florida.

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[1] Britton, *Garden and Forest*, vi. 463 (1893).

Halesia parviflora, Michaux, *Fl. Bor.-Am.* ii. 40 (1803). — Persoon, *Syn.* ii. 4. — Pursh, *Fl. Am. Sept.* ii. 450. — Nuttall, *Gen.* ii. 83. — Don, *Gen. Syst.* iv. 6. — Loudon, *Arb. Brit.* ii. 1190 (excl. *Bot. Reg.* xi. t. 952). — A. de Candolle, *Prodr.* viii. 270. — Chapman, *Fl.* 272. — Miers, *Contrib.* i. 194. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 71.

Mohria parviflora, Britton, *l. c.* 434 (1893).

Carlomohria parviflora, Greene, *Erythea*, i. 246 (1893).

Mohrodendron produces light close-grained wood, but is not known to possess useful properties. Their lovely flowers and their immunity from the attacks of insects[1] and fungal diseases[2] make all the Mohrodendrons desirable inhabitants of parks and gardens, in which the two arborescent species are often cultivated. They are easily raised from seeds, which, if allowed to become dry, do not germinate until the second year; they can be transplanted without difficulty, and flourish in well-drained rich soil.

The generic name commemorates the scientific accomplishments of Dr. Charles Mohr.[3]

CONSPECTUS OF THE ARBORESCENT SPECIES OF MOHRODENDRON.

Corolla slightly lobed; ovary 4-celled; fruit 4-winged. Leaves oval or ovate-oblong . . . . 1. M. CAROLINUM

Corolla divided nearly to the base; ovary usually 2-celled; fruit 2-winged. Leaves ovate or sometimes slightly obovate . . . . 2. M. DIPTERUM.

[1] Few records of injury to Mohrodendron by insects have been published, although the species seem to be favorites with one of the American large silk-worms, *Attacus Promethea*, Harris, whose cocoons may be often seen on the branches in winter. A geometrid moth, *Therina fervidaria*, Hübner, was first bred from larvæ found on *Mohrodendron Carolinum* in Georgia by Abbot, and although not known to be particularly injurious to the plants of this genus, it is often destructive to the foliage of Oaks (J. J. Walker, *Ent. Month. Mag.* August, 1888, 65).

[2] The species of Mohrodendron appear to be unusually exempt from the attacks of fungi, *Polyporus Halesiæ*, Berkeley & Curtis, being the only species that has been described as growing on *Mohrodendron Carolinum* in the United States. This fungus was supposed, by the botanist who first described it, to be peculiar to Mohrodendron, although several subsequent writers have expressed the opinion that it is merely a form of the older *Polyporus amorphus*, Fries.

[3] See iv. 90.

MOHRODENDRON CAROLINUM.

Silver Bell Tree.

COROLLA slightly lobed; ovary 4-celled. Fruit 4-winged. Leaves oval or ovate-oblong.

Mohrodendron Carolinum, Britton, *Garden and Forest*, vi. 163 (1893).

Halesia Carolina, Linnæus, *Syst. Nat.* ed. 10, 1044 (1759).

Halesia tetraptera, Ellis, *Phil. Trans.* li. 932, t. 22, f. A (1761). — Linnæus, *Spec.* ed. 2, 636. — Moench, *Bäume Weiss.* 47; *Meth.* 507. — Marshall, *Arbust. Am.* 57. — Castiglioni, *Viag. negli Stati Uniti*, ii. 257. — Gærtner, *Fruct.* i. 160, t. 32. — Lamarck, *Dict.* iii. 66; *Ill.* ii. 521, t. 404, f. 1. — Du Roi, *Harbk. Baumz.* ed. 2, i. 419. — Abbot, *Insects of Georgia*, i. t. 46. — Willdenow, *Berl. Baumz.* 138; *Spec.* ii. 849; *Enum.* 496. — Cavanilles, *Diss.* vi. 338, t. 186. — Michaux, *Fl. Bor.-Am.* ii. 40. — Persoon, *Syn.* ii. 4. — Desfontaines, *Hist. Arb.* i. 246. — Du Mont de Courset, *Bot. Cult.* ed. 2, iii. 318. — *Nouveau Duhamel*, v. 143 (excl. syn. Michaux), t. 43. — Pursh, *Fl. Am. Sept.* ii. 449. — Nuttall, *Gen.* ii. 82. — *Bot. Mag.* xxxiii. t. 910. — Elliott, *Sk.* i. 507. — Hayne, *Dendr. Fl.* 67. — Schmidt, *Oestr. Baumz.* iv. 37, t. 220. — Loddiges, *Bot. Cab.* xii. t. 1173. — Jaume St. Hilaire, *Traité des Arbrisseaux*, i. t. 88. — Sprengel, *Syst.* iii. 84. — Guimpel, Otto & Hayne, *Abbild. Holz.* 42, t. 35. — Don, *Gen. Syst.* iv. 6. — Spach, *Hist. Vég.* ix. 426. — A. de Candolle, *Prodr.* viii. 269. — Miers, *Contrib.* i. 191, t. 31. — Agardh, *Theor. et Syst. Pl.* t. 22, f. 16, 17. — Chapman, *Fl.* 271. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 80. — Ørsted, *Videnskab. Medd. fra Nat. For. Kjöbenh.* 1866, 94, f. 2. — Koch, *Dendr.* ii. 199. — Lauche, *Deutsche Dendr.* ed. 2, 220, f. 82. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 71. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 106. — Watson & Coulter, *Gray's Man.* ed. 6, 334. — Koehne, *Deutsche Dendr.* 486.

Halesia stenocarpa, Koch, *Wochenschr. Gärtn. Pflanzenk.* i. 190 (1858); *Dendr.* ii. 200.

Mohria Carolina, Britton, *Garden and Forest*, vi. 434 (1893).

Carlomohria Carolina, Greene, *Erythea*, i. 246 (1893).

A tree, occasionally eighty or ninety feet in height, with a tall straight trunk sometimes three feet in diameter, and short stout branches which form a narrow head; or usually much smaller and often a shrub with many stout wide-spreading stems. The bark of the trunk is half an inch thick, bright red-brown and broadly ridged, the surface of the rounded ridges separating into thin papery scales. The branchlets, when they first appear, are coated with thick pale tomentum, which soon disappears, and during their first summer they are light reddish brown, glabrous or pubescent, and often covered with a glaucous bloom; during their first winter they are lustrous, reddish brown or orange-color, and marked by the large obcordate leaf-scars. In the second year the thin bark grows darker, sometimes separates in thread-like scales, and begins to display the pale shallow longitudinal fissures which mark the older branches and young trunks. The winter-buds are an eighth of an inch long, and obtuse, with thick broadly ovate dark red scales rounded on the back and covered, especially at the base and above the middle, with pale hairs; those of the inner rows lengthen with the branchlets, and when fully grown are strap-shaped, rounded at the apex, light bright yellow, and sometimes half an inch long. The leaves are oval or ovate-oblong, gradually or rather abruptly contracted into long points acute or rounded at the apex, wedge-shaped or rounded at the base, and finely serrate with remote callous teeth; when they unfold they are ciliate on the margins, coated on the lower surface and on the petioles with dense pale tomentum, and bronze-red, glabrous or pilose on the upper surface; at maturity they are four to six inches long, two to three inches wide, thin and firm, light bright green and puberulous above, paler and more or less pubescent below, especially along the slender midribs and the primary veins which are arcuate near the margins and connected by remote reticulated veinlets. They are borne on stout petioles two thirds of an inch long, and, having turned light yellow late in the autumn, fall toward the beginning of winter. The flowers, which appear when the leaves are about one third grown, from the end of March at the south to the end of May at the north or on high elevations above the level of the ocean, are produced in crowded fascicles or short few-flowered racemes, on slender drooping pedicels an inch or two long and developed from the axils of obovate yellow-green caducous bracts rounded or acute at the apex, gradually narrowed at the base, half to two thirds of an inch long, and a quarter of an inch broad. The flower-buds are ovate and obtuse. When fully expanded the flowers are nearly an inch long, with a slightly lobed corolla narrowed into a short tube at the base and bronzy red before anthesis, ten to sixteen stamens, and a four-celled ovary. The fruit, which ripens late in the autumn and remains on the branches until during the winter, is ellipsoidal, equally four-winged, an inch and a half to two inches long, and an inch broad; the stone is broadly obovate, obscurely ridged, and contracted into a short or sometimes elongated stipe.

Mohrodendron Carolinum ranges from the mountains of West Virginia to southern Illinois, and southward to middle Florida, central Alabama and Mississippi, and through Arkansas to western Louisiana and eastern Texas. It inhabits rich wooded slopes and the banks of streams, and is most abundant in the elevated Appalachian region, growing to its largest size in the forests of Oaks, Hickories, Maples, Black Birches, Ashes, Buckeyes, Magnolias, and Cherry-trees which clothe the western slopes of the high mountains of North Carolina and Tennessee, where it sends up tall straight trunks often free from branches for fifty or sixty feet above the ground.

The wood of *Mohrodendron Carolinum* is light, soft, and close-grained, with many thin medullary rays; it is light brown, with thick lighter colored sapwood composed of fifty or sixty layers of annual growth. The specific gravity of the absolutely dry wood is 0.5628, a cubic foot weighing 35.07 pounds.

The earliest description of *Mohrodendron Carolinum* was published by Mark Catesby in the *Natural History of Carolina* in 1731.[1] Introduced into gardens a few years later,[2] it is valued and often planted for the beauty of its abundant flowers, which every year cover the branches with wreaths of drooping snow-white bells.[3]

Mohrodendron Carolinum is hardy in the United States as far north as eastern Massachusetts, where, however, it rarely loses its shrubby habit, and in central and northern Europe.[4]

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[1] *Frutex, Padi foliis non serratis, floribus monopetalis albis, campaniformibus, fructu crasso tetragono*, i. 64. t. 64.

[2] Aiton, *Hort. Kew.* ii. 125. — Loudon, *Arb. Brit.* ii. 1190, f. 1012, t. 196, 197.

[3] In some parts of the country *Mohrodendron Carolinum* is called Rattle Box, Calico Wood, and Snowdrop-tree.

[4] A curious seedling form of *Mohrodendron Carolinum* (*Halesia tetraptera Mechani*, *Garden and Forest*, v. 534, f. 91; 611), which originated a few years ago in the nursery of Thomas Meehan & Sons of Germantown, Pennsylvania, is distinguished by small flowers with short pedicels and cup-shaped corollas, and by thick rugose leaves conspicuously glandular-serrate on young and vigorous plants.

EXPLANATION OF THE PLATES.

Plate CCLVII. Mohrodendron Carolinum.

1. A flowering branch, natural size.
2. A flowering branch before the opening of the flowers, natural size.
3. Diagram of a flower.
4. A corolla laid open, slightly enlarged.
5. Side and front views of a stamen, enlarged.
6. A flower, the corolla and stamens removed, enlarged.
7. Vertical section of an ovary, enlarged.
8. An ovule, much magnified.
9. A winter branchlet, natural size.

Plate CCLVIII. Mohrodendron Carolinum.

1. A fruiting branch, natural size.
2. Vertical section of a fruit with one seed developed, natural size.
3. Cross section of a fruit with one seed developed, natural size.
4. A nutlet, enlarged.
5. A seed, enlarged.
6. Vertical section of a seed, enlarged.
7. An embryo, enlarged.

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MOHRODENDRON CAROLINUM.

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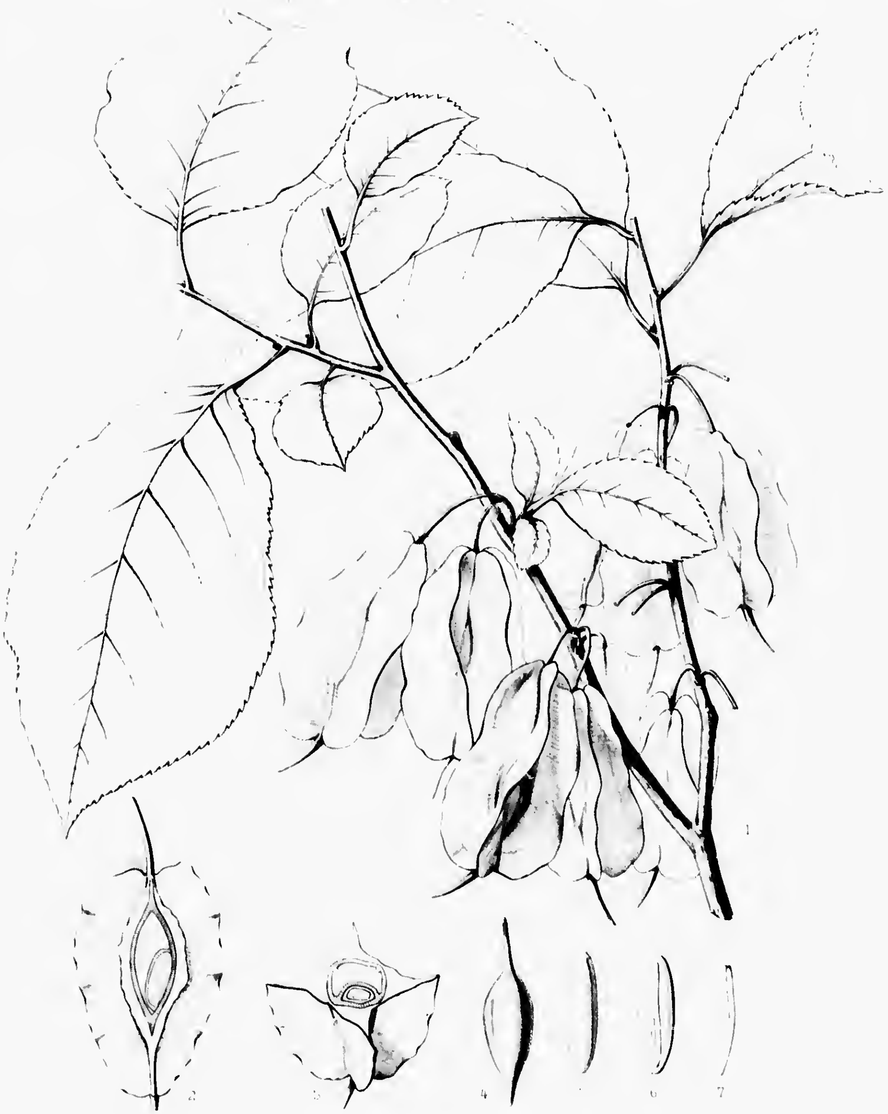

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MOHRODENDRON DIPTERUM.

Snowdrop Tree. Silver Bell Tree.

Corolla divided nearly to the base; ovary usually 2-celled. Fruit 2-winged. Leaves ovate or sometimes slightly obovate.

Mohrodendron dipterum, Britton, *Garden and Forest*, vi. 163 (1893).

Halesia diptera, Ellis, *Phil. Trans.* li. 932, t. 22, f. B (1761). — Linnæus, *Spec.* ed. 2, 636. — Marshall, *Arbust. Am.* 57. — Lamarck, *Dict.* iii. 66. — Willdenow, *Berl. Baumz.* 138; *Spec.* ii. 849; *Enum.* 496. — Cavanilles, *Diss.* vi. 338, t. 187. — Michaux, *Fl. Bor.-Am.* ii. 40. — Persoon, *Syn.* ii. 4. — *Nouveau Duhamel*, v. 144. — Pursh, *Fl. Am. Sept.* ii. 450. — Nuttall, *Gen.* ii. 83. — Elliott, *Sk.* i. 508. — Hayne, *Dendr. Fl.* 66. — Loddiges, *Bot. Cab.* xii. t. 1172. — Sprengel, *Syst.* iii. 84. — Don, *Gen. Syst.* iv. 7. — Spach, *Hist. Vég.* ix. 426. — A. de Candolle, *Prodr.* viii. 270. — Miers, *Contrib.* i. 193. — Payer, *Organ. Compt.* 537, t. 126, f. 20–28. — Chapman, *Fl.* 271. — Koch, *Dendr.* ii. 201. — Lauche, *Deutsche Dendr.* ed. 2, 220. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 71. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 105. — Koehne, *Deutsche Dendr.* 486.

Halesia reticulata, Buckley, *Proc. Phil. Acad.* 1860, 444.

Mohria diptera, Britton, *Garden and Forest*, vi. 434 (1893).

Carlomohria diptera, Greene, *Erythea*, i. 246 (1893).

A tree, rarely thirty feet in height, with a short trunk occasionally eight or ten inches in diameter, and horizontal branches which form a low broad head;[1] or more often a shrub sending up from the ground numerous stout spreading stems. The bark of the trunk, which varies from a third to half an inch in thickness, is brown tinged with red, and divided by irregular longitudinal often broad fissures, the surface exfoliating into small thin appressed scales. The branchlets, when they first appear, are light green and more or less coated with pale pubescence, which generally disappears during the summer; in their first winter they are usually glabrous, orange-color or reddish brown, lustrous and marked with the large elevated obcordate leaf-scars; in their second year the bark becomes dark red-brown, often separating into thread-like scales, and during the following season begins to divide into irregular pale longitudinal fissures. The winter-buds are axillary, a sixteenth of an inch long, ovate, and obtuse, with broadly ovate acute light red puberulous scales; at maturity those of the inner ranks are strap-shaped, scarious, and a quarter of an inch long. The end of the branch dies before a terminal bud is formed and remains during the winter as a dark withered stub at the side of the upper axillary bud which the following spring prolongs the branch. The leaves are ovate, sometimes slightly obovate, acuminate, wedge-shaped or rounded at the base, and remotely serrate with minute callous teeth; when they unfold they are coated with pale tomentum on the lower surface, and are puberulous on the upper surface; at maturity they are thin, light green, glabrous above except along the narrow midribs, pubescent below, four to five inches long and an inch and a half to three inches wide, with conspicuous pale arcuate veins, reticulated veinlets, and stout petioles two thirds of an inch in length. The flowers, which open from the middle of March to the end of April, are produced in fascicles or short racemes, and are borne on slender pedicels an inch and a half or two inches long, and developed in the axils of obovate or acute puberulous caducous bracts often a quarter of an inch long. The calyx is inversely pyramidal, with minute triangular teeth. The corolla is nearly an inch long, puberulous on the outer surface, and divided nearly to the base into slightly obovate spreading divisions about as long as the stamens, which are usually eight, although they vary in number from eight to sixteen; the filaments are covered with pale hairs, and are sometimes free from the corolla. The ovary is usually two, rarely four-celled, and, like the exserted stigma, is coated with pale tomentum. The fruit is oblong, compressed, an inch and a half to two inches long and often nearly an inch wide, with two broad wings.

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[1] W. Bartram, *Travels*, 410.

and frequently with two or sometimes three narrow supplementary wings between them; the stone is narrowly obovate, conspicuously sulcate, with about eight dark ridges, and is contracted into a slender stipe sometimes an inch in length.

Mohrodendron dipterum inhabits low wet woods on the borders of swamps in the coast region of the south Atlantic and Gulf states from South Carolina to northern Florida and eastern Texas, and west of the Mississippi River ranges northward through Louisiana to central Arkansas.

The wood of *Mohrodendron dipterum* is light, soft, strong, and very close-grained, with many thin medullary rays. It is light brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.5705, a cubic foot weighing 35.55 pounds.

Mohrodendron dipterum was introduced into English gardens in 1758[1] by Mr. John Ellis,[2] to whom it had been sent by Dr. Alexander Garden[3] of South Carolina.

In early spring the graceful pure white flowers which cover the branches of the southern Silver Bell Tree standing by the dark waters of some impenetrable swamp in the midst of a gloomy forest of Pines, bring to the mournful landscape light and cheerfulness which are the peculiar charms of this little tree. In the southern United States *Mohrodendron dipterum* is sometimes found in gardens, in which its beautiful flowers, its graceful habit, and freedom from disease make it a desirable inhabitant. It is hardy, and occasionally cultivated as far north as eastern Pennsylvania,[4] and in central Europe.

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[1] Aiton, *Hort. Kew.* ed. 2, iii. 113. — Loudon, *Arb. Brit.* ii. 1191, f. 1014.

[2] See i. 10.

[3] See i. 10.

[4] A plant in Bartram's garden in Philadelphia, now dead, in 1853 had attained a height of fifteen feet and a trunk diameter of three inches. (See Meehan, *American Handbook of Ornamental Trees*, 130.) In Pennsylvania *Mohrodendron dipterum* flowers at the end of May, or about three weeks later than *Mohrodendron Carolinum*.

EXPLANATION OF THE PLATE.

Plate CCLIX. Mohrodendron dipterum.

1. A flowering branch, natural size.
2. A flower, the corolla displayed, enlarged.
3. An ovary cut transversely, enlarged.
4. A fruiting branch, natural size.
5. Vertical section of a fruit with one seed developed, and without the stipe and the base of the wings, natural size.
6. Cross section of a fruit, natural size.
7. Vertical section of a nutlet without the stipe, enlarged.
8. An embryo, much magnified.
9. A winter branchlet, natural size.

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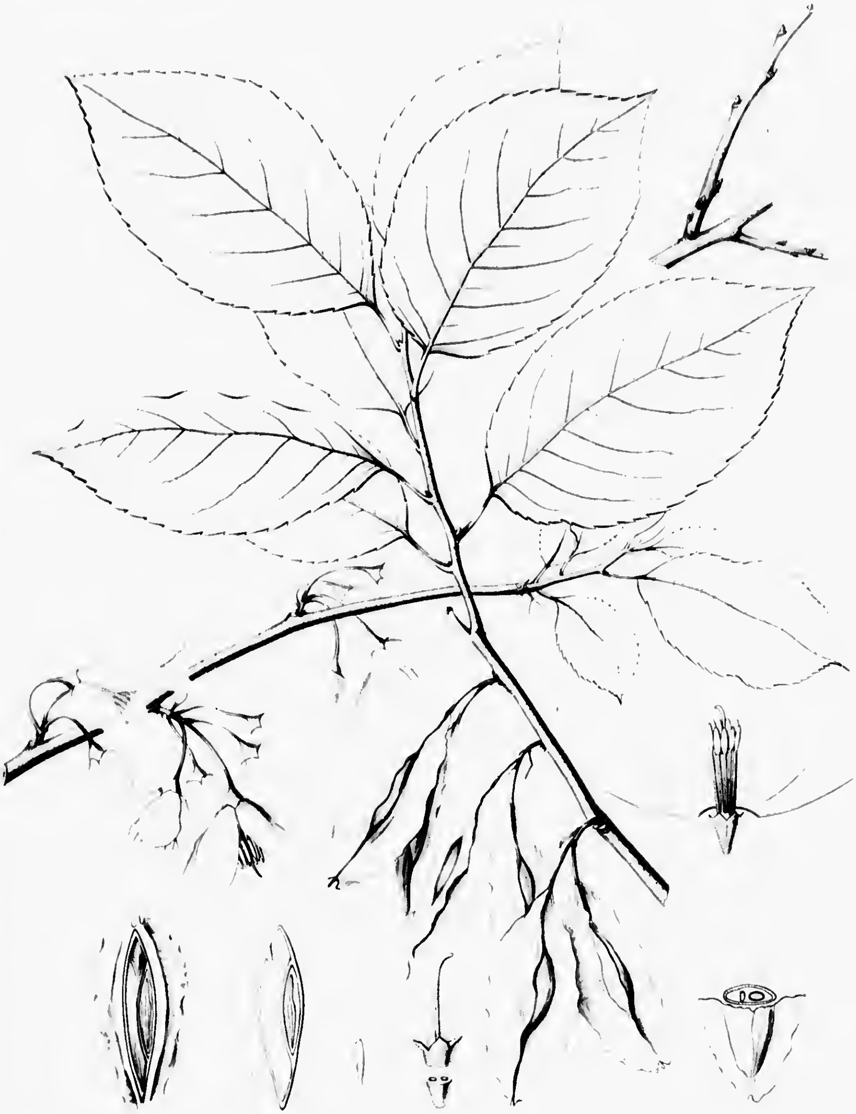

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MOHRODENDRON DIPTERUM

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FRAXINUS.

Flowers regular, diœcious or polygamous, rarely perfect; calyx 4-lobed, or 0; corolla 2 to 6-parted, the divisions induplicate or valvate in æstivation, or 0; stamens usually 2; disk 0; ovary superior, 2 or rarely 3 or 4-celled; ovules usually 2 in each cell, suspended. Fruit a 1 or rarely 2 or 3-seeded and winged samara. Leaves unequally pinnate or rarely reduced to a single leaflet, destitute of stipules, deciduous.

Fraxinus, Linnæus, *Gen.* 318 (1737). — Adanson, *Fam. Pl.* ii. 445. — A. L. de Jussieu, *Gen.* 105. — Endlicher, *Gen.* 573. — Meisner, *Gen.* 256. — Bentham & Hooker, *Gen.* ii. 676. — Baillon, *Hist. Pl.* xi. 251. — Engler & Prantl, *Pflanzenfam.* iv. pt. ii. 5.

Ornus, Necker, *Elem. Bot.* ii. 375 (1790).

Mannaphorus, Rafinesque, *Am. Monthl. Mag. and Crit. Rev.* ii. 175 (1818).

Leptalix, Rafinesque, *New Fl.* iii. 93 (1836).

Ornanthes, Rafinesque, *New Fl.* iii. 93 (1836).

Aplilia, Rafinesque, *New Fl.* iii. 93 (1836).

Samarpses, Rafinesque, *New Fl.* iii. 93 (1836).

Glabrous or pubescent trees or shrubs, with colorless watery juices, light tough wood, thick furrowed or rarely thin and scaly bark, usually ash-colored branchlets with thick pith, leaf-buds with few thick accrescent scales marking in falling the base of the branches with ring-like persistent scars, and fibrous roots. Leaves opposite, petiolate, unequally pinnate or rarely reduced to a single leaflet, destitute of stipules; leaflets conduplicate in vernation, membranaceous or subcoriaceous, usually serrate, petiolulate or sessile. Flowers produced in early spring in open or compact slender-branched panicles terminal on leafy shoots of the year, or developed from the axils of new leaves, or from separate buds in the axils of leaves of the previous year or at the base of young branchlets and covered with two ovate scales.[1] Bracts obovate, linear or lanceolate, caducous. Pedicels slender, elongated, ebracteolate. Calyx campanulate, four-lobed, deciduous or persistent under the fruit, or wanting. Corolla composed of two or four or rarely of five or six[2] petals free or united in pairs at the base, or wanting. Stamens usually two or sometimes three or four, attached to the base of the petals or hypogynous; rudimentary or wanting in unisexual pistillate flowers; filaments terete, abbreviated or elongated; anthers ovate or linear-oblong, apiculate or muticous, introrse, attached on the back near the base, two-celled, the cells opening longitudinally by lateral slits. Ovary superior, two or rarely three-celled, contracted into a short or elongated style crowned with a two-lobed stigma; rudimentary or wanting in unisexual staminate flowers; ovules two in each cell, suspended in pairs from its inner angle, anatropous; raphe dorsal, micropyle superior. Fruit samaroid, lanceolate or oblong-spatulate, indehiscent, the body terete or slightly flattened contrary to the septum, with a dry and woody pericarp produced into an elongated terminal and more or less decurrent wing, usually one-celled by abortion,

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[1] In the American species of the section Fraxinastrum the inflorescence is a three-branched panicle inclosed in the bud by a pair of opposite broadly ovate scales, the lower branches being developed from their axils. The central division of the panicle is furnished with two branches which spring from the axils of bracts, and as the axis of the inflorescence lengthens these are carried up with it, remaining at the base of the branches. Where the central division of the panicle branches near the base these bracts are not carried up, the base of the panicle then appearing to be surrounded by four scales. The lower bracts usually resemble the bud-scales in color and texture, although they are larger, usually narrow, often obovate, and generally wither before falling. The bracts at the base of the lateral flowers of the three-flowered ultimate divisions of the panicle are narrowly obovate or lanceolate, and sometimes laciniately cut.

[2] In *Fraxinus Mariesii*, Hooker f. (*Bot. Mag.* cix. t. 6678 [1883]), the corolla is usually divided into five or six petals.

or sometimes two or three-celled and winged. Seed solitary by abortion in each cell, oblong, compressed, suspended, filling the cavity of the fruit; testa thin, chestnut-brown. Embryo erect in copious fleshy albumen; cotyledons flat; radicle terete, abbreviated, superior, turned towards the minute hilum.[1]

Fraxinus is widely distributed in the temperate regions of the northern hemisphere, and within the tropics occurs on the island of Cuba.[2] Of the thirty species which are now distinguished, nearly one half inhabit North America.[3] The genus is well represented in eastern Asia,[4] where ten or twelve species are recognized; it appears on the Himalayas,[5] in central Asia,[6] the Orient,[7] Europe,[8] and northern Africa.[9] Except in the extreme north, Fraxinus is found in all parts of North America, the largest number of species occurring in the eastern part of the continent, where they are often important elements of the forest.[10] The type is an ancient one, and during the tertiary epoch Fraxinus inhabited the Arctic Circle, from which it gradually spread southward.[11]

Fraxinus produces tough straight-grained valuable wood, and several of the North American species, the European and Asiatic *Fraxinus excelsior*,[12] and the Manchurian and Japanese *Fraxinus Mandshurica*,[13] are large and important timber-trees. The saccharine exudation from the trunk and leaves of *Fraxinus Ornus*,[14] of southern Europe and Asia Minor, furnishes the manna[15] of commerce, which is used in medicine as a gentle laxative; and from the branches of *Fraxinus Chinensis*[16] and of *Fraxinus rhynchophylla*[17] the Chinese white wax is obtained.[18] Several species of Fraxinus are planted

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[1] The genus Fraxinus is divided into two sections: —

ORNUS. Panicles terminal on leafy shoots or axillary on branches of the year or of the previous year. Flowers polygamous or perfect, with two or four or rarely with five or six petals.

FRAXINASTRUM. Panicles from separate buds developed in the axils of leaves of the previous year, or from the leafless base of shoots of the year. Flowers diœcious, polygamous, or rarely perfect, apetalous.

[2] Grisebach, *Cat. Pl. Cub.* 170.

[3] Gray, *Syn. Fl. N. Am.* ii. pt. i. 73. — Hemsley, *Bot. Biol. Am. Cent.* ii. 301.

[4] Franchet & Savatier, *Enum. Pl. Jap.* i. 310; ii. 451. — Franchet, *Pl. David.* i. 203. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 84.

[5] C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iii. 605.

[6] Regel, *Act. Hort. Petrop.* viii. 685, t. 12.

[7] Boissier, *Fl. Orient.* iv. 39.

[8] Nyman, *Conspect. Fl. Europ.* 495.

[9] Cosson & Durieu, *Bull. Soc. Bot. France*, ii. 367.

[10] Authors have unnecessarily multiplied the number of North American species of Fraxinus, especially Bosc in France (*Mém. Inst.* 1808) and Rafinesque in the United States (*Alsograph. Am.*), and many of their species cannot be distinguished by the descriptions. The following species of Bosc, mostly founded upon the foliage of cultivated trees, cannot be safely referred to our species: *Fraxinus alba*, *F. cinerea*, *F. elliptica*, *F. fusca*, *F. mixta*, *F. nigra*, *F. ovata*, *F. pannosa*, *F. pulverulenta*, *F. Richardi*, *F. rubicunda*, and *F. rufa*.

[11] Saporta, *Origine Paléontologique des Arbres*, 231, f. 29. — Zittel, *Handb. Palæontolog.* ii. 760, f. 389, 390.

[12] Linnæus, *Spec.* 1057 (1753). — *Fl. Dan.* vi. t. 969. — Hayne, *Arzn.* xiii. t. 10. — De Candolle, *Prodr.* viii. 276. — Boissier, *l. c.* — Koch, *Dendr.* ii. 240. — Wenzig, *Bot. Jahrb.* iv. 176. — C. B. Clarke, *l. c.* — Koehne, *Deutsche Dendr.* 513.

[13] Ruprecht, *Bull. Phys. Mat. Acad. Sci. St. Pétersbourg*, xv. 371 (1857). — Regel, *Mém. Acad. Sci. St. Pétersbourg*, iv. 104 (*Tent. Fl. Uss.*). — Maximowicz, *Prim. Fl. Amur.* 191; *Bull. Acad. Sci. St. Pétersbourg*, xx. 432 (*Mél. Biol.* ix. 395). — Franchet & Savatier, *l. c.* ii. 435. — Wenzig, *l. c.* 179. — Forbes & Hemsley, *l. c.* 86.

[14] Linnæus, *Spec. l. c.* (1753). — Sibthorp, *Fl. Græc.* i. 4, t. 4. — *Nouveau Duhamel*, iv. 64, t. 15. — De Candolle, *l. c.* 274. — Watson, *Dendr. Brit.* ii. 107, t. 107. — Koch, *l. c.* 235. — Wenzig, *l. c.* 168. — Koehne, *l. c.* 508.

Fraxinus rotundifolia, Du Roi, *Harbk. Baumz.* i. 286 (1771). — Lamarck, *Dict.* ii. 546. — Willdenow, *Berl. Baumz.* 116, t. 6, f. 1. — Vahl, *Enum.* i. 49. — De Candolle, *l. c.* — Koch, *l. c.* 237. — Koehne, *l. c.* 508.

Fraxinus florifera, Scopoli, *Fl. Carn.* ed. 2, ii. 282 (1772).

Ornus Europæa, Persoon, *Syn.* i. 9 (1805). — Hayne, *l. c.* t. 11.

Ornus rotundifolia, Persoon, *l. c.* ii. 605 (1807). — Hayne, *l. c.* t. 12.

[15] The medical manna of commerce is now produced in Sicily from trees planted for the purpose, the principal plantations being established near the shores of the Gulf of Castellamare and in the district of Cefalù. The trees, which are planted in rows, stand about seven feet apart, and are carefully cultivated and manured. When the trunk has attained a diameter of three inches the harvesting of the manna begins, and may be continued during ten or twelve years, when the tree is usually cut down and replaced by a shoot from the old roots. Dry weather is essential for the flow of manna, and the most favorable months for its production are July and August. It is obtained by making transverse incisions in the bark, beginning at the bottom of the tree, the juice which flows from the wounds in the bark being collected on the surface or on sticks and straws inserted in the cuts, or on pieces of tile. After it is removed from the trees the manna is allowed to dry and harden before it is packed. (See Hooker *Jour. Bot.* i. 130. — Stettner, *Archiv. der Pharm.* iii. 194. — Cleghorn, *Trans. Bot. Soc. Edinburgh*, x. 132. — Flückiger & Hanbury, *Pharmacographia*, 366.)

[16] Roxburgh, *Fl. Ind.* i. 150 (1820). — De Candolle, *l. c.* 277. — Hance, *Jour. Bot.* xxi. 323. — Forbes & Hemsley, *l. c.* 85.

[17] Hance, *l. c.* vii. 164 (1869); xiii. 131. — Franchet, *l. c.* 203, t. 17; *Mém. Soc. Sci. Nat. Cherbourg*, xxiv. 236. — Sargent, *Garden and Forest*, vi. 181, f. 70.

Fraxinus Chinensis var. *rhynchophylla*, Forbes & Hemsley, *l. c.* 86 (1889).

[18] The Chinese white wax is principally produced in the province of Sze-ch'uen, and is obtained by allowing an insect, *Coccus Pe-la*, Westwood (*Gard. Chron.* 1853, 532, f.), to puncture the young branches of Ash-trees. The insects are carefully bred, in districts

to decorate parks and gardens, especially *Fraxinus Americana* in the United States, *Fraxinus excelsior*, with its varieties,[1] and *Fraxinus Ornus* in Europe, and *Fraxinus floribunda*[2] in northern India.

Numerous insects[3] prey upon Fraxinus in North America, where many of the species are attacked by fungal diseases.[4]

The species of Fraxinus can be easily raised from seeds, which sometimes do not germinate until the second year; and the varieties can be multiplied by grafting. Their fibrous roots, which usually remain near the surface of the ground, make the operation of transplanting Ash-trees easy and safe.

Fraxinus, the classical name of the Ash-tree, was adopted by Linnaeus as the name of the genus.

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at some distance from those in which the wax is produced, on trees of *Ligustrum lucidum*, Aiton, planted for the purpose; and during the month of April the cocoons are carried by trains of porters, who travel only at night that the heat of the sun may not cause the cocoons to hatch prematurely. Arrived at their destination, the cocoons are placed on the young shoots of the Ash-trees planted along the borders of canals and irrigating ditches and kept down by constant cutting to the height of six or seven feet. At the end of a few days the insects begin to appear and spread over the branches, which are gradually covered with a white waxy substance. Toward the end of August the incrusted branches are cut off and boiled in water, when the wax rises to the surface; it is then melted, poured into deep pans, and allowed to harden, when it is ready for shipment.

Chinese white wax is chiefly used to cover candles made of vegetable or animal tallow, to coat pills and boluses in order to preserve them, and to give a glossy surface to paper, cotton cloth, the soles of shoes, and other articles. (See Martini, *Novus Atlas Sinensis*, 76, 115. — Chanseaume, *Mémoire sur la cire d'arbre, envoyée de la province de Hou-quang, Lettres Édifiantes et Curieuses*, ed. Toulouse, xxiii. 118. — Julien, *Comptes Rendus*, x. 618; *Industries de l'Empire Chinois*, 109. — Hanbury, *Pharmaceutical Journal*, xii. 476, f.; *Notes on Chinese Mat. Med.* 10, f. 17. — Rathouis, *Étude sur le Coccus Pé-la.* — Hosie, *Three Years in Western China*, 189. — *Kew Bulletin of Miscellaneous Information*, April and May, 1893, 84.)

[1] Loudon, *Arb. Brit.* ii. 1241. — Wenzig, *Bot. Jahrb.* iv. 177. — Wesmael, *Bull. Bot. Soc. Belg.* xxx. 91.

[2] Roxburgh, *Fl. Ind.* i. 150 (1820). — Wallich, *Pl. As. Rar.* iii. 47, t. 277. — De Candolle, *Prodr.* viii. 275. — Brandis, *Forest Fl. Brit. Ind.* 302, t. 37. — Wenzig, *l. c.* 173. — C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iii. 605.

Ornus floribunda, Dietrich, *Spec.* i. 249 (1831). — Loudon, *l. c.* 653, f. 1270.

Ornus urophylla, Don, *Gen. Syst.* iv. 57 (1837).

Fraxinus urophylla, De Candolle, *l. c.* (1844).

[3] More than a hundred species of insects are recorded as attacking Fraxinus in America and Europe, although few of them appear peculiar to the genus. In America the most destructive of the wood borers are *Podosesia Syringæ*, Harris, *Carmenta Fraxini*, H. Edwards, and *Neoclytus Capræa*, Say. The larva of a large beetle, *Centrodera decolorata*, Harris, bores into the trunks of living trees, although probably only when they have been previously injured. *Fatua dentulata*, Harris, is described as a root borer on young trees growing in swampy ground. Bark beetles of the genus Hylesinus attack the dead wood.

There are few foliage destroyers found on Ash-trees in the United States which do not also injure the leaves of other trees. Among the lepidopterous larvæ which live upon the Ashes several species of large *Sphingidæ* and *Bombycidæ* are conspicuous. Sawfly larvæ, like those of *Monophadnus bardus*, Say, and others, are somewhat injurious to Ash-trees, and a large beetle, *Dynastes Tityus*, Linnaeus, has been reported as attacking these trees in the southern states (Packard, *5th Rep. U. S. Entomolog. Comm.* 1890, 551). The fruit is sometimes infested by little larvæ belonging to the *Curculionidæ*, and scale-insects are sometimes troublesome. An aphis, *Pemphigus fraxinifolii*, Thomas, distorts the leaves; and gall mites like *Phytoptus Fraxini*, Garman, make minute galls on the leaves or occasionally distort them as well as the twigs and flowers. The conspicuous dark distorted growths which often remain on the trees in winter are panicles injured probably by mites (Garman, *12th Rep. Illinois State Entomologist*, 1882, 136).

[4] Many parasitic fungi attack the different species of Fraxinus in the United States. Among them several are abundant and striking in appearance even to the naked eye. Of these the Ash-leaf Rust, *Æcidium Fraxini*, Schweinitz, is perhaps the most conspicuous. It appears in early summer on the leaves and sometimes on the young twigs of *Fraxinus Americana*, *Fraxinus nigra*, and other species; and although it is peculiar to America, and has not been observed in Europe, it attacks the European species when cultivated in this country. This fungus appears most frequently on the under side of the leaves in the form of numerous small tubes or cylinders of an orange-red color, which become white after the discharge of the spores. In some years the Ash-leaf Rust produces a widespread epidemic, while in others it is extremely scarce. A remarkable epidemic occurred in 1885, when this fungus appeared in immense quantities all over the United States, attacking the trees in large cities as well as those growing spontaneously in the forest. Since 1885, although occasionally mild epidemics have appeared the Ash-leaf Rust has not been common.

Sphæronema Spina, Berkeley & Ravenel, often attacks our native species, especially *Fraxinus Americana*. It is found on the smaller branches, where it appears in the form of sharp projecting black spines about an eighth of an inch in length. A number of species belonging to the genera Septoria, Sphæropsis, Cylindrosporium, Glœosporium, etc., produce spots on the leaves of our Ash-trees, some of them causing considerable injury; and a number of Pyrenomycetes attack the bark. In spite of the large number of parasites which attack the Ash in North America, it is, so far as diseases caused by fungi are concerned, a comparatively healthy tree.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Ornus. Flowers with a 2 to 4-parted corolla, polygamous or often perfect; panicles loose, terminal or axillary on leafy branches of the year, or from the axils of leaves of the previous year.

- Divisions of the corolla, 4; leaflets, 3 to 7; lanceolate or ovate-lanceolate, gradually narrowed into cuspidate tips, sharply serrate or entire . . . . 1. F. cuspidata.
- Divisions of the corolla, 2; leaflets, 3 to 9, oval or oblong, obtuse or acute, coarsely serrate above the middle . . . . 2. F. dipetala.
- Leaflets 3 to 7, usually 5 or 7, narrowly spatulate to oblong-obovate, obtuse; petioles wing-margined . . . . 3. F. Greggii.

Fraxinaster. Flowers apetalous, diœcious, polygamous, or rarely perfect; panicles compact, developed from separate buds in the axils of leaves of the previous year.

- Flowers perfect.
  - Leaflets 5 to 9, usually 7, ovate-oblong to lanceolate, acute, coarsely serrate; branchlets quadrangular . . . . 4. F. quadrangulata.
- Flowers polygamous.
  - Leaflets 7 to 11, oblong-lanceolate, gradually acuminate, the lateral sessile . . . . 5. F. nigra.
  - Leaflets mostly reduced to a simple leaflet or rarely 2 or 3-foliolate . . . . . . 6. F. anomala.
- Flowers diœcious; calyx of the staminate flower minute or wanting; calyx of the pistillate flower persistent.
  - Anthers linear-oblong.
    - Leaflets 3 to 9, lanceolate to oval, entire or serrate, the lateral short-petiolulate or subsessile . . . . 7. F. velutina.
    - Leaflets 5 to 9, usually 7, ovate to oblong-lanceolate, mostly acute, pale on the lower surface . . . . 8. F. Americana.
    - Leaflets usually 5, ovate to broadly oval, rounded or slightly acute at the apex, pale on the lower surface . . . . 9. F. Texensis.
    - Leaflets, 7 to 9, oblong-lanceolate to ovate, mostly coarsely serrate, clothed on the lower surface with velvety pubescence or sometimes, in var. *lanceolata*, glabrous 10. F. Pennsylvanica.
    - Leaflets 3 to 5, oblong-lanceolate, acute or rounded at the apex, entire or coarsely serrate . . . . 11. F. Berlandieriana.
    - Leaflets 5 to 7, ovate or oblong, acute, sharply serrate or entire, glabrous or pubescent . . . . 12. F. Caroliniana.
  - Anthers short-oblong.
    - Leaflets 5 to 7, oblong-lanceolate to oval, acute, usually villous-pubescent while young . . . . 13. F. Oregona.

FRAXINUS CUSPIDATA.

Ash.

Panicles usually terminal on short leafy lateral branches of the year. Flowers perfect; corolla deeply 4-parted. Leaflets 3 to 7, lanceolate or ovate-lanceolate, long-pointed, sharply serrate or entire.

Fraxinus cuspidata. Torrey. *Bot. Mex. Bound. Surv.* 166 (1859). — Gray. *Syn. Fl. N. Am.* ii. pt. i. 74. — Hemsley, *Bot. Biol. Am. Cent.* ii. 304. — Wenzig. *Bot. Jahrb.* iv. 171. — Havard. *Proc. U. S. Nat. Mus.* viii. 510. — Pringle. *Garden and Forest*, i. 142. — Sargent, *Garden and Forest*, ii. 447. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 259 (*Man. Pl. W. Texas*). — Wesmael. *Bull. Bot. Soc. Belg.* xxx. 80.

A tree, rarely twenty feet in height, with a short trunk six to eight inches in diameter; or more often a shrub sending up from the ground a number of slender spreading stems six or eight feet tall. The branches are slender and terete, and when they first appear are light red-brown, soon becoming darker and marked with scattered pale lenticels; in their second year they are ashy gray and roughened by the dark elevated lunate leaf-scars. The winter-buds are acute and nearly half an inch long, with dark reddish brown glutinous scales. The leaves are five to seven inches long, with slender pale petioles sometimes slightly wing-margined, and three to seven leaflets; these are lanceolate or ovate-lanceolate, gradually narrowed at the apex into long cuspidate tips, wedge-shaped at the base and coarsely and remotely serrate above the middle with recurved teeth, or entire; when they unfold they are slightly puberulous on the lower surface, and at maturity they are thin, dark green above, paler and covered with minute black dots below, an inch and a half to two inches long and a quarter of an inch to nearly an inch wide, with pale midribs and obscure veins, and are sessile or borne on slender petiolules which are sometimes nearly an inch in length. The flowers, which are extremely fragrant, appear in April and are produced in open glabrous panicles three or four inches long and broad, terminating lateral leafy branchlets developed from the axils of leaves of the previous year. The calyx is cup-shaped, and a sixteenth of an inch long, with acute apiculate teeth. The corolla is two thirds of an inch long, thin and white, and divided to below the middle into four linear-oblong lobes pointed at the apex and much longer than the nearly sessile oblong anthers. The ovary is two-celled and crowned with a thick two-lobed nearly sessile stigma. The fruit is spatulate-oblong or obovate-oblong, and an inch long; the body is flat and nerveless, the margined edges gradually broadening upward into the shorter wing, which is rounded or often slightly emarginate at the apex and a quarter of an inch wide.[1]

Fraxinus cuspidata is distributed from the great cañon of the Rio Grande in southwestern Texas, through southern New Mexico to the Grand Cañon of the Colorado River in Arizona,[2] and ranges southward to the mountain slopes of Cohahuila and Nuevo Leon and to the cañons of the Santa Eulalia Mountains in Chihuahua. An inhabitant of rocky slopes and dry ridges, *Fraxinus cuspidata* grows as a shrub within the territory of the United States, and only attains the size and habit of a tree on the mountains of Chihuahua.

Fraxinus cuspidata was discovered in June, 1851, at Eagle Spring, in western Texas by Mr. Charles Wright.[3] Its abundant clusters of fragrant white flowers, the beauty of its foliage and its graceful habit, make this little tree a desirable ornamental plant, and it is occasionally seen in the streets and gardens of the cities of Nuevo Leon.

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[1] I have been unable to examine the bark and wood of this rare and still imperfectly known species.

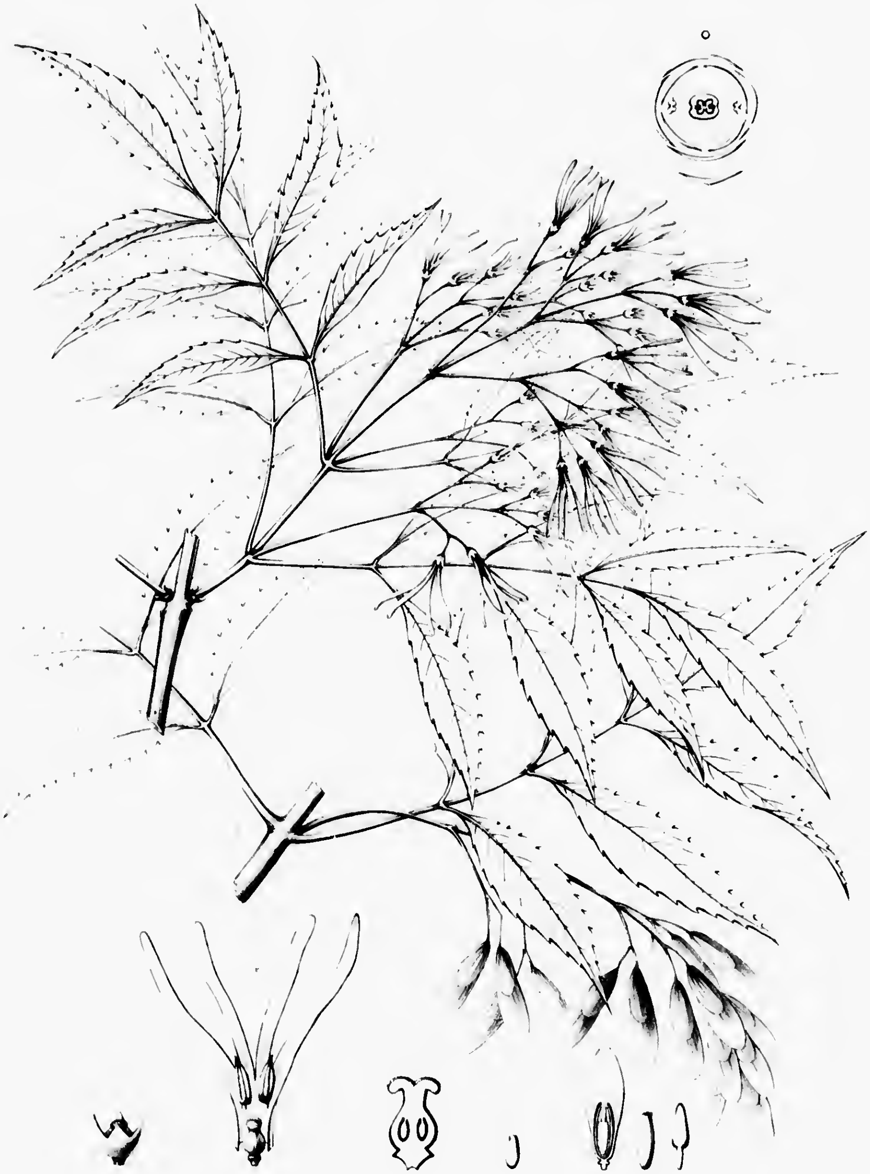
[2] *Fraxinus cuspidata* was discovered in the Grand Cañon of the Colorado River in Arizona in June, 1892, by Professor J. W. Toumey of the University of Arizona.

[3] See i. 94.

EXPLANATION OF THE PLATE.

PLATE CCLX. FRAXINUS CUSPIDATA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, the corolla removed, enlarged.
4. A flower, the corolla displayed, enlarged.
5. Vertical section of a pistil, enlarged.
6. An ovule, much magnified.
7. A fruiting branch, natural size.
8. Vertical section of a fruit, natural size.
9. A seed, natural size.
10. An embryo, enlarged.



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FRAXINUS DIPETALA.

Fringe-flowered Ash.

PANICLES clustered, often on short lateral branches, in the axils of leaves of the previous year. Flowers mostly perfect, corolla 2-parted to the base. Leaflets 3 to 9, oval or oblong, obtuse or acute, coarsely serrate above the middle.

Fraxinus dipetala. Hooker & Arnott, *Bot. Voy. Beechey*, 362. t. 87 (1840). — Gray, *Brewer & Watson Bot. Cal.* i. 472; *Syn. Fl. N. Am.* ii. pt. i. 73. — Hemsley, *Bot. Biol. Am. Cent.* ii. 305. — Wenzig, *Bot. Jahrb.* iv. 173. — Wesmael, *Bull. Soc. Bot. Belg.* xxx. 79. — Koehne, *Deutsche Dendr.* 509. — Coville, *Contrib. U. S. Nat. Herb.* iv. 148 (*Bot. Death Valley Exped.*).

Ornus dipetala. Nuttall, *Sylva.* iii. 66. t. 101 (1849).

Chlonanthus fraxinifolia. Kellogg, *Proc. Cal. Acad.* v. 18 (1873).

A shrub, with many spreading stems ten or twelve feet tall; or possibly under favorable conditions a small tree. The branchlets are stout and terete or more or less four-angled; when they first appear they are dark green and marked with pale lenticels, and in their second year become rather bright red-brown or gray tinged with red. The leaves are two to six inches long, with stout petioles and three to nine leaflets; these are oval or oblong, rounded or acute at the apex, wedge-shaped at the base, and coarsely serrate above the middle with slightly incurved teeth; they are puberulous when they unfold and at maturity are thick and firm, dark green on the upper surface, rather paler on the lower, half an inch to two inches long, a quarter of an inch to three quarters of an inch wide, and long-petiolulate or sometimes nearly sessile. The flowers are borne on slender puberulous pedicels which vary from a quarter to half an inch in length and are produced in narrow panicles two or three inches long, clustered in the axils of leaves of the previous year, and often on short lateral spur-like branches naked or furnished with one or two leaves. The calyx is puberulous on the outer surface, cup-shaped, a sixteenth of an inch long, and slightly four-toothed, or occasionally almost entire. The corolla is a third of an inch long, thin, creamy white, and divided into two broadly ovate petals rounded at the apex, abruptly narrowed at the base into slender claws, and as long as the stamens, which are composed of slender filaments and elongated linear anthers. The ovary is ovate and gradually contracted into a style slightly lobed at the apex. The fruit is linear-oblong or spatulate-oblong, with a broad terminal wing rounded and apiculate or often emarginate at the apex and about as long as the flat sharp-edged body several-nerved on both surfaces.[1]

Fraxinus dipetala is a common shrub in the coast region and on the western foothills of the Sierra Nevada of California, growing near the banks of streams on dry rocky slopes and ranging southward into Lower California.[2]

Fraxinus dipetala appears to have been discovered by David Douglas,[3] who visited California in 1830, although it was not described until several years after his death.[4]

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[1] The following forms have been distinguished: —

Var. *brachyptera*, with short obovate fruit one half to three quarters of an inch long, with a wing only half as long as the body (Gray, *Syn. Fl. N. Am.* ii. pt. i. 71 (1878). — Wenzig, *Bot. Jahrb.* iv. 171).

Var. *trifoliata*, with leaves composed of one to three small coriaceous obscurely serrate leaflets and small fruit (Torrey, *Bot. Mex. Bound. Surv.* 167 (1859). — Gray, *l. c.* — Wenzig, *l. c.*).

[2] T. S. Brandegee, *Proc. Cal. Acad.* ser. 2, ii. 182 (*Pl. Baja Cal.*).

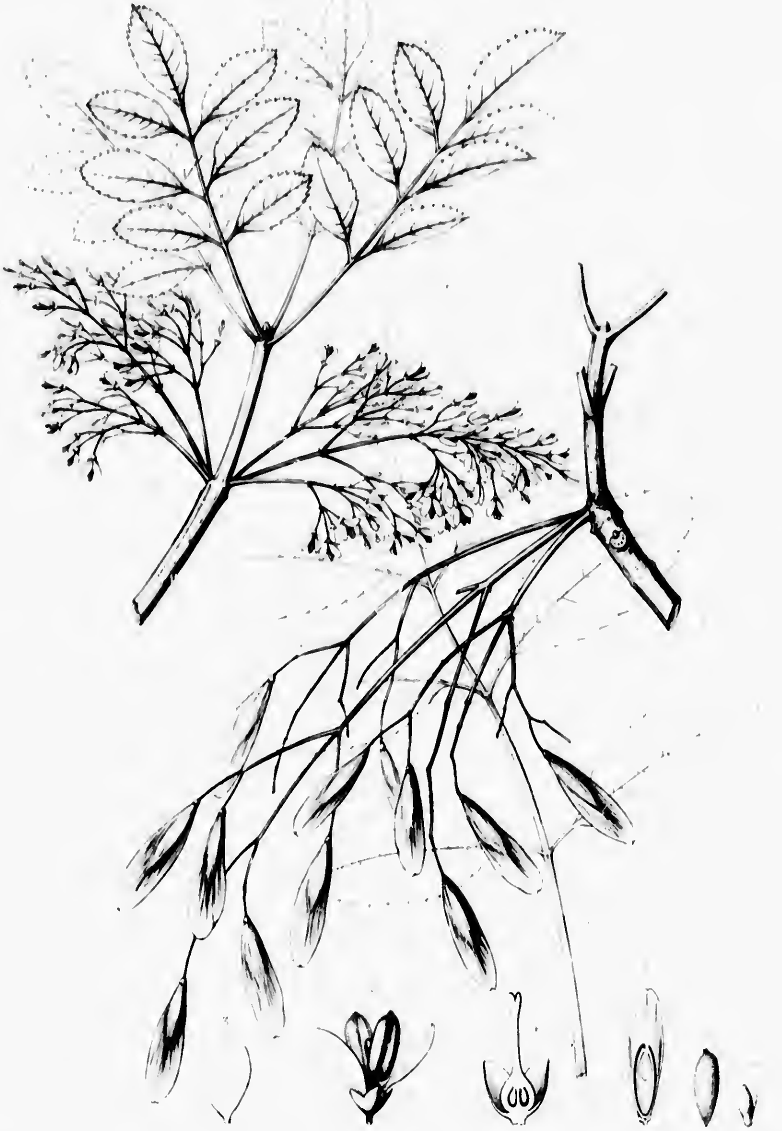
[3] See ii. 94.

[4] I have not examined the bark or wood of this plant, which is a shrub rather than a tree. But as it is the only American species which is not known to be arborescent in habit, it is admitted into *The Silva* to complete the account of the American Ashes.

EXPLANATION OF THE PLATE.

Plate CCLXI. Fraxinus dipetala.

1. A flowering branch, natural size.
2. A flower, enlarged.
3. A petal, enlarged.
4. Vertical section of a flower, the petals removed, enlarged.
5. A fruiting branch, natural size.
6. Vertical section of a fruit, natural size.
7. A seed, natural size.
8. An embryo, enlarged.
9. A leaf, natural size.



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FRAXINUS DIPETALA, Hook. et Arn.

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FRAXINUS GREGGII.

Ash.

PANICLES axillary on branches of the year or of the previous year. Leaflets 3 to 7, narrowly spatulate to oblong-obovate, obtuse; petioles wing-margined.

Fraxinus Greggii, Gray, *Proc. Am. Acad.* xii. 63 (1876); *Syn. Fl. N. Am.* ii. pt. i. 74. — Hemsley, *Bot. Biol. Am. Cent.* ii. 305. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 106; *Garden and Forest*, ii. 447. f. 128. — Havard, *Proc. U. S. Nat. Mus.* viii. 510. — Pringle, *Garden and Forest*, iv. 338, 362. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 259 (*Man. Pl. W. Texas*). — Wesmael, *Bull. Soc. Bot. Belg.* xxx. 106.

Fraxinus Schiedeana, var. **parvifolia**, Torrey, *Bot. Mex. Bound. Surv.* 168 (1859).

A tree, rarely twenty to twenty-five feet in height, with a trunk eight or ten feet long and occasionally eight inches in diameter; or more often a shrub sending up from a single crown many slender erect stems four to twelve feet in length. The bark of the trunk is thin, gray, or light brown tinged with red, and separates on the surface in large papery scales. The branchlets are slender and terete, and are dark green and puberulous when they first appear, soon becoming ashy gray; they are roughened with many minute pale elevated lenticels, and in their second or third years gradually turn dark gray or brown. The winter-buds are about an eighth of an inch long, and obtuse, with thick ovate light brown pubescent scales rounded on the back. The leaves are an inch and a half to three inches long, with winged petioles and three to seven leaflets; these are narrowly spatulate or oblong-obovate, and entire or occasionally coarsely serrate above the middle with remote blunt teeth, slender midribs, and obscure reticulate veins; they are thick and coriaceous, dark green on the upper surface, rather paler and covered with small black spots on the lower surface, half an inch to an inch long, an eighth to a quarter of an inch wide, and nearly sessile. The flowers are unknown. The fruit is oblong-linear or obovate, and a half to two thirds of an inch long; the thin wing is decurrent on the short terete body, and is rounded and emarginate at the apex, which is tipped with the elongated persistent conspicuous style.[1]

Fraxinus Greggii is scattered along the valley of the Rio Grande in western Texas from the mouth of the San Pedro to that of the Pecos River, and ranges southward on the mountains of Nuevo Leon, Cohahuila, and Chihuahua. It grows on dry limestone cliffs and ledges, and appears to be most common and to attain its greatest size on the Sierra Nevada of Nuevo Leon, where it occasionally appears as a small tree.

The wood of *Fraxinus Greggii* is heavy, hard, and close-grained, with obscurely marked layers of annual growth and numerous thin medullary rays, and is brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.7904, a cubic foot weighing 49.26 pounds.

Fraxinus Greggii was discovered in 1847 in Nuevo Leon by Josiah Gregg,[2] the author of *The Commerce of the Prairies*, whose services to botany are commemorated in the specific name.

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[1] On a specimen collected by Mr. C. G. Pringle (No. 3253, 1890) in the state of Cohahuila on September 19, 1890, the wings of the ripe fruit are rounded and sometimes apiculate at the apex, and show no trace of the styles, which are very conspicuous on the full grown fruit which I gathered on the mountains near Monterey in Nuevo Leon in April, 1887.

[2] Little is known of the early life of Josiah Gregg. Broken health first made him a traveler on the prairies, which he afterwards crossed several times as a trader under the patronage of Mr. Thomas G. Rockhill, a Philadelphia merchant. In 1841 and 1842 he contributed a series of letters on the history and condition of the Santa Fé trade to the *Galveston Advertiser* and the *Arkansas Intelligencer*; and in 1844 appeared *The Commerce of the Prairies*, a journal of a Santa Fé trader during eight journeys across the great western prairies and a residence of nearly nine years in northern Mexico. In preparing his notes for this publication he was assisted by Mr. John Bigelow, who testifies to the purity, modesty, and general elevation of Gregg's character, and to his conscientiousness, which made it impossible for him to state anything which he did not know personally, or to make an overstate-

ment or an understatement. The precise records of his expeditions are therefore valuable, and in *The Commerce of the Prairies* is found the most trustworthy record of the condition of commerce in the west before the great midcontinental plains were crossed by railroads. During his residence in Mexico Mr. Gregg devoted some attention to botany and discovered a number of undescribed plants. *Greggia*, a genus of cruciferous herbs of western Texas and northern Mexico, was dedicated to him by Asa Gray. In 1846 Gregg accompanied General Wool's division of the United States Army to Chihuahua as guide, and later marched to Saltillo with General Butler. He is believed to have died in California in 1850 (*Garden and Forest*, vii. 12).

EXPLANATION OF THE PLATE.

PLATE CCLXII. FRAXINUS GREGGII.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, enlarged.
3. A seed, enlarged.
4. An embryo, much magnified.
5. A leafy branch, natural size.

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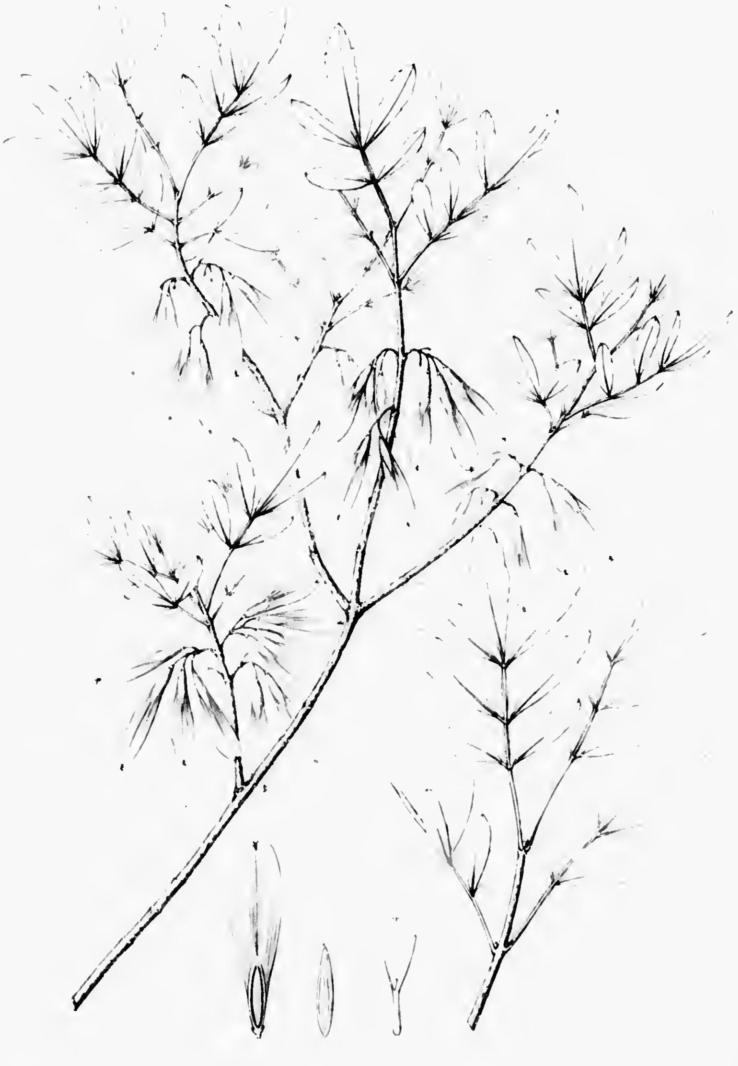

FRAXINUS GREGGII.

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FRAXINUS QUADRANGULATA.

Blue Ash.

FLOWERS perfect. Leaflets 5 to 9, usually 7, ovate-oblong to lanceolate, acute, coarsely serrate. Branchlets quadrangular.

Fraxinus quadrangulata, Michaux, *Fl. Bor.-Am.* ii. 255 (1803). — Vahl. *Enum.* i. 50. — Willdenow, *Spec.* iv. 1102. — Persoon, *Syn.* ii. 605. — *Nouveau Duhamel*, iv. 64. — Desfontaines, *Hist. Arb.* i. 103. — Bosc, *Mém. Inst.* ix. 211. — Michaux f. *Hist. Arb. Am.* iii. 118, t. 11. — Poiret, *Lam. Dict.* Suppl. ii. 671. — Pursh, *Fl. Am. Sept.* i. 8. — Roemer & Schultes, *Syst.* i. 278. — Nuttall, *Gen.* ii. 231. — Hayne, *Dendr. Fl.* 223. — Sprengel, *Syst.* i. 96. — Don, *Gen. Syst.* iv. 55. — Spach, *Hist. Vég.* viii. 296. — De Candolle, *Prodr.* viii. 278. — Chapman, *Fl.* 370. — Koch, *Dendr.* ii. 259. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 75. — Lauche, *Deutsche Dendr.* ed. 2, 161, f. 53. — Engelmann, *Bot. Gazette*, v. 63. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 69. — Burgess, *Bot. Gazette*, vii. 95. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 110. — Wenzig, *Bot. Jahrb.* iv. 185. — Watson & Coulter, *Gray's Man.* ed. 6, 336. — Wesmael, *Bull. Soc. Bot. Belg.* xxx. 114. — Koehne, *Deutsche Dendr.* 513, f. 90, M.

Fraxinus tetragona, Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 583 (1811). — Bosc, *Nouv. Cours d'Agric.* vii. 73.

Fraxinus quadrangulata, var. **nervosa**, Loudon, *Arb. Brit.* ii. 1235 (1838).

Fraxinus Americana, var. **quadrangulata**, D. J. Browne, *Trees of America*, 397 (1846).

Fraxinus Americana, var. **quadrangulata nervosa**, D. J. Browne, *Trees of America*, 397 (1846).

Fraxinus quadrangulata, var. **subpubescens**, Wesmael, *Bull. Soc. Bot. Belg.* xxx. 114 (1892).

A slender tree, sometimes one hundred and twenty feet in height, with a trunk two or three feet in diameter, although generally much smaller and usually not more than sixty or seventy feet tall. The bark of the trunk varies from a half to two thirds of an inch in thickness and is irregularly divided into large plate-like scales, the light gray surface, which is slightly tinged with red, separating into thin minute scales. The branchlets are stout, four-angled, and more or less four-winged between the nodes, and when they first appear are dark orange-color and covered with short rufous pubescence; in their second year they are gray tinged with red, and marked with scattered pale lenticels and with the large elevated obcordate leaf-scars in which are a lunate row of fibro-vascular bundle-scars; in their third year they are light brown or ashy gray, and gradually become terete. The terminal bud is about a quarter of an inch long, with three pairs of scales; those of the outer row, which are thick, rounded on the back, usually obscurely pinnate toward the apex, dark reddish brown and slightly pubescent, or often coated with pale tomentum, partly cover the bud; the scales of the inner rows, which are strap-shaped, coated with light brown tomentum and often pinnate, lengthen with the young shoot, and at maturity are an inch to an inch and a half in length. The leaves are eight to twelve inches long, with slender petioles glabrous or puberulous toward the base, and five to nine leaflets; these are ovate-oblong to lanceolate, long-pointed, unequally rounded or wedge-shaped at the base, and serrate above with incurved teeth; when they unfold they are coated on the lower surface with thick brown tomentum, and at maturity they are thick and firm, yellow-green and glabrous above, pale and glabrous, or sometimes furnished with tufts of pale hairs along the base of the conspicuous midribs below, three to five inches long, and an inch to two inches wide, with short broad petiolules grooved on the upper side, and eight to twelve pairs of veins arcuate near the margins. Having turned to a pale yellow color, the leaves fall early in the autumn. The flowers, which appear as the terminal buds begin to expand, are borne in loose-branched panicles from small obtuse buds developed in the axils of leaves of the previous year and protected by broadly ovate scales keeled on the back, apiculate at the apex, and covered with thick brown tomentum. The bracts at the base of the secondary branches of the inflorescence are ovate, acute, and also covered with tomentum. The ultimate divisions of the inflorescence are three or rarely two or four-flowered, the pedicels of the lateral flowers being produced from the axils of linear acute caducous pale pink bracts an eighth to a quarter of an inch in length. The flowers are borne on slender pedicels and are composed of a calyx which is reduced to an obscure ring, two nearly sessile stamens with broad connectives and dark purple oblong obtuse anthers, and an oblong-ovate ovary gradually narrowed into a short style divided at the apex into two light purple stigmatic lobes which generally mature and wither before the anthers open. The fruit is linear-oblong or cuneate-oblong, one to two inches long, and a quarter of an inch to nearly an inch wide, the broad wing, which is usually conspicuously emarginate at the apex, surrounding the long flat body faintly many-rayed on both faces.

Fraxinus quadrangulata is distributed from southern Michigan to central Missouri, and southward to eastern Tennessee and northern Alabama, and through Iowa and Missouri to northeastern Arkansas. Nowhere very common, the Blue Ash usually inhabits rich limestone hills, occasionally descending into the fertile bottom-lands of river valleys, and reaching its greatest size in the basin of the lower Wabash River in Illinois and on the western slopes of the Big Smoky Mountains in Tennessee.

The wood of *Fraxinus quadrangulata* is heavy, hard, close-grained, and rather brittle, with numerous obscure medullary rays and bands of three rows of large open ducts marking the layers of annual growth. It is light yellow streaked with brown, with thick lighter colored sapwood sometimes composed of eighty or ninety layers of annual growth. The specific gravity of the absolutely dry wood is 0.7184, a cubic foot weighing 44.77 pounds. It is largely used for flooring and in carriage-building, and probably is not often distinguished commercially from that of the other species of the northern and middle states.

A blue dye may be obtained by macerating the inner bark in water.

The Blue Ash was discovered in 1795 by the French botanist Michaux[1] during his journey west of the Alleghany Mountains, and by him was introduced into European gardens. The excellent habit of this tree, its hardiness, rapidity of growth, and freedom from disease and the attacks of insects make it a desirable inhabitant of parks, where, however, it is less commonly cultivated than the White Ash or the Green Ash.

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[1] See i. 58.

EXPLANATION OF THE PLATE.

Plate CCLXIII. Fraxinus quadrangulata.

1. A flowering branch, natural size.
2. A flower, enlarged.
3. A stamen, enlarged.
4. A pistil cut transversely, enlarged.
5. A fruiting branch, natural size.
6. Vertical section of a fruit, natural size.
7. A seed, natural size.
8. An embryo, slightly enlarged.
9. A winter branchlet, natural size.

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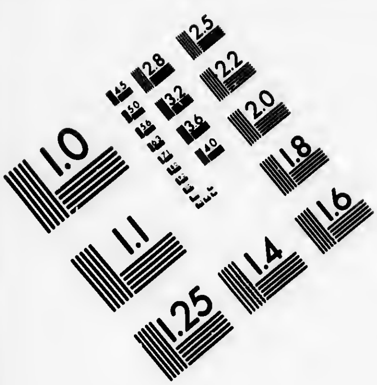

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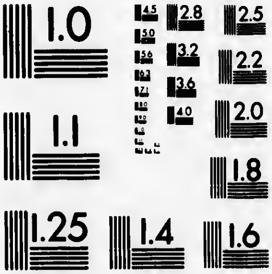

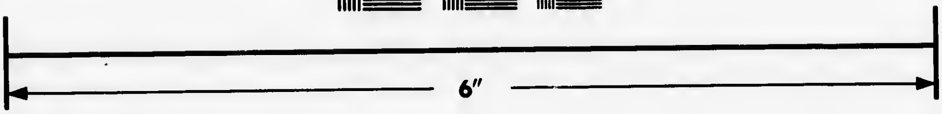

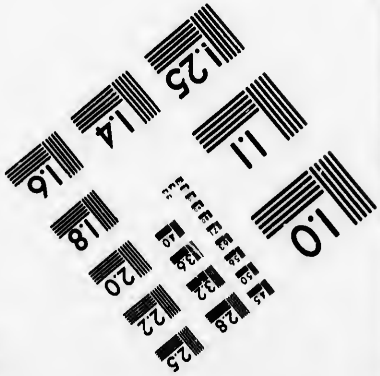

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FRAXINUS NIGRA.

Black Ash.

Flowers polygamous, without calyx. Leaflets 7 to 11, oblong-lanceolate, gradually acuminate, the lateral sessile.

Fraxinus nigra, Marshall, *Arbust. Am.* 51 (1785). — Castiglioni, *Viag. negli Stati Uniti*, ii. 244. — Du Roi, *Harbk. Baumz.* ed. 2, i. 398. — Koch, *Dendr.* ii. 257. — Lauche, *Deutsche Dendr.* ed. 2, 163. — Sudworth, *Rep. Sec. Agric.* (1892) 326. — Koehne, *Deutsche Dendr.* 512.

Fraxinus Novæ-Angliæ, Du Roi, *Harbk. Baumz.* ed. 1, i. 290 (not Miller) (1771). — Wangenheim, *Nordam. Holz.* 51.

Fraxinus sambucifolia, Lamarck, *Dict.* ii. 549 (1786). — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 393. — Borkhausen, *Handb. Forst. Bot.* i. 829. — Willdenow, *Berl. Baumz.* 121; *Spec.* iv. 1099; *Enum.* 1059. — Vahl, *Enum.* i. 51. — Persoon, *Syn.* ii. 605. — Bosc, *Mém. Inst.* ix. 211. — *Nouveau Duhamel*, iv. 60. — Desfontaines, *Hist. Arb.* i. 103. — Michaux f. *Hist. Arb. Am.* iii. 122, t. 12. — Pursh, *Fl. Am. Sept.* i. 8. — Roemer & Schultes, *Syst.* i. 279. — Nuttall, *Gen.* ii. 231. — Don, *Gen. Syst.* iv. 54. — Spach, *Hist. Vég.* viii. 299. — Hooker, *Fl. Bor.-Am.* ii. 50. — De Candolle, *Prodr.* viii. 278. — Darlington, *Fl. Cestr.* ed. 3, 239. — Emerson, *Trees Mass.* ed. 2, 381, t. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 76. — Ridgway, *Proc. U. S. Nat. Mus.* 1882. 69. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 111. — Wenzig, *Bot. Jahrb.* iv. 180. — Watson & Coulter, *Gray's Man.* ed. 6, 336. — Hitchcock, *Trans. St. Louis Acad.* v. 507.

Fraxinus Americana, var. sambucifolia, D. J. Browne, *Trees of America*, 396 (1846).

Fraxinus nigra, subspec. nigra, Wesmael, *Bull. Bot. Belg.* xxx. 112 (1892).

A tree, occasionally eighty to ninety feet in height, with a tall trunk rarely exceeding twenty inches in diameter, and slender mostly upright branches which form a narrow head; or usually much smaller. The bark of the trunk, which varies from a third to a half of an inch in thickness, is divided into large irregular plates, the gray surface which is slightly tinged with red separating into thin papery scales. The branches are stout and terete, and when they first appear are dark green and slightly puberulous; they soon become ashy gray or orange-color, and are marked with large pale scattered lenticels; during their first winter they grow darker and are roughened by the large suborbicular leaf-scars in which appear a semicircular row of conspicuous fibro-vascular bundle-scars. The leaf-buds are broadly ovate, acute, and rather less than a quarter of an inch long, with three pairs of scales; those of the outer pair are thick and rounded on the back at the base, gradually narrowed and acute at the apex, dark brown or almost black and slightly puberulous; they nearly inclose the bud, and fall as it begins to grow in the spring; the scales of the two inner rows are coated on the outer surface with rufous pubescence and lengthen with the young branch; at maturity the scales of the second pair, which are thickened at the base, are strap-shaped, an inch long, a third of an inch wide, and about half the length of those of the inner pair, which are pinnate and usually foliaceous, with a broad stalk. The leaves are twelve to sixteen inches long, with stout pale petioles and seven to eleven leaflets; these are sessile, with the exception of the terminal one, which is borne on a long or short petiolule, oblong or oblong-lanceolate, long-pointed at the apex, unequally wedge-shaped or sometimes rounded at the base, and remotely serrate with small incurved teeth; when they unfold they are covered, especially on the lower surface, with rufous hairs, and at maturity they are thin and firm, dark green above, paler below, glabrous, with the exception of occasional tufts of rufous hairs along the under side of the broad pale midribs, four or five inches long, and an inch to two inches wide, with many conspicuous primary veins arcuate near the margins, and obscure reticulate veinlets. The leaves, which usually do not unfold in New England until after the middle of May, or until the beginning of June at the north, turn rusty brown, and fall early in the autumn. The flowers appear before the leaves in compact or ultimately elongated panicles four or five inches long when fully grown, and covered in the bud by broadly ovate dark brown or nearly black scales rounded at the apex. The lower bracts are ovate, boat-shaped, rounded on the back, acute at the apex, and covered with scurfy rufous or dark brown pubescence; the upper bracts are linear-lanceolate, more or less laciniately cut on the margins, sometimes fan-shaped and divided into five narrow segments, and covered with rufous hairs. The staminate flowers are borne on separate individuals or are found mixed with perfect flowers on trees which mostly produce pistillate flowers. The staminate flower consists of two large deeply pitted oblong dark purple anthers attached on the back to short broad filaments; the pistillate flower of an ovary gradually narrowed into a long slender style deeply divided at the apex into two broad purple stigmas, and often accompanied by one or by two perfect, or globose rudimentary pink anthers, which are sessile or borne on long or short filaments. The fruit, which is borne in open panicles eight or ten inches in length, is lanceolate-oblong or linear-oblong, and an inch or an inch and a half long, with a broad thin wing which surrounds the short flat faintly nerved body, and is conspicuously emarginate at the apex.

Fraxinus nigra inhabits deep cold swamps and the low banks of streams and lakes, and is distributed from southern Newfoundland and the northern shores of the Gulf of St. Lawrence to Lake Winnipeg, and southward through the northern states to Newcastle County, Delaware, the mountains of Virginia, southern Illinois, central Missouri, and northwestern Arkansas.

The wood of *Fraxinus nigra* is heavy, rather soft, not strong, tough, coarse-grained, durable in contact with the soil, and easily separable into thin layers; it contains numerous thin medullary rays and bands of large open ducts marking the layers of annual growth, and is dark brown, with thin light brown or often nearly white sapwood. The specific gravity of the absolutely dry wood is 0.6318, a cubic foot weighing 39.37 pounds. It is largely used in the interior finish of houses and cabinet-making, and for fences, barrel-hoops, and in the manufacture of baskets. According to Lamarck[1] the Black Ash was cultivated in the King's Garden at Paris in 1786. Transplanted from its native swamps it is a short-lived tree,[2] and in cultivation one of the least beautiful and satisfactory of the Ash-trees of the Atlantic states.

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[1] *Dict.* ii. 549.

The *Fraxinus ex Nova Anglia, pinnis foliorum in mucronem productioribus* of Miller (*Dict.* No. 5. — Duhamel, *Traité des Arbres*, i. 248) may have been this species.

[2] The increase in the diameter of the trunk of the Black Ash is sometimes remarkably slow in the case of a tree growing in rich moist soil, which usually produces rapid growth. The trunk specimen in the Jesup Collection of North American Woods in the American Museum of Natural History in New York is twenty-two inches in diameter inside the bark, and displays two hundred and thirty-four layers of annual growth, the period of slowest growth being between its tenth and one hundred and seventieth years.

EXPLANATION OF THE PLATES.

Plate CCLXIV. Fraxinus nigra.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. A staminate flower, enlarged.
4. An anther, rear and front views, enlarged.
5. A pistillate flower with rudimentary stamens, enlarged.
6. Vertical section of an ovary, enlarged.

Plate CCLXV. Fraxinus nigra.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, natural size.
3. A seed, natural size.
4. An embryo, enlarged.
5. A leaf, natural size.
6. A winter branchlet, natural size.

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FRAXINUS ANOMALA.

Ash.

FLOWERS polygamous. Leaves mostly reduced to a single leaflet, or rarely 2 or 3-foliolate.

Fraxinus anomala. Watson, *King's Rep.* v. 283 (1871). — Parry, *Am. Nat.* ix. 203. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 74. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 106. — Wenzig, *Bot. Jahrb.* iv. 186. — Wesmael, *Bull. Soc. Bot. Belg.* xxx. 114. — Koehne, *Deutsche Dendr.* 511, f. 90, D. — Coville, *Contrib. U. S. Nat. Herb.* iv. 148 (*Bot. Death Valley Exped.*).

A tree, eighteen to twenty feet in height, with a short trunk six or seven inches in diameter and stout contorted branches which form a round-topped head; or often a low shrub with numerous spreading stems. The bark of the trunk, which is dark brown slightly tinged with red and a quarter of an inch thick, is divided by shallow fissures into narrow ridges, and separates into small thin appressed scales. The branches, when they first appear, are quadrangular, dark green tinged with red, and covered with pale pubescence; in their first winter they are orange-color, puberulous, and marked with elevated pale lenticels and narrow lunate leaf-scars, and in their second or third year become ashy gray and terete. The leaf-buds are broadly ovate, acuminate or obtuse, and covered with thick orange-colored tomentum. The leaves are reduced to a single leaflet, or are occasionally two or three-foliolate; the leaflets are broadly ovate or sometimes rotund, rounded or acute or rarely obcordate at the apex, wedge-shaped or cordate at the base, and entire or sparingly crenately serrate above the middle; when they unfold they are covered with short pale hairs on the upper surface, and are pubescent on the lower; and at maturity they are thin and rather coriaceous, dark green above, paler below, an inch and a half to two inches long, and an inch to nearly two inches broad, or, when more than one, much smaller; they have broad rather conspicuous midribs and many obscure veins, and when solitary are borne on stout grooved petioles often an inch and a half in length, or, when the leaves are composed of several leaflets, these are short-petiolulate. The flowers appear when the leaves are about two thirds grown, in short compact pubescent panicles produced from the axils of leaves of the previous year. The bracts of the inflorescence are strap-shaped or lanceolate, acute, half an inch long, and coated with thick brown tomentum. The flowers are sometimes perfect and sometimes unisexual by the abortion of the stamens, the two forms occurring in the same panicle. The calyx is cup-shaped and minutely four-toothed. The anthers are linear-oblong, orange-color, and raised on slender filaments which are nearly as long as the stout columnar style divided at the apex into two stigmatic lobes. The fruit is oblong or obovate-oblong, and two thirds of an inch long, the broad wing, which is rounded and sometimes slightly emarginate at the apex, surrounding the long flattened striately nerved body.

Fraxinus anomala is distributed from the valley of the McElmo River in southwestern Colorado, through southern Utah, where it is not rare in the neighborhood of streams on elevated sandstone mesas, and occurs on the western slopes of the Charleston Mountains in southern Nevada.

The wood of *Fraxinus anomala* is heavy, hard, and close-grained; it contains many large open scattered ducts and numerous thin medullary rays, the layers of annual growth being marked by several rows of small ducts. It is light brown, with thick lighter colored sapwood composed of thirty or forty layers of annual growth. The specific gravity of the absolutely dry wood is 0.6597, a cubic foot weighing 41.11 pounds.

Fraxinus anomala was discovered in 1859 by Professor J. S. Newberry[1] in the Labyrinth Cañon

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[1] John Strong Newberry (1822–1892), a native of Warren, Connecticut, and at the time of his death professor of geology and palæontology in the School of Mines at Columbia College, was educated in the Western Reserve College in Ohio, from which he was

of the Colorado River in southern Utah. In 1874 it was introduced into the Arnold Arboretum, where it has proved hardy and flowers every year.[1]

EXPLANATION OF THE PLATE.

Plate CCLXVI. Fraxinus anomala.

1 and 2. Flowering branches, natural size.
3. A perfect flower, just expanding, enlarged.
4. A pistillate flower, enlarged.
5. A perfect flower, enlarged.
6. A pistil, enlarged.
7. Vertical section of an ovary, enlarged.
8. A fruiting branch, natural size.
9. Vertical section of a fruit, natural size.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. A branch with pinnate leaves, natural size.
13. A winter branchlet, natural size.

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graduated in 1816. He studied medicine, taking his degree in 1848, and then having spent two years in Europe, took up the practice of medicine in Cleveland, Ohio. Dr. Newberry's interest in science induced him to accept the position of geologist and botanist to the party under command of Lieutenant Williamson, sent to the Columbia River by the Government of the United States to explore a railroad route to the Pacific. The account of his collections was published in 1857 in the sixth volume of the *Reports of Explorations and Surveys to ascertain the most Practical and Economical Route for a Railroad from the Missouri River to the Pacific Ocean*; it included an important account of the forest trees of northern California and Oregon, which contained much useful information. Dr. Newberry was joined to the party under Lieutenant Ives, which in 1857 and 1858 explored the Colorado River, and in 1859 he accompanied Captain Macombe from Santa Fé to the junction of the Grand and Green rivers. In 1861 Dr. Newberry became a member of the United States Sanitary Commission, which he served during five years, when he was appointed professor at Columbia College. He was the author of many papers on botany, especially on palæobotany, and on geology. In botany his name has been commemorated in *Newberrya*, a genus of leafless plants of which he discovered the type among the Cascade Mountains of Oregon. (See *Bull. Torrey Bot. Club*, xx. 89.)

[1] *Garden and Forest*, iii. 51.

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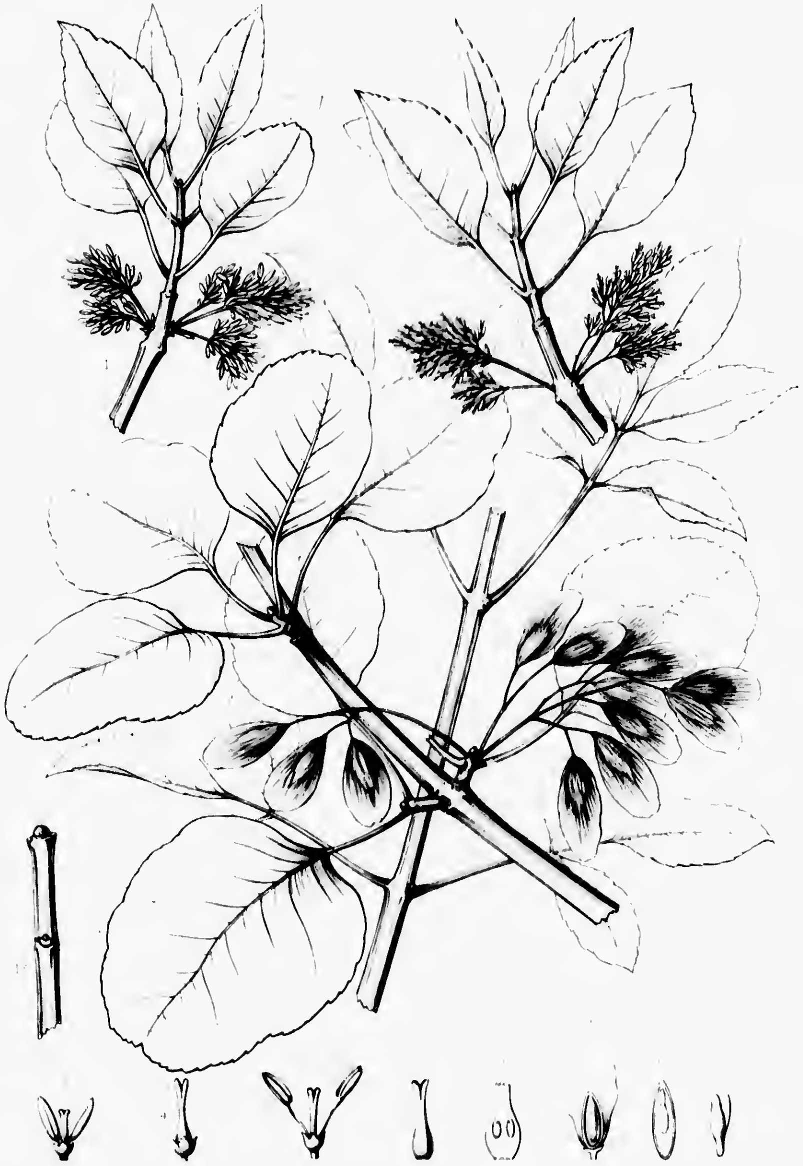

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FRAXINUS VELUTINA.

Ash.

LEAFLETS 3 to 9, lanceolate to oval, entire or serrate, the lateral short-petiolulate or subsessile.

Fraxinus velutina, Torrey, *Emory's Rep.* 149 (1848). — Sudworth, *Rep. Sec. Agric.* 1892, 326.

Fraxinus pistaciæfolia, Torrey, *Pacific R. R. Rep.* iv. 128 (1856); *Bot. Mex. Bound. Surv.* 166. — Rusby, *Bull. Torrey Bot. Club*, ix. 54. — Hemsley, *Bot. Biol. Am. Cent.* ii. 305. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 74. — Watson, *Proc. Am. Acad.* xviii. 113. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 106.

Fraxinus coriacea, Watson, *Am. Nat.* vii. 302 (in part) (1873). — Rothrock, *Wheeler's Rep.* vi. 185, t. 22. — Coville, *Contrib. U. S. Nat. Herb.* iv. 148 (*Bot. Death Valley Exped.*).

Fraxinus pistaciæfolia, var. coriacea, Gray, *Syn. Fl. N. Am.* ii. pt. i. 74 (1878). — Wenzig, *Bot. Jahrb.* iv. 182.

Fraxinus Americana, var. pistaciæfolia, Wenzig, *Bot. Jahrb.* iv. 182 (1883). — Wesmael, *Bull. Soc. Bot. Belg.* xxx. 108.

A tree, thirty to forty feet in height, with a trunk rarely exceeding eight inches in diameter, and stout often spreading branches which usually form a round-topped handsome head. The bark of the trunk, which varies from a third to a half of an inch in thickness, is gray slightly tinged with red, and deeply divided into broad flat broken ridges separating on the surface into small thin scales. The branchlets are slender and terete, and are coated, when they first appear, with pale pubescence or with thick white tomentum; and in their first winter they are red-brown or ashy gray, glabrous or tomentose, often covered with a glaucous bloom, and marked with small pale lenticels and with semiorbicular slightly obcordate leaf-scars, in the middle of which appears a lunate row of fibro-vascular bundle-scars. The leaf-buds are acute, and an eighth of an inch long, with three pairs of broadly ovate pointed scales which are coated with thick rufous tomentum; the inner scales lengthen on the young shoot, and when fully grown are half an inch long, strap-shaped, and rounded at the apex. The leaves are three to six inches long, with stout grooved petioles, and from three to nine stalked or sometimes nearly sessile leaflets; these are lanceolate or rarely obovate, occasionally falcate, long-pointed and acute or rounded at the apex, or sometimes nearly oval, wedge-shaped and often decurrent on the petiolule or unequally rounded at the base, and entire or remotely serrate above the middle with acute or recurved teeth; when they unfold they are light green or reddish brown, and glabrous, pubescent, or tomentose, especially on the under surface; and at maturity they are thick and firm or sometimes coriaceous, dark yellow-green above, paler and often pubescent below, and occasionally furnished with tufts of long pale hairs along the under side of the broad midribs, three to five inches long, and a quarter of an inch to nearly an inch wide, with prominent veins arcuate near the margins and connected by conspicuous reticulate veinlets. The flowers, which appear late in May or early in June with the unfolding of the leaves, are produced in short compact panicles, the males and females on different individuals, from buds in the axils of leaves of the previous year covered by broadly ovate scales rounded at the apex and coated with rusty tomentum. The calyx is cup-shaped, light green, and larger and more deeply divided in the pistillate than in the staminate flower. The anthers are oblong, apiculate, and borne on short slender filaments. The ovary is gradually narrowed into a short style deeply divided into two stigmatic lobes. The fruit ripens in the summer or early autumn, and hangs in dense clusters four or five inches long; it is spatulate-oblong, surrounded at the base by the persistent calyx, an inch long and an eighth of an inch to nearly a quarter of an inch wide, with a terminal wing which is acute, rounded, or emarginate at the apex, tipped with the remnants of the style, and about as long as the terete nearly clavate conspicuously rayed wingless body.

Fraxinus velutina ranges from the mountains of western Texas through southern New Mexico and Arizona to southern Nevada and the Panamint Mountains and the shores of Owen's Lake in southeastern California;[1] it is common and widely distributed in northern Mexico and occurs in Lower California.[2] It is usually found growing in the neighborhood of streams, in elevated cañons, and occasionally on dry mesas, when the leaves are thick and coriaceous and are sometimes coated with dense velvety tomentum.

The wood of *Fraxinus velutina* is heavy, rather soft, not strong, and close-grained; it contains numerous thin medullary rays, and is light brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6810, a cubic foot weighing 42.43 pounds. It is used locally for axe-handles and in the manufacture of wagons.

Fraxinus velutina was discovered in New Mexico in 1846 by Colonel William H. Emory[3] while in the command of a military reconnaissance from Fort Leavenworth in Missouri to San Diego in California.

In the towns of southern Arizona and northern Mexico *Fraxinus velutina* is often planted in the streets and on the borders of irrigating ditches for the shade afforded by its abundant foliage.

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[1] Coville, *Contrib. U. S. Nat. Herb.* iv. 148 (*Bot. Death Valley Exped.*).

[2] T. S. Brandegee, *Proc. Cal. Acad.* ser. 2, ii. 182 (*Pl. Baja Cal.*).

[3] See iv. 60.

EXPLANATION OF THE PLATE.

Plate CCLXVII. Fraxinus velutina.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. Fruits of different forms, natural size.
7. Vertical section of a fruit, somewhat enlarged.
8. A seed, enlarged.
9. An embryo, enlarged.

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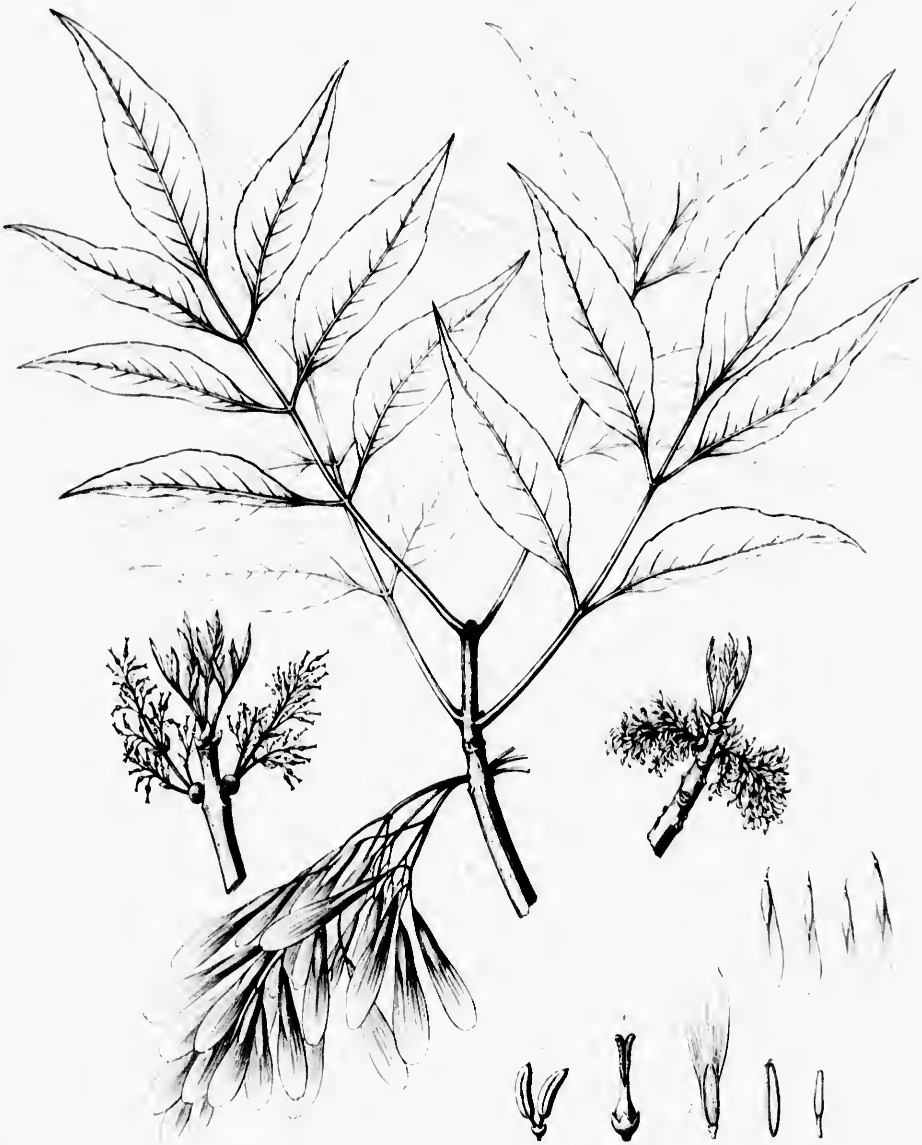

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FRAXINUS AMERICANA.

White Ash.

Leaflets 5 to 9, usually 7, ovate to oblong-lanceolate, mostly acute, pale on their lower surface.

Fraxinus Americana, Linnæus, *Spec.* 1075 (1753). — Castiglioni, *Viag. negli Stati Uniti*, ii. 244. — Walter, *Fl. Car.* 254. — Willdenow, *Berl. Baumz.* 116; *Spec.* iv. 1102; *Enum.* 1060. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 393. — Vahl, *Enum.* i. 49. — Persoon, *Syn.* ii. 604. — *Nouveau Duhamel*, iv. 63. — Desfontaines, *Hist. Arb.* i. 102. — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 580. — Michaux f. *Hist. Arb. Am.* iii. 106, t. 8 (excl. fruit). — Bigelow, *Fl. Boston.* 249. — Sprengel, *Syst.* i. 95. — Hayne, *Dendr. Fl.* 221. — Hooker, *Fl. Bor.-Am.* ii. 51 (in part). — Torrey, *Fl. N. Y.* ii. 125, t. 89. — De Candolle, *Prodr.* viii. 277. — Darlington, *Fl. Cestr.* ed. 3, 238. — Chapman, *Fl.* 369. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 54. — Koch, *Dendr.* ii. 252. — Lauche, *Deutsche Dendr.* ed. 2, 163. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 74. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 107. — Wenzig, *Bot. Jahrb.* iv. 180. — Watson & Coulter, *Gray's Man.* ed. 6, 335. — Koehne, *Deutsche Dendr.* 511.

? **Fraxinus Nova Anglia**, Miller, *Dict.* ed. 8. No. 5 (1768).

Fraxinus alba, Marshall, *Arbust. Am.* 51 (1785). — Hayne, *Dendr. Fl.* 223.

Fraxinus acuminate, Lamarck, *Dict.* ii [illegible] 7 (1786). — Borkhausen, *Handb. Forst. Bot.* i. 824. — Bosc, *Mém. Inst.* ix. 205. — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 580. — Pursh, *Fl. Am. Sept.* i. 9. — Nuttall, *Gen.* ii. 231; *Sylva*, iii. 64. — Hayne, *Dendr. Fl.* 220. — Elliott, *Sk.* ii. 672. — Roemer & Schultes, *Syst.* i. 277. — Sprengel, *Syst.* i. 95. — Darlington, *Fl. Cestr.* ed. 2, 8. — Don, *Gen. Syst.* iv. 56. — Emerson, *Trees Mass.* ed. 2, ii. 376, t.

? **Fraxinus juglandifolia**, Lamarck, *Dict.* ii. 548 (1786). — Bosc, *Mém. Inst.* ix. 209.

Fraxinus Caroliniensis, Wangenheim, *Nordam. Holz.* 81 (1787).

Fraxinus Canadensis, Gærtner, *Fruct.* i. 222, t. 49 (1788).

Fraxinus epiptera, Michaux, *Fl. Bor.-Am.* ii. 256 (1803). — Vahl, *Enum.* i. 50. — Willdenow, *Spec.* iv. 1102; *Berl. Baumz.* ed. 2, 147. — Persoon, *Syn.* ii. 605. — Desfontaines, *Hist. Arb.* i. 103. — Poiret, *Lam. Dict.* Suppl. ii. 671. — Nuttall, *Gen.* ii. 231. — Pursh, *Fl. Am. Sept.* i. 8. — Elliott, *Sk.* ii. 672. — Roemer & Schultes, *Syst.* i. 278. — Sprengel, *Syst.* i. 96. — Don, *Gen. Syst.* iv. 55. — Loudon, *Arb. Brit.* ii. 1237. — Hooker, *Fl. Bor.-Am.* ii. 50. — De Candolle, *Prodr.* viii. 277.

Fraxinus Americana, var. latifolia, Loudon, *Arb. Brit.* ii. 1232 (1838). — D. J. Browne, *Trees of America*, 395.

Fraxinus Americana, var. normale, Wesmael, *Bull. Soc. Bot. Belg.* xxx. 107 (1892).

Fraxinus Americana, var. acuminata, Wesmael, *Bull. Soc. Bot. Belg.* xxx. 107 (1892).

Fraxinus Americana, var. epiptera, Wesmael, *Bull. Soc. Bot. Belg.* xxx. 107 (1892).

A tree, sometimes one hundred and twenty feet in height, with a tall massive trunk five or six feet in diameter, although usually much smaller, and stout upright or spreading branches, which in the forest form a narrow crown, or, if the tree has found sufficient space in which to extend them, a broad round-topped or pyramidal head. The bark of the trunk, which varies from one to three inches in thickness, is dark brown or gray tinged with red, and deeply divided by narrow fissures into broad flattened ridges separating on the surface into thin appressed scales. The branches are stout and terete, and when they first appear are dark green or brown tinged with red, and covered with scattered pale hairs; they soon become light orange-color or ashy gray and marked with pale lenticels, and in their first winter they are gray or light brown, lustrous, often covered with a glaucous bloom, and roughened by the large pale semiorbicular leaf-scars which display near the margin a line of conspicuous fibro-vascular bundle-scars; later the branches grow darker. The leaf-buds are broadly ovate, and obtuse, with four pairs of scales; those of the outer pair are ovate, acute, apiculate, conspicuously keeled on the back, nearly black, slightly puberulous, and about half the length of those of the second pair, which are ovate, rounded or apiculate at the apex, dark-colored and puberulous above the middle, and do not entirely inclose the scales of the third pair, which lengthen with the young shoot, and at maturity are oblong-obovate, narrowed and rounded at the apex, keeled, half an inch long, and coated with rusty pubescence; the scales of the inner row are also accrescent, and when fully grown are two thirds of an inch long, ovate, pointed, keeled, sometimes slightly pinnatifid, green, tinged with brown toward the apex, covered with pellucid spots, and very lustrous. The leaves are eight to twelve inches long, with stout grooved petioles and five to nine stalked leaflets; these are ovate to oblong-lanceolate, generally falcate, long-pointed, unequally wedge-shaped or often rounded at the base, and entire or remotely and obscurely crenulate-serrate; when they unfold they are thin and glabrous, or sometimes pubescent on the lower surface, and at maturity they are thick and firm, or subcoriaceous, dark green and often lustrous above, pale, frequently silvery white, and glabrous or pubescent below, three to five inches long and an inch and a half to three inches wide, with broad pale midribs compressed above, and many conspicuous veins arcuate near the margins. The leaves appear late in the spring, and fall early in the autumn after turning on some individuals deep purple and on others clear bright yellow. The flowers open before the leaves, and are produced, the males and females on separate plants, in compact or ultimately elongated glabrous panicles from buds covered with dark ovate scales rounded at the apex and slightly keeled on the back. The lower bracts are oblong-ovate, narrowed at the apex, light green and rather longer than those at the base of the lateral flowers of the ultimate divisions of the inflorescence, which are linear, one third of an inch in length, and caducous. The calyx is campanulate, slightly four-lobed in the sterile flower, and deeply lobed or laciniately cut in the pistillate flower. The stamens, of which three occasionally appear in one flower, are composed of short stout filaments and of large oblong-ovate apiculate anthers which, when the buds first open, are nearly black, later becoming reddish purple, and finally appearing yellow by the discharge of the abundant pollen. The ovary of the pistillate flower is contracted into a long slender style, divided into two spreading dark purple stigmatic lobes, which usually mature and wither before the anthers of trees in the neighborhood shed their pollen. The fruit, which varies from an inch to nearly two inches in length, or sometimes, on trees in the Gulf states, is less than half an inch long,[1] is produced in crowded clusters six or eight inches long, and hangs on the leafless branches until midwinter; it is lanceolate or oblong, and surrounded at the base by the persistent calyx, with a short terete oblong marginless conspicuously many-rayed body much shorter than the thin terminal wing which is pointed or emarginate at the apex.

Fraxinus Americana, which is one of the most valuable timber-trees of eastern North America, is distributed from Nova Scotia, New Brunswick, and southern Ontario[2] to northern Minnesota; it ranges south to northern Florida, central Alabama and Mississippi, and west in the United States to eastern Nebraska[3] and Kansas, the Indian Territory, and to the valley of the Trinity River in Texas. In much of this great region it is a common inhabitant of the forest, growing in rich rather moist soil on low hills or often in the neighborhood of streams, and attaining its greatest size on the fertile bottom-lands of the basin of the lower Ohio River. In the south, and west of the Mississippi River, the White Ash is less common and of smaller size, and produces less valuable wood, than in the northeastern and central states.

The wood of *Fraxinus Americana* is heavy, hard, strong, coarse-grained, and tough, although ultimately brittle; it contains numerous obscure medullary rays and rows of large open ducts clearly marking the layers of annual growth, and in slowly grown specimens often occupying nearly the entire width of the annual rings. It is brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6543, a cubic foot weighing 40.77 pounds. It is used in immense quantities

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[1] The small-fruited variety, first noticed in northern Florida, was described by Gray as: —

Fraxinus Americana, var. *microcarpa*, *Syn. Fl. N. Am.* ii. pt. i. 75 (1878). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 108. — Mohr, *Garden and Forest*, v. 508.

Fraxinus albicans, Buckley, *Proc. Phil. Acad.* 1862, 4 (in part).

Fraxinus Curtissii, Vasey, *Cat. Forest Trees U. S.* 20 (1876).

The fruit of all the American Ash-trees, however, varies in size, and it is not uncommon to find the largest and smallest fruits of *Fraxinus Americana* mixed together on a single branch.

[2] Brunet, *Cat. Vég. Lig. Can.* 41. — Macoun, *Cat. Can. Pl.* i. 310.

[3] Bessey, *Bull. Exper. Stat. Nebraska*, iv. art. iv. 21.

in the manufacture of agricultural implements, for the handles of tools, in carriage-building, for oars and furniture, and in the interior finish of buildings. The inner bark of the White Ash has been successfully employed in dysmenorrhœa,[1] and in homœopathic practice.[2]

The earliest description of *Fraxinus Americana* appears in the *Flora Virginica* of Clayton, published in 1739.[3] By Aiton[4] it was said to have been introduced into English gardens in 1724 by Mark Catesby, although the Ash described by Catesby is another species.

The rapid growth of the White Ash, its freedom from disease and the attacks of insects, its dense crown of large dark green leaves, its clean gray trunk, the beauty of its foliage in autumn and of its leafless branches in winter, make the White Ash, in spite of its late leafage, one of the best ornamental trees of the American forest; and in the eastern states it is more often used for the decoration of parks and streets than any other American Ash.[5]

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[1] Johnson, *Man. Med. Bot. N. Am.* 231. — *U. S. Dispens.* ed. 16, 1789.

[2] Millspaugh, *Am. Med. Pl. in Homœopathic Remedies*, ii. 137, t. 137.

[3] *Fraxinus foliolis integerrimis*, 122. — Royen, *Fl. Leyd. Prodr.* 533 (excl. syn. Catesby).

[4] *Hort. Kew.* iii. 445. — London, *Arb. Brit.* ii. 1232, f. 1055, t.

[5] Experiments in forest-planting have been made in recent years with the White Ash on the western prairies where, however, it appears less able to resist the effects of drought and to grow less rapidly than the Green Ash. In the elevated regions of central Europe it is more promising as a timber-tree; and, as it begins to grow there fully two weeks later in the season than the European *Fraxinus excelsior*, it generally escapes the effects of late spring frosts, which often destroy the tender shoots of that tree. (See R. Hartig, *Ausl. Holz. Bayer. Staatswald.* 39 [*Forst.-nat. Zeit.* 1892].)

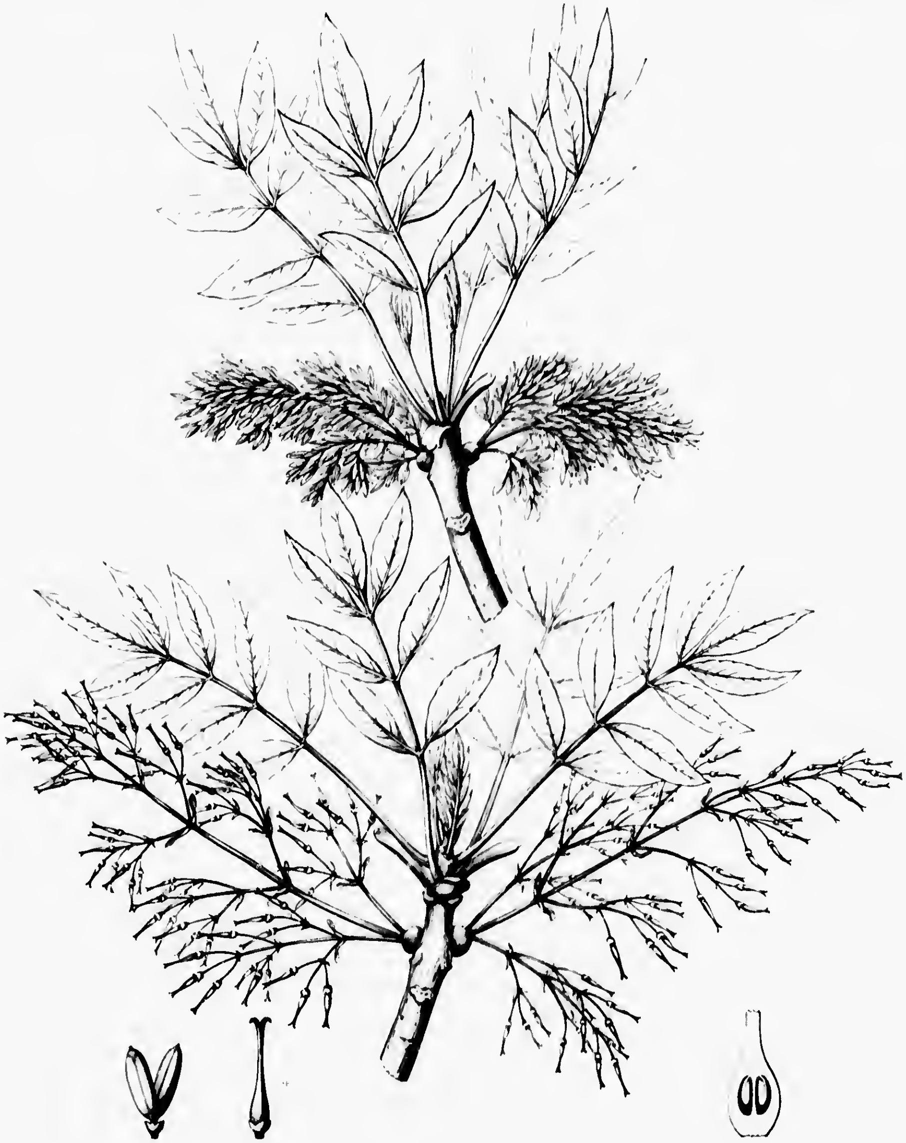
EXPLANATION OF THE PLATES.

Plate CCLXVIII. Fraxinus Americana.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. Vertical section of an ovary, enlarged.

Plate CCLXIX. Fraxinus Americana.

1. A fruiting branch, natural size.
2. A fruit, natural size.
3. Vertical section of a fruit, natural size.
4. A seed, enlarged.
5. An embryo, enlarged.
6. A leaf, natural size.
7. A winter branchlet, natural size.
8. A cluster of fruit of the variety *microcarpa*, natural size.



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FRAXINUS AMERICANA.

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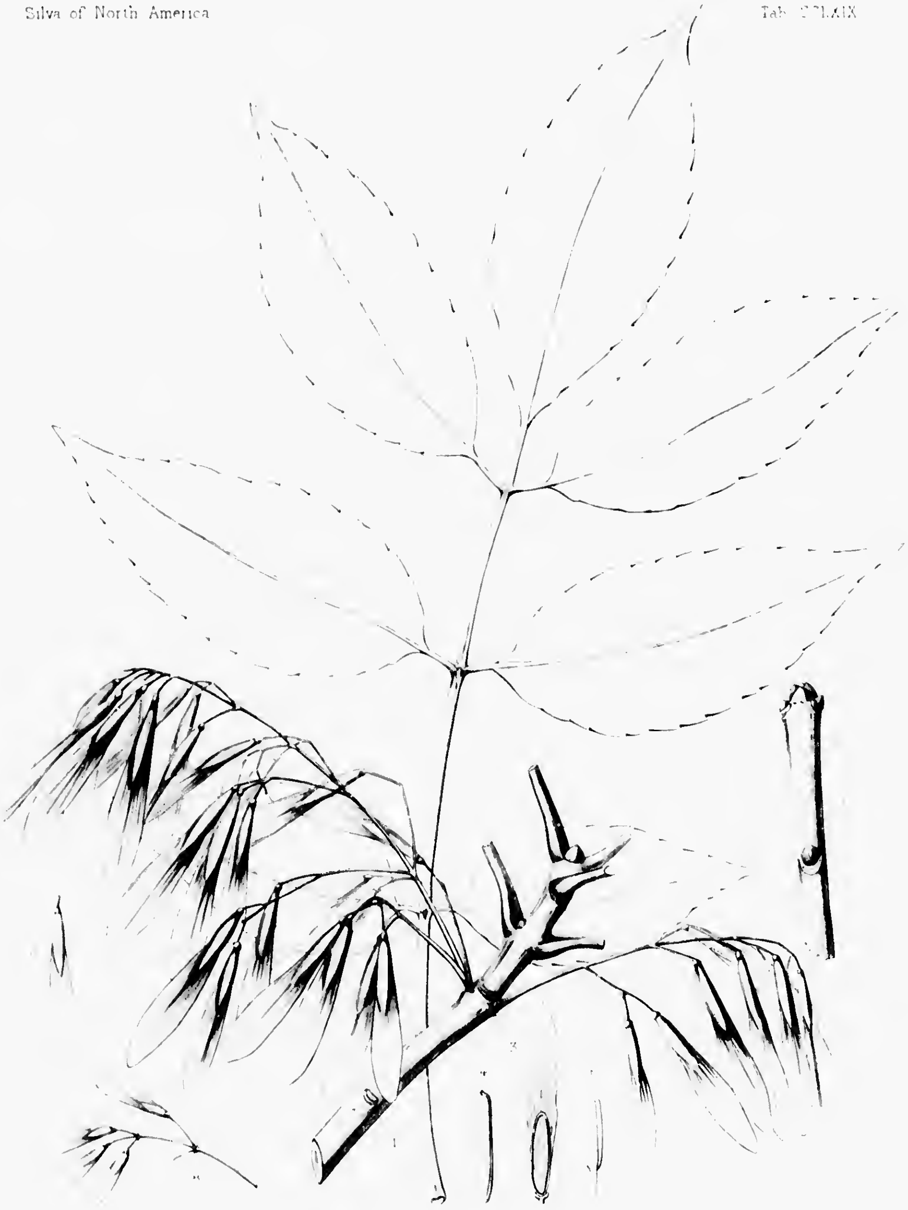

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FRAXINUS TEXENSIS.

Mountain Ash.

Leaflets usually 5, ovate to broadly oval, rounded or slightly acute at the apex, pale on the lower surface.

Fraxinus Texensis.
Fraxinus albicans, Buckley, *Proc. Phil. Acad.* 1862, 4 (in part).
Fraxinus coriacea, Watson, *Am. Nat.* vii. 302 (in part) (1873).
Fraxinus Americana, var. **Texensis**. Gray, *Syn. Fl. N. Am.* ii. pt. i. 75 (1878). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 108. — Wenzig, *Bot. Jahrb.* iv. 182. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 259 (*Man. Pl. W. Texas*). — Reverchon, *Garden and Forest*, vi. 524.

A tree, rarely fifty feet in height, with a short trunk occasionally two or three feet in diameter, and thick spreading often contorted branches; or usually much smaller. The bark of the trunk is half to three quarters of an inch in thickness, dark gray, and deeply divided by narrow fissures into broad scaly ridges. The branchlets are stout and terete, and when they first appear are dark green, often tinged with red, and slightly puberulous; during the summer they become light yellow-brown, or light orange-color, and during their first winter they are light brown marked with remote oblong pale lenticels and with large elevated lunate leaf-scars which display a row of conspicuous fibro-vascular bundle-scars; in the second or third year they grow dark gray or reddish brown. The leaf-buds are ovate and acute, with three pairs of scales; the scales of the outer row are broadly ovate, rounded at the apex, dark orange-color, and pilose toward the base; those of the second row are accrescent, ovate, rounded, coated with rufous tomentum, nearly half an inch long when fully grown, and about half the length of those of the inner rank, which are linear-strap-shaped, truncate or emarginate at the apex, and orange-color. The leaves are five to eight inches long, with elongated slender terete petioles and five or occasionally seven usually long-stalked leaflets; these are ovate, broadly oval, or obovate, rounded or acute at the apex, wedge-shaped, rounded or sometimes slightly cordate at the base, and coarsely crenulate-serrate mostly above the middle; when they unfold they are light green slightly tinged with red, and pilose with occasional pale caducous hairs; and at maturity they are thick and firm, dark green on the upper surface, pale and sometimes silvery white on the lower surface, two inches to two inches and a half long and an inch to two inches wide, with broad midribs deeply impressed above and often furnished below with tufts of short white hairs in the axils of the numerous conspicuous veins which fork near the margins and are connected by coarse reticulate veinlets. The male and female flowers, which are borne on separate individuals, appear early in March as the leaves begin to unfold, and are produced in compact glabrous panicles developed from the axils of leaves of the previous year and covered in the bud by ovate rounded orange-colored scales. The bracts are narrowly obovate, rounded or acute at the apex, scarious and early deciduous. The staminate flower is composed of a minute or nearly obsolete slightly four-lobed calyx and of two stamens with short filaments and linear-oblong light purple apiculate anthers. In the female flower the calyx is oblong, cup-shaped, and divided to the base into four acute lobes; the ovary is gradually narrowed into a long slender style terminating in two large stigmatic lobes. The fruit, which hangs in short compact clusters, ripens in May; it is spatulate or oblong, surrounded at the base by the persistent calyx, and half an inch to nearly an inch in length, with a short terete marginless many-rayed body about one third as long as the terminal wing, which is usually rounded or sometimes emarginate at the apex.

Fraxinus Texensis, which grows on high dry limestone bluffs and ridges, is distributed through northern, central, and western Texas from the neighborhood of the city of Dallas to the valley of the Devil's River.

The wood of *Fraxinus Texensis* is heavy, hard, strong, and coarse-grained, with numerous obscure medullary rays and bands of one or several rows of open ducts marking the layers of annual growth, and is light brown, with thin lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.7636, a cubic foot weighing 47.59 pounds. It makes excellent fuel, and when it can be obtained of sufficient size is used and much valued for flooring.

Fraxinus Texensis was discovered near the Devil's River on the 16th of September, 1852, by Dr. J. M. Bigelow[1] of the United States and Mexican Boundary Survey Commission.

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[1] See i. 88.

EXPLANATION OF THE PLATE.

Plate CCLXX. Fraxinus Texensis.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. Vertical section of a fruit, natural size.
7. An embryo, enlarged.
8. A winter branchlet, natural size.

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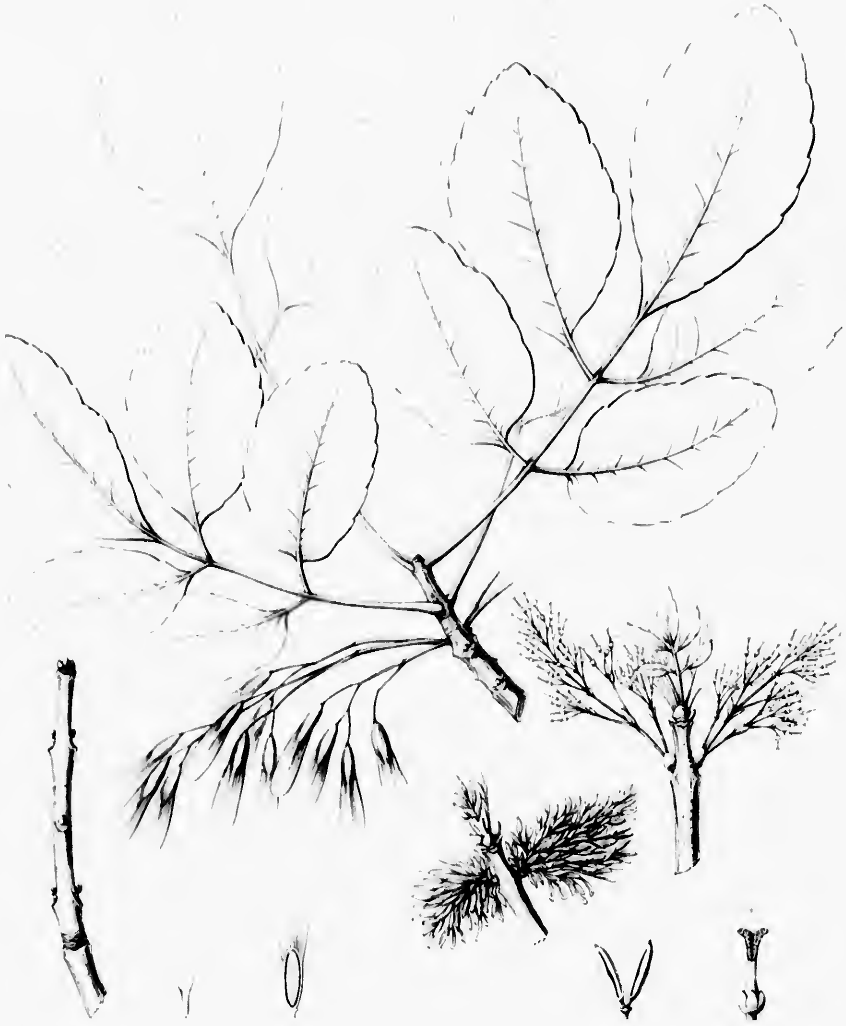

FRAXINUS TEXENSIS

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FRAXINUS PENNSYLVANICA.

Red Ash.

Leaflets 7 to 9, oblong-lanceolate to ovate, mostly coarsely serrate, clothed on their lower surface like the young shoots with velvety pubescence.

Fraxinus Pennsylvanica, Marshall, *Arbust. Am.* 51 (1785). — Koch, *Dendr.* ii. 253. — Lauche, *Deutsche Dendr.* ed. 2, 163, f. 53. — Sudworth, *Rep. Sec. Agric.* 1892, 326. — Koehne, *Deutsche Dendr.* 511. f. 90. E–H.

Fraxinus pubescens, Lamarck, *Dict.* ii. 548 (1786). — Walter, *Fl. Car.* 254. — Willdenow, *Berl. Baumz.* 119; *Spec.* iv. 1103; *Enum.* 1060. — Borkhausen, *Handb. Forst. Bot.* i. 827. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 393. — Vahl, *Enum.* i. 51. — Persoon, *Syn.* ii. 604. — *Nouveau Duhamel*, iv. 62. — Desfontaines, *Hist. Arb.* i. 102. — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 582. — Pursh, *Fl. Am. Sept.* i. 9. — Roemer & Schultes, *Syst.* i. 279. — Nuttall, *Gen.* ii. 231. — Hayne, *Dendr. Fl.* 223. — Elliott, *Sk.* ii. 673. — Sprengel, *Syst.* i. 95. — Don, *Gen. Syst.* iv. 55. — Hooker, *Fl. Bor.-Am.* ii. 51. — De Candolle, *Prodr.* viii. 278. — Emerson, *Trees Mass.* 337. — Darlington, *Fl. Cestr.* ed. 3, 239. — Chapman, *Fl.* 370. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 54. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 75. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 69. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 108. — Wenzig, *Bot. Jahrb.* iv. 183. — Watson & Coulter, *Gray's Man.* ed. 6, 336.

Fraxinus pubescens, β longifolia, Vahl, *Enum.* i. 52 (1804). — Willdenow, *Spec.* iv. 1104. — Pursh, *Fl. Am. Sept.* ii. 9. — Loudon, *Arb. Brit.* ii. 1233. — De Candolle, *Prodr.* viii. 278.

Fraxinus pubescens, γ latifolia, Vahl, *Enum.* i. 52 (1804). — Willdenow, *Spec.* iv. 1104. — Pursh, *Fl. Am. Sept.* i. 9. — Hayne, *Dendr. Fl.* 223. — Loudon, *Arb. Brit.* ii. 1233. — De Candolle, *Prodr.* viii. 278.

Fraxinus pubescens, var. **subpubescens**, Persoon, *Syn.* ii. 605. — Pursh, *Fl. Am. Sept.* i. 9. — Loudon, *Arb. Brit.* ii. 1234. — De Candolle, *Prodr.* viii. 278.

Fraxinus longifolia, Bosc, *Mém. Inst.* ix. 209 (1808).

Fraxinus subvillosa, Bosc, *Mém. Inst.* ix. 209 (1808).

Fraxinus tomentosa, Michaux f. *Hist. Arb. Am.* iii. 112, t. 9 (1813).

? **Fraxinus discolor**, Rafinesque, *Fl. Ludovic.* 37 (1817). — Spach, *Hist. Vég.* viii. 297.

Fraxinus Americana, var. **pubescens**, D. J. Browne, *Trees of America*, 395 (1846).

Fraxinus oblongocarpa, Buckley, *Proc. Phil. Acad.* 1862, 4.

Fraxinus viridis, var. **pubescens**, Hitchcock, *Trans. St. Louis Acad.* v. 507 (1891).

A tree, forty to sixty feet in height, with a trunk rarely exceeding eighteen or twenty inches in diameter, and stout upright twiggy branches which form a compact irregularly shaped head. The bark of the trunk is one half to two thirds of an inch thick, brown tinged with red and slightly furrowed, the surface of the ridges separating into thin appressed scales. The branchlets are slender and terete, and when they first appear are more or less coated with pale pubescence, which sometimes continues to cover them until the second or third year and often disappears during the first summer; ultimately they become ashy gray or light brown tinged with red, and are frequently covered with a glaucous bloom, and marked with pale lenticels and in their first winter with semicircular leaf-scars in which appears a short row of large fibro-vascular bundle-scars. The leaf-buds are about an eighth of an inch long, with three pairs of scales coated with rufous tomentum; those of the outer pair are acute, rounded on the back, and truncate at the apex; those of the second and third pairs lengthen with the young shoot and are shorter than those of the inner rank, which at maturity are often an inch or an inch and a half long and are sometimes pinnately cut toward the apex. The leaves are ten to twelve inches long, with stout slightly grooved pubescent petioles and seven to nine leaflets; these are oblong-lanceolate or ovate, gradually narrowed at the apex into long slender points, unequally wedge-shaped at the base, and obscurely serrate, or often entire below the middle; when they unfold they are coated on the lower surface and on the petioles with thick white tomentum, and are lustrous and puberulous on the upper surface; at maturity they are thin and firm, with conspicuous midribs and branching veins, four to six inches long, an inch to an inch and a half wide, light yellow-green on the upper side and pale on the under side, which is covered, like the short thick grooved petiolules, with silky pubescence. In the autumn the leaves turn yellow or rusty brown before falling. The flowers appear late in the spring as the leaves begin to unfold, the males and females being produced on separate trees in rather compact tomentose panicles covered in the bud with ovate scales coated with rusty tomentum. The lower bracts are obovate, rounded, and a little larger than those at the base of the ultimate divisions of the panicle, which are lanceolate and more or less laciniately cut. The staminate flower is composed of a minute obscurely toothed cup-shaped calyx and of two stamens with linear-oblong light green anthers tinged with purple and borne on short slender filaments. The calyx of the pistillate flower is cup-shaped, deeply divided, and as long as the ovary, which is gradually narrowed into an elongated style divided at the apex into two green stigmatic lobes. The fruit, which is borne in open glabrous or pubescent panicles, and remains on the branches during the winter, is one to two inches in length, surrounded at the base by the persistent calyx, and linear or narrowly spatulate, with a slender terete many-rayed body tapering gradually from the summit to the base and margined above by the thin decurrent wing, which is narrowed, rounded, acute or apiculate at the apex, and as long or somewhat longer than the body.

Fraxinus Pennsylvanica is distributed from New Brunswick to southern Ontario,[1] eastern Nebraska, and the Black Hills of Dakota, and southward to northern Florida and central Alabama. It inhabits low rich moist soil near the banks of streams and lakes, and is most common and attains its largest size in the north Atlantic states. West of the Alleghany Mountains it is smaller and less common.

The wood of *Fraxinus Pennsylvanica* is heavy, hard, rather strong, brittle, and coarse-grained; it contains numerous thin medullary rays, and is light brown, with thick lighter brown sapwood streaked with yellow. The specific gravity of the absolutely dry wood is 0.6215, a cubic foot weighing 38.96 pounds. It is sometimes confounded with the more valuable wood of the White Ash, and is employed in the same way.

The Red Ash, which probably owes its name to the light red color of the inner surface of the outer bark[2] of the branches, was, according to Aiton,[3] introduced into English gardens in 1783. It is often cultivated in the eastern states, although as a shade or ornamental tree it is less valuable than the White Ash.

The Green Ash,[4] which is perhaps best considered as a variety of this species, ranges from the

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[1] Brunet, *Cat. Vég. Lig. Can.* 42. — Macoun, *Cat. Can. Pl.* i. 316.

[2] The inner surface of the bark of the branches of the White Ash is often of the same color.

[3] *Hort. Kew.* ed. 2, v. 476. — Loudon, *Arb. Brit.* ii 1233, f. 1056 (*Fraxinus pubescens*).

[4] *Fraxinus Pennsylvanica*, var. *lanceolata*.

Fraxinus juglandifolia, Willdenow, *Berl. Baumz.* 117 (not Lamarck) (1795); *Spec.* iv. 1104; *Enum.* 1060. — Vahl, *Enum.* i. 50. — Persoon, *Syn.* ii. 604. — *Nouveau Duhamel*, iv. 63, t. 16. — Aiton, *l. c.* — Pursh, *Fl. Am. Sept.* i. 9. — Roemer & Schultes, *Syst.* i. 278. — Sprengel, *Syst.* i. 96. — Don, *Gen. Syst.* iv. 55. — Loudon, *l. c.* 1236, f. 1061, 1062, t. — Gray, *Man.* 373.

Fraxinus Caroliniana, Willdenow, *Berl. Baumz.* 119 (not Miller nor Lamarck) (1796); *Spec.* iv. 1103; *Enum.* 1060. — Pursh, *l. c.* — Nuttall, *Gen.* ii. 231. — Elliott, *Sk.* ii. 673. — Hayne, *Dendr. Fl.* 223. — Sprengel, *l. c.* — Don, *l. c.* — Koehne, *Deutsche Dendr.* 511.

Fraxinus lanceolata, Borkhausen, *Handb. Forst. Bot.* i. 826 (1800).

Fraxinus juglandifolia, β *subintegerrima*, Vahl, *l. c.* (1804). — Loudon, *l. c.*

Fraxinus Caroliniana, β *latifolia*, Willdenow, *Spec.* iv. 1103 (1805).

Fraxinus expansa, Willdenow, *Berl. Baumz.* ed. 2, 150 (1811). — Roemer & Schultes, *l. c.* 279. — Don, *l. c.* — Loudon, *l. c.* 1238. — De Candolle, *Prodr.* viii. 278. — Wenzig, *Bot. Jahrb.* iv. 184. — Sudworth, *Rep. Sec. Agric.* 1892, 326.

Fraxinus viridis, Michaux, *Hist. Arb. Am.* iii. 115, t. 10 (excl. fruit) (1813). — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 582. — Hayne, *l. c.* 222. — Chapman, *Fl.* 370. — Gray, *Pacific R. R. Rep.* xii. pt. ii. 46; *Syn. Fl. N. Am.* ii. pt. i. 75. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 51. — Watson, *King's Rep.* v. 284. — Bell, *Rep. Geolog. Surv. Can.* 1879-80, 19c. — Hemsley, *Bot. Biol. Am. Cent.* ii. 305. — Burgess, *Bot. Gazette*, vii. 95. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 109. — Wenzig, *l. c.* 186. — Macoun, *Cat. Can. Pl.* i. 316. — Watson & Coulter, *Gray's Man.* ed. 6, 336. — Koehne, *l. c.* 512.

Fraxinus Americana, Hooker, *Fl. Bor.-Am.* ii. 51 (in part) (1838).

Fraxinus pubescens, Torrey, *Fl. N. Y.* ii. 126, t. 90 (not Lamarck) (1843).

Fraxinus Americana, var. *juglandifolia*, D. J. Browne, *Trees of America*, 398 (1846).

Fraxinus Novæ-Angliæ, Koch, *Dendr.* ii. 251 (not Miller nor Wangenheim) (1872). — Lauche, *Deutsche Dendr.* ed. 2, 162, f. 53.

Fraxinus Americana, subspec. *Novæ-Angliæ*, Wesmael, *Bull. Bot. Soc. Belg.* xxx. 108 (1892).

shores of Lake Champlain in Vermont through the Appalachian region to northern Florida, and westward to the valley of the Saskatchewan, the valley of the Colorado River in Texas, the eastern ranges of the Rocky Mountains, the Wasatch Range of Utah, and the mountains of eastern and northern Arizona. In extreme forms it may be distinguished from the Red Ash by its glabrous leaves and branchlets and by its rather narrower and shorter and usually more sharply serrate leaflets, which are lustrous and bright green on both surfaces. The leaflets are often pale on the lower surface, however, and on trees in Nebraska and North Dakota they are occasionally coated, as well as the branches, with pale tomentum. In the territory east of the Mississippi River, where the Red Ash and the Green Ash sometimes grow side by side, they retain their individual character, but in the west the two extremes are connected by many intermediate forms which can as well be referred to one as to the other. The flowers of the two trees are indistinguishable, and the fruit of one shows all the varieties of form of the other.

Fraxinus Pennsylvanica, var. *lanceolata*, which rarely attains a greater height than sixty feet or produces a trunk more than two feet in diameter covered with gray furrowed bark, is a handsome round-topped tree with slender spreading branches, ashy gray terete branchlets marked with pale lenticels, and bud-scales covered with dark rusty pubescence. It grows on the banks of rivers, and, comparatively rare east of the Alleghany Mountains, is most abundant in the Mississippi basin, often covering the banks of streams flowing east from the Rocky Mountains and farther west inhabiting elevated cañons.

The wood of *Fraxinus Pennsylvanica*, var. *lanceolata*, is heavy, hard, strong, brittle, and rather coarse-grained; it is brown, with thick lighter colored sapwood, and contains numerous obscure medullary rays and bands of several rows of open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.7117, a cubic foot weighing 44.35 pounds. Inferior in quality, it is sometimes used as a substitute for the wood of the White Ash.

The beauty of the dark and lustrous foliage of the Green Ash, its great hardiness and ability to flourish in regions of small and uncertain rainfall, the rapid growth of seedling plants and the ease with which they may be transplanted, have made it a favorite ornamental tree in many of the western states, where it is now more frequently planted in streets, parks, and shelter-belts than any other Ash-tree.

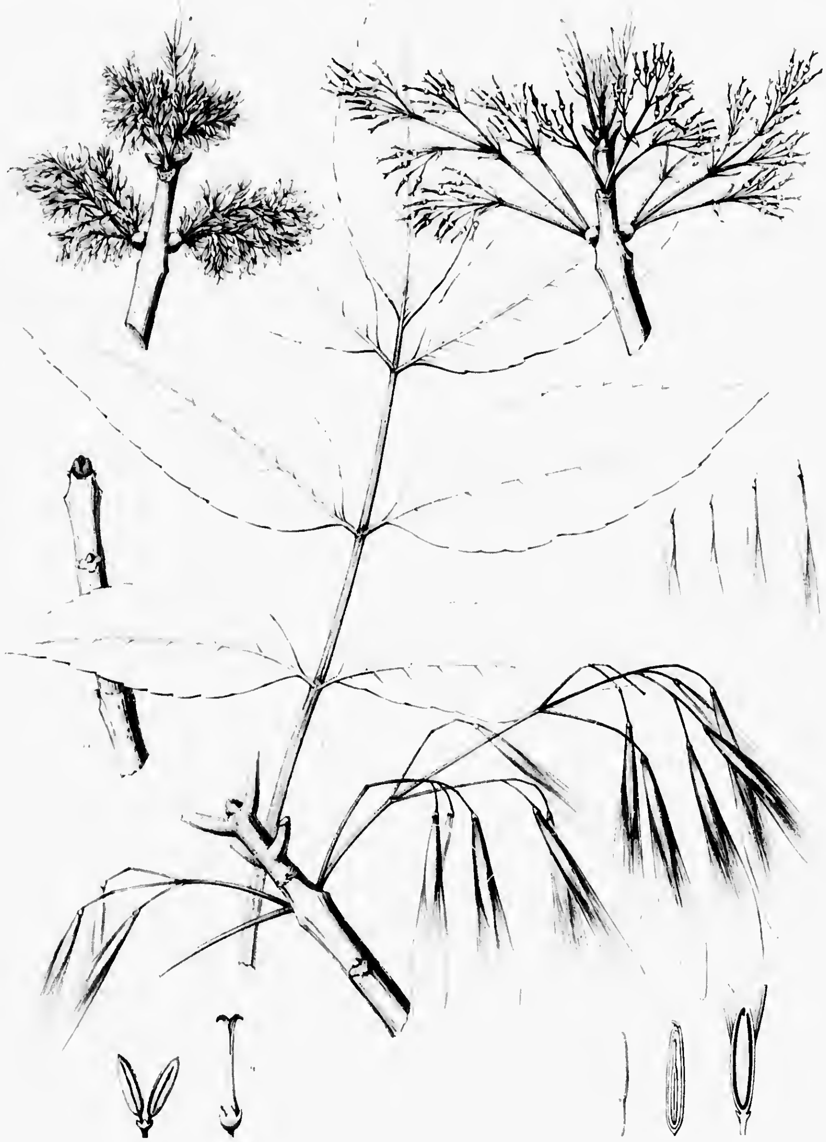
EXPLANATION OF THE PLATES.

PLATE CCLXXI. FRAXINUS PENNSYLVANICA.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. Fruits of different forms, natural size.
7. Vertical section of a fruit, natural size.
8. Vertical section of a seed, enlarged.
9. An embryo, enlarged.
10. A leaf, natural size.
11. A winter branchlet, natural size.

PLATE CCLXXII. FRAXINUS PENNSYLVANICA, *var.* LANCEOLATA.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. Staminate flowers, enlarged.
4. A pistillate flower, enlarged.
5. Vertical section of a pistil, enlarged.
6. A fruiting branch, natural size.
7. Fruits of different forms, natural size.
8. Vertical section of a fruit, natural size.
9. A seed, natural size.
10. A leaf, natural size.
11. A winter branchlet, natural size.



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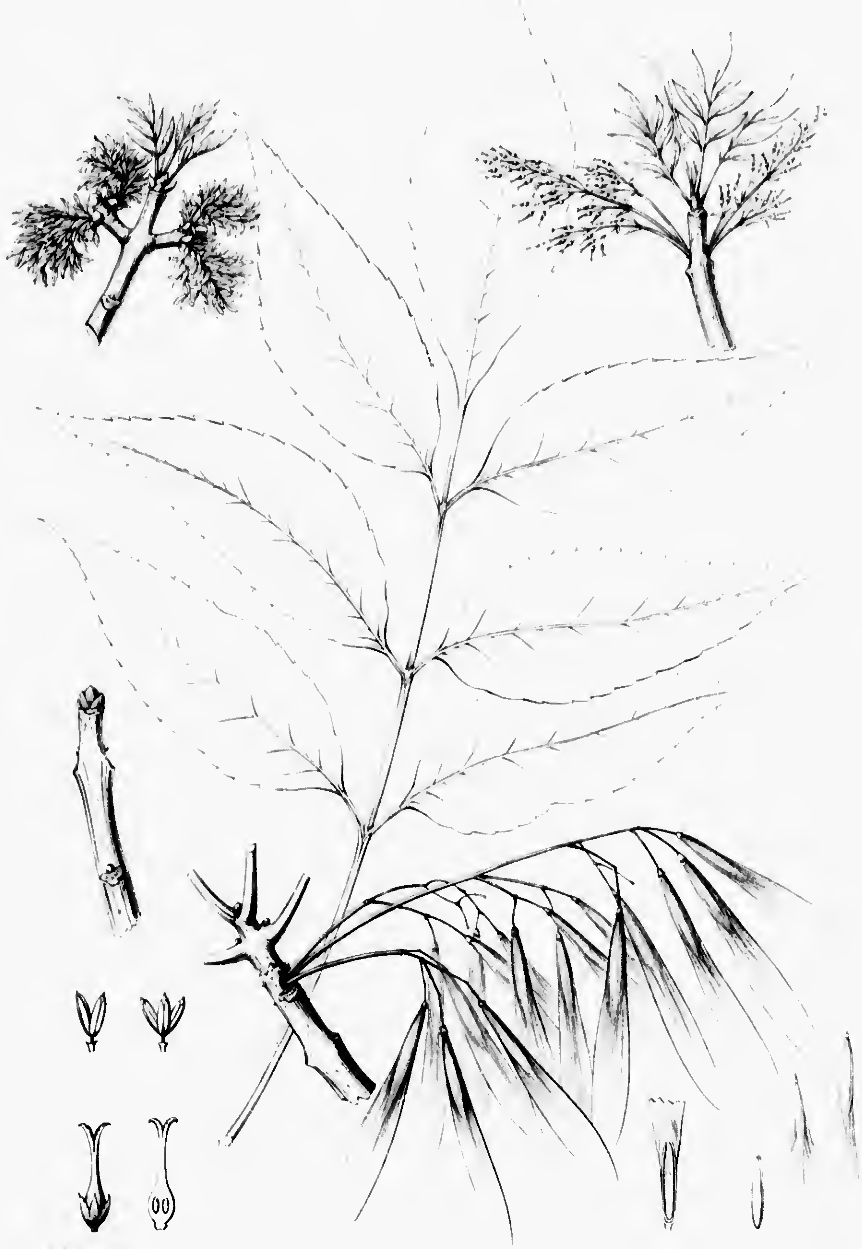

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FRAXINUS BERLANDIERIANA.

Ash.

Leaflets 3 to 5, oblong-lanceolate, acute or rounded at the apex, entire or coarsely serrate.

Fraxinus Berlandieriana, De Candolle, *Prodr.* viii. 278 (1844).

Fraxinus viridis, var. **Berlandieriana**, Torrey, *Bot. Mex. Bound. Surv.* 166 (1859). — Gray, *Syn. Fl. N. Am.* ii. pt. i. 75. — Hemsley, *Bot. Biol. Am. Cent.* ii. 305. — Watson, *Proc. Am. Acad.* xviii. 113. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 109. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 259 (*Man. Pl. W. Texas*).

Fraxinus trialata, Buckley, *Proc. Phil. Acad.* 1862, 5.

Fraxinus pubescens, var. **Berlandieriana**, Wenzig, *Bot. Jahrb.* iv. 183 (1883).

Fraxinus pubescens, var. **Lindheimeri**, Wenzig, *Bot. Jahrb.* iv. 184 (1883).

Fraxinus Americana, var. **Berlandieriana**, Wesmael, *Bull. Soc. Bot. Belg.* xxx. 108 (1892).

A tree, rarely attaining within the territory of the United States a greater height than thirty feet or producing a trunk more than a foot in diameter; but in Mexico, especially in cultivation, sometimes sixty or seventy-five feet tall, with a trunk six or eight feet in diameter, and spreading branches which form a broad graceful head. The bark of the trunk is dark gray tinged with red, an inch to an inch and a half thick, and divided by shallow interrupted fissures into narrow ridges. The branchlets are terete and slender, and when they first appear are light green, becoming in their first winter light brown tinged with red, or ashy gray, and marked with occasional lenticels and with the small elevated nearly circular leaf-scars, which display a short row of large fibro-vascular bundle-scars. The buds are acute, with dark brown puberulous scales. The leaves are three to seven inches long, with slender elongated petioles and three to five glabrous leaflets; these are ovate or rarely obovate, pointed or rounded at the apex, gradually narrowed at the base into long petiolules, sharply and coarsely serrate above the middle with acute teeth, or sometimes almost entire, thick and coriaceous, dark green and lustrous on the upper surface, paler on the lower, an inch and a half to four inches long, and half an inch to an inch and a half wide, with prominent midribs, and primary veins connected by conspicuous reticulated veinlets. The male and female flowers are produced on different individuals in short glabrous panicles inclosed in the bud by broadly ovate rounded chestnut-brown pubescent scales. The bracts are obovate or lanceolate, about half an inch long, covered with rusty pubescence, and caducous. The staminate flower consists of a minute obscurely lobed calyx and two linear-oblong apiculate anthers borne on short filaments. The calyx of the female flower is cup-shaped, deeply divided, and as long as the ovary, which is gradually narrowed into a slender style two-lobed and stigmatic at the apex. The fruit, which is often three-winged, is ovate or spatulate, surrounded at the base by the persistent calyx, and an inch to an inch and a half long, with a short clavate body more or less margined by the thin wing, which is ovate or obovate and usually narrowed toward the acute or rounded apex.

Fraxinus Berlandieriana grows naturally in the mountain forests of the state of Michoacan in southern Mexico, where it is probably widely distributed;[1] through the agency of man it has become common near streams in northeastern Mexico, and is occasionally found on the banks of the Nueces, the Rio Blanco, and other rivers of western Texas, where possibly it has been introduced since the settlement of the country by the Spaniards.

The wood of a small tree grown in western Texas is light, soft, close-grained, with many obscure medullary rays, small scattered open ducts and bands of larger ducts marking the layers of annual

[1] *Garden and Forest*, vii. 44.

growth. It is light brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.5780, a cubic foot weighing 36.02 pounds.[1]

Fraxinus Berlandieriana was discovered by the Belgian botanist[2] whose name it commemorates in the valley of the lower Rio Grande in July, 1829. For centuries it has been planted in the cities of the Mexican table-land, except in those of Chihuahua, and their parks and plazas are often dignified by single individuals or noble avenues of this species, which no other Ash-tree surpasses in stateliness and beauty.

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[1] The specific gravity of a specimen of the wood of this species taken from a larg tree cultivated in northern Mexico is 0.5459, a cubic foot weighing 34.01 pounds. In Mexico the wood is used in construction, for the interior finish of houses, and in the manufacture of tools.

[2] See i. 82.

EXPLANATION OF THE PLATE.

Plate CCLXXIII. Fraxinus Berlandieriana.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. Fruits of different forms, natural size.
7. Vertical section of a fruit, natural size.

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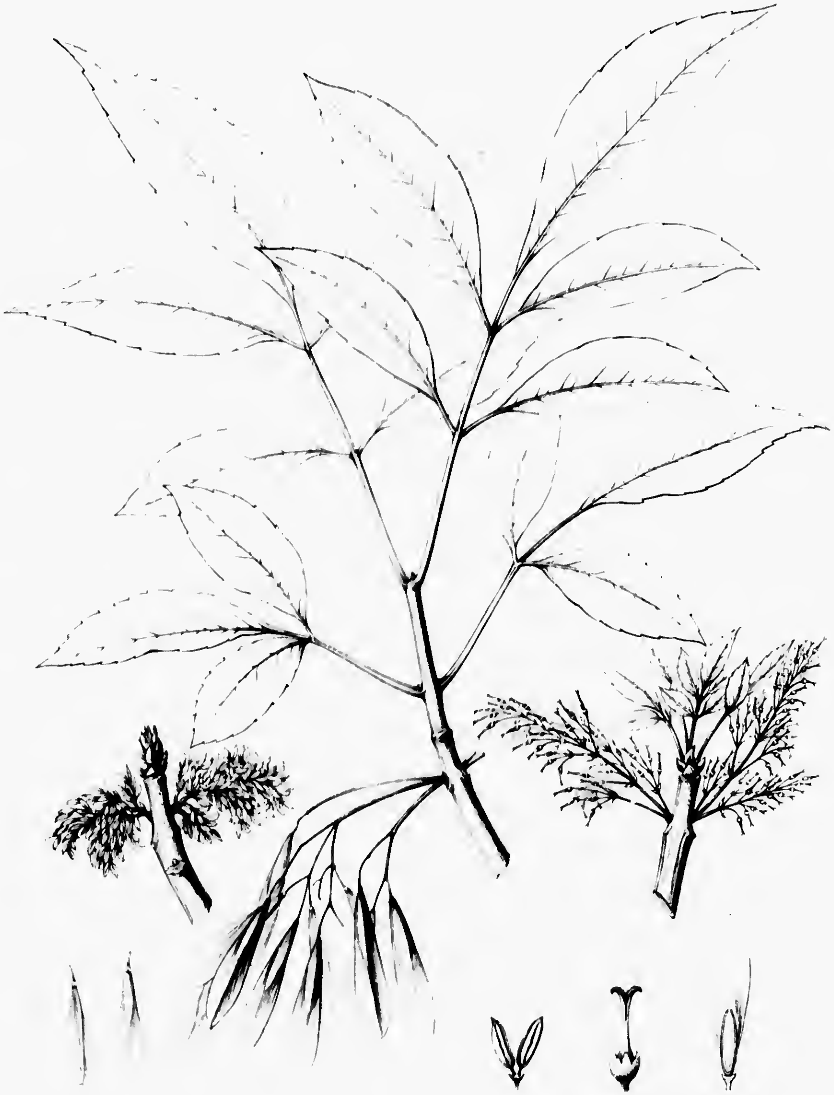

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FRAXINUS CAROLINIANA.

Water Ash. Swamp Ash.

Leaflets 5 to 7, ovate-oblong, acute, sharply serrate or entire, glabrous or pubescent.

Fraxinus Caroliniana, Miller, *Dict.* ed. 8, No. 6 (1768). — Du Roi, *Harbk. Baumz.* i. 287. — Lamarck, *Dict.* ii. 548. — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 582. — Roemer & Schultes, *Syst.* i. 279. — Don, *Gen. Syst.* iv. 55. — Koch, *Dendr.* ii. 258. — Lauche, *Deutsche Dendr.* ed. 2, 163. — Koehne, *Deutsche Dendr.* 511.

Fraxinus Americana, Marshall, *Arbust. Am.* 50 (not Linnæus) (1785).

? Fraxinus juglandifolia, Lamarck, *Dict.* ii. 548 (1786).

Fraxinus excelsior, Walter, *Fl. Car.* 254 (not Linnæus) (1788).

Fraxinus platycarpa, Michaux, *Fl. Bor.-Am.* ii. 256 (1803). — Vahl, *Enum.* i. 49. — Willdenow, *Spec.* iv. 1103. — Persoon, *Syn.* ii. 605. — *Nouveau Duhamel*, iv. 64. — Desfontaines, *Hist. Arb.* i. 103. — Michaux f. *Hist. Arb. Am.* iii. 128, t. 13. — Poiret, *Lam. Dict. Suppl.* ii. 671. — Pursh, *Fl. Am. Sept.* i. 9. — Roemer & Schultes, *Syst.* i. 278. — Nuttall, *Gen.* ii. 231. — Hayne, *Dendr. Fl.* 224. — Elliott, *Sk.* ii. 673. — Sprengel, *Syst.* i. 96. — Don, *Gen. Syst.* iv. 55. — De Candolle, *Prodr.* viii. 277. — Chapman, *Fl.* 370. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 53. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 75. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 110. — Wenzig, *Bot. Jahrb.* iv. 181. — Watson & Coulter, *Gray's Man.* ed. 6, 336.

Fraxinus pallida, Bosc, *Mém. Inst.* ix. 201 (1808).

Fraxinus pubescens, Bosc, *Mém. Inst.* ix. 210 (not Lamarck) (1808).

Fraxinus triptera, Nuttall, *Gen.* ii. 232 (1818); *Sylva*, iii. 62, t. 100. — Elliott, *Sk.* ii. 674. — Don, *Gen. Syst.* iv. 56. — Loudon, *Arb. Brit.* ii. 1240. — De Candolle, *Prodr.* viii. 277.

Fraxinus curvidens, Hoffmannsegg, *Verz. Pflanzenkult.* 29 (1824).

Fraxinus pauciflora, Nuttall, *Sylva*, iii. 61, t. 100 (1849).

Fraxinus Americana, var. **Caroliniana**, D. J. Browne, *Trees of America*, 398 (1846).

Fraxinus Americana, var. **triptera**, D. J. Browne, *Trees of America*, 399 (1846).

Fraxinus Nuttallii, Buckley, *Proc. Phil. Acad.* 1860, 441.

Fraxinus nigrescens, Buckley, *Proc. Phil. Acad.* 1862, 5.

Fraxinus Cubensis, Grisebach, *Cat. Pl. Cub.* 170 (1866).

Fraxinus platycarpa, var. **Floridana**, Wenzig, *Bot. Jahrb.* iv. 185 (1883).

Fraxinus nigra, subspec. **Caroliniana**, Wesmael, *Bull. Soc. Bot. Belg.* xxx. 113 (1892).

Samarpses triptera, Rafinesque, *New Fl.* iii. 93.

A tree, rarely exceeding forty feet in height, with a trunk sometimes twelve inches in diameter and slender branches which form a narrow often round-topped head. The bark of the trunk, which varies from a sixteenth to an eighth of an inch in thickness, is light gray, more or less marked with large irregularly shaped brown patches, and separates into small thin closely appressed scales. The branchlets are terete and slender, and when they first appear are light green, and glabrous or coated with rufous tomentum which soon disappears; and in their first winter they are light brown tinged with red and sometimes covered with a glaucous bloom, light gray, or yellow, and occasionally marked with large pale lenticels, and with the elevated semiorbicular leaf-scars in which appear a short row of conspicuous fibro-vascular bundle-scars. The leaf-buds are an eighth of an inch long, with three pairs of ovate acute chestnut-brown puberulous scales; those of the outer rank are thickened at the base, rounded on the back, and do not entirely inclose the scales of the second row. The leaves are seven to twelve inches long, with elongated stout terete pale petioles and five to seven long-stalked leaflets; these are ovate or oblong, acuminate, and usually long-pointed or rarely rounded at the apex, wedge-shaped or sometimes rounded or subcordate at the base, and coarsely serrate with acute incurved teeth or entire; when they unfold they are pilose above and more or less covered with pale tomentum below, and at maturity they are thick and firm, three to six inches long, two to three inches wide, dark green on the upper surface, and paler or sometimes yellow-green on the lower surface, which is glabrous, or pubescent, especially along the conspicuous pale midribs deeply impressed on the upper side, and the numerous arcuate veins connected by obscure reticulate veinlets. The flowers appear in February and March, the males and females being borne on different trees, and are produced in short or ultimately elongated panicles inclosed in the bud by chestnut-brown pubescent scales. The bracts are obovate, a third of an inch long, rounded at the apex, and coated with rusty pubescence. The staminate flower consists of a minute or nearly obsolete calyx, and of two or sometimes of four stamens with slender filaments and linear apiculate anthers. In the pistillate flower the deeply divided and laciniate cup-shaped calyx is as long as the ovary, which is gradually narrowed into an elongated slender style two-lobed and stigmatic at the apex. The fruit is elliptical, obovate or spatulate, frequently three-winged, surrounded at the base by the persistent calyx, and often marked on the two faces by a conspicuous impressed midvein; the broad thin wing, which is many-nerved, acute, and rounded or emarginate at the apex, surrounds the short compressed body, and is usually narrowed below into a stalk-like base.

Fraxinus Caroliniana inhabits the coast region of the Atlantic and Gulf states from southern Virginia to Cape Canaveral and the Caloosa River in Florida and the valley of the Sabine River in Texas, ranging northward through western Louisiana to southwestern Arkansas, and occurring also on the island of Cuba.[1] In the United States it grows always in deep often almost impassable river-swamps, inundated during several months of every year, under the shade of the Bald Cypress, the Red Maple, the Cotton Gum, the Water Oak, and the Liquidamber.

The wood of *Fraxinus Caroliniana* is light, soft, weak, close-grained, with remote obscure medullary rays and ducts; it is nearly white sometimes tinged with yellow, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.3541, a cubic foot weighing 22.07 pounds.

The first description of *Fraxinus Caroliniana* was published in 1731 by Mark Catesby in the *Natural History of Carolina*.[2] Although introduced by Catesby into English gardens in 1724,[3] the Water Ash, which is the smallest and the least valuable of the eastern species, probably cannot be found now beyond the limits of its native swamps.

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[1] *Fraxinus Caroliniana*, a form with comparatively narrow-winged fruit, was discovered in western Cuba by Mr Charles Wright in 1865. (See Grisebach, *Cat. Pl. Cub.* 170 (*Fraxinus Cubensis*).)

[2] *Fraxinus Caroliniensis, foliis angustioribus utrinque acuminatis pendulis*, i. 80, t. 80.

Fraxinus Caroliniana, latiori fructu, Miller, *Dict.* No. 6. — Duhamel, *Traité des Arbres*, i. 248.

Fraxinus floridana, foliis angustioribus utrinque acuminatis pendulis, Romans, *Nat. Hist. Florida*, 26.

[3] Miller, *Dict.* ed. 8, No. 6. — Loudon, *Arb. Brit.* ii. 1238, f. 1063, 1064 (*Fraxinus platycarpa*).

EXPLANATION OF THE PLATES.

Plate CCLXXIV. Fraxinus Caroliniana.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3 and 4. Staminate flowers, enlarged.
5. A pistillate flower, enlarged.

Plate CCLXXV. Fraxinus Caroliniana.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, natural size.
3. A seed, natural size.
4. A leaf, natural size.
5. A winter branchlet, natural size.

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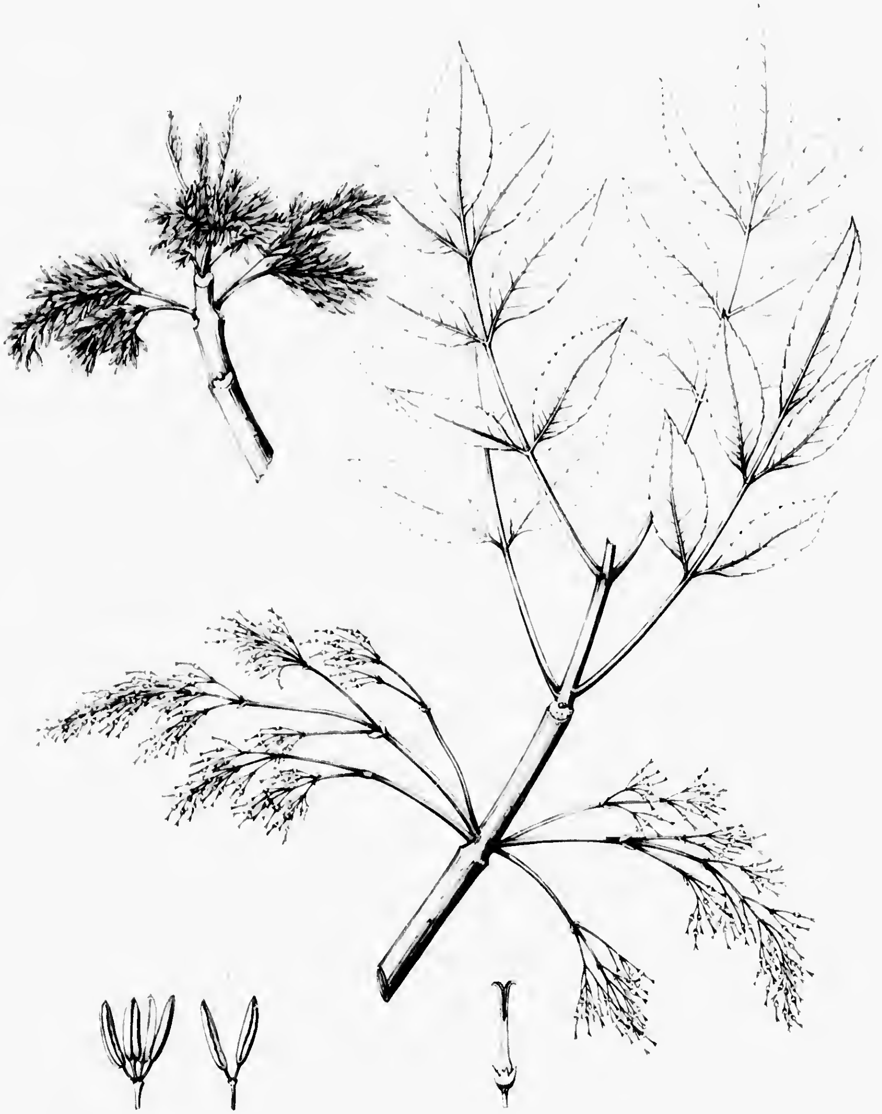
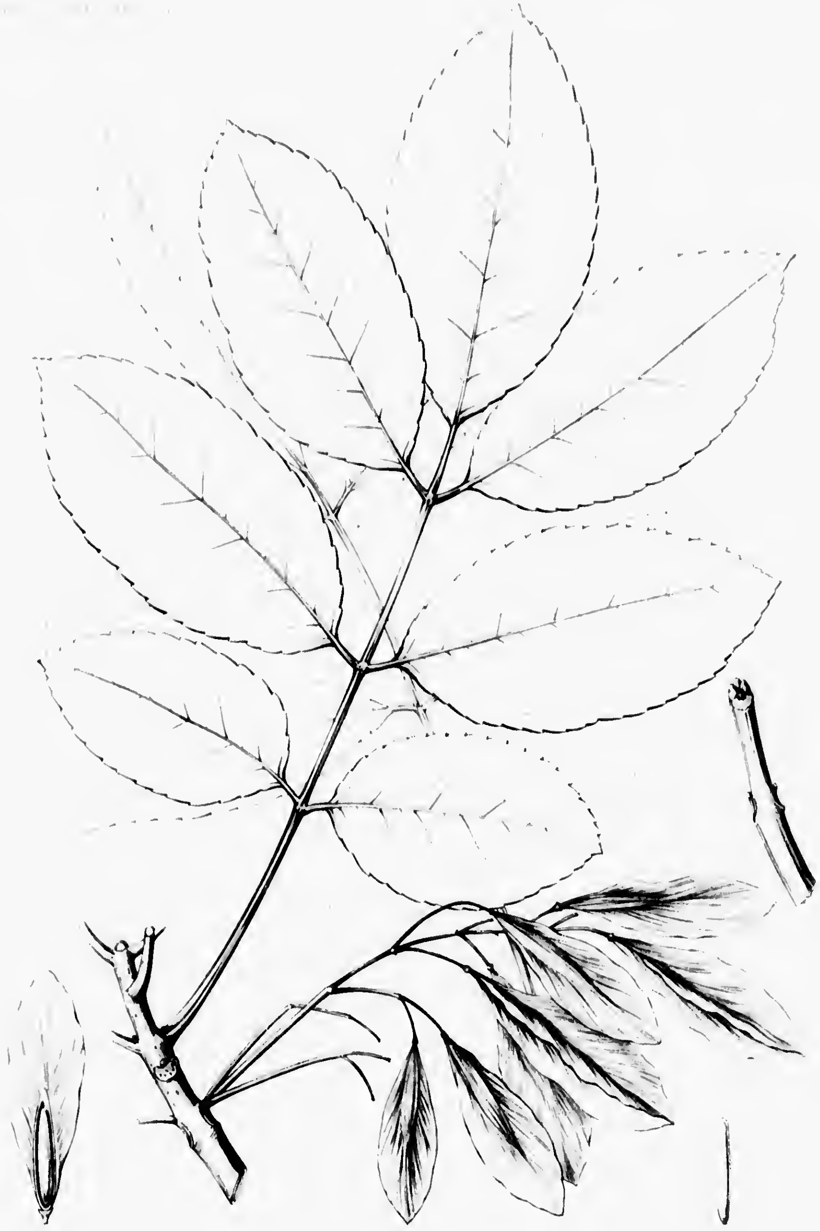


FRAXINUS CAROLINIANA



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FRAXINUS OREGONA.

Ash.

LEAFLETS 5 to 7, oblong to oval, acute, the lateral sessile or rarely short-petiolulate, villous-pubescent while young.

Fraxinus Oregona, Nuttall, *Sylva*, iii. 59, t. 99 (1849). — Torrey, *Pacific R. R. Rep.* iv. 128. — Newberry, *Pacific R. R. Rep.* vi. 25, 87. — Cooper, *Pacific R. R. Rep.* xii. pt. ii. 68; *Am. Nat.* iv. 307. — Koch, *Dendr.* ii. 260. — Gray, *Brewer & Watson Bot. Cal.* i. 472; *Syn. Fl. N. Am.* ii. pt. i. 76. — Lauche, *Deutsche Dendr.* ed. 2, 164. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 111. — Wenzig, *Bot. Jahrb.* iv. 187. — Koehne, *Deutsche Dendr.* 511.

Fraxinus pubescens, var. β, Hooker, *Fl. Bor.-Am.* ii. 51 (1838).

Fraxinus latifolia, Bentham, *Bot. Voy. Sulphur*, 33 (not Willdenow) (1844).

Fraxinus Oregona, β, Nuttall, *Sylva*, iii. 59 (1849).

Fraxinus Oregona, var. **riparia**, Wenzig, *Bot. Jahrb.* iv. 187 (1883).

Fraxinus Americana, subspec. **Oregona**, Wesmael, *Bull. Soc. Bot. Belg.* xxx. 110 (1892).

A tree, frequently seventy or eighty feet in height, with a tall trunk occasionally four feet in diameter, and stout branches which form a narrow upright head or a broad shapely crown. The bark of the trunk varies from an inch to an inch and a half in thickness, and is dark gray or brown slightly tinged with red, and deeply divided by interrupted fissures into broad flat ridges which separate on the surface into thin papery scales. The branchlets are stout and terete, and when they first appear are glabrous or more or less thickly coated with pale or rarely rufous silky tomentum, which sometimes continues to cover them during their second year, and sometimes disappears during their first summer, when they become light red-brown or orange-color, glabrous or puberulous, often covered with a slight glaucous bloom, and marked with small remote pale lenticels, and during their first and second winters with the large elevated semiorbicular leaf-scars in which appear a short row of conspicuous fibro-vascular bundle-scars. The leaf-buds are acute, an eighth to a quarter of an inch long, with four pairs of scales covered with pale hairs or with rusty pubescence; those of the inner rows when fully grown are elongated and often foliaceous. The leaves are five to fourteen inches long, with stout grooved and angled pubescent or glabrous petioles and five to seven leaflets; these are oblong or oval, usually contracted at the apex into short broad points, gradually narrowed at the base, and entire or remotely and obscurely serrate; when they unfold they are usually coated on the lower surface and on the petioles with thick pale tomentum, and are pubescent on the upper surface, or they are nearly glabrous or pilose with a few scattered hairs; at maturity they are thick and firm in texture, light green above, paler and tomentose, pubescent or puberulous below, three to seven inches long, and an inch to an inch and a half wide, with broad pale midribs impressed above, conspicuous veins arcuate near the margins, and reticulate veinlets; the terminal leaflet is raised on a slender petiolule often an inch in length, and the lateral leaflets are sessile or are borne on short stout grooved stalks. The leaves turn yellow or russet-brown in the autumn, and fall early. The flowers, which appear in April or May as the leaves begin to unfold, are produced, the males and females on separate individuals, in compact glabrous panicles covered in the bud with broadly ovate scales coated with rufous pubescence. The bracts are obovate, rounded, scarious, a third of an inch long, and early deciduous. The staminate flower consists of a minute calyx and of two stamens with short filaments and short oblong apiculate anthers. The calyx of the pistillate flower is laciniately cut and shorter than the ovary, which is narrowed into a stout style divided into two conspicuous stigmatic lobes. The fruit, which is produced in ample crowded clusters, is obovate, surrounded at the base by the persistent calyx, and an inch and a half to two inches long;

the body is clavate and slightly compressed, with margined edges which gradually widen upward into a longer wing, which is many-nerved, and narrowed, rounded, apiculate, or sometimes emarginate at the apex.

Fraxinus Oregona inhabits the region surrounding the shores of Puget Sound,[1] and ranges southward through western Washington and Oregon, the California coast region as far south at least as the Bay of San Francisco, and along the western foothills of the Sierra Nevada to those of the mountains of San Bernardino and San Diego counties in southern California. It grows usually in rich moist soil in the neighborhood of streams, and attains its greatest size on the bottom-lands of the rivers of southwestern Oregon, where it sometimes forms with the Alder, the Broad-leaved Maple, and the California Laurel, forests of considerable extent.

The wood of *Fraxinus Oregona* is light, hard, brittle, coarse-grained, and contains many thin medullary rays and open scattered ducts, the layers of annual growth being clearly marked by several rows of similar ducts. It is brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.5731, a cubic foot weighing 35.72 pounds. It is largely used in the manufacture of furniture, for the frames of carriages and wagons, in cooperage, the interior finish of houses, and for fuel.

Fraxinus Oregona, which is one of the most valuable deciduous-leaved trees of the Pacific forests of North America, was discovered on the banks of the lower Columbia River by David Douglas in 1825. It is often planted as a shade-tree in the streets of the cities of Washington and Oregon, and of Victoria in British Columbia. The Oregon Ash has proved hardy in the Arnold Arboretum, into which it was introduced nearly twenty years ago, and in western and central Europe, where it is occasionally found in botanic gardens.

[1] Macoun, *Cat. Can. Pl.* i. 317.

EXPLANATION OF THE PLATE.

Plate CCLXXVI. Fraxinus Oregona.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. Vertical section of a fruit, natural size.
7. A seed, natural size.
8. An embryo, enlarged.
9. A leaf, natural size.
10. A winter branchlet, natural size.

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CHIONANTHUS.

FLOWERS perfect or polygamous; calyx 4-lobed, the divisions imbricated in æstivation; corolla deeply 4-lobed or divided, the divisions conduplicate-valvate in æstivation; stamens 2, rarely 4, inserted on the tube of the corolla, extrorse; disk 0; ovary superior, 2-celled; ovules 2 in each cell, suspended. Fruit a fleshy usually 1-seeded drupe. Leaves opposite, simple, destitute of stipules, deciduous.

Chionanthus, Linnæus, *Gen.* 335 (1737). — Adanson, *Fam. Pl.* ii. 224. — A. L. de Jussieu, *Gen.* 105. — Endlicher, *Gen.* 571. — Meisner, *Gen.* 256. — Bentham & Hooker, *Gen.* ii. 677. — Baillon, *Hist. Pl.* xi. 247. — Engler & Prantl, *Pflanzenfam.* iv. pt. ii. 11.

Trees or shrubs, with watery colorless juices, stout terete or slightly angled branches with thick pith, buds with numerous opposite scales, those of the inner ranks accrescent, and fibrous roots. Leaves opposite, simple, conduplicate in vernation, deciduous. Flowers on elongated ebracteolate pedicels in three-flowered clusters terminal on the slender opposite branches of ample loose panicles from separate buds produced in the axils of upper leaves of the previous year. Bracts foliaceous, persistent. Calyx minute, deeply four-parted, persistent under the fruit. Corolla white, deeply divided into four or rarely into five or six elongated linear or ovate lobes united at the base into a short tube, or rarely separable. Stamens two, inserted on the base of the corolla opposite the axis of the flower, or rarely four, included; filaments terete, short; anthers ovate, attached on the back below the middle, apiculate by the elongation of the connective, two-celled, the cells opening by longitudinal, lateral, or subextrorse slits. Ovary two-celled, abruptly contracted into a short columnar style; stigma thick and fleshy, emarginate or slightly two-lobed; ovules two in each cell, laterally attached near its apex, pendulous, anatropous; raphe ventral; micropyle superior. Fruit drupaceous, ovoid or oblong, usually one or occasionally two or three-seeded;[1] exocarp thin, dry, and fleshy; putamen thick, crustaceous. Seed filling the cavity of the stone, ovoid, suspended; testa thin, chestnut-brown. Embryo straight, axile in thick fleshy albumen; cotyledons flat, longer than the short terete superior radicle turned toward the hilum.

Two species of Chionanthus are known. The type of the genus, *Chionanthus Virginica*, a small tree or shrub, inhabits the middle and southern United States, and *Chionanthus retusa*,[2] northern and central China.

The bark of *Chionanthus Virginica* is tonic, and is sometimes used in medicine. The genus is not known to possess other economic properties. The two species are cultivated for the beauty of their abundant white flowers, and the American species is a common garden plant.

In the United States Chionanthus is not known to be seriously injured by insects or affected by dangerous fungal diseases.

The specific name, from χιών and ἄνθος, alludes to the light and graceful clusters of snow-white flowers.

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[1] Gray, *Proc. Am. Acad.* v. 332.

[2] Lindley & Paxton, *Fl. Gard.* iii. 85, f. 273 (1853). — Walpers, *Ann.* v. 482. — *Gard. Chron.* n. ser. xxiii. 820, f. 178. — *Gartenflora*, 1886, 667, f. 81. — Koehne, *Deutsche Dendr.* 503.

Chionanthus Chinensis, Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, xx. 430 (*Mél. Biol.* ix. 393) (1874). — Franchet & Savatier, *Enum. Pl. Jap.* i. 312.

CHIONANTHUS VIRGINICA.

Fringe Tree. Old Man's Beard.

FLOWERS perfect: corolla divided into long linear lobes. Leaves oval or oblong, short-petiolate.

Chionanthus Virginica, Linnæus, *Spec.* 8 (1753). — Du Roi, *Harbk. Baumz.* i. 150. — Moench, *Baume Weiss.* 22. — Marshall, *Arbust. Am.* 33. — Wangenheim, *Nordam. Holz.* 92. — Walter, *Fl. Car.* 60. — Lamarck, *Ill.* i. 30, t. 9, f. 1. — Willdenow, *Berl. Baumz.* 61; *Spec.* i. 46; *Enum.* 14. — Abbot, *Insects of Georgia*, ii. t. 98. — Michaux, *Fl. Bor.-Am.* i. 3. — Vahl, *Enum.* i. 41. — Persoon, *Syn.* i. 9. — Desfontaines, *Hist. Arb.* i. 111. — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 588. — Pursh, *Fl. Am. Sept.* i. 7. — Roemer & Schultes, *Syst.* i. 72. — Nuttall, *Gen.* i. 5; *Sylva*, iii. 56, t. 98. — Elliott, *Sk.* i. 6. — Hayne, *Dendr. Fl.* 2. — Sprengel, *Syst.* i. 34. — Loddiges, *Bot. Cab.* xiii. t. 1261. — Guimpel, Otto & Hayne, *Abbild. Holz.* 93, t. 73. — Don, *Gen. Syst.* iv. 50. — Spach, *Hist. Vég.* viii. 259. — Dietrich, *Syn.* i. 37. — De Candolle, *Prodr.* viii. 295. — Darlington, *Fl. Cestr.* ed. 3, 238. — Chapman, *Fl.* 369. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 95. — Koch, *Dendr.* ii. 262. — Lauche, *Deutsche Dendr.* ed. 2, 167, f. 56. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 77. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 112. — Watson & Coulter, *Gray's Man.* ed. 6, 337. — Koehne, *Deutsche Dendr.* 503. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 261 (*Man. Pl. W. Texas*).

Chionanthus Zeylonica, Linnæus, *Spec.* 8 (1753). — Burman f. *Fl. Ind.* 6. — Houttuyn, *Pflanzensyst.* i. 204, t. 5, f. 1. — Lamarck, *Dict.* i. 735; *Ill.* i. 30, t. 9, f. 2. — Willdenow, *Spec.* i. pt. i. 47. — Roxburgh, *Fl. Ind.* i. 107. — Thwaites, *Enum. Pl. Zeylan.* 188.

Chionanthus Virginica, var. **latifolia**, Aiton, *Hort. Kew.* i. 14 (1789). — Vahl, *Enum.* i. 41. — Willdenow, *Spec.* i. 46. — Hayne, *Dendr. Fl.* 2. — Don, *Gen. Syst.* iv. 50.

Chionanthus Virginica, var. **angustifolia**, Aiton, *Hort. Kew.* i. 14 (1789). — Vahl, *Enum.* i. 41. — Willdenow, *Spec.* i. 46. — Hayne, *Dendr. Fl.* 2. — Watson, *Dendr. Brit.* i. 1, t. 1. — Don, *Gen. Syst.* iv. 50.

Chionanthus trifida, Moench, *Meth.* 478 (1794).

Chionanthus vernalis, Salisbury, *Prodr.* 11 (1796).

Chionanthus cotinifolia, Willdenow, *Spec.* i. 47 (1797).

Linociera cotinifolia, Vahl, *Enum.* i. 46 (1805). — De Candolle, *Prodr.* viii. 297.

Chionanthus triflora, Stokes, *Bot. Mat. Med.* i. 19 (1812).

Chionanthus Virginica, var. **montana**, Pursh, *Fl. Am. Sept.* i. 8 (1814). — De Candolle, *Prodr.* viii. 295.

Chionanthus Virginica, var. **maritima**, Pursh, *Fl. Am. Sept.* i. 8 (1814). — Don, *Gen. Syst.* iv. 50. — De Candolle, *Prodr.* viii. 295. — Regel, *Gartenflora*, 1867, 357, t. 564.

Chionanthus maritima, Rafinesque, *New Fl.* iii. 86 (1836).

Chionanthus heterophylla, Rafinesque, *New Fl.* iii. 87 (1836).

Chionanthus montana, Rafinesque, *New Fl.* iii. 87 (not Blume) (1836).

Chionanthus longifolia, Rafinesque, *New Fl.* iii. 88 (1836).

Chionanthus angustifolia, Rafinesque, *New Fl.* iii. 88 (1836).

A slender tree, twenty or thirty feet in height, with a short trunk eight or ten inches in diameter and stout ashy gray or light brown branches which form an oblong rather narrow head; or often a shrub sending up from the ground several stout thick spreading stems. The bark of the trunk, which varies from a quarter to a half of an inch in thickness, is irregularly divided into small thin appressed brown scales tinged with red. The branchlets, when they first appear, are light green and are covered with pale pubescence or are sometimes glabrous; in their first winter they are terete or slightly angled, often much thickened below the nodes, light brown or orange-color, and marked by large scattered darker colored lenticels and by the elevated semiorbicular leaf-scars which display a semicircular row of conspicuous fibro-vascular bundle-scars, and do not entirely disappear until the end of several years. The leaf-buds are broadly ovate, acute, and an eighth of an inch long, with about five pairs of scales, which increase in length from the outer to the inner pair, and are ovate, acute, keeled on the back, light brown and slightly pilose on the outer surface, bright green and lustrous on the inner surface, and ciliate on the margins with scattered white hairs; those of the inner pair lengthen on the young shoot, and at maturity are obovate, gradually narrowed below, foliaceous, and an inch to an inch and a half long. The leaves are ovate or oblong, acuminate, with short broad points, or sometimes rounded at the apex, gradually narrowed below into stout puberulous petioles, entire with undulate margins, and coarsely reticulate-venulose; when they unfold they are yellow-green and lustrous on the upper surface, pubescent on the lower, and ciliate on the margins, and at maturity they are four to eight inches long, half an inch to four inches broad, thick and firm, dark green above, and pale and glabrous below, except along the stout midribs and conspicuous arcuate primary veins, which are more or less covered with short white hairs; they are borne on petioles which vary from half an inch to nearly an inch in length, and, having turned bright clear yellow, fall early in the autumn. The flowers appear from the middle of April in the south to the beginning of June in New England, when the leaves are about a third grown, in loose pubescent drooping panicles four to six inches long, and are slightly and agreeably fragrant. The bracts at the base of the lower branches of the inflorescence are obovate, foliaceous, glabrous on the upper surface, pubescent on the lower, and sometimes an inch long; those at the base of the upper branches are oval, successively smaller, and gradually pass into the minute laciniate bracts which subtend the lateral pedicels of the three-flowered clusters which terminate the last divisions of the panicle. The calyx is light green, glabrous, and deeply divided into four acute entire or laciniately cut lobes. The corolla is an inch long, marked on the inner surface near the base by a row of bright purple spots. It is divided into four or sometimes into five or six narrow strap-shaped divisions usually united below or separable. The anthers are light yellow with a green connective. The stigma is two-lobed, and matures and begins to wither before the anthers discharge their pollen. The fruit, which ripens in September, is borne in loose few-fruited clusters on which the persistent leaf-like bracts have sometimes become two inches long; it is oval or oblong, surrounded at the base by the persistent calyx, tipped with the remnants of the style, an inch long, dark blue or nearly black, and often covered with a glaucous bloom; it has a thick skin, thin dry flesh, and a thin rather brittle-walled stone. The seed is a third of an inch long, ovate, narrowed at the apex, and covered by a thin light chestnut-brown coat marked by reticulate veins which radiate from the short hilum.

Chionanthus Virginica usually inhabits the banks of streams, where it grows in rich moist soil, and is distributed from Lancaster and Chester counties in southern Pennsylvania to the shores of Tampa Bay in Florida, and through the Gulf states to southern Arkansas and to the valley of the Brazos River in Texas.

The wood of *Chionanthus Virginica* is heavy, hard, and close-grained, and contains numerous obscure medullary rays, the layers of annual growth being marked by several rows of large open ducts connected by branching groups of similar ducts. It is light brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6372, a cubic foot weighing 39.71 pounds.

The bark is tonic, and is sometimes used in decoction, in the treatment of intermittent fevers, or as an aperient or diuretic;[1] and in homœopathic practice.[2]

The first authentic figure of *Chionanthus Virginica* was published by Mark Catesby in the *Natural History of Carolina*[3] in 1771.[4] It is said to have been first cultivated in Europe in 1736[5] by Peter Collinson.[6]

[1] Griffith, *Med. Bot.* 441. — Porcher, *Resources of Southern Fields and Forests*, 494. — *U. S. Dispens.* ed. 16, 1752.

[2] Millspaugh, *Am. Med. Pl. in Homœopathic Remedies*, ii. 136, t. 136.

[3] *Amelanchier Virginiana, Lauro cerasifolio*, i. 68, t. 68.

Chionanthus, Linnæus, *Hort. Cliff.* 17. — Clayton, *Fl. Virgin.* 10. — Royen, *Fl. Leyd. Prodr.* 399. — Duhamel, *Traité des Arbres*, i. 165, t. 63.

Chionanthus pedunculis multifloris paniculatis, Linnæus, *Fl. Zeylan.* 5.

Chionanthus pedunculis trifidis trifloris, Miller, *Dict.* ed. 7.

[4] The figure of Plukenet's *Arbor Zeylanica, Cotini foliis subtus lanugine villosis, floribus albis, Cuculi modo laciniatis* (*Phyt.* t. 241, f. 4; *Alm. Bot.* 44. — Ray, *Hist. Pl.* iii. *Dendr.* 124. — Burman, *Thes. Zeylan.* 31), published in 1691, upon which Linnæus established the genus Chionanthus, and Willdenow his *Chionanthus cotinifolia*, was intended to represent *Chionanthus Virginica*, although in the figure the corolla is generally five-parted, and the native country of the plant is said to have been Ceylon, where, however, nothing like it is now known to exist. This was the view of Catesby and of Duhamel, who both quoted Plukenet's descriptive phrase as a synonym of the American species; De Candolle suggested the same explanation (*Prodr.* viii. 295), which has now been substantiated by Plukenet's specimen in the British Museum (Britten, *Jour. Bot.* xxvii. 38).

[5] Aiton, *Hort. Kew.* i. 15. — Loudon, *Arb. Brit.* ii. 1206, f. 1029, 1030.

[6] See i. 8.

The charming appearance of the Fringe Tree when its branches are covered with the ample clusters of pure white flowers, and the vigor of its constitution, which enables it to flourish in climates more severe than that of its native home, have made this little tree a favorite for more than a century, and few inhabitants of the forests of North America are more often used for the decoration of parks and gardens, although its value as an ornamental plant is somewhat affected by the tardy appearance of the leaves, which do not unfold until the branches of most plants are completely clothed in vernal green.

EXPLANATION OF THE PLATES.

Plate CCLXXVII. Chionanthus Virginica.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. Vertical section of a flower, the corolla removed, enlarged.
5. The base of the corolla displayed, enlarged.
6. Front and rear views of a stamen, enlarged.
7. An ovule, much magnified.

Plate CCLXXVIII. Chionanthus Virginica.

1. A fruiting branch, natural size.
2. A fruit cut transversely, slightly enlarged.
3. Vertical section of a fruit, slightly enlarged.
4. A stone, enlarged.
5. A seed, enlarged.
6. An embryo, enlarged.
7. A leaf of a sterile branch, natural size
8. A winter branchlet, natural size.

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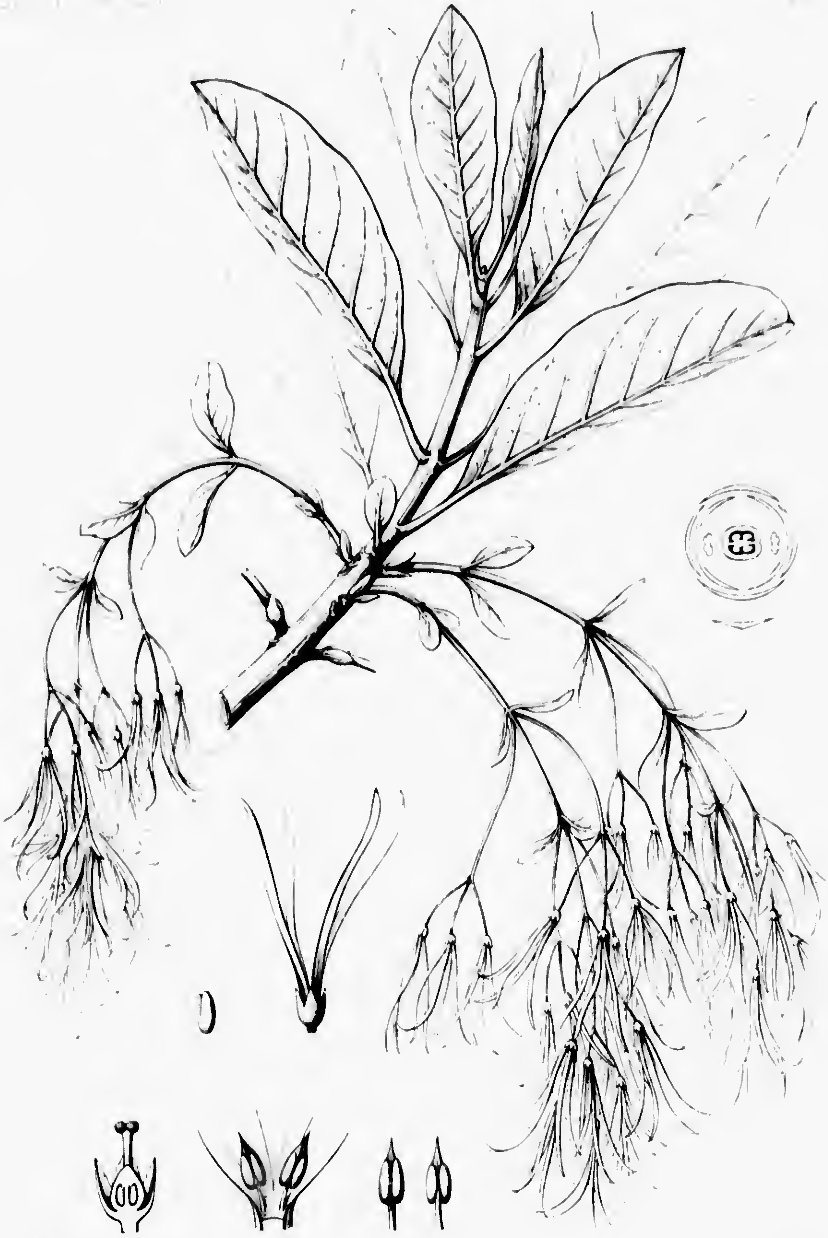
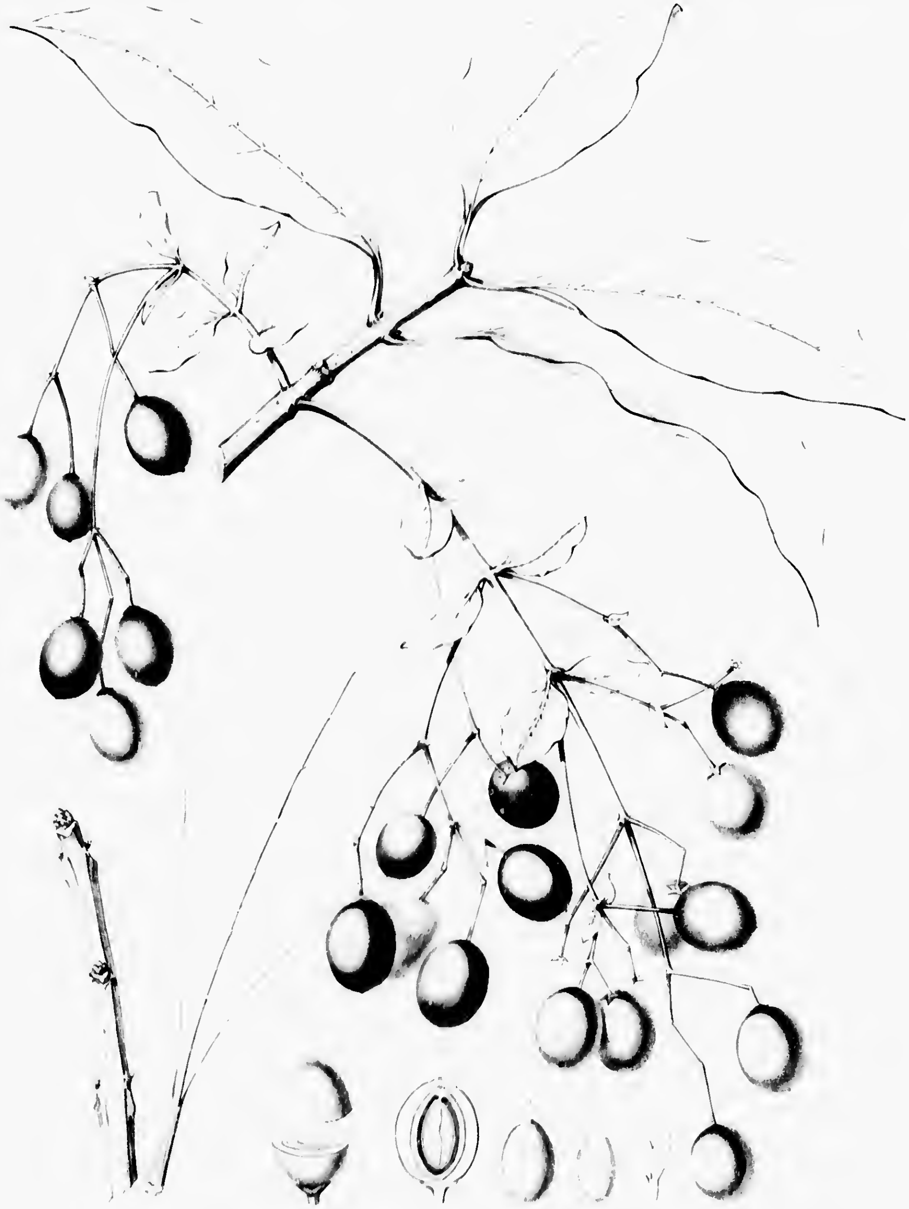


CHIONANTHUS VIRGINICA



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OSMANTHUS.

Flowers polygamo-diœcious or perfect; calyx 4-toothed or divided, the divisions imbricated in æstivation; corolla 4-lobed, the lobes imbricated in æstivation; stamens 2 or rarely 4, inserted on the tube of the corolla, introrse; disk 0; ovary superior, 2-celled; ovules 2 in each cell, suspended. Fruit a fleshy usually 1-seeded drupe. Leaves opposite, persistent, destitute of stipules.

Osmanthus, Loureiro, *Fl. Cochin.* i. 28 (1790). — Bentham & Hooker, *Gen.* ii. 677. — Baillon, *Hist. Pl.* xi. 249. — Engler & Prantl, *Pflanzenfam.* iv. pt. ii. 9.

Trees or shrubs, with watery colorless juices, terete or slightly angled branches, scaly buds, and fibrous roots. Leaves opposite, entire or dentate, persistent. Flowers fragrant, vernal or autumnal, in short axillary racemes, or in short axillary or rarely terminal fascicles. Pedicels short or elongated, subtended by scale-like bracts, ebracteolate. Calyx short, four-toothed or divided, persistent under the fruit. Corolla white, creamy white, or yellow, tubular, four-lobed, the lobes ovate, obtuse, spreading after anthesis. Stamens two, inserted on the base of the corolla opposite the lateral lobes of the calyx, or rarely four; filaments terete, short; anthers ovate or linear-oblong, muticous or apiculate by the prolongation of the connective, attached on the back below the middle, two-celled, the cells opening longitudinally by marginal slits; sometimes rudimentary or wanting in the pistillate flower. Ovary two-celled, subulate, rudimentary or wanting in the staminate flower; style columnar, short or elongated, crowned with an entire capitate stigma; ovules two in each cell, laterally attached near its apex, pendulous, anatropous; raphe ventral; micropyle superior. Fruit drupaceous, ovoid or globose, tipped with the remnants of the style, usually one-seeded; exocarp thin and fleshy; putamen thick, hard or bony. Seed pendulous, filling the cavity of the stone; testa thin. Embryo elongated, axile in thick fleshy albumen; cotyledons flat, much longer than the short superior radicle turned toward the hilum.

Ten species of Osmanthus are now distinguished; they inhabit eastern North America, where one species occurs, the Sandwich Islands,[1] Polynesia,[2] Japan,[3] China,[4] and the Himalayas.[5] The type of the genus, *Osmanthus fragrans*,[6] a native of China and the temperate Himalayas, is cultivated in China for its deliciously fragrant minute cream-colored or yellow flowers used by the Chinese to perfume tea[7] and as a conserve,[8] and is everywhere a favorite garden plant. *Osmanthus Aquifolium*,[9] a native of China and Japan, is often planted in its native countries, in temperate Europe, and in the southern United States, for its handsome Holly-like leaves and fragrant autumnal flowers.

The genus is not known to possess economic properties.

In the United States Osmanthus is not seriously injured by insects or fungal diseases.

The generic name, from ὀσμή and ἄνθος, relates to the fragrance of the flowers of the original species.

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[1] Gray, *Proc. Am. Acad.* v. 331 (Olea). — Hillebrand, *Fl. Haw. Is.* 301 (Olea).

[2] Bentham & Hooker, *Gen.* ii. 677.

[3] Franchet & Savatier, *Enum. Pl. Jap.* i. 312 (Olea).

[4] Bentham, *Fl. Hongk.* 215 (Olea). — Franchet, *Bull. Soc. Linn. Paris*, No. 77, 613. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 87.

[5] C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iii. 606.

[6] Loureiro, *Fl. Cochin.* 29 (1790). — De Candolle, *Prodr.* viii. 291. — C. B. Clarke, *l. c.* — Forbes & Hemsley, *l. c.* 88.

Olea fragrans, Thunberg, *Fl. Jap.* 18, t. 2 (1784). — *Bot. Mag.* xxxviii. t. 1552. — Loddiges, *Bot. Cab.* xviii. t. 1786. — *Nouveau Duhamel*, v. 68, t. 21. — Siebold & Zuccarini, *Abhand. Akad. Münch.* iv. pt. iii. 167. — Blume, *Mus. Bot. Lugd. Bat.* i. 316. — Brandis, *Forest Fl. Brit. Ind.* 309.

[7] Fortune, *Three Years' Wanderings in the Northern Provinces of China*, 213. — Smith, *Chinese Mat. Med.* 161.

[8] Soubeiran & Thiersant, *Mat. Med. Chin.* 175.

[9] Bentham & Hooker, *l. c.* 677 (1876). — *Gard. Chron.* n. ser. vi. 689, f. 132. — Forbes & Hemsley, *l. c.* 87.

Ilex Aquifolium, Thunberg, *l. c.* 79 (not Linnæus) (1784). — Blume, *Bijdr. Fl. Ned. Ind.* 1150.

Olea ilicifolia, Hasskarl, *Cat. Hort. Bogor.* 118 (1844).

Osmanthus ilicifolius, *Gard. Chron.* n. ser. vii. 239, f. 38 (1877).

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OSMANTHUS AMERICANUS.

Devil Wood.

FLOWERS polygamo-diœcious, in short axillary racemes or cymes. Leaves lanceolate-oblong, entire.

Osmanthus Americanus, Bentham & Hooker, *Gen.* ii. 677 (1876). — Gray, *Syn. Fl. N. Am.* ii. pt. i. 78. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 113.

Olea Americana, Linnæus, *Mant.* 21 (1767). — Marshall, *Arbust. Am.* 98. — Lamarck, *Ill.* i. 28; *Dict.* iv. 543. — Willdenow, *Spec.* i. pt. i. 45; *Enum.* 13. — Michaux, *Fl. Bor.-Am.* ii. 222. — Vahl, *Enum.* i. 41. — Persoon, *Syn.* i. 9. — Desfontaines, *Hist. Arb.* i. 112. — Du Mont de Courset, *Bot. Cult.* ed. 2. ii. 592. — *Nouveau Duhamel*, v. 67. — Michaux f. *Hist. Arb. Am.* iii. 50, t. 6. — Pursh, *Fl. Am. Sept.* i. 7. — Roemer & Schultes, *Syst.* i. 70. — Rafinesque, *Fl. Ludovic.* 38. — Nuttall, *Gen.* i. 5. — Elliott, *Sk.* i. 5. — Sprengel, *Syst.* i. 34. — Croom, *Am. Jour. Sci.* xxvi. 315. — Don, *Gen. Syst.* iv. 48. — Loudon, *Arb. Brit.* ii. 1208, f. 1034. — Spach, *Hist. Vég.* viii. 267. — Dietrich, *Syn.* i. 37. — De Candolle, *Prodr.* viii. 286. — Chapman, *Fl.* 369. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 57. — Porcher, *Resources of Southern Fields and Forests*, 493. — Gray, *Man.* ed. 5, 401.

A tree, occasionally forty-five feet in height, with a trunk sometimes a foot in diameter; usually much smaller and often shrubby in habit. The bark of the trunk is thin, dark gray or gray tinged with red, and roughened with small thin appressed scales which in falling display the dark cinnamon-red inner bark. The branchlets are slender, slightly angled, ultimately terete, light or bright red-brown, and marked with minute pale lenticels, becoming ashy gray in their second year, when they are roughened by the small elevated orbicular leaf-scars in which appear a ring of minute fibro-vascular bundle-scars. The winter-buds are half an inch long and linear-lanceolate, with two thick lanceolate reddish-brown scales puberulous on both surfaces. The leaves are involute in vernation, lanceolate, oblong or sometimes obovate, acute or rarely emarginate at the apex, gradually narrowed at the base into broad stout petioles, and entire, with thickened revolute margins; when they unfold they are coated on the lower surface with pale tomentum, and at maturity are thick and coriaceous, glabrous, bright green, lustrous on the upper surface, obscurely reticulate-venulose, four or five inches long, and half an inch to nearly two inches wide, with broad pale midribs impressed on the upper side, and remote forked primary veins arcuate near the margins; they are borne on petioles which vary from half an inch to three quarters of an inch in length, and, unfolding in the spring after the appearance of the flowers, do not fall until the second year. The flowers, which are exceedingly fragrant, open in March from stout-branched pilose inflorescence-buds formed during the previous autumn in the axils of leaves of the year. The staminate and the pistillate and perfect flowers are borne on different individuals in three-flowered clusters, and are sessile or short-pedicellate and produced in pedunculate cymes or short racemes. The bracts are scale-like, nearly triangular, acute, keeled on the back, puberulous, slightly ciliate on the margins, and persistent. The calyx is minute, puberulous, with acute rigid lobes, and much shorter than the creamy white corolla, which before anthesis forms an oblong-ovate bud coated with pale pubescence, and when expanded is an eighth of an inch long, with an elongated tube and short spreading ovate rounded lobes. The stamens are inserted on the middle of the tube of the corolla and are included or slightly exserted; in the pistillate flower they are small and often rudimentary. The ovary is abruptly contracted into a stout columnar style crowned with a large slightly exserted capitate stigma, and in the staminate flower is reduced to a minute point. The fruit, which ripens early in the autumn, is oblong or obovate, an inch long, and dark blue, with thin dry flesh, a thick or sometimes thin-walled brittle ovate pointed stone, and a solitary ovate seed covered with a thin chestnut-brown coat marked with broad conspicuous pale veins which, radiating from the short broad ventral hilum and encircling the seed, terminate near the micropyle.

Osmanthus Americanus inhabits the coast region of the south Atlantic and Gulf states from the valley of the Cape Fear River in North Carolina to the shores of the Kissimmee River and Tampa Bay, Florida, and eastern Louisiana. It grows usually in moist rich soil near the borders of streams and Pine-barren ponds and swamps, and occasionally on dry sandy upland.

The wood of *Osmanthus Americanus* is heavy, very hard and strong, close-grained, and difficult to work; it contains radiating groups of open cells arranged parallel with the thin obscure medullary rays, and is dark brown, with thick light brown or yellow sapwood. The specific gravity of the absolutely dry wood is 0.8111, a cubic foot weighing 50.55 pounds.

The Devil Wood, which owes its popular name to the character of the wood, which is difficult to split, was first described by Mark Catesby in the *Natural History of Carolina*,[1] and was introduced into Europe in the middle of the eighteenth century.[2] It is now rarely cultivated, although its large lustrous leaves, its fragrant flowers and handsome fruit make it a desirable inhabitant of the gardens of temperate regions.

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[1] *Ligustrum Lauri folio, fructu violaceo*, i. 61, t. 61.

[2] Aiton, *Hort. Kew.* i. 14.

EXPLANATION OF THE PLATES.

PLATE CCLXXIX. OSMANTHUS AMERICANUS.

1. A flowering branch of a staminate tree, natural size.
2. A flowering branch of a pistillate tree, natural size.
3. Diagram of a staminate flower.
4. Diagram of a pistillate flower.
5. A staminate flower, enlarged.
6. A pistillate flower, enlarged.
7. Vertical section of a staminate flower, enlarged.
8. Front and rear views of an anther, enlarged.
9. A pistillate flower with half the corolla removed, enlarged.
10. A pistil, the ovary cut vertically, enlarged.
11. An ovule, much magnified.

PLATE CCLXXX. OSMANTHUS AMERICANUS.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, enlarged.
3. A stone, enlarged.
4. A seed, enlarged.
5. An embryo, enlarged.

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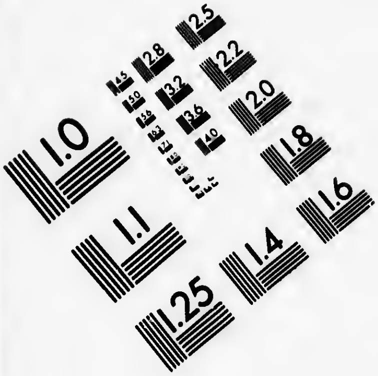
OSMANTHUS AMERICANUS



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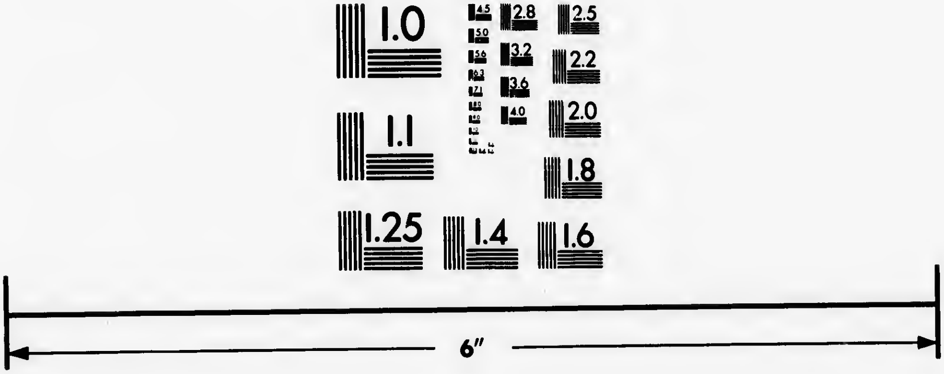

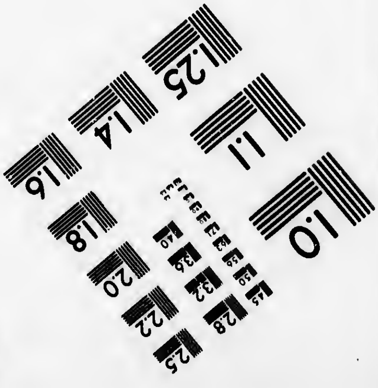

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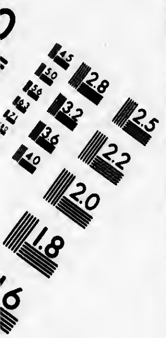

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CORDIA.

Flowers regular, perfect or polygamous; calyx 3 to 5-toothed; corolla gamopetalous, usually 5, rarely 4 to 6-lobed or divided; stamens as many as the lobes of the corolla, inserted on its tube; disk annular; ovary superior, 4-celled; ovules solitary, ascending. Fruit drupaceous, often inclosed in the enlarged calyx. Leaves alternate or rarely subopposite, destitute of stipules.

Cordia, Linnæus, *Gen.* 52 (1737). — A. L. de Jussieu, *Gen.* 128. — Endlicher, *Gen.* 643. — Meisner, *Gen.* 278. — Bentham & Hooker, *Gen.* ii. 838. — Baillon, *Hist. Pl.* x. 396. — Engler & Prantl, *Pflanzenfam.* iv. pt. iii. 81.

Gerascanthus, Browne, *Nat. Hist. Jam.* 170, t. 29, f. 3 (1756).

Varronia, Browne, *Nat. Hist. Jam.* 172 (1756). — Adanson, *Fam. Pl.* ii. 177. — Linnæus, *Syst. Nat.* ed. 10, 916; *Gen.* ed. 6, 102. — A. L. de Jussieu, *Gen.* 129. — Meisner, *Gen.* 278.

Sebesten, Adanson, *Fam. Pl.* ii. 177 (1763).

Firensia, Scopoli, *Introduct.* 157 (1777).

Macielia, Vandelli, *Fl. Lusit. et Brasil.* 14 (1788).

Borellia, Necker, *Elem. Bot.* i. 275 (1790).

Cerdana, Ruiz & Pavon, *Prodr. Fl. Peruv.* 37, t. 6 (1794).

Macria, Tenore, *Mem. Soc. Modena*, xxiv. pt. i. 362 (not E. Meyer) (1842).

Hemigymnia, Griffith, *Calcutta Jour. Nat. Hist.* iii. 363 (1843).

Gynaion, A. de Candelle, *Prodr.* ix. 468 (1845).

Hymenesthes, Miers, *Trans. Linn. Soc.* ser. 2, i. 26 (1874).

Paradigma, Miers, *Trans. Linn. Soc.* ser. 2, i. 30, t. 8 (1874).

Plethostephia, Miers, *Trans. Linn. Soc.* ser. 2, i. 32, t. 3 (1874).

Scabrous-pubescent villose or glabrous trees or shrubs, sometimes subscandent, with watery juices. Leaves alternate or rarely subopposite, entire or dentate, petiolate. Flowers in dichotomous scorpioid-branched open cymes, or in dense heads or spikes, ebracteate or occasionally furnished with minute bracts, sessile or pedicellate, the pedicels without bractlets. Calyx tubular or campanulate, ribbed or smooth, usually three to five-toothed or variously cut, or calyptrate, often accrescent, and then at maturity shorter or sometimes longer than and inclosing the fruit. Corolla hypocraterimorphous, infundibuliform or campanulate, white or orange-color, generally five, rarely four to six-lobed, the lobes in æstivation variously plicate or plane, imbricated or slightly contorted. Stamens inserted on the tube of the corolla and as many as its lobes, exserted or included; filaments filiform; anthers ovate-oblong or linear, sagittate or hastate, attached on the back below the middle, introrse, two-celled, the cells opening longitudinally. Ovary sessile on the thin annular disk, four-celled; style slender, elongated, two-branched above the middle, the branches slightly or deeply two-parted; stigma clavate or cuspidate; ovules solitary, ascending, laterally attached below the middle to the inner angle of the cell, suborthotropous; micropyle superior. Fruit a drupe tipped with the persistent style and often entirely or partly inclosed in the thickened calyx; exocarp dry and corky, or juicy, mucilaginous, astringent or acid; putamen thick-walled, hard or bony, one to four-celled, usually one or two-seeded. Seed ascending, exalbuminous. Embryo filling the cavity of the seed; cotyledons thick and fleshy, or membranaceous, longitudinally plicated or corrugated; much shorter than the superior radicle turned toward the hilum.

Cordia inhabits the tropics and warm extratropical regions in the two hemispheres. One hundred and eighty to two hundred species are known,[1] the largest number being found in America. Four

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[1] Aublet, *Pl. Guian.* i. 219. — Ruiz & Pavon, *Fl. Peruv.* ii. 24. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 68. — Kunth, *Syn. Pl. Æquin.* ii. 191; iv. 227. — Blume, *Bijdr. Fl. Ned. Ind.* 842. — De Candolle, *Prodr.* ix. 471. — A. Richard, *Fl. Cub.* iii.

species occur within the territory of the United States; two of these are small trees and two are shrubs, *Cordia globosa*,[1] a West Indian and Central American plant which reaches the keys of southern Florida, and *Cordia podocephala*[2] of the Rio Grande valley.

The fruit of several of the species of Cordia is edible; the most valued are those of *Cordia Myxa*,[3] a native of tropical Asia and Australia, and for centuries cultivated in the countries bordering the Red Sea, and of *Cordia vestita*[4] and *Cordia Rothii*[5] of India. *Cordia subcordata*[6] of Malaya, northern Australia, and the Pacific Islands produces handsome brown streaked wood with the smell of musk, and is often planted as a shade-tree. In the West Indies the wood of *Cordia Gerascanthus*,[7] a large and stately tree, is valued in construction; the young stems are used for the hoops of sugar hogsheads, and oil is extracted from the fruit;[8] and in Brazil the light and fragrant wood of *Cordia alliodora*[9] is employed for the interior finish of houses.[10]

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106. — Miquel, *Fl. Ind. Bat.* ii. 914; Suppl. 244. — Fresenius, *Martius Fl. Brasil.* viii. 3. — Grisebach, *Fl. Brit. W. Ind.* 477; *Cat. Pl. Cub.* 208. — Bentham, *Fl. Austral.* iv. 385. — Kurz, *Forest Fl. Brit. Burm.* ii. 206. — Hemsley, *Bot. Biol. Am. Cent.* ii. 366. — C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iv. 136. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 143. — Robinson, *Proc. Am. Acad.* xxvi. 169. — Baker, *Kew Bull. Miscellaneous Information*, Jan., 1894, 26.

[1] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 76 (1818). — Kunth, *Syn. Pl. Æquin.* ii. 198. — Grisebach, *Fl. Brit. W. Ind.* 481. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 180. — Hemsley, *l. c.* 367.

Varronia bullata, Linnæus, *Syst. Nat.* ed. 10, 916 (in part) (1759).

Varronia globosa, Jacquin, *Enum. Pl. Carib.* 14 (1760); *Hist. Stirp. Am.* 41. — Linnæus, *Spec.* ed. 2, 276. — Willdenow, *Spec.* i. pt. ii. 1080.

Cordia bullata, De Candolle, *Prodr.* ix. 496 (1845). — Chapman, *Fl.* 329.

[2] Torrey, *Bot. Mex. Bound. Surv.* 135 (1859). — Gray, *l. c.* — Hemsley, *l. c.* 369. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 283 (*Man. Pl. W. Texas*).

[3] Linnæus, *Spec.* 190 (1753). — De Candolle, *l. c.* 479. — Delile, *Fl. d'Égypte*, 47, t. 19, f. 1, 2. — Miquel, *l. c.* ii. 915. — Bentham, *l. c.* 386. — Boissier, *Fl. Orient.* iv. 124. — C. B. Clarke, *l. c.*

Cordia Sebestena, Forskål, *Fl. Ægypt-Arab.* p. lxiii. (not Linnæus) (1775).

Cordia dichotoma, Forster, *Fl. Ins. Austr. Prodr.* No. 110 (1786). — R. Brown, *Prodr. Fl. Nov. Holl.* 498.

Sebestena officinalis, Gærtner, *Fruct.* i. 364, t. 76 (1788).

Cordia officinalis, Lamarck, *Ill.* i. 420, t. 96, f. 3 (1791).

Cordia Africana, Lamarck, *l. c.* (1791).

Cordia Indica, Lamarck, *l. c.* 422 (1791); *Dict.* vii. 49. — De Candolle, *l. c.* 500.

Cordia paniculata, Roth, *Nov. Pl. Spec.* 125 (1821). — De Candolle, *l. c.* 482.

Ehretia glabra, Roth, *l. c.* 127 (1821).

Cordia latifolia, Roxburgh, *Fl. Ind.* ii. 330 (1824). — De Candolle, *l. c.* 478.

Bourreria glabra, Don, *Gen. Syst.* iv. 390 (1838).

Cordia Brownii, De Candolle, *l. c.* 499 (1845).

Cordia Myxa is distributed from tropical India and Ceylon to the Philippine Islands and northern Australia; and through cultivation has been established in southern Persia, Arabia, Palestine, and Egypt from very early times. The dried fruits of this tree are the smaller sebestens of commerce, valued by the ancients for their soothing and laxative properties, and introduced by the Arabs into the pharmacopœia. Once esteemed by European physicians in the treatment of bronchial and pulmonary affections, sebestens are now only used medicinally in the East. From the seeds a powder is made which in India is believed to be an infallible cure for ringworm; the bark is used in astringent gargles, and the root is considered laxative (Endlicher, *Enchirid. Bot.* 319. — Honigberger, *Mat. Med.* 343. — Guibourt, *Hist. Drog.* ed. 7, ii. 512. — Balfour, *Cyclopædia of India*, ed. 3, i. 812; iii. 559). The pulp, which is sweet and exceedingly mucilaginous, is sometimes eaten and is employed to trap birds. The young fruit is cooked and eaten as a vegetable, or is pickled; and from the fruit a glue was made in Egypt and Arabia, which was once an article of export to Europe. (See Forskål, *l. c.* p. xxiii. — Olivier, *Voyage dans l'Empire Othoman*, ii. 177.)

The wood is soft and strong, and is used in India in boatbuilding, for gun-stocks, the handles of agricultural implements, and as fuel. Ropes are made from the bark, and the fibre is used in calking boats. The leaves serve for plates and for the wrappers of cheroots (Brandis, *Forest Fl. Brit. Ind.* 336).

[4] Hooker f. *Jour. Linn. Soc.* ii. 128 (1858). — Brandis, *l. c.* 338. — C. B. Clarke, *l. c.* 130.

Gynaion vestitum, A. de Candolle, *l. c.* 468 (1845).

[5] Roemer & Schultes, *Syst.* iv. 798 (1819). — De Candolle, *l. c.* 480. — Brandis, *l. c.*

Cordia reticulata, Roth, *l. c.* 124 (not Vahl) (1821).

Cordia angustifolia, Roxburgh, *l. c.* 336 (not Roemer & Schultes) (1824).

Cordia subopposita, De Candolle, *l. c.* 480 (1845).

[6] Lamarck, *Ill.* i. 421 (1791). — Miquel, *l. c.* 914. — De Candolle, *l. c.* 477. — Seemann, *Fl. Vit.* 168, t. 34. — Mann, *Proc. Am. Acad.* vii. 194. — Nadeaud, *Enum. Pl. Tahiti*, 57. — Bentham, *l. c.* 385. — Kurz, *l. c.* 209. — C. B. Clarke, *l. c.* 140. — Hillebrand, *Fl. Haw. Is.* 321. — Hemsley, *Bot. Challenger Exped.* i. pt. iii. 167.

Cordia Sebestena, Forster, *l. c.* No. 108 (not Linnæus) (1786).

Cordia orientalis, R. Brown, *l. c.* 498 (1810).

Cordia hexandra, Roemer & Schultes, *l. c.* 799 (1819).

Cordia campanulata, Roxburgh, *l. c.* 336 (1824).

Cordia Rhumphii, Blume, *Bijdr. Fl. Ned. Ind.* 843 (1825).

[7] Jacquin, *Hist. Stirp. Am.* 43, t. 175, f. 10 (1763). — Lamarck, *l. c.* t. 96, f. 2. — Swartz, *Obs.* 86. — Lunan, *Hort. Jam.* ii. 182. — Roemer & Schultes, *l. c.* 450. — Grisebach, *l. c.* 478.

[8] Browne, *Nat. Hist. Jam.* 170, t. 29, f. 3. — Barham, *Hort. Amer.* 57.

[9] De Candolle, *l. c.* 472 (1845). — Fresenius, *l. c.* 3.

Cerdana alliodora, Ruiz & Pavon, *Fl. Peruv.* ii. 47, t. 184 (1799).

Cordia Cerdana, Roemer & Schultes, *l. c.* 467 (1819).

[10] This tree, the Louro of the Brazilians, is said to grow so rapidly that seedling plants can in eight years produce trunks large enough to furnish saw-logs. The dust made by sawing the wood

The generic name, which commemorates the botanical labors of Valerius Cordus,[1] established by Plumier[2] for one of the West Indian species, was afterwards adopted by Linnæus.

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causes extraordinary thirst, and the freshly cut shavings absorb moisture from the hands of the workmen to a painful degree (Saldanha da Gama, *Ann. Sci. Nat.* sér. 5, xix. 217).

[1] Valerius Cordus (1515-1544), the son of the German physician, poet, and botanist, was born at Simmtshausen in Hesse. After studying botany, chemistry, and pharmacy, he traveled through Europe to Italy, where he died in Rome at the early age of twenty-nine, leaving the manuscripts of several works on pharmacy and botany which were published after his death.

[2] *Nov. Pl. Am. Gen.* 13.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Corolla orange or flame-color; fruit inclosed in the smooth glabrous and thickened calyx; leaves ovate	1. CORDIA SEBESTENA.
Corolla white with a yellow centre; fruit entirely or partly inclosed in the thin many-ribbed tomentose calyx; leaves oval or oblong-ovate	2. CORDIA BOISSIERI.

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CORDIA SEBESTENA.

Geiger Tree.

FLOWERS orange or flame-color. Fruit inclosed in the smooth glabrous thickened calyx. Leaves ovate.

Cordia Sebestena, Linnæus, *Spec.* 190 (1753). — Jacquin, *Hist. Stirp. Am.* 42; *Hist. Select. Stirp. Am.* 26, t. 44. — *Icon. Am. Gewäch.* i. 19, t. 53. — Lamarck, *Ill.* i. 421, t. 96, f. 1. — *Bot. Mag.* xxi. t. 794. — Wiildenow, *Spec.* i. pt. ii. 1073; *Enum.* 248. — Andrews, *Bot. Rep.* iii. 157, t. 157. — Poiret, *Lam. Dict.* vii. 45. — Persoon, *Syn.* i. 166. — Du Mont de Courset, *Bot. Cult.* ed. 2, iii. 186. — Deliie, *Fl. d'Égypte*, 50. — Trattinick, *Archiv.* t. 354. — Kerner, *Hort.* t. 155. — Lunan, *Hort. Jam.* i. 198. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 68. — Roemer & Schuites, *Syst.* iv. 452. — Kunth, *Syn. Pl. Æquin.* ii. 191. — Sprengel, *Syst.* i. 649. — Descourtilz, *Fl. Méd. Antill.* iv. 205, t. 277. — Chamisso, *Linnæa*, vi. 755. — Audubon, *Birds*, t. 177. — Don, *Gen. Syst.* iv. 375. — Dietrich, *Syn.* i. 611. — Nuttall, *Sylva*, iii. 81, t. 106. — Grisobach, *Fl. Brit. W. Ind.* 478; *Cat. Pl. Cub.* 208. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 180. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 113. — Mez, *Bot. Jahrb.* xii. 585, t. 5, f. 43. — Hitchcock, *Rep. Missouri Bot. Gard.* iv. 108.

? **Cordia juglandifolia**, Jacquin, *Enum. Pl. Carib.* 14 (1760); *Hist. Stirp. Am.* 43.

Cordia speciosa, Roemer & Schultes, *Syst.* iv. 799 (1819). — A. de Candolle, *Prodr.* ix. 476. — Richard, *Fl. Cub.* iii. 109.

Sebestena scabra, Rafinesque, *Sylva Tellur.* 38 (1838).

Cordia Sebestena, var. **rubra**, Eggers, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1876, 132 (*Fl. St. Croix*).

A tree, in Florida twenty-five to thirty feet in height, with a tall trunk five or six inches in diameter, and slender upright branches which form a narrow close round-topped head. The bark of the trunk is one half to three quarters of an inch thick, dark brown, frequently nearly black, and deeply and irregularly divided into narrow ridges, which are broken on the surface into short thick appressed scales. The branchlets are stout and terete, with thick pith, and while young are dark green and covered, like the branches of the inflorescence, the young leaves, and the calyxes, with thick close rusty tomentum and with short rigid pale deciduous hairs; later the branches become ashy gray, and are marked after the leaves fall with large nearly orbicular cordate leaf-scars, which display in the centre two circular clusters of fibro-vascular bundle-scars. The leaves, which continue to unfold through a large part of the year, are ovate, short-pointed or rounded at the apex, rounded, subcordate, or wedge-shaped at the base, and entire or sometimes remotely and coarsely serrate above the middle; they are thick and firm, dark green, scabrous-pubescent, or often nearly glabrous on the lower surface, reticulate-venulose, five or six inches long and three or four inches wide, with broad midribs usually covered below with pale hairs, especially in the axils of the remote primary veins connected by conspicuous cross veinlets, and stout pubescent petioles which vary from an inch to an inch and a half in length. The flowers, which appear throughout the year, are raised on slender pedicels, and are borne in open terminal flat cymes six or seven inches across; they are dimorphous, some individuals producing flowers with short included stamens and elongated styles, and others flowers with exserted stamens and included styles. The calyx forms before anthesis an oblong or slightly obovate bud rounded at the apex, and is cylindrical, one half to two thirds of an inch long, and obscurely many-rayed, with short nearly triangular rigid teeth. The corolla is funnel-form, orange or flame-color, and puberulous on the outer surface, with a slender tube about twice as long as the calyx, and spreading rounded lobes with irregularly undulate margins, imbricated in the bud, and an inch to an inch and a half across when expanded. The stamens are inserted above the middle of the tube of the corolla, and are composed of short or elongated filaments and of ovate-oblong anthers. The ovary is conical, and glabrous, and is contracted into a slender style branched near the apex, the divisions of the branches being stigmatic to the base. The drupe is broadly ovate, rather abruptly narrowed and pointed at the apex, tipped with the persistent style, and entirely inclosed in the thickened fibrous calyx, which is smooth and ivory-white on the outer surface; the flesh is thin, pale, and corky, and is inseparable from the irregularly sulcate thick-walled stone, which has a deep depression at the base, and is one or often two-seeded. The seed is linear-lanceolate, half an inch long, and covered with a delicate white coat.

Cordia Sebestena now grows spontaneously in the forests of Key West and in those of some of the other islands of the south Florida coast, to which it may perhaps have been first brought as a garden plant. It is common on the Bahama Islands, where it is probably indigenous, on most of the Antilles, and in Guiana and New Granada.[1]

The wood of *Cordia Sebestena* is heavy, hard, and close-grained, with a satiny surface, numerous thin medullary rays, and occasional small scattered open ducts, and is dark brown, with thick light brown or yellow sapwood. The specific gravity of the absolutely dry wood is 0.7108, a cubic foot weighing 44.30 pounds.

Cordia Sebestena appears to have been first noticed by Sir Hans Sloane, who described it in 1691;[2] according to Aiton,[3] it was cultivated in 1728 by Dr. James Sherard,[4] in whose garden at Eltham in England it probably flowered for the first time in Europe. It is occasionally planted on Key West;[5] and in many gardens of the Antilles its abundant and beautiful flowers, set off by large dark green leaves, and its great clusters of ivory-white fruit, can be admired.

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[1] Grisebach, *Fl. Brit. W. Ind.* 478.

[2] *Caryophyllus spurius inodorus, folio subrotundo scabro, flore racemoso hexapetaloide coccinea speciosissimo*, *Cat. Pl. Jam.* 136; *Nat. Hist. Jam.* ii. 20, t. 164. — Ray, *Hist. Pl.* iii. *Dendr.* 38. — Catesby, *Nat. Hist. Car.* ii. 91, t. 91.

Cordia nucis juglandis folio, flore purpureo, Plumier, *Nov. Pl. Am. Gen.* 13, t. 14.

Sebestena scabra, flore miniato crispo, Dillenius, *Hort. Elth.* 340, t. 255, f. 331.

Cordia foliis amplioribus hirtis ovatis, tubo floris subæquali, Browne, *Nat. Hist. Jam.* 202.

[3] *Hort. Kew* i. 258.

[4] See i. 77.

[5] The popular name by which this tree is known in Florida is that of the man who is supposed to have first planted it in Key West.

EXPLANATION OF THE PLATES.

PLATE CCLXXXI. CORDIA SEBESTENA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, the corolla displayed, enlarged.
4. A calyx, enlarged.
5. Front and rear views of a stamen, enlarged.
6. Vertical section of an ovary, enlarged.
7. Apex of a style, enlarged.
8. An ovule, much magnified.

PLATE CCLXXXII. CORDIA SEBESTENA.

1. A fruiting branch, natural size.
2. Cross section of a fruit, natural size.
3. Vertical section of a fruit, natural size.
4. A drupe, natural size.
5. An embryo, enlarged.

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Cordia [illegible] Plumier, *Nov. Pl. Amer.* [illegible]

[illegible] 240, [illegible]

Cordia foliis [illegible] *floris subæquali*, Browne, *Nat. Hist. Jam.* 202.

[3] *Hort. Kew.* i. 258.

[4] See i. 77.

[5] The popular name by which this tree is known in Florida is that of the man who is supposed to have first planted it in Key West.

EXPLANATION OF THE PLATES.

PLATE CCLXXXI. CORDIA SEBESTENA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, the corolla displayed, enlarged.
4. A calyx, enlarged.
5. Front and rear views of a stamen, enlarged.
6. Vertical section of an ovary, enlarged.
7. Apex of a style, enlarged.
8. An ovule, much magnified.

PLATE CCLXXXII. CORDIA SEBESTENA.

1. A fruiting branch, natural size.
2. Cross section of a fruit, natural size.
3. Vertical section of a fruit, natural size.
4. A drupe, natural size.
5. An embryo, enlarged.

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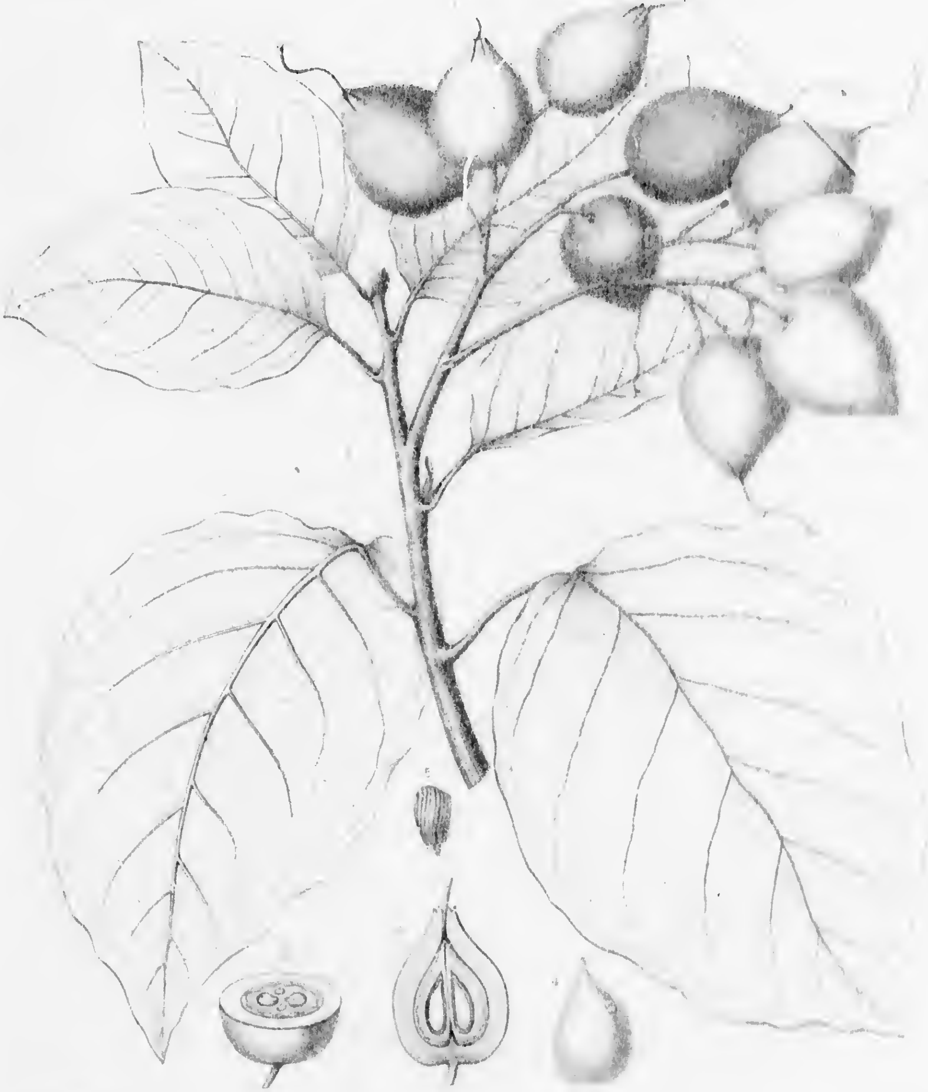

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CORDIA SEBESTENA

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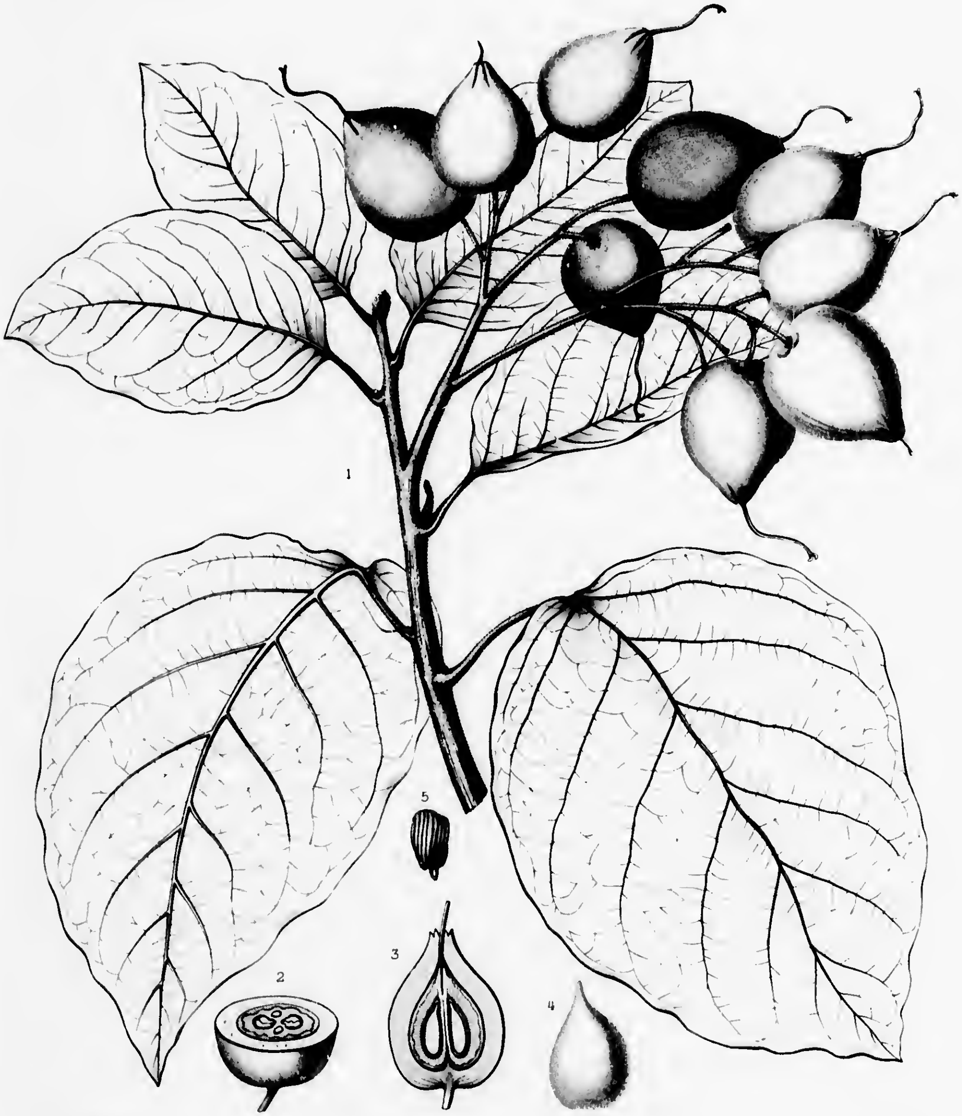
Tab. CCLXXXII



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CORDIA BOISSIERI.

Anacahuita.

CoROLLA white with a yellow centre. Fruit entirely or partly inclosed in the thin many-ribbed tomentose calyx. Leaves oval or oblong-ovate.

Cordia Boissieri, A. de Candolle, *Prodr.* ix. 478 (1845). — Torrey, *Bot. Mex. Bound. Surv.* 135. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 180. — Hemsley, *Bot. Biol. Am. Cent.* ii. 366. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 114. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 283 (*Man. Pl. W. Texas*).

A tree, occasionally twenty to twenty-five feet in height, with a short often crooked trunk six or eight inches in diameter, and stout spreading branches which form a low round-topped head; or often a shrub sending up from the ground numerous stems sometimes only two or three feet tall. The bark of the trunk is thin, gray tinged with red, and irregularly divided into broad flat ridges, the surface ultimately separating into long thin papery scales. The branchlets are stout and terete, and when they first appear are covered, as well as the young leaves, the branches of the inflorescence, and both surfaces of the calyx, with thick rusty or dark brown tomentum, through which short white usually matted hairs are scattered; in their second year the branches are dark gray or brown, slightly puberulous, and marked with occasional large lenticels and with the elevated obcordate leaf-scars. The leaves are oval or oblong-ovate, acute or rounded at the apex, rounded or subcordate at the base, entire or obscurely crenulate-serrate, thick and firm, dark green, minutely rugose and more or less scabrous on the upper surface, coated on the lower surface with thick soft pale or rufous tomentum, four or five inches long and three or four inches wide, with broad midribs and conspicuous primary veins forked near the margins and connected by cross veinlets; they are borne on stout petioles covered with tomentum, and are an inch to an inch and a half long, and fall when they are about a year old. The flowers, which appear from April until June and are slightly fragrant, are sessile or short-pedicellate, and are produced in open terminal dichotomous cymes. The calyx is short-cylindrical or subcampanulate, and conspicuously many-ridged, with five linear acute teeth, and is about half as long as the tube of the white corolla, which is funnel-form, puberulous on the outer surface, and marked in the throat with a large light yellow spot; the lobes are rounded, imbricated in the bud, and two inches across when fully expanded. The stamens are inserted below the middle of the tube of the corolla, and are composed of slender filaments and of ovate-oblong anthers. The ovary is glabrous, and is gradually narrowed into a slender two-branched style, the divisions of the branches being stigmatic to their base. The drupe is ovate, an inch long, pointed and tipped at the apex with the remnants of the style, lustrous and bright red-brown, and is inclosed entirely or partly by the thin fibrous conspicuously rayed calyx, coated on the outer surface with thick short pale tomentum, and often split nearly to the base; the flesh is thin, sweet, and pulpy, and separates easily from the stone; this is ovate, long-pointed, smooth, light brown, faintly reticulate-veined, and marked with four longitudinal lines corresponding with the divisions of the ovary and at the apex with a deeply four-lobed thin cap; it is thick-walled, hard, and bony, with a deep cavity at the base through which a large cluster of fibro-vascular bundles passes. The seed is ovate, acute, and a quarter of an inch long, and is covered with a thin delicate pure white coat.

Cordia Boissieri inhabits dry limestone ridges, and depressions in the desert, and from the valley of the Rio Grande in Texas and from southern New Mexico ranges southward into northern Mexico. Comparatively rare and of small size within the territory of the United States, the Anacahuita is exceedingly abundant and grows to its largest size in Nuevo Leon between the mouth of the Rio Grande and the base of the Sierra Madre, enlivening the dry mesas with its beautiful white flowers, which are produced in the greatest profusion and continue to open during several weeks.

The wood of *Cordia Boissieri* is light, rather soft, close-grained, with many thin conspicuous medullary rays and small scattered open ducts, and is dark brown, with thick light brown sapwood. The specific gravity of the absolutely dry wood is 0.6790, a cubic foot weighing 42.32 pounds.

All parts of *Cordia Boissieri*, which contains an aromatic principle, are used by the Mexicans in the treatment of bronchial affections.[1] An extract of the wood is believed by them to be valuable as an expectorant and diaphoretic; the fruit is eaten, and in the form of jelly is used to relieve coughs; and a decoction of the leaves is employed in the treatment of rheumatism.[2]

Cordia Boissieri was discovered by J. L. Berlandier[3] in the valley of the Rio Grande. Occasionally planted in the gardens of western Texas and northern Mexico, it might well find a home in those of other warm dry countries, for few trees of temperate regions produce more beautiful or abundant flowers.[4]

The specific name commemorates the scientific labors of Edmond Boissier,[5] the distinguished Swiss botanist.

EXPLANATION OF THE PLATES.

PLATE CCLXXXIII. CORDIA BOISSIERI.

1. A flowering branch, natural size.
2. A flower, the corolla and half of the calyx removed.
3. A corolla displayed.
4. A stamen, front and rear views.
5. Vertical section of an ovary, enlarged.
6. Cross section of an ovary, enlarged.
7. An ovule, much magnified.

PLATE CCLXXXIV. CORDIA BOISSIERI.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, natural size.
3. Cross section of a fruit, natural size.
4. A seed, natural size.
5. An embryo, enlarged.
6. An embryo cut across the cotyledons, enlarged.

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[1] Havard, *Proc. U. S. Nat. Mus.* viii. 510.

[2] In 1860 Anacahuita wood attracted some attention in Germany as a remedy for consumption, and considerable quantities were imported from Tampico and sold at high prices, but as an analysis did not demonstrate that it possessed important medical properties, and no good results following its use in the treatment of phthisis, it was soon given up as a remedy. (See Berg, *Bonplandia*, 1860, 302. — Buchner, *Neues Repertorium für Pharmacie*, x. 97. — Müller, *Vierteljahresschrift für Prakt. Pharm.* x. 519. — Seemann, *Pharm. Jour. and Trans.* iii. 164. — Hanbury, *Pharm. Jour. and Trans.* ser. 2, ii. 407; iv. 272, t.; *Science Papers*, 277, t.)

[3] See i. 82.

[4] Two plants of *Cordia Boissieri* were sent in 1861 by the Hanoverian consul at Tampico to the Botanic Garden at Göttingen; in the following year they were alive and in good condition (*Regensb. Flora*, xlv. 444).

[5] Pierre-Edmond Boissier (1810–1875), a native of Geneva, a traveler in Spain, northern Africa, and Asia Minor, and best known by his *Voyage botanique dans le midi de l'Espagne*, 1839–1845, and by his *Flora Orientalis*, 1867–1884. *Boissiera*, a genus of Grasses, was established by Hochstetter in his honor. (See A. de Candolle, *Arch. Sci. Phys. et Nat. de Genève*, xlv. 308.)

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[3] See i. 82.

[4] Two plants of *Cordia Boissieri* were sent in 1861 by the Hanoverian consul at Tampico to the Botanic Garden at Gottingen; in the following year they were alive and in good condition (*Regensb. Flora*, xlv. 441).

[5] Pierre-Edmond Boissier (1810–1875), a native of Geneva, a traveler in Spain, northern Africa, and Asia Minor, and best known by his *Voyage botanique dans le midi de l'Espagne*, 1839–1845, and by his *Flora Orientalis*, 1867–1884. *Boissiera*, a genus of Grasses, was established by Hochstetter in his honor. (See A. de Candolle, *Arch. Sci. Phys. et Nat. de Genève*, xiv. 308.)

[illegible]

[illegible] *Cordia Boissieri*.

1. [illegible] size.
2. [illegible] (the calyx removed).
3. A [illegible]
4. A stamen [illegible]
5. Vertical section of an ovary, enlarged.
6. Cross section of an ovary, enlarged.
7. An ovule, much magnified.

Plate CCLXXXIV. Cordia Boissieri.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, natural size.
3. Cross section of a fruit, natural size.
4. A seed, natural size.
5. An embryo, enlarged.
6. An embryo cut across the cotyledons, enlarged.

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A Riocreux direxᵗ *Imp. J Taneur, Paris*

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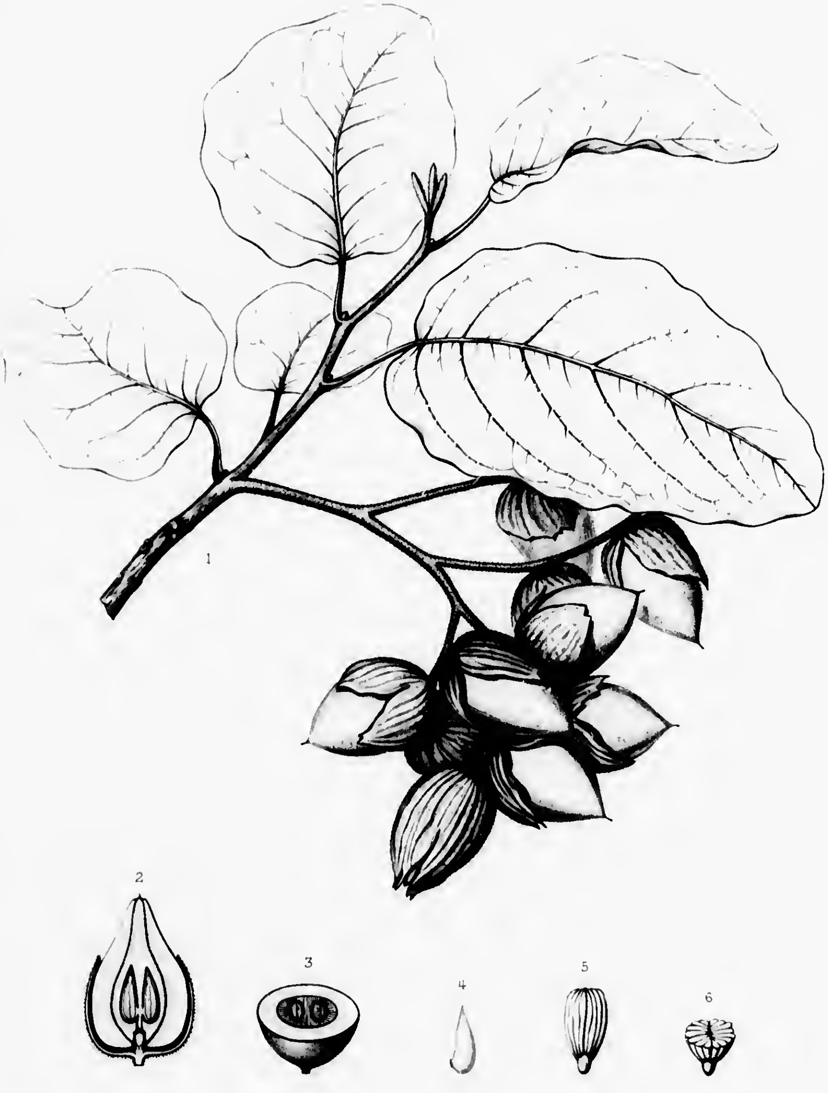
CORDIA BOISSIERI A. DC.

A. Riocreux direx. Imp. J. Taneur, Paris.



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CORDIA BOISSIERI, A DC

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BOURRERIA.

Flowers perfect; calyx closed in the bud, 2 to 5-toothed or divided, the lobes valvate in æstivation; corolla gamopetalous, 5-lobed, the lobes imbricated in æstivation; stamens 5; disk annular; ovary superior, spuriously 4-celled; ovules solitary in each cell. Fruit a fleshy drupe. Leaves alternate or subverticillate, without stipules.

Bourreria, Browne, *Nat. Hist. Jam.* 168 (1756). — Adanson, *Fam. Pl.* ii. 177. — Bentham & Hooker, *Gen.* ii. 840 (excl. *Hymenesthes*). — Baillon, *Hist. Pl.* x. 392 (excl. *Hymenesthes*).

Beurreria, Jacquin, *Hist. Stirp. Am.* 44 (1763). — Endlicher, *Gen.* 645. — Engler & Prantl, *Pflanzenfam.* iv. pt. iii. 86.

Morelosia, La Llave & Lexarza, *Nov. Veg. Desc.* i. 1 (1824).

Crematomia, Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 301 (1869); *Contrib.* ii. 242.

Small trees or shrubs, with watery juices and fibrous roots. Leaves involute in vernation, alternate or occasionally subverticillate, obovate-oblong or ovate, glabrous, or scabrous on the upper surface. Flowers on slender pedicels, bracteolate, small or large, in terminal corymbose dichotomous cymes usually many-flowered, sometimes few or rarely one-flowered. Bracts and bractlets linear-lanceolate, caducous. Calyx closed before anthesis, globose or ovoid, splitting in two to five short teeth, persistent and sometimes accrescent under the flower. Corolla white, campanulate or infundibuliform, the tube short or elongated, often enlarged in the throat, five-lobed, the lobes broadly ovate, spreading after anthesis. Stamens five, inserted on the tube of the corolla, introrse, included or exserted; filaments filiform; anthers ovate or oblong, often rugulose, two-celled, opening laterally by longitudinal slits. Ovary sessile on the thin annular disk, incompletely four-celled by the development of the two parietal placentas, narrowed into a terminal style two-parted toward the apex, the divisions more or less coalescent; stigma truncate, capitate, or clavate; ovules solitary in each cell, attached on the back near the middle of the inner face of the revolute placenta, anatropous; raphe ventral; micropyle superior. Drupe subglobose, tipped with the remnants of the style; exocarp thin and fleshy; endocarp somewhat four-lobed and separable into four thick-walled bony one-seeded nutlets rounded and furnished on the back with a thick spongy longitudinally many-ridged appendage, flattened on their converging inner faces, and attached at the apex to a filiform column. Seed terete, filling the seminal cell longitudinally incurved round a small cavity opposite an elevated oblong scar on one of the inner faces of the nutlet and connected with the hilum by a narrow passage; testa membranaceous, light brown. Embryo axile in fleshy albumen; cotyledons plane; radicle slender, elongated, superior, turned toward the hilum.

Bourreria is tropical American, with sixteen or eighteen species[1] distributed from southern Florida, where one species occurs, through the West Indies to southern Mexico, Central America, and Colombia.

The genus is not known to possess economic properties.

The generic name perpetuates that of J. A. Bourrer, an apothecary at Nuremberg.

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[1] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 67. — Kunth, *Syn. Pl. Æquin.* ii. 190. — Grisebach, *Fl. Brit. W. Ind.* 481; *Cat. Pl. Cub.* 209. — Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 199; *Contrib.* ii. 230. — Hemsley, *Bot. Biol. Am. Cent.* ii. 380.

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BOURRERIA HAVANENSIS.

Strong Back.

Calyx campanulate, usually 5-toothed. Leaves coriaceous, glabrous or tuberculate-scabrous. Fruit bright orange-red.

Bourreria Havanensis, Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 207 (1869); *Contrib.* ii. 238, t. 86. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 181. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 114. — Hitchcock, *Rep. Missouri Bot. Gard.* iv. 108. — Engler & Prantl, *Pflanzenfam.* iv. pt. iii. 87, f. 35, E.

Ehretia Bourreria, Linnæus, *Spec.* ed. 2, 275 (in part) (1762). — Willdenow, *Spec.* i. pt. ii. 1078 (in part). — Desfontaines, *Ann. Mus.* i. 279. — Chapman, *Fl.* 329.

Ehretia Havanensis, Roemer & Schultes, *Syst.* iv. 805 (1819). — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* vii. 206. — De Candolle, *Prodr.* ix. 508.

Bourreria recurva, Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 203 (1869); *Contrib.* ii. 234.

Bourreria ovata, Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 203 (1869); *Contrib.* ii. 234.

Bourreria tomentosa, γ **Havanensis**, Grisebach, *Fl. Brit. W. Ind.* 482 (1864); *Cat. Pl. Cub.* 209.

A bushy tree, in Florida occasionally forty-five feet in height, with a buttressed and often fluted trunk eight or ten inches in diameter, and slender terete branchlets; usually much smaller, and often a shrub with numerous spreading stems. The bark of the trunk varies from a sixteenth to an eighth of an inch in thickness and is light brown tinged with red, more or less fissured, and divided on the surface into thick plate-like irregular scales. The branches, when they first appear, are light red and pilose with pale hairs which soon disappear; and in their first winter they are covered with thin dark red, orange-colored, or ashy gray bark which is sometimes roughened with pale lenticels and often separates in delicate scales. The leaves are obovate-oblong or ovate, acute, rounded, apiculate or emarginate at the apex, wedge-shaped at the base, and entire with thickened revolute margins; they are covered, when they unfold, with soft pale caducous hairs, and at maturity are thick, coriaceous, conspicuously reticulate-venulose, dark green and glabrous, or in one form[1] tuberculate-scabrous or hispidulous on the upper surface, pale yellow-green and glabrous or pubescent on the lower surface, two to three and a half inches long and an inch to an inch and a half wide, with broad orange-colored midribs deeply impressed on the upper side, and thin arcuate veins; they are borne on slender rigid grooved petioles three quarters of an inch to an inch in length, and, unfolding in Florida in April and May, usually remain on the branches through their second summer. The flowers, which open in the spring and late in the autumn, are produced in open terminal cymes three or four inches across with slender glabrous branches, and are borne on pedicels half an inch long and furnished near the middle with a scarious bractlet an eighth of an inch in length and, like the small bracts, caducous from a persistent base. The calyx before opening forms an ovate pointed glabrous or puberulous bud, and after anthesis is campanulate and five-toothed, with acute teeth ciliate on the margins. The corolla is subcampanulate and creamy white, with a short tube somewhat enlarged in the throat, and broad ovate spreading lobes three quarters of an inch across when expanded. The stamens, which are inserted near the middle of the tube of the corolla and are exserted, are composed of slender filaments and of ovate rugulose apiculate anthers. The ovary is conical and glabrous, and is gradually contracted into a slender exserted style

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[1] *Bourreria Havanensis*, var. *radula*, Gray, *Syn. Fl. N. Am.* ii. pt. i. 181 (1878). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 114.

Bourreria radula, Don, *Gen. Syst.* iv. 390 (1836). — Chamisso, *Linnæa*, viii. 120. — Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 205; *Contrib.* ii. 237.

Ehretia radula, Poiret, *Lam. Dict.* Suppl. ii. 2 (1811). — Dietrich, *Syn.* i. 630. — De Candolle, *Prodr.* ix. 506. — Chapman, *Fl.* 329.

Cordia Floridana, Nuttall, *Sylva*, iii. 83, t. 107 (1849).

Bourreria virgata, Grisebach, *Mem. Am. Acad.* n. ser. viii. 528 (*Pl. Wright.* pt. ii.) (1862); *Cat. Pl. Cub.* 209.

which is divided only toward the apex, or is sometimes nearly entire, and is crowned with two capitate stigmas. The fruit ripens in the autumn, or early in the spring from autumnal flowers, and is bright orange-red, subglobose, half an inch in diameter, tipped with the remnants of the style, and surrounded at the base by the enlarged spreading calyx which sometimes becomes half an inch across; it has a thick tough skin and thin dry flesh inclosing the four thick-walled nutlets.

Bourreria Havanensis is a common inhabitant of the forests of Key West, Key Largo, Upper Metacombe and Elliott's Keys, in Florida, and of those of the Bahama Islands and of many of the Antilles.

The wood of *Bourreria Havanensis* is hard, strong, very close-grained, with a satiny surface susceptible of receiving a beautiful polish; it contains numerous obscure medullary rays, and is brown streaked with orange, with thick hardly distinguishable sapwood. The specific gravity of the absolutely dry wood is 0.8073, a cubic foot weighing 50.31 pounds.

The Strong Back[1] was first described in the *Natural History of Carolina*[2] by Mark Catesby, who discovered it on the Bahama Islands; it was first noticed in Florida[3] by Dr. J. L. Blodgett.[4]

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[1] This name, which was in use among the inhabitants of the Bahama Islands when Catesby visited them early in the last century, was probably given to this tree on account of the hard tough nature of the wood. On the Florida keys, which were first settled by fishermen and woodchoppers from the Bahamas, Strong Back is sometimes replaced by Strong Bark.

[2] *Pittoniæ similis, Laureolæ foliis, floribus albis, baccis rubris*, ii. 79, t. 79.

[3] The Porto Rico plant that flowered in the Jardin des Plantes in Paris in 1801, and was described by Desfontaines (*Ann. Mus.* i. 279) as *Ehretia Bourreria*, was, according to Miers (*Ann. & Mag. Nat. Hist.* ser. 4, iii. 203) his *Bourreria recurva* here reduced to *Bourreria Havanensis*.

[4] See i. 33.

EXPLANATION OF THE PLATES.

Plate CCLXXXV. Bourreria Havanensis.

1. A flowering branch, natural size.
2. A diagram of a flower.
3. A calyx, enlarged.
4. A flower, the calyx removed and the corolla displayed, enlarged.
5. A stamen, front and rear views.
6. Vertical section of an ovary, enlarged.
7. An ovule, much magnified.

Plate CCLXXXVI. Bourreria Havanensis.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, enlarged.
3. Cross section of a fruit, enlarged.
4. A nutlet, enlarged.
5. An embryo, much magnified.

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BOURRERIA HAVANENSIS, Miers.

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[illegible] through the apex, or is sometimes [illegible] and is crowned with [illegible] capitate [illegible]. The fruit ripens in the autumn or early in the spring from autumnal flowers, and is bright [illegible] half an inch in diameter, tipped with the remnants of the style, and surrounded [illegible] by the enlarged spreading calyx which sometimes becomes half an inch across; it has a [illegible] the four thick-walled nutlets.

[illegible] *Havanensis* is a common inhabitant of the forests of Key West, Key Largo, Upper [illegible] and [illegible] Keys in Florida, and of those of the Bahama Islands and of many of the [illegible].

The wood of *Bourreria Havanensis* is hard, strong, very closegrained, with a [illegible] surface susceptible of receiving a beautiful polish; it contains numerous obscure medullary rays, and is brown streaked with orange, with thick hardly distinguishable sapwood. The specific gravity of the absolutely dry wood is 0.8075, a cubic foot weighing 50.31 pounds.

The Strong Back[1] was first described in the *Natural History of Carolina*[2] by Mark Catesby, who discovered it on the Bahama Islands; it was first noticed in Florida[3] by Dr. J. L. Blodgett.[4]

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[1] This name, which was in use among the inhabitants of the Bahama Islands when Catesby visited them early in the last century, was probably given to this tree on account of the hard tough nature of the wood. On the Florida keys, which were first settled by fishermen and woodchoppers from the Bahamas, Strong Back is sometimes replaced by Strong Bark.

[2] *Pittonia similis, Laureolæ foliis, floribus albis, baccis rubris*, ii. 79, t. 79.

[3] The Porto Rico plant that flowered in the Jardin des Plantes in Paris in 1801, and was described by Desfontaines (*Ann. Mus.* i. 279) as *Ehretia Bourreria*, was, according to Miers (*Ann. & Mag. Nat. Hist.* ser. 4, iii. 203) his *Bourreria recurva* here reduced to *Bourreria Havanensis*.

[4] See i. 33.

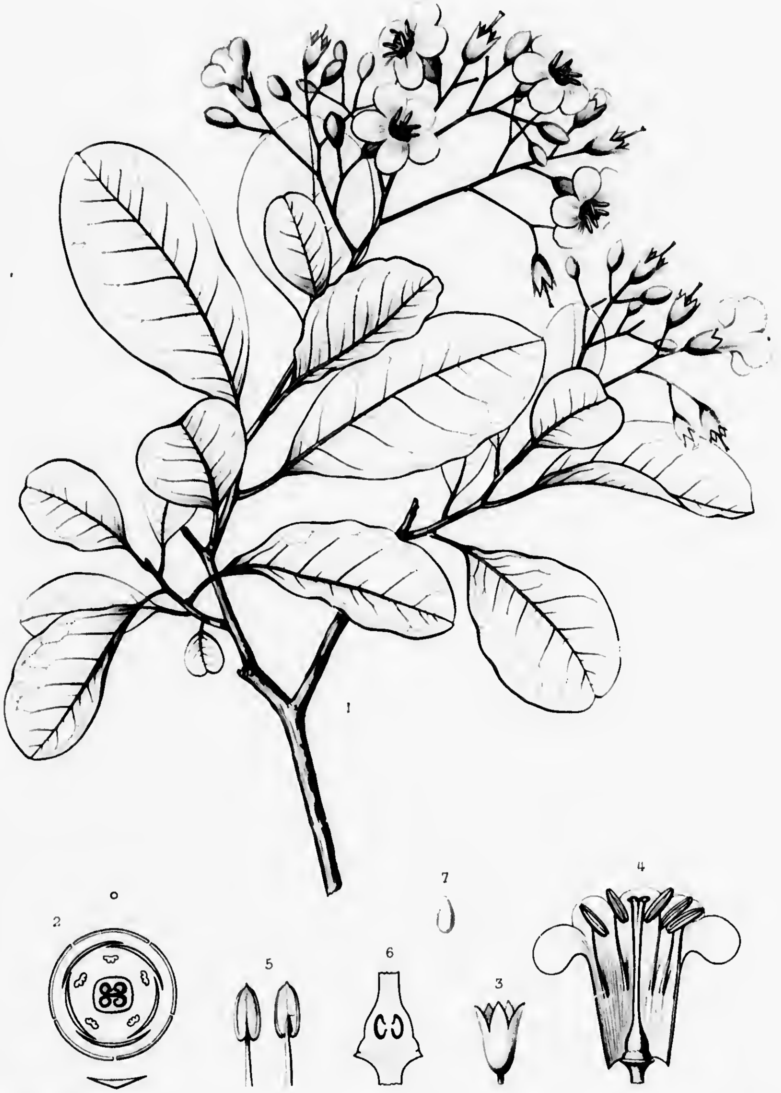
EXPLANATION OF THE PLATES.

PLATE CCLXXXV. [illegible] HAVANENSIS.

1. A flowering branch, natural size.
2. A diagram of a flower.
3. [illegible] enlarged.
4. [illegible]
5. [illegible]
6. [illegible]
7. An [illegible] much magnified.

PLATE CCLXXXVI. BOURRERIA HAVANENSIS.

1. A fruiting branch, natural size.
2. Vertical section of a fruit, enlarged.
3. Cross section of a fruit, enlarged.
4. A nutlet, enlarged.
5. An embryo, much magnified.



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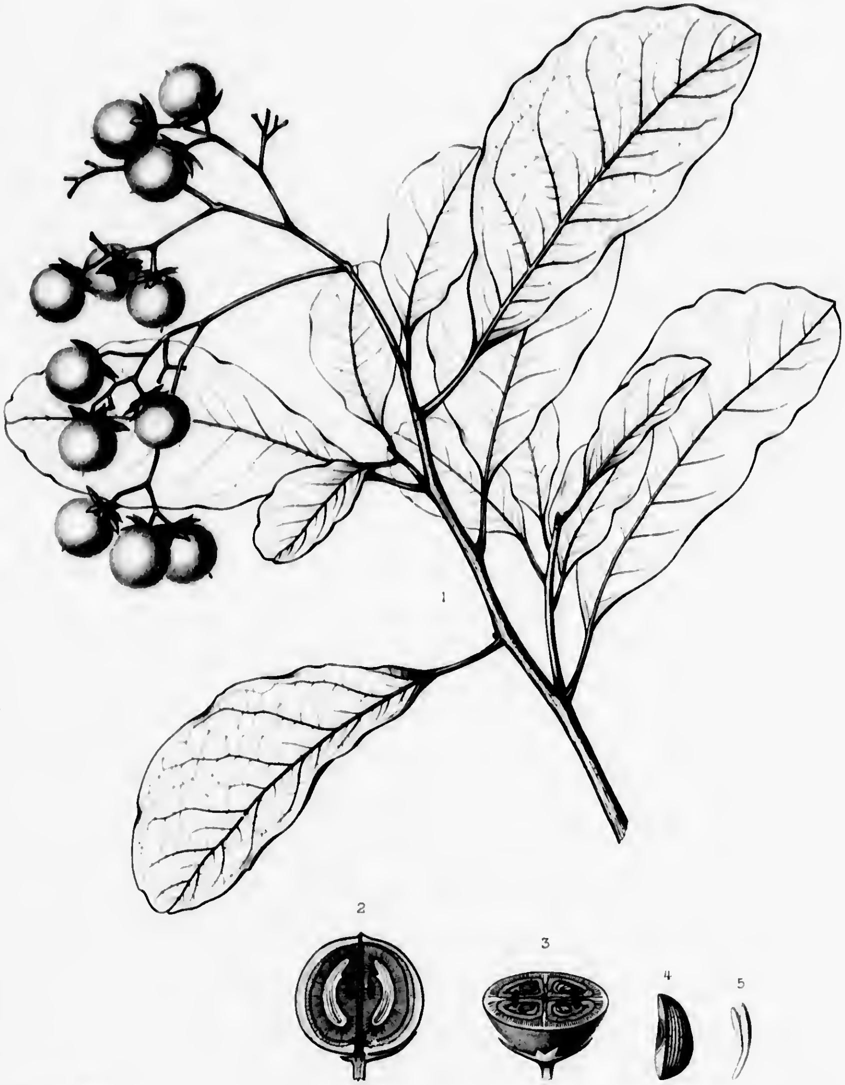
BOURRERIA HAVANENSIS, Miers

A. Riocreux direxᵗ Imp. J. Taneur Paris.

C. E. Faxon del. [illegible]

BOURRERIA HAVANENSIS, Miers.

A. Riocreux direx. [illegible]



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BOURRERIA HAVANENSIS, Miers.

A Riocreux direx^{t} Imp. J Taneur, Paris

EHRETIA.

Flowers regular, perfect; calyx 5-parted, open or closed in æstivation, the divisions imbricated; corolla gamopetalous, 5-lobed, the lobes imbricated in æstivation; stamens 5; disk annular; ovary incompletely 4-celled; ovule solitary. Fruit a fleshy 2 or 4-stoned drupe. Leaves alternate, entire or dentate, without stipules.

Ehretia, Browne, *Nat. Hist. Jam.* 168 (1756). — Adanson, *Fam. Pl.* ii. 177. — Linnæus, *Syst. Nat.* ed. 10, 936; *Gen.* ed. 6, 102. — A. L. de Jussieu, *Gen.* 128. — Meisner, *Gen.* 278. — Endlicher, *Gen.* 645. — Bentham & Hooker, *Gen.* ii. 840. — Baillon, *Hist. Pl.* iii. 392. — Engler & Prantl, *Pflanzenfam.* iv. pt. iii. 87.

Carmona, Cavanilles, *Anal. Cienc. Nat.* i. 38, t. 3 (1799); *Icon.* v. 22, t. 438.

Hilsenbergia, Meisner, *Gen.* ii. 198 (1840).

Glabrous or scabrous-pubescent trees or shrubs, with terete branchlets and fibrous roots. Leaves alternate, entire, or dentate. Flowers small, in terminal or rarely in axillary scorpioid cymes, corymbs, or panicles. Calyx open or closed before anthesis, five-parted, the divisions ovate or linear, persistent under the fruit. Corolla usually white, the tube short or cylindrical, with five spreading obtuse lobes. Stamens five, inserted on the tube of the corolla, introrse, exserted or included; filaments filiform; anthers ovate or oblong, attached on the back near the base, two-celled, the cells opening longitudinally. Ovary oblong-conical, sessile on the annular disk, one-celled before anthesis, incompletely four-celled by the development of the two parietal placentas; style columnar, slightly or deeply parted into two divisions terminating in capitate or clavate stigmas; ovules solitary in each cell, attached laterally near or above the middle on the inner face of the revolute placenta, anatropous; raphe ventral; micropyle superior. Fruit small, usually globose, tipped with the remnants of the style, and surrounded at the base by the persistent calyx; epicarp thin, dry, or juicy; endocarp separable into two two-celled or into four one-celled thick-walled bony nutlets rounded on the back, plane on the face, and attached to a thin axile columella. Seed terete, usually erect, filling the longitudinally incurved seminal cavity; testa thin, membranaceous, light brown. Embryo axile in thin albumen; cotyledons ovate, plane, shorter than the elongated superior radicle turned toward the hilum.

Ehretia is found in the tropics and warm extratropical regions of the two hemispheres, about fifty species being now distinguished.[1] In the United States the genus is represented by a single species, a small tree of southwestern Texas and northern Mexico.

Some of the species produce edible fruit, and wood of moderate value. The genus is not known to possess other useful properties. *Ehretia acuminata*,[2] an inhabitant of the Himalaya forests, is often planted as a shade-tree in India, China, and Japan.

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[1] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 65. — Kunth, *Syn. Pl. Æquin.* ii. 189. — Blume, *Bijdr. Fl. Ned. Ind.* 841. — De Candolle, *Prodr.* ix. 502 (excl. sec. *Bourreria* in part). — Miquel, *Fl. Ind. Bat.* ii. 919. — Bentham, *Fl. Hongk.* 234; *Fl. Austral.* iv. 387. — Grisebach, *Fl. Brit. W. Ind.* 481. — Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 106; *Contrib.* ii. 224. — Hemsley, *Bot. Biol. Am. Cent.* ii. 370. — C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iv. 141. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 143. — Watson, *Proc. Am. Acad.* xxvi. 144.

[2] R. Brown, *Prodr. Fl. Nov. Holl.* 497 (1810). — De Candolle, *l. c.* 503. — Bentham, *Fl. Austral.* iv. 387. — C. B. Clarke, *l. c.* — Forbes & Hemsley, *l. c.*

Ehretia serrata, Roxburgh, *Fl. Ind.* ii. 340 (1824); *Bot. Reg.* xiii. t. 1097. — De Candolle, *l. c.* — Franchet & Savatier, *Enum. Pl. Jap.* i. 333. — Kurz, *Forest Fl. Brit. Burm.* ii. 210.

Ehretia pyrifolia, D. Don, *Prodr. Fl. Nepal.* 102 (1825).

Ehretia ovalifolia, Hasskarl, *Cat. Hort. Bogor.* 137 (not Wight) (1844).

Cordia thyrsiflora, Siebold & Zuccarini, *Abhand. Akad. Münch.* iv. pt. iii. 150 (1846).

In India the fruit of this handsome tree, which is sweet and insipid, is eaten, and the soft and easily worked wood is used in building and in the manufacture of agricultural implements, scabbards, sword-handles, and gun-stocks (Brandis, *Forest Fl. Brit. Ind.* 339, under *Ehretia serrata*).

The generic name commemorates the artistic and scientific labors of Georg Dionysius Ehret,[1] a botanical painter of the eighteenth century.

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[1] Georg Dionysius Ehret (1708–1770) was born in the grand duchy of Baden, where his father was gardener to Charles, Prince of Baden Bulach, a patron of botany and horticulture. Ehret early displayed a talent for drawing, and a collection of five hundred paintings of flowers which he made in the ducal gardens was purchased by Dr. Trew, the distinguished physician and botanist of Nuremberg. With the money which he obtained in this way he was able to travel through Germany, Switzerland, and France, and visiting Paris found employment in painting the flowers in the Jardin du Roi under the direction of Jussieu. He crossed to London, but soon returned to the continent, and in 1736 was working in George Clifford's famous garden in Amsterdam, where he was found by Linnæus, under whose eye he prepared the drawings for the *Hortus Cliffortianus*. Ehret returned to London in 1740, married a sister of Philip Miller of the Physic Garden at Chelsea, and passed the remainder of his life in England occupied in flower-painting and in teaching his art. Of his published drawings, which represent a small part of his accomplishment, the most important are the illustrations of the sumptuous *Plantæ Selectæ*, of which seven decades were issued by Trew and three by Vogel after the death of the former. He drew the figures for Patrick Browne's *Natural History of Jamaica*, and drew and engraved a series of tables of exotic plants and butterflies, published in London in 1748–1759. Several papers on botanical subjects written by Ehret, including an account of the Sassafras-tree of North America, were printed in the *Nova Acta Academiæ Curiosorum*.

EHRETIA ELLIPTICA.

Anaqua. Knackaway.

FLOWERS in terminal racemose panicles. Nutlets 2. Leaves oval or oblong.

Ehretia elliptica, De Candolle, *Prodr.* ix. 503 (1845). — Torrey, *Bot. Mex. Bound. Surv.* 136. — Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 110; *Contrib.* ii. 228, t. 85. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 118. — Hemsley, *Bot. Biol. Am. Cent.* ii. 376. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 114. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 283 (*Man. Pl. W. Texas*).

? **Ehretia scabra**, Kunth & Bouché, *Ind. Sem. Hort. Berol.* 1847, 12. — Walpers, *Ann.* i. 524. — Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 111; *Contrib.* ii. 229.

Ehretia ciliata, Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 111; *Contrib.* ii. 229.

Ehretia exasperata, Miers, *Ann. & Mag. Nat. Hist.* ser. 4, iii. 112; *Contrib.* ii. 230.

A tree, sometimes forty to fifty feet in height, with a trunk occasionally three feet in diameter, and stout spreading branches which form a handsome compact round-topped leafy head; usually much smaller within the territory of the United States, and often reduced to a low shrub. The bark of old trunks is sometimes an inch thick, and is deeply furrowed and divided into long thick irregular plate-like scales with a gray or reddish brown surface which separates in thin flakes; or on young stems and on the branches it is thin, light brown, and broken into thick appressed scales. The branchlets are slender and terete, and when they first appear are covered like the under surface of the leaves, the branches of the inflorescence, and the outer surface of the calyx of the flower, with rigid hirsute pale hairs; during their first winter they are light brown tinged with red, sometimes puberulous, and often roughened by numerous pale lenticels. The leaf-scars are small, depressed, and obcordate, and display a short lunate row of minute fibro-vascular bundle-scars; in their axils are one, or two superposed minute buds buried in the bark, and covered with two pairs of dark scales which remain on the base of the growing branchlet and at maturity are lanceolate, acute, dark chestnut brown, coated with pale hairs, and sometimes a quarter of an inch long.[1] The leaves are oval or oblong, pointed and apiculate at the apex, gradually rounded or wedge-shaped at the base, entire or occasionally furnished above the middle with a few broad teeth, and conspicuously reticulate-venulose, with short stout grooved pubescent petioles; they unfold late in the winter, and are then thin and light green, lustrous, minutely tuberculate and pilose on the upper surface, and are often furnished below with tufts of white hairs in the axils of the veins; at maturity they are thick, subcoriaceous, dark green and roughened above by the enlarged circular rigid pale tubercles, and are more or less covered with soft pale or rufous pubescence below, especially on the narrow midribs and the numerous primary veins which are arcuate near the margins. The flowers are produced in compact racemose scorpioid-branched panicles two to three inches long and broad, terminal on short leafy branches of the year, and appear in the autumn, during the winter, or usually in very early spring. The bracts and bractlets are linear, acute, about a quarter of an inch long, and early deciduous. The calyx, which is open in the bud, is divided to the base into five linear acute divisions and is nearly as long as the campanulate tube of the corolla, which forms before anthesis an obovate bud rounded at the apex, and is half an inch across the expanded lobes, which are ovate, thin and white, and rather shorter than the exserted stamens. The fruit ripens in the autumn and in the spring, and is globose, surrounded at the base by the persistent somewhat enlarged calyx, light yellow, and a quarter of an inch in diameter, with thin sweet rather juicy edible flesh, and two two-seeded nutlets.

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[1] On the specimens of *Ehretia elliptica* which I have examined there is no terminal bud, the winter branchlet ending in a small black point close to the scar of the last leaf of the previous season.

Ehretia elliptica is most abundant in the fertile soil of river valleys, although it often covers dry barren ridges with a shrubby growth,[1] and is distributed in western Texas from the valley of the upper San Marcos River to the Rio Grande, and through Nuevo Leon and Cohahuila to the mountains of San Luis Potosí. It is often extremely common on the bottom-lands of western Texas, and probably attains its largest size within the territory of the United States on those of the Guadaloupe and Nueces rivers, sixty or seventy miles from the coast of the Gulf of Mexico.

The wood of *Ehretia elliptica* is heavy, hard, not strong, close-grained, and difficult to split; it contains many thin medullary rays and small open ducts arranged in numerous concentric rings within the layers of annual growth which are marked by several rows of larger ducts, and is light brown, with thick slightly lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6440, a cubic foot weighing 40.13 pounds.

Ehretia elliptica was discovered in Nuevo Leon by the Belgian botanist Berlandier, and was first found in Texas near New Braunfels by Frederick Lindheimer.[2]

The rapid growth of this tree, which is not much affected by drought, its compact round head of dark green foliage, and abundant clusters of white flowers, which frequently quite cover the branches, make it a desirable ornamental tree, and the Anaqua is often found shading the streets of the cities of western Texas and northern Mexico.

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[1] "Poor as a Knackaway hill" has become a proverbial expression among Texas farmers (*Garden and Forest*, vi. 242).

[2] See i. 74.

EXPLANATION OF THE PLATE.

PLATE CCLXXXVII. EHRETIA ELLIPTICA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. A stamen, front and side views, enlarged.
5. A pistil, enlarged.
6. Vertical section of an ovary, enlarged.
7. Cross section of an ovary, much magnified.
8. An ovule, much magnified.
9. A fruiting branch, natural size.
10. Cross section of a fruit, enlarged.
11. Vertical section of a fruit, enlarged.
12. A seed, enlarged.
13. An embryo, much magnified.

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EHRETIA [illegible]

[illegible] and of river valleys, althoug[illegible] dry [illegible] in western Texas from the va[illegible] upper [illegible] through Nuevo Leon and Coahuila to the mon[illegible] San [illegible] bottom-lands of western Texas, and proba[illegible] [illegible] States on those of the Guadaloupe and Nueces [illegible], [illegible] the Gulf of Mexico.

[illegible] is heavy, hard, not strong, close-grained, and difficult to split; it [illegible] rays and small open ducts arranged in numerous concentric rings within [illegible] growth which are marked by several rows of larger ducts, and is light brown, [illegible] lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6410, [illegible] foot weighing 40.13 pounds.

[illegible] was discovered in Nuevo Leon by the Belgian botanist Berlandier, and was first found in Texas near New Braunfels by Frederick Lindheimer.[2]

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[1] "Poor as a Knackaway hill" has become a proverbial expression among Texas farmers (*Garden and Forest*, vi. 242).

[2] See [illegible] 74.

EXPLANATION OF THE PLATE.

PLATE CCLXXXVII. EHRETIA ELLIPTICA.

1. A flowering branch, natural size.
2. [illegible] of a flower.
3. [illegible]
4. A [illegible], enlarged.
5. [illegible], enlarged.
6. [illegible], enlarged.
7. [illegible] of an ovary, much magnified.
8. [illegible], much magnified.
9. A fruiting branch, natural size.
10. [illegible] of a fruit, enlarged.
11. Vertical section of a fruit, enlarged.
12. A seed, enlarged.
13. An embryo, much magnified.

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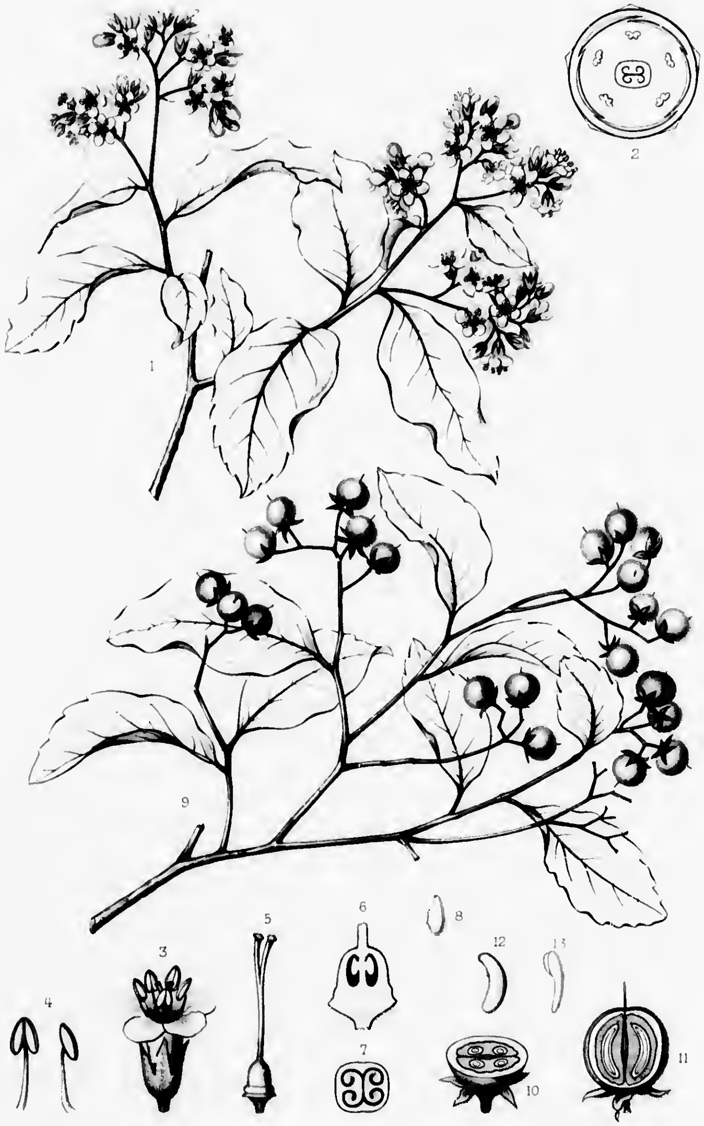

C. E. Faxon del.

Lovendal sc.

EHRETIA ELLIPTICA, DC.

A. Riocreux direx.t

Imp. J. Taneur Paris

CATALPA.

Flowers perfect; calyx gamosepalous, closed in the bud, bilabiately splitting in anthesis; corolla gamopetalous, 2-lipped, 5-lobed, the lobes imbricated in æstivation; stamens usually 2; staminodia 3; disk hypogynous, nearly obsolete; ovary 2-celled; ovules numerous. Fruit a linear woody capsule. Leaves simple, usually opposite, destitute of stipules.

Catalpa, Scopoli, *Introduct.* 170 (1777). — A. L. de Jussieu, *Gen.* 13[illegible]. — Meisner, *Gen.* 301. — Endlicher, *Gen.* 711. — Bentham & Hooker, *Gen.* ii. 1041. — Baillon, *Hist. Pl.* x. 45.

Catalpium, Rafinesque, *Jour. Phys.* lxxxix. 259 (1819).

Trees, with watery juices, terete branchlets with thick pith, thin scaly bark, scaly buds, soft light-colored wood, and fibrous roots. Leaves opposite, verticillate, or alternate, involute in vernation, simple, entire or lobed, oblong-ovate or cordate, long-petiolate, deciduous. Flowers vernal or æstival in ample terminal compound trichotomously branched panicles or corymbs. Bracts and bractlets linear-lanceolate, deciduous. Calyx membranaceous, subglobose and apiculate in the bud, in anthesis splitting nearly to the base into two broadly ovate entire lobes. Corolla gamopetalous, thin and membranaceous, white or yellow, variously marked and spotted on the inner surface, inserted on the nearly obsolete disk, the tube occasionally furnished on the upper side near the base with an external lobed appendage, oblique and enlarged above into a broad bilabiate limb, with spreading lips undulate on the margins, the posterior two-parted, the anterior deeply three-lobed. Stamens and staminodia inserted near the base of the corolla; stamens two, introrse, anterior, included or slightly exserted, or rarely four; filaments flattened, arcuate; anthers attached on the back, oblong or linear, carried to the rear of the corolla and face to face on either side of the stigma by a half turn in the filaments near their base, two-celled, the cells divergent in anthesis, opening longitudinally; staminodia filiform, minute or rudimentary. Ovary sessile, two-celled, abruptly contracted into an elongated filiform style divided at the apex into two stigmatic lobes exserted above the anthers;[1] ovules numerous, inserted in many series on a central placenta, horizontal, anatropous; raphe ventral; micropyle superior. Fruit an elongated subterete capsule tapering from the middle to the two ends, persistent on the branches during winter and ultimately splitting loculicidally into two valves. Seeds numerous, compressed, oblong, exalbuminous, inserted in two to four ranks near the margin of the flat or more or less thickened, woody septum free from the walls of the capsule; testa thin, light brown or silvery gray, longitudinally veined, produced into broad lateral wings notched at the base of the seed and divided at their narrowed or rounded ends into comas of long coarse white hairs. Embryo filling the cavity of the seed; cotyledons plane, broader than long, slightly two-lobed, rounded laterally; radicle short, erect, turned toward the oblong conspicuous basal hilum.

Catalpa is now confined to the eastern United States, the West Indies, and China. During the

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[1] In the North American species of Catalpa the flowers are protandrous; the anthers open in the morning and discharge their pollen, while the lobes of the stigma remain closed until the evening of the same day, when the anthers have become effete (Engelmann, *Bot. Gazette*, v. 3). The flowers are visited by humble-bees, who enter the corolla in search of the nectar secreted by the small oblong glands on the margin of the disk, and probably insure their cross-fertilization. (See Antisdale, *Bot. Gazette*, viii. 171. — Delpino, *Ulteriori Osservazioni*, i. 149; ii. 172.)

tertiary epoch it was common in Europe, from which it has now disappeared;[1] and in North America ranged westward to the northern Rocky Mountain region, where traces of *Catalpa crassifolia*,[2] the ancestor of the existing species, have been discovered in the miocene strata on the banks of the Yellowstone River.

Seven species are distinguished; of these, two are North American. One species, *Catalpa longissima*,[3] is a native of the Antilles; two others, still imperfectly known, have been detected on the island of Cuba,[4] and *Catalpa ovata*[5] and *Catalpa Bungei*[6] inhabit northern and central China.

Catalpa contains a bitter principle, and is tonic and diuretic, and produces soft straight-grained and durable wood.

In the United States Catalpa is not seriously injured by insects[7] or fungal diseases.[8] The North American and Chinese species are easily raised from seeds, which germinate early in the first season; and can be multiplied by cuttings taken from young shoots, which root readily.

The generic name is that by which one of the North American species, the type of the genus, was known among the Cherokee Indians.

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[1] Saporta, *Ann. Sci. Nat.* sér. 7, x. 62. — Zittel, *Handb. Palæontolog.* ii. 780, f. 397.

[2] Newberry, *Ann. Lyc. N. Y.* ix. 56 (1870).

[3] Sims, *Bot. Mag.* xxvii. under t. 1094 (1808). — De Candolle, *Prodr.* ix. 226.

Bignonia longissima, Jacquin, *Enum. Pl. Carib.* 25 (1760); *Hist. Stirp. Am.* 182, t. 176, f. 78. — Swartz, *Prodr.* 91; *Fl. Ind. Occ.* ii. 1037. — Willdenow, *Spec.* iii. pt. i. 290. — Lunan, *Hort. Jam.* i. 309.

Bignonia Quercus, Lamarck, *Dict.* i. 417 (1783). — Tussac, *Fl. Antill.* iv. 118, t. 37. — Descourtils, *Fl. Méd. Antill.* i. 87, t. 18.

Catalpa longisiliqua, Grisebach, *Fl. Brit. W. Ind.* 446 (1864).

Catalpa longissima is a handsome tree forty to fifty feet in height, with an oblong round-topped head, narrow ovate pointed leaves, small fragrant nearly white flowers, and long slender fruits, and in the West Indies is often planted for shade or ornament. The wood, known as French oak or Spanish oak, is moderately strong, and is considered valuable (Browne, *Nat. Hist. Jam.* 264). The bark, leaves, and flowers are believed to possess tonic and anti-periodic properties, and are sometimes used medicinally in the West Indies (Baillon, *Hist. Pl.* x. 23).

[4] Grisebach, *Cat. Pl. Cub.* 192.

[5] Don, *Gen. Syst.* iv. 230 (1838).

Bignonia Catalpa, Thunberg, *Fl. Jap.* 251 (not Linnæus) (1784).

Catalpa bignonioides, var. *Kæmpferi*, De Candolle, *l. c.* (1845).

Catalpa Kæmpferi, Siebold & Zuccarini, *Abhand. Akad. München.* iv. pt. iii. 142 (1846). — Miquel, *Ann. Mus. Bot. Lugd. Bat.* iii. 122. — Franchet & Savatier, *Enum. Pl. Jap.* i. 326. — Lavallée, *Icon. Arb. Segrez.* 33, t. 10. — *Bot. Mag.* cx. t. 6611. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 235.

This tree was first made known to Europeans by the German botanist Engelbert Kaempfer, who visited Japan in 1690, and in 1712 published an excellent description and figure of it in his *Amœnitates Exoticæ* (p. 841). It is not, however, indigenous in Japan, where it now only exists in cultivation, being rarely seen outside of the inclosures of Buddhist temples, and where it was brought from China about the beginning of the Christian era by the priests of Buddha, who appear to have a particular fondness for the Catalpa. *Catalpa ovata* is probably a native of the forests of western China, although it has been so long cultivated in the northern and central provinces that, like several other Chinese trees, it is not possible, with the existing knowledge of the flora of western Asia, to determine its original home. *Catalpa ovata* was introduced into Europe by Siebold in 1849. In the northern United States it is hardier than either of the North American species, producing in great profusion during the month of July its small light yellow flowers, which are succeeded by slender fruits.

A hybrid of *Catalpa ovata* and of one of the North American species appeared several years ago at Baysville, Indiana, in the nursery of Mr. J. C. Teas, whose name it bears (Sargent, *Garden and Forest*, ii. 303, f.).

[6] C. A. Meyer, *Bull. Acad. Sci. St. Pétersbourg*, ii. 49 (1837). — De Candolle, *l. c.* — Hance, *Jour. Bot.* xx. 37. — Franchet, *Pl. David.* i. 229; *Mém. Soc. Sci. Nat. Cherbourg*, xxiv. 236. — Forbes & Hemsley, *l. c.* 235.

Catalpa syringifolia, Bunge, *Mém. Sav. Étr. St. Pétersbourg*, ii. 119 (*Enum. Pl. Chin. Bor.*) (not Sims) (1834).

Catalpa Bungei, which is often planted in Peking and other cities of central and northern China, is described as a large tree with fœtid lobed or entire leaves varying in size and shape, large white flowers spotted with purple and appearing in May, and long slender pods (Bretschneider, *Jour. China Branch Roy. Asiatic Soc.* n. ser. xvi. pt. i. 112; xxv. 341 [*Botanicon Sinicon*, i., ii.]).

[7] Few insects are reported as injuring Catalpa in North America. In the southern states the foliage is sometimes entirely destroyed by the larvæ of *Sphinx Catalpæ*, Boisduval, although in the north it is considered a rare insect (*Rep. U. S. Agric.* 1882, 189). The Fall Web-worm also feeds upon the leaves; and *Diplosis Catalpæ*, Comstock, is described as infesting the fruit on trees growing in the city of Washington (*Rep. U. S. Agric.* 1880, 266).

[8] The fungal parasites of Catalpa are principally species which produce spotting of the leaves. The most characteristic are *Cercospora Catalpæ*, Winter, which makes small white spots, and *Macrosporium Catalpæ*, Ellis & Martin, and *Amphyllosticta Catalpæ*, Ellis & Martin, which make black spots. The mildew of Catalpa leaves is due in part to *Phyllactinia suffulta*, Saccardo, a species diffused on many different plants, and to the more special *Microsphæra elevata*, Burrill, which infests both North American species.

CONSPECTUS OF THE NORTH AMERICAN SPECIES OF CATALPA.

Flowers in many-flowered crowded panicles; corolla thickly spotted on the inner surface; fruit slender, thin-walled; leaves slightly acuminate . . . . 1. CATALPA CATALPA.

Flowers in few-flowered open panicles; corolla inconspicuously spotted; fruit stout, thick-walled; leaves caudate-acuminate . . . . 2. CATALPA SPECIOSA.

CATALPA CATALPA.

Catalpa. Indian Bean.

FLOWERS in many-flowered crowded panicles; corolla thickly spotted on the inner surface. Fruit slender. Leaves slightly acuminate.

Catalpa Catalpa, Karsten, *Pharm. Med. Bot.* 927 (1882). — Sudworth, *Garden and Forest*, iv. 466.

Bignonia Catalpa, Linnæus, *Spec.* 622 (in part) (1753). — Du Roi, *Harbk. Baumz.* i. 114. — Lamarck, *Dict.* i. 417. — Moench, *Bäume Weiss.* 15. — Marshall, *Arbust. Am.* 21. — Wangenheim, *Nordam. Holz.* 58, t. 20, f. 45. — Castiglioni, *Viag. negli Stati Uniti*, ii. 210. — Schmidt, *Oestr. Baumz.* i. 42, t. 41. — Willdenow, *Berl. Baumz.* 46; *Spec.* iii. 289; *Enum.* 649. — Michaux, *Fl. Bor.-Am.* ii. 25. — Schkuhr, *Handb.* ii. 201, t. 175. — Desfontaines, *Hist. Arb.* i. 189. — Michaux f. *Hist. Arb. Am.* iii. 217, t. 6. — Rafinesque, *Fl. Ludovic.* 159. — Le Maout & Decaisne, *Traité Gén. Bot.* 209, f.; English ed. 602, f.

Catalpa bignonioides, Walter, *Fl. Car.* 64 (1788). — Borkhausen, *Handb. Forstbot.* ii. 1601. — De Candolle, *Prodr.* ix. 226. — Gray, *Man.* 292 (in part); *Syn. Fl. N. Am.* ii. pt. i. 319 (in part); ed. 2, 456. — Darlington, *Fl. Cestr.* ed. 3, 182. — Chapman, *Fl.* 285. — Curtis, *Rep. Geolog. Surv. N. Car.* iii. 1860, 50. — Bureau, *Bignoniacées*, t. 25. — Koch, *Dendr.* ii. 302. — Lauche, *Deutsche Dendr.* ed. 2, 146, f. 45. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 115. — Watson & Coulter, *Gray's Man.* ed. 6, 399. — Koehne, *Deutsche Dendr.* 520, f. 91, H-L.

Catalpa cordifolia, Moench, *Meth.* 464 (1794). — *Nouveau Duhamel*, ii. 13 (excl. t.). — Nuttall, *Gen.* i. 10. — Elliott, *Sk.* i. 24. — Darlington, *Fl. Cestr.* ed. 2, 363. — Spach, *Hist. Vég.* ix. 133.

Catalpa syringifolia, Sims, *Bot. Mag.* xxvii. t. 1094 (1808). — Pursh, *Fl. Am. Sept.* i. 10. — Hayne, *Dendr. Fl.* 2. — Loddiges, *Bot. Cab.* xiii. t. 1285. — Sprengel, *Syst.* i. 70. — *Sertum Botanicum*, i. t. — Don, *Gen. Syst.* iv. 230. — Dietrich, *Syn.* i. 82. — Nuttall, *Sylva*, iii. 77. — Torrey, *Fl. N. Y.* ii. 25. — Hofmeister, *Abhand. Königl. Sächsisch. Gesell. Wiss.* vi. 632, t. 23, f. 7.

Catalpa communis, Du Mont de Courset, *Bot. Cult.* ed. 2, iii. 242 (1811).

A tree, rarely sixty feet in height, with a short trunk sometimes three or four feet in diameter, and stout elongated brittle branches which form a broad head,[1] and dichotomous branchlets. The bark of the trunk varies from a quarter to a third of an inch in thickness, and is light brown tinged with red on the surface, which separates in large thin irregular scales. The branchlets, when they first appear, are green shaded with purple, and slightly puberulous; during their first winter they are thickened at the nodes, lustrous, light orange-color or gray-brown, covered with a slight glaucous bloom, and marked with large pale scattered lenticels, the outer layer of the thin bark separating easily from the bright green inner layer. The leaf-scars, in which appear a circle of conspicuous fibro-vascular bundle-scars, are large, oval, and elevated, and do not entirely disappear until the third or fourth year, when the branches are reddish brown, and marked with a network of thin flat brown ridges. The branch continues to grow through the summer, the end dying in the autumn without forming a terminal bud, and appearing during the winter as a black scar by the side of the upper axillary bud. The axillary buds are minute, globose, and deeply immersed in the bark, with several pairs of chestnut-brown broadly ovate rounded slightly puberulous and loosely imbricated scales; those of the inner ranks are accrescent, and when fully grown are bright green, pubescent, and sometimes two inches in length. The leaves are opposite or in threes, broadly ovate, rather abruptly contracted into slender points or sometimes rounded at the apex, cordate at the base, and entire or often laterally lobed; when they unfold they are coated on the lower surface with pale tomentum, and are pilose on the upper surface; and at maturity they are thin and firm, light green and glabrous above, pale and pubescent below, five or six inches long and

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[1] Sometimes when not interfered with the branches grow to a great length, and, resting on the ground, form roots, and produce new trunks in succession (*Garden and Forest*, iii. 536, f. 68).

four or five inches broad, with stout terete petioles five or six inches in length, prominent midribs and primary veins arcuate near the margins, connected by reticulate veinlets, and furnished in their axils with clusters of dark glands.[1] They smell disagreeable when bruised, and turn black and fall after the first severe frost in the autumn. The flowers, which appear from May in the south to the middle of July in New England, are produced in compact many-flowered panicles eight or ten inches long and broad, with light green branches tinged with purple, and are borne on slender pubescent pedicels half an inch in length. The calyx is half an inch long, and green or light purple. The corolla is white, with a broad campanulate flat tube, and a spreading limb which, when it is expanded, is an inch and a half wide and nearly two inches long; it is marked on the inner surface on the lower side with two rows of yellow blotches following two parallel lateral ridges or folds, and in the throat and on the lower lobes of the limb with crowded conspicuous purple spots. The stamens and style are slightly exserted. The fruit, which ripens in the autumn, hangs in thick-branched orange-colored panicles, and remains on the trees without opening during the winter; it is six to twenty inches long, a quarter to a third of an inch thick in the middle, with a thin wall which is bright chestnut-brown on the outside and light olive-brown and lustrous on the inside, and in the spring splits into two flat valves before finally falling; the partition is thin and light brown. The seed is about an inch long, a quarter of an inch wide, silvery gray, with pointed wings terminating in long pencil-shaped tufts of white hairs.

Catalpa Catalpa is usually supposed to be indigenous on the banks of the rivers of southwestern Georgia, western Florida, and central Alabama and Mississippi. The hardiness of this tree, however, in severe climates like that of New England, would indicate an origin in some colder and more elevated region, and it is possible that the Catalpa-trees which now appear to be growing naturally in the southern states are the offspring of trees carried there by man.[2]

The wood of *Catalpa Catalpa* is soft, not strong, coarse-grained, and very durable in contact with the soil, with numerous obscure medullary rays and rows of large open ducts clearly marking the layers of annual growth; it is light brown, with lighter colored often nearly white sapwood composed of one or two layers of annual growth. The specific gravity of the absolutely dry wood is 0.4474, a cubic foot weighing 27.88 pounds. It is used and highly valued for fence-posts, rails, and other purposes where durable wood is needed.

The bark, which contains tannin and an amorphous bitter principle, has been occasionally used, as well as the seeds, in decoction for the treatment of asthma and bronchitis,[3] and in homœopathic practice.[4]

The first account of *Catalpa Catalpa* was published in the *Natural History of Carolina*[5] by Mark Catesby, by whom it was introduced into English gardens about 1726.[6] Its value as an orna-

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[1] In the North American and Chinese species of Catalpa the leaves are furnished with these glands, which, on the American species, at least, secrete nectar, and are visited by numerous insects who feed upon it (Kerner, *Flowers and their Unbidden Guests*, 136. — Ryder, *Proc. Phil. Acad.* 1879, 161; *Am. Nat.* xiii. 648).

[2] The light large-winged seeds of Catalpa, which are carried far and wide by the wind, and are able to float for a long time on the surface of the water, are perfectly adapted to insure its wide dissemination, especially in a region abounding in swift-flowing streams like that which surrounds the southern extremity of the Appalachian mountain system. Catesby, who is the first botanist who speaks of this Catalpa, found it in the uninhabited part of Carolina, which in his time was all the middle and western part of the state, and carried it to the coast. Although not now known in the forests which cover the foothills of the southern Alleghany Mountains except in the neighborhood of human habitations and on the banks of streams, it is not improbable that they contain the home of this tree, which, during the last hundred years, has become completely naturalized in populous regions in the middle and southern states.

[3] *Nat. Dispens.* ed. 2, 367. — Johnson, *Man. Med. Bot. N. Am.* 201; *U. S. Dispens.* ed. 16, 1747.

[4] Millspaugh, *Am. Med. Pl. in Homœopathic Remedies*, i. 109, t. 109.

[5] *Bignonia Urucu foliis flore sordide albo, intus maculis purpureis & luteis asperso, siliqua longissima & angustissima*, i. 49, t. 49.

Bignonia; Americana; Arbor; Syringæ Cæruleæ foliis flore purpureo, Miller, *Dict.* No. 4.

Bignonia foliis simplicibus cordatis, Linnæus, *Hort. Cliff.* 317. — Royen, *Fl. Leyd. Prodr.* 280.

Bignonia foliis simplicibus cordatis, flore sordide albo, intus maculis cœruleis purpureis irregulariter adspersis; silique longissima et angustissima, Romans, *Nat. Hist. Florida*, 27.

[6] Aiton, *Hort. Kew.* ii. 346 (Bignonia). — Loudon, *Arb. Brit.* 1261, t. (*Catalpa syringifolia*).

mental tree was soon recognized, and for one hundred and fifty years it has been planted in the parks and gardens of all temperate countries, which it decorates in early summer with its abundant clusters of showy flowers.[1]

Catalpa Catalpa is hardy in the United States as far north as eastern New England, where the ends of the branches, however, are often killed in winter, and young plants are sometimes injured, and in central and western Europe.

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[1] A dwarf bushy form of *Catalpa Catalpa* of unknown origin, with spreading stems three or four feet tall, is common in gardens, under the name of *Catalpa Bungei.* It is not known to have produced flowers. A seedling variety of Catalpa with yellow leaves is also occasionally planted.

EXPLANATION OF THE PLATES.

Plate CCLXXXVIII. Catalpa Catalpa.

1. The end of a flowering branch, natural size.
2. Diagram of a flower.
3. A corolla displayed, natural size.
4. Stamens, front and rear views, slightly enlarged.
5. Vertical section of an ovary, enlarged.
6. An ovule, much magnified.

Plate CCLXXXIX. Catalpa Catalpa.

1. A fruiting branch, natural size.
2. The end of a fruit, one of the valves removed, natural size.
3. A seed, natural size.
4. Vertical section of a seed, natural size.
5. An embryo, natural size.
6. A winter branchlet, natural size.

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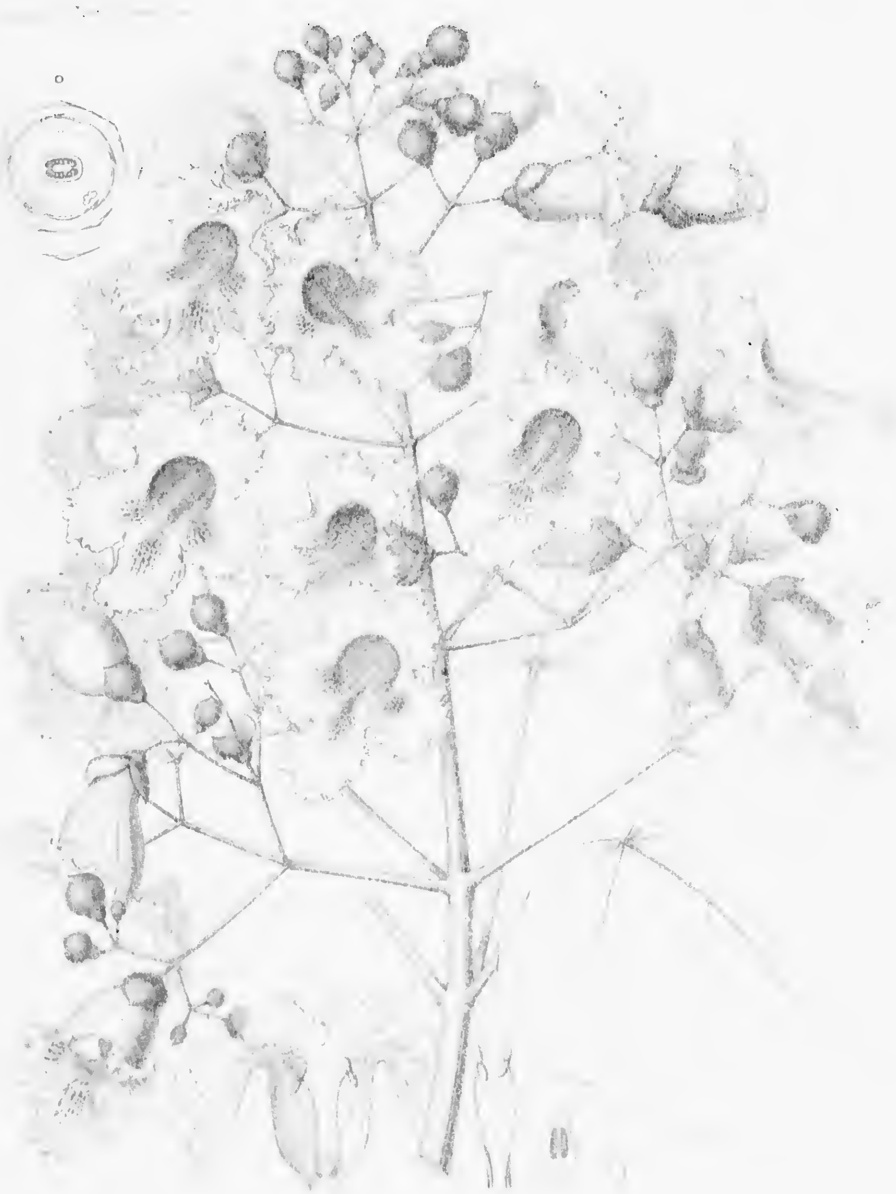
with yellow leaves is



[illegible] one hundred and fifty years it has been planted in the parks [illegible] which it decorates in early summer [illegible]

[illegible] hardy in the United States as far north as eastern New England [illegible] the [illegible] however, are often killed in winter, and young plants are sometimes injured and [illegible] Europe.

[illegible] unknown origin [illegible] common in gardens, [illegible] not known to have produced flowers. A seedling variety of Catalpa with yellow leaves is also occasionally planted.

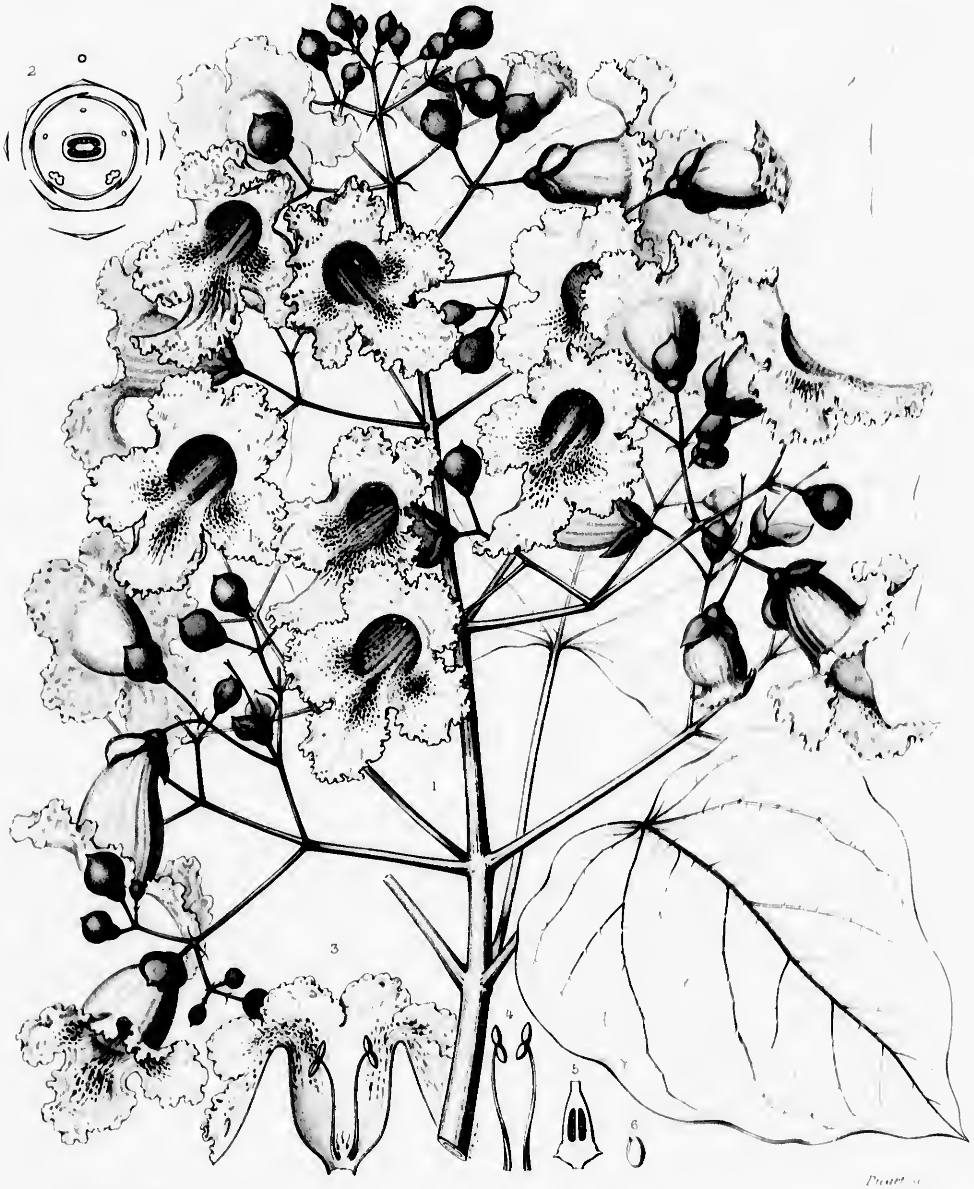
EXPLANATION OF THE PLATES.

Plate CCLXXXVIII. Catalpa Catalpa.

1. The end of a flowering branch, natural size.
2. Diagram of a flower.
3. A corolla displayed, natural size.
4. Stamens, front and rear views, slightly enlarged.
5. Vertical section of an ovary, enlarged.
6. An ovule, much magnified.

Plate CCLXXXIX. Catalpa Catalpa.

1. A fruiting branch, natural size.
2. The end of a fruit, one of the valves removed, natural size.
3. [illegible] natural size.



C E Faxon del.

Picart sc.

CATALPA CATALPA, Karst.

A Riocreux direx.t

Imp. J. Taneur Paris

[illegible]

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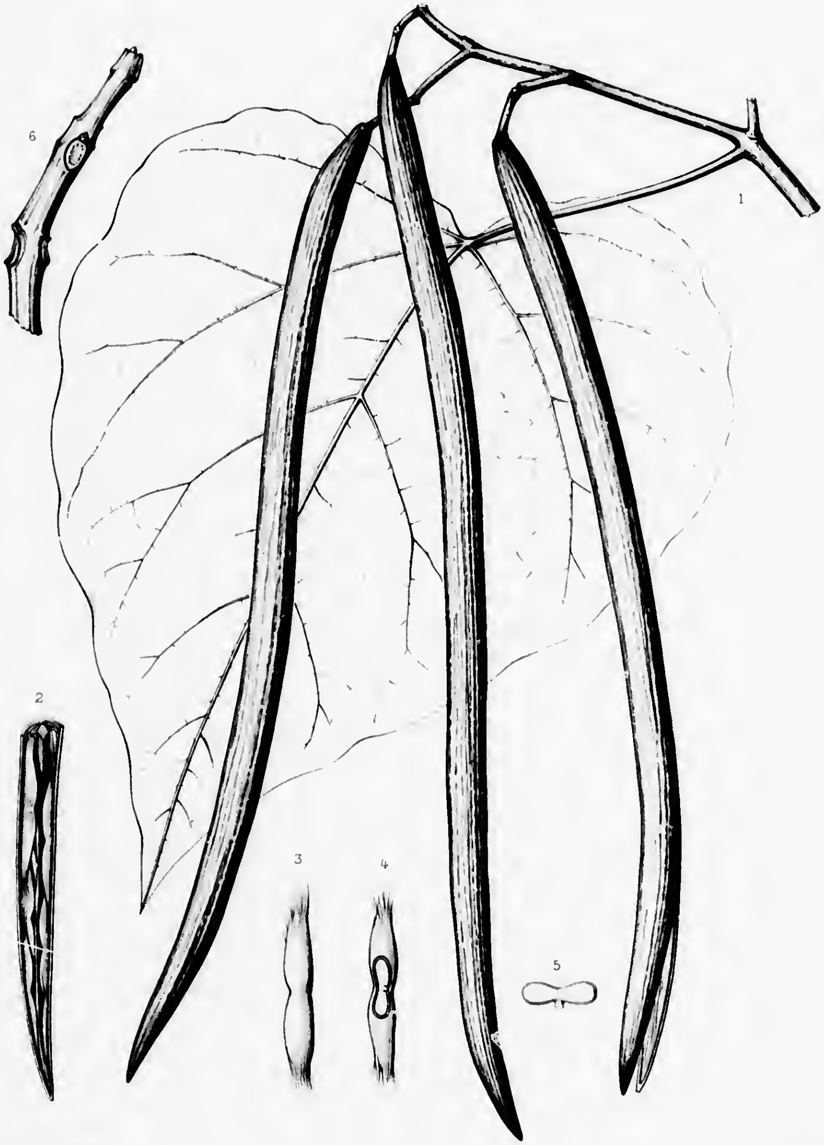

C. E. Faxon del.

Picart sc.

CATALPA CATALPA, Karst.

A. Riocreux direx.t

Imp. J. Taneur Paris

CATALPA SPECIOSA.

Western Catalpa.

Flowers in few-flowered open panicles; corolla inconspicuously spotted. Fruit stout. Leaves caudate-acuminate.

Catalpa speciosa, Engelmann, *Bot. Gazette*, v. 1 (1880). — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 70. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 115. — Gray, *Syn. Fl. N. Am.* ed. 2, i. pt. ii. 456. — Lauche, *Deutsche Dendr.* ed. 2, 145. — Watson & Coulter, *Gray's Man.* ed. 6, 399. — Koehne, *Deutsche Dendr.* 520.

Catalpa cordifolia, *Nouveau Duhamel*, ii. t. 5 (1802). — Nuttall, *Trans. Am. Phil. Soc.* ser. 2, v. 183 (not Moench).

Catalpa bignonioides, Lesquereux, *Owen's Second Rep. Geolog. Surv. Ark.* 375 (not Walter) (1860). — Gray, *Man.* ed. 5, 321 (in part); *Syn. Fl. N. Am.* ii. pt. i. 319 (in part). — Broadhead, *Bot. Gazette*, iii. 59.

A tree, in the forest occasionally one hundred and twenty feet in height, with a tall straight trunk rarely four and a half feet in diameter, and a narrow round-topped crown of slender branches; usually smaller, although often a hundred feet high, and when grown in open situations rarely more than fifty feet in height, with a short trunk and a broad head of spreading branches. The bark of the trunk is three quarters of an inch or sometimes nearly an inch in thickness, brown tinged with red, and broken on the surface into thick scales. The branchlets are stout, and when they first appear are light green, often tinged with purple, and covered with scattered pale hairs; during their first winter they are light orange-color or reddish brown, covered with a slight bloom, and marked with many pale conspicuous lenticels, and with the elevated oval leaf-scars which are a quarter of an inch long and display a circular row of large fibro-vascular bundle-scars; in their second and third years the branches grow darker and the leaf-scars and lenticels nearly disappear. The end of the branch dies in the autumn without forming a terminal bud, and during the winter appears as an elevated circular scar close to the upper axillary bud. The buds are minute, globose, partly immersed in the bark and covered with loosely imbricated chestnut-brown ovate scales, keeled on the back and slightly apiculate at the apex; those of the inner ranks are accrescent, and at maturity are foliaceous, obovate, acute, gradually narrowed below to a sessile base, many-nerved with dark veins, pubescent on the lower surface, and sometimes nearly two and a half inches long and three quarters of an inch broad. The leaves are opposite, or in threes, oval, long-pointed, cordate at the base, and usually entire or furnished with one or two lateral teeth; when they unfold they are pilose on the upper surface and covered on the lower and on the petioles with pale or rufous tomentum which soon disappears, and at maturity they are thick and firm, dark green above, and pale and covered with soft pubescence below, especially along the stout midribs and the principal veins marked in their axils with large clusters of dark glands; they are ten to twelve inches long, seven or eight inches broad, and are borne on stout terete petioles four to six inches in length. They turn black and fall after the first severe frost of the autumn. The flowers, which appear late in May or early in June, are borne on slender purple pedicels furnished near the middle with one, two, or three bractlets, and are produced in open few-flowered glabrous panicles five or six inches long and broad, with green or purple branches marked with orange-colored lenticels, the lowest branches being often developed from the axils of small leaves. The calyx is purple, and divided to the base into two ovate pointed apiculate divisions. The corolla is white, with a broad conical oblique tube nearly an inch long, often marked externally with purple spots near the base and internally on the lower side with two bands of yellow blotches which follow two parallel lateral ridges, and with occasional purple spots spreading over the lobes of the lower lip of the limb, which, when the flower is fully open, has a vertical diameter of nearly two inches and a horizontal diameter of two inches and a half. The filaments, which are marked near the base with a few oblong purple spots, are slightly exserted, and rather longer than the slender glabrous style. The fruit is eight to twenty inches long and one half to three quarters of an inch in diameter in the middle, with a thick wall which toward spring splits into two concave valves; the partition is thickened in the middle and nearly triangular in section. The seed is an inch long and a third of an inch broad, with a light brown coat, and wings which are rounded at the ends and terminate in a fringe of rather short hairs.

Catalpa speciosa inhabits the borders of streams and ponds and fertile often inundated bottom-lands, and is distributed from the valley of the Vermillion River in Illinois through southern Illinois and Indiana, western Kentucky and Tennessee, southeastern Missouri and northeastern Arkansas; through cultivation it has become naturalized near habitations in southern Arkansas, western Louisiana, and eastern Texas. In southern Illinois and Indiana, where it probably grew to its largest size, the Western Catalpa was formerly extremely abundant.

The wood of *Catalpa speciosa* is light, soft, not strong, coarse-grained, and very durable in contact with the soil.[1] It contains numerous obscure medullary rays and bands of large open ducts, which clearly mark the layers of annual growth, and is light brown, with thin nearly white sapwood composed of one or two layers of annual growth. The specific gravity of the absolutely dry wood is 0.4165, a cubic foot weighing 25.96 pounds. It is largely used for railway ties, fence-posts, and rails, and occasionally for furniture and the interior finish of houses.

Long confounded with the Catalpa of the Atlantic and eastern Gulf states, *Catalpa speciosa* was first distinguished by Dr. J. A. Warder,[2] who published the earliest account of it in 1853.[3] Twenty years later its rapid growth,[4] its hardiness, and the remarkable durability of its wood drew the attention of the public to the value of the Western Catalpa for planting on the prairies, where, chiefly through the efforts of E. E. Barney[5] and Robert Douglas,[6] many plantations have been made with this tree.

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[1] The trunks of the Catalpa-trees killed by the sinking and subsequent submersion of a large tract of land near New Madrid, Missouri, which followed the earthquake of August, 1811, were standing and perfectly sound sixty-seven years later, although all their companions in the forest had disappeared long before. Undecayed fence-posts believed to have been continuously in the ground for more than half a century demonstrate, too, the remarkable durability of the wood of *Catalpa speciosa*. (See E. E. Barney, *Additional Facts and Information in Relation to the Catalpa-tree*, 5.)

[2] John Aston Warder (1812–1883), of a family of the Society of Friends, was born in the neighborhood of Philadelphia, where he had his schooling, and with his parents moved in 1830 to Springfield, Ohio. He was graduated in 1836 from the Jefferson Medical College of Philadelphia, and established himself as a physician in Cincinnati. In 1855 he gave up the practice of medicine, and settled on a farm in North Bend, Ohio, which was his home during the remainder of his life, passed in the study and practice of horticulture and forestry. In 1873 Dr. Warder was appointed United States Commissioner to the International Exhibition at Vienna, and his report on the exhibits in the Forestry Department is an interesting contribution to the knowledge of forestry. The last years of Dr. Warder's life were devoted to creating a public interest in American forests and forest-planting; and in 1875 he took the principal part in organizing the American Forestry Association, which held its first meeting in Philadelphia the following year.

Among Dr. Warder's numerous contributions to the literature of horticulture and forestry are a *Manual on Hedges and Evergreens*, published in 1858; *American Pomology: Apples*, published in 1867, in which are included the results of many years of careful observation; *The Woody Plants of Ohio*, published in 1882; and many valuable papers in *The American Journal of Forestry*, and other technical periodicals.

[3] *Western Horticultural Review*, iii. 533.

[4] Young plants of *Catalpa speciosa* in good soil sometimes increase in diameter of the trunk with great rapidity, and specimens with three or four layers of annual growth each nearly an inch in thickness are not uncommon. In one of these quickly grown specimens Professor C. R. Barnes (*Bot. Gazette*, ix. 74, *f.* 4) found the layers of annual growth separated by thin well-defined plates of cork.

After the first few years the growth of *Catalpa speciosa* in the forest is not particularly rapid. Of the two log specimens in the Jesup Collection of North American Woods in the American Museum of Natural History in New York, collected in southeastern Missouri, one is 37½ inches in diameter inside the bark, with 178 layers of annual growth, and the other is 22½ inches in diameter, with 105 layers of annual growth.

[5] Eliam Eliakim Barney (1807–1880) was born in Henderson near Sackett's Harbor, New York, and in 1831 was graduated from Union College at Schenectady. For many years a teacher, he afterwards became interested in a saw-mill in Dayton, Ohio, where later he established the Barney & Smith Car Company, of which he was president until his death. Attracted by the beauty of the Catalpas shading the streets of Dayton, he became interested in the tree, and in 1878 published for free distribution two tracts, in which he had gathered all the available information concerning it, entitled *Facts and Information in relation to the Catalpa-tree (Catalpa bignonioides), its Value, and importance of its extensive cultivation in groves*, and *Additional Facts and Information in relation to the Catalpa-tree (Catalpa bignonioides) and its variety ? speciosa.*

[6] Robert Douglas was born in Gateshead near Halifax in Eng-

The dark green foliage of the Western Catalpa, and its abundant clusters of large nearly white flowers, which begin to appear on plants eight to twelve years old, make it a valuable ornamental tree, and it is already a familiar inhabitant in many of the gardens of the United States and Europe.

land in 1813, and having learned the tailor's trade, emigrated to Canada in 1836. Two years later he settled in Whitingham, Vermont, where for a short time he kept the country inn, but the tide of emigration was setting to the west, and in 1844 he drove through the then sparsely inhabited country to Illinois, and established his home on the shores of Lake Michigan about thirty miles north of Chicago, in what is now the town of Waukegan. Here he opened a tailor's shop; but in 1848, impelled by a strong love of nature which had declared itself in his boyhood, when he lived with his parents in Fallon's nursery near Newcastle, he established a small nursery business. The next year, the California gold fever being at its height, Mr. Douglas joined a party of his neighbors and started to cross the continent. In fording the Bear River, among the Wahsatch Mountains, he lost his team of cattle, and, impatient of the slow progress of the emigrant train, walked on alone ahead of his party, crossing the deserts of Utah and Nevada and the Sierra Nevada on foot. After a short stay in California, Mr. Douglas returned home by the Isthmus of Panama, and has since devoted himself to raising conifer and other tree seedlings, of which he has distributed millions. In recent years Mr. Douglas has taken large contracts for planting trees in different parts of the country, and the most successful plantations of *Catalpa speciosa* in the United States were made by him near Farlington, in Kansas, on the line of the Kansas City, Fort Scott & Memphis Railroad, in 1879–83. (See *6th Ann. Rep. Kansas Forestry*, 47.) No one in his time has been more active than Mr. Douglas in increasing the love of planting trees in the United States, or has studied them from the cultural point of view with greater zeal, intelligence, and success.

EXPLANATION OF THE PLATES.

Plate CCXC. Catalpa speciosa.

1. The end of a flowering branch, natural size.
2. A corolla displayed, natural size.
3. A flower, the corolla removed, natural size.
4. A stamen, enlarged.

Plate CCXCI. Catalpa speciosa.

1. A cluster of fruit, natural size.
2. A seed, natural size.
3. Vertical section of a seed, natural size.
4. An embryo, enlarged.
5. A leaf, natural size.
6. A winter branchlet, natural size.

[illegible]

[illegible] del.

CATALPA SPECIOSA

[illegible]

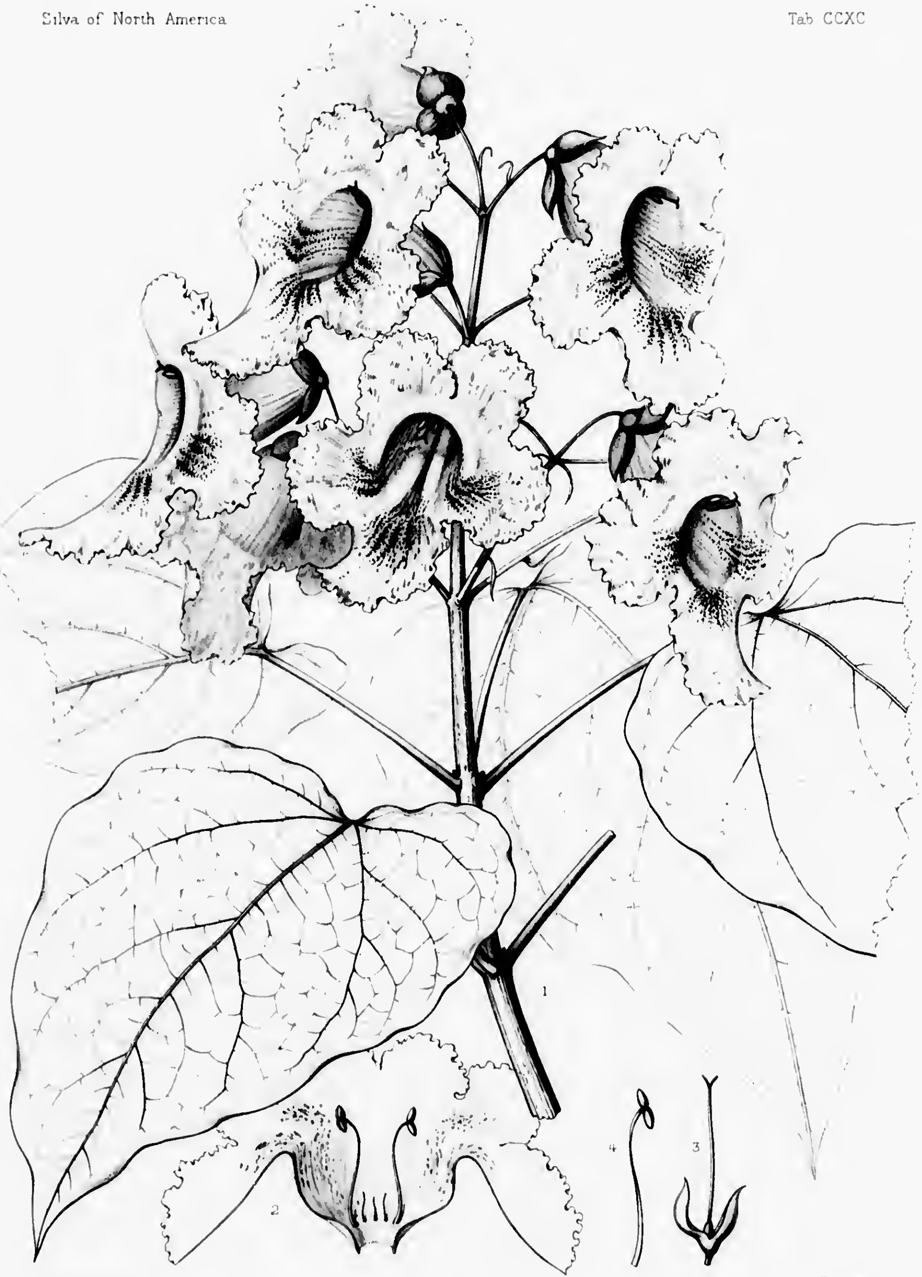
EXPLANATION OF THE PLATES

PLATE CCXC. CATALPA SPECIOSA.

1. End of a flowering branch, natural size.
2. A corolla displayed, natural size.
A flower, the corolla removed, natural size.
4. A stamen, enlarged.

PLATE CCXCI. CATALPA SPECIOSA.

1. A fruiting branch, natural size.
2. A seed, natural size.
3. Vertical section of a seed, natural size.
4. Germinating plant.



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CATALPA SPECIOSA. Engelm

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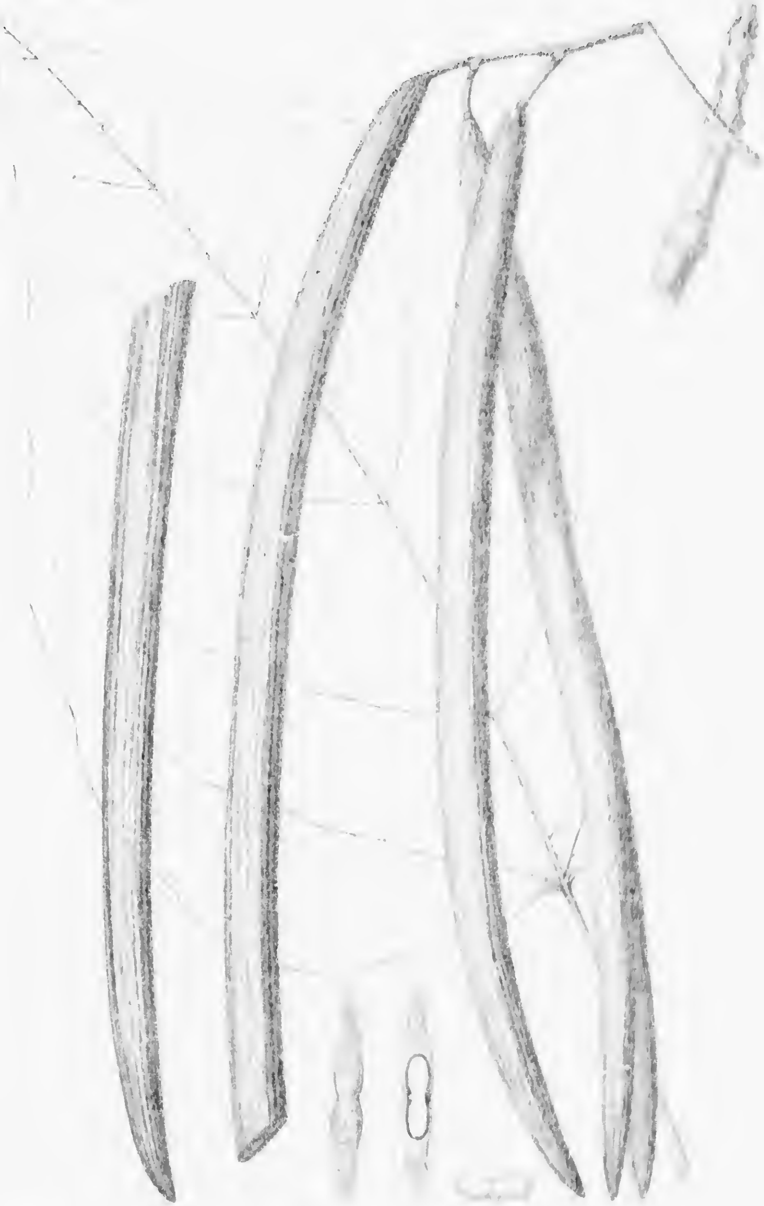

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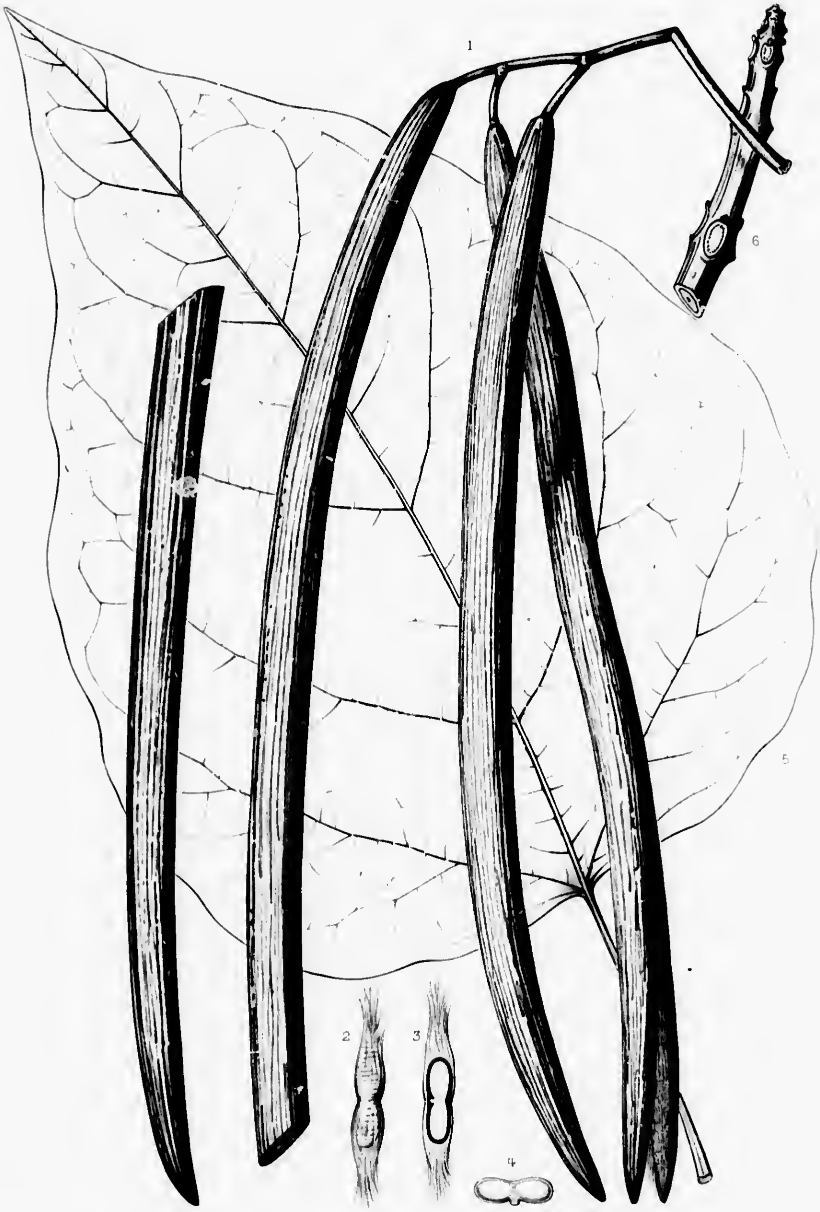

C E Faxon del. Picart sc

CATALPA SPECIOSA, Engelm

A Riocreux direx^{t} Imp J Taneur Paris

CHILOPSIS.

Flowers perfect; calyx gamosepalous, closed in the bud, bilabiately splitting in anthesis; corolla gamopetalous, 2-lipped, 5-lobed, the lobes imbricated in æstivation; stamens 4; staminodium 1; disk hypogynous, nearly obsolete; ovary 2-celled; ovules numerous. Fruit a linear woody capsule. Leaves opposite or alternate, linear or linear-lanceolate, entire, deciduous, destitute of stipules.

Chilopsis, D. Don, *Edinburgh New Phil. Jour.* ix. 261 (1823). — Meisner, *Gen.* 300. — Endlicher, *Gen.* 712. — Engelmann, *Wislizenus Memoir of a Tour to Northern Mexico* (*Senate Doc.* 1848, *Bot. Appx.* 94). — Bentham & Hooker, *Gen.* ii. 1041. — Baillon, *Hist. Pl.* x. 46.

A tree, with slender terete branchlets, buds with several imbricated scales, those of the inner rows accrescent, deeply furrowed bark, soft coarse-grained dark-colored wood, and fibrous roots. Leaves opposite, alternate, or scattered, involute in vernation, linear, or linear-lanceolate, long-pointed, entire, three-nerved, the lateral nerves obscure, reticulate-venulose, membranaceous, light green, smooth or glutinous, short-petiolate or sessile from an enlarged base. Flowers in short puberulous crowded racemes terminal on leafy branches of the year, pedicellate, the slender pedicels produced from the axils of ovate acute scarious tomentose deciduous bracts, and bibracteolate near the middle. Bractlets ovate, acute, tomentose, deciduous. Calyx gamosepalous, coated with pale tomentum, closed before anthesis into an ovoid rounded apiculate bud, splitting to the base into two ovate divisions, minutely toothed at the apex, the upper with three, the lower with two, rigid teeth, membranaceous, dark green. Corolla white, shaded within and without into pale purple, slightly oblique, enlarged and blotched with yellow in the throat, the limb undulate-margined, two-lipped, the upper lip two-lobed, the lower unequally three-lobed, the central lobe much longer than the others. Stamens four, inserted in one row near the base of the corolla, didymous, introrse, included or slightly exserted; filaments filiform, glabrous, the anterior nearly twice as long as the posterior; anthers oblong, attached on the back, two-celled, the cells divergent in anthesis, opening longitudinally; staminodium posterior, linear, acute. Ovary two-celled, sessile on the thin nearly obsolete annular disk, conical, glabrous, gradually narrowed into a slender style divided at the apex into two ovate flat rounded lobes; ovules numerous, inserted in many series on a central placenta, horizontal, anatropous; raphe ventral; micropyle superior. Fruit a slender elongated thin-walled capsule, gradually narrowed from the middle to the two ends, splitting longitudinally into two concave valves. Seeds numerous, inserted in two ranks near the margin of the thin flat woody septum free from the walls of the capsule, compressed, oblong, exalbuminous; testa thin, light brown, longitudinally veined, produced into broad lateral wings, divided at their rounded ends into long fringes of thin soft white hairs. Embryo filling the seminal cavity; cotyledons plane, broader than long, slightly two-lobed and rounded laterally; radicle short, erect, turned toward the oblong basal hilum.

The wood of Chilopsis is soft, not strong, close-grained, with many small open ducts, numerous medullary rays, and bands of large ducts marking the layers of annual growth. It is brown streaked with yellow, with thin light-colored sapwood composed of two or three layers of annual growth. The specific gravity of the absolutely dry wood is 0.5902, a cubic foot weighing 36.78 pounds.

Chilopsis was first described in the last century from a plant cultivated in the Botanic Garden at Madrid which had probably been obtained from Mexico. In the United States it appears to have been first noticed during the summer of 1846 by Dr. F. A. Wislizenus[1] near Sabina on the Rio Grande in New Mexico.

The generic name, which is formed from χεῖλος and ὄψις, is without special significance.

The genus is represented by a single species.

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[1] Friedrich Adolph Wislizenus (1810–1889), the son of a Protestant minister, was born at Koenigsee in Schwarzburg-Rudolstadt. He began the study of medicine in the University of Jena, and afterwards at Göttingen and Würzburg; but having become interested in the visionary plans of the Burschenschaft, he joined in an unsuccessful attempt made at Hamburg to overthrow the monarchical government of Germany, and was obliged to escape to Switzerland. Wislizenus was graduated from the University of Zurich in 1834, visited the hospitals in Paris, and the next year began the practice of medicine in New York. Two years later he settled in the small town of Mascoutah in Illinois, but soon tiring of the quiet life he went to St. Louis, and attached himself to one of the parties of the St. Louis Fur Company, with which he visited the Wind River Mountains. His companions being about to return home, he joined a wandering band of Flat Head and Nez Percés Indians, and with them crossed the Rocky Mountains into the country of the Utes, returning to the east by the way of the Arkansas. In 1846 Wislizenus joined a trading expedition to Mexico. News of the breaking out of hostilities between the United States and Mexico reached him at Santa Fé, but he continued his journey to Chihuahua, where he was imprisoned, and did not finally return to St. Louis until the end of the next year. An account of his Mexican journey was published by order of the Senate of the United States in 1848, with a botanical appendix by Dr. George Engelmann, in which are described the plants discovered by Wislizenus, including *Pinus Chihuahuana*, *Pinus edulis*, and several species of Opuntia and Cereus. The remainder of Dr. Wislizenus's life was passed in St. Louis engaged in the practice of medicine, and active in the affairs of the St. Louis Academy of Science, of which he was one of the founders, of the St. Louis Medical Society, and of the German Medical Society, which for many years he served as president. *Wislizenia*, a genus established by his friend Engelmann to receive a New-Mexican herb, commemorates the name of its discoverer.

CHILOPSIS LINEARIS.

Desert Willow.

Chilopsis linearis, De Candolle, *Prodr.* ix. 227 (1845). — Coville, *Contrib. U. S. Nat. Herb.* iv. 174 (*Bot. Death Valley Exped.*).

Bignonia linearis, Cavanilles, *Icon.* iii. 35, t. 269 (1794).

Chilopsis saligna, D. Don, *Edinburgh New Phil. Jour.* ix. 261 (1823). — Don, *Gen. Syst.* iv. 228. — Dietrich, *Syn.* iii. 566. — Gray, *Brewer & Watson Bot. Cal.* i. 587; *Syn. Fl. N. Am.* ii. pt. i. 320. — Rothrock, *Wheeler's Rep.* vi. 217. — Hemsley, *Bot. Biol. Am. Cent.* ii. 49[illegible]. — Rusby, *Bull. Torrey Bot. Club*, ix. 54. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 116. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 319 (*Man. Pl. W. Texas*).

Chilopsis glutinosa, Engelmann, *Wislizenus Memoir of a Tour to Northern Mexico* (*Senate Doc.* 1848, *Bot. Appx.* 94).

Chilopsis linearis is a tree, twenty or thirty feet in height, with a trunk usually more or less reclining, often hollow, and sometimes a foot in diameter, and slender upright branches which form a narrow head; or often a straggling shrub. The bark of the trunk is an eighth to a quarter of an inch in thickness, dark brown, and divided into broad branching ridges broken on the surface into small thick plate-like scales. The branches, when they first appear, are glabrous, glutinous, or covered with dense tomentum, and during their first season are light chestnut-brown, later becoming darker and tinged with red, or sometimes ashy gray. The leaves, which unfold in the early spring, and fall during the following winter, are six to twelve inches long, and from a quarter to a third of an inch wide. The flowers appear in early summer in racemes three or four inches in length, and continue to open for several months in succession; they are an inch and a half long and about an inch and a quarter across the expanded lobes of the limb of the corolla. The fruit, which ripens in the autumn, hangs on the branches during the winter; it is seven to twelve inches long, and a quarter of an inch thick in the middle. The seed is a third of an inch long and an eighth of an inch broad.

Chilopsis linearis is a common inhabitant of the banks of streams, and depressions in the desert, growing in dry gravelly porous soil, and is distributed from the neighborhood of Laredo in southwestern Texas through western Texas, southern New Mexico, Arizona, southern Utah and Nevada, San Diego County, California, and the states of northern Mexico.

Its long drooping crowded bright green leaves make *Chilopsis linearis* a conspicuous object in the desert, which it enlivens with its lovely delicate flowers, exhaling at night the odor of violets. It is occasionally cultivated in the gardens of the southern states[1] and in those of northern Mexico, where it grows to its largest size.

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[1] Reverchon, *Garden and Forest*, v. 615.

EXPLANATION OF THE PLATE.

Plate CCXCII. Chilopsis linearis.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A corolla displayed, natural size.
4. A pistil, enlarged.
5. Vertical section of an ovary, enlarged.
6. An ovule, much magnified.
7. Part of a cluster of fruit, natural size.
8. Cross section of the base of an open fruit, the seed removed from the septum, enlarged.
9. A seed, natural size.
10. Vertical section of a seed, natural size.
11. An embryo, enlarged.

EXPLANATION OF THE PLATE.

Plate CCXCII. Chilopsis linearis.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A corolla displayed, natural size.
4. A pistil, enlarged.
5. Vertical section of an ovary, enlarged.
6. An ovule, much magnified.
7. Part of a cluster of fruit, natural size.
8. Cross section [illegible]
   [illegible]
9. A seed, [illegible]
10. Vertical section of a seed, [illegible]
11. An [illegible]

C. E. Faxon del. Himely sc.

CHILOPSIS LINEARIS, DC.

A. Riocreux direx.t Imp. Taneur Paris

CRESCENTIA.

Flowers perfect; calyx gamosepalous, closed in the bud, bilabiately splitting in anthesis; corolla gamopetalous, ventricose on the anterior side by a transverse fold, obscurely 5-lobed, the lobes imbricated in æstivation; stamens, 4; staminodium, 1; disk pulvinate; ovary 1-celled; ovules numerous. Fruit a many-seeded berry. Leaves alternate, coriaceous or membranaceous, destitute of stipules.

Crescentia, Linnæus, *Gen.* 182 (1737). — A. L. de Jussieu, *Gen.* 127. — Endlicher, *Gen.* 723. — Meisner, *Gen.* 301. — Bentham & Hooker, *Gen.* ii. 1053. — Baillon, *Hist. Pl.* x. 54.

Cuiete, Adanson, *Fam. Pl.* ii. 207 (1763).

Trees, with watery juices, scaly bark, and stout terete or slightly angled branchlets. Leaves alternate, solitary or fascicled, coriaceous or membranaceous, short-petiolate. Flowers long-pedunculate, the peduncles bibracteolate, produced in the axils of upper leaves or from the sides of the branches, solitary or in few-flowered fascicles. Calyx coriaceous, closed in the bud, splitting in anthesis into two unequal broad divisions or sometimes slightly five-lobed, deciduous. Corolla inserted under the hypogynous pulvinate fleshy disk, yellow streaked with purple, or dingy purple, tubular-campanulate, more or less ventricose on the lower side by a transverse fold, abruptly dilated into an oblique two-lipped obscurely five-lobed laciniately toothed limb. Stamens four, inserted in two ranks on the tube of the corolla, didymous, introrse, included or slightly exserted; filaments filiform; anthers oblong, attached on the back, two-celled, the cells divergent, opening longitudinally; staminodium solitary, posterior, often wanting. Ovary sessile, one-celled, ovate-conical, gradually narrowed into an elongated simple style two-lobed and stigmatic at the apex; ovules numerous, attached horizontally in many ranks on two thickened two-lobed lateral parietal placentas, anatropous; raphe ventral; micropyle superior. Fruit globose or ovoid, indehiscent, rounded or umbonate at the apex, many-seeded; perianth fleshy, green, thin or thick, ultimately becoming hard, light brown and separable into two layers, the inner thin and membranaceous, filled with the united and thickened fleshy or spongy placentas attached at the base by a cluster of thick fibro-vascular bundles. Seed imbedded irregularly in the placental mass, compressed, small, flattened on the two faces, cordate at the summit and cuneate at the base, or large, suborbicular, cordate above and below, and deeply grooved on the two faces. Embryo filling the seminal cavity, flattened, white and waxy, or thick and fleshy, deeply grooved and becoming black in drying;[1] radicle minute, vague, turned toward the small basal or lateral hilum.

Crescentia is tropical American, with five or six species distributed from southern Florida through the Antilles to southern Mexico and Brazil. The Calabash-tree, *Crescentia Cujete*,[2] a native of the West Indies and now planted in all tropical countries, is the most useful member of the genus. The

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[1] By Miers (*Trans. Linn. Soc.* xxvi. 167) Crescentia is divided into two sections: —

Eucrescentia. Fruit large, rounded at the apex; pericarp thick and hard; mature placentas viscid and fleshy; seeds small, flat on the two faces, obcordate, cuneate at the base; hilum basal. Leaves fascicled.

Enallagma. Fruit small, umbonate; pericarp thin and brittle; mature placentas dry and pithy; seeds large, suborbicular, cordate above and below, deeply grooved on the convex faces; hilum lateral. Leaves alternate.

[2] Linnæus, *Spec.* 626 (1753). — Jacquin, *Hist. Stirp. Amer.* 175, t. 111; *Fragm.* 30, t. 33, f. 5. — Swartz, *Obs.* 234. — Tussac, *Fl. Antill.* ii. 80, t. 19. — Descourtilz, *Fl. Méd. Antill.* iv. 47, t. 244. — *Bot. Mag.* lxii. t. 3430. — De Candolle, *Prodr.* ix. 246. — Seemann, *Hooker Jour. Bot. and Kew Gard. Misc.* vi. 275. — Grisebach, *Fl. Brit. W. Ind.* 445. — Miers, *Trans. Linn. Soc.* xxvi. 167. — Hemsley, *Bot. Biol. Am. Cent.* ii. 498.

Crescentia acuminata, Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 157 (1818). — Kunth, *Syn. Pl. Æquin.* ii. 235. — De Candolle, *l. c.* — Miers, *l. c.* 169.

Crescentia cuneifolia, Gardner, *Hooker Jour. Bot.* ii. 422 (1840). — Miers, *l. c.* 168.

hard woody shell of the large fruit is used for drinking-cups, vases, and all sorts of domestic vessels.[1] The pulp is emollient and astringent, the seeds are cooked and eaten, the wood is used in cabinet-making,[2] and the juice of the fruit dyes silk black.[3] In Sonora *Crescentia alata*[4] is sometimes cultivated as a shade-tree; and the fruit is used medicinally.[5]

The generic name, which commemorates that of Pietro de' Crescenzi,[6] the distinguished Italian writer on agriculture of the fourteenth century, was established by Linnæus, who discarded the older Cuiete[7] of Plumier.

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[1] Seemann, *Bot. Voy. Herald*, 183; *Hooker Jour. Bot. and Kew Gard. Misc.* ix. 142.

[2] Baillon, *Hist. Pl.* x. 24.

[3] Seemann, *Hooker Jour. Bot. and Kew Gard. Misc.* ix. 143.

[4] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* iii. 158 (1818). — Kunth, *Syn. Pl. Æquin.* ii. 255. — De Candolle, *Prodr.* ix. 247. — Seemann, *l. c.*

Parmentiera alata, Miers, *Trans. Linn. Soc.* xxvi. 166 (1867). — Hemsley, *Bot. Biol. Am. Cent.* ii. 498.

[5] Watson, *Proc. Am. Acad.* xxiv. 66.

[6] Pietro de' Crescenzi (1233–1320), a native of Bologna, and one of the earliest scientific writers on agriculture, produced in his time a profound impression on the development of the rural arts in southern Europe. His greatest work, *Opus Ruralium Commodorum*, was printed in Augsburg in 1471 and in a French edition in 1486.

[7] *Nov. Pl. Am. Gen.* 23, t. 16.

CRESCENTIA CUCURBITINA.

Black Calabash.

FRUIT ovate-oblong, umbonate. Seeds large, 2-lobed. Leaves obovate-oblong or ovate-oblong, alternate.

Crescentia cucurbitina, Linnæus, *Mant.* 250 (1771). — Swartz, *Obs.* 234. — Willdenow, *Spec.* iii. 311. — Persoon, *Syn.* ii. 168. — Aiton, *Hort. Kew.* ed. 2, iv. 37. — Lunan, *Hort. Jam.* i. 141. — Gærtner f. *Fruct.* iii. 230, t. 223. — Dietrich, *Syn.* iii. 567. — Don, *Gen. Syst.* iv. 232. — De Candolle, *Prodr.* ix. 246. — Seemann, *Hooker Jour. Bot. and Kew Gard. Misc.* vi. 274. — Walpers, *Ann.* v. 524. — Grisebach, *Fl. Brit. W. Ind.* 445. — Eggers, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1876, 136 (*Fl. St. Croix*); *Bull. U. S. Nat. Mus.* No. 13, 79 (*Fl. St. Croix and the Virgin Islands*). — Hemsley, *Bot. Biol. Am. Cent.* ii. 498. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 116. — Gray, *Syn. Fl. N. Am.* ed. 2, ii. pt. i. 456.

Crescentia ovata, Burman f. *Fl. Ind.* 132 (1768).

Crescentia latifolia, Lamarck, *Dict.* i. 558 (1783); *Ill.* iii. 96, t. 547. — Miller, *Dict.* ed. 8, No. 2. — Descourtilz, *Fl. Méd. Antill.* iii. 143, t. 182. — Miers, *Trans. Linn. Soc.* xxvi. 176.

Crescentia lethifera, Tussac, *Fl. Antill.* iv. 50, t. 17 (1827).

Crescentia obovata, Bentham, *Bot. Voy. Sulphur*, 130, t. 46 (1844). — Miers, *Trans. Linn. Soc.* xxvi. 175.

Crescentia, species, Cooper, *Smithsonian Rep.* 1860, 439.

? **Crescentia coriacea**, Miers, *Trans. Linn. Soc.* xxvi. 177, t. 9 (1867).

A tree, in Florida eighteen or twenty feet in height, with a trunk four or five inches in diameter, and long slender drooping branches covered with warts. The bark of the trunk is an eighth of an inch thick, light brown tinged with red, and irregularly divided into large thin scales. The branchlets are stout, slightly angled, roughened and somewhat enlarged at the nodes by the thickening of the large crowded cup-shaped persistent woody bases of the leaves, and are covered with thin creamy white bark, which in the third year becomes dark or ashy gray. The buds are protected by linear acute apiculate scales, which become woody and do not disappear for a year or two. The leaves, which are alternate and crowded near the ends of the branches, are obovate-oblong or ovate-oblong, contracted into short broad points or rarely rounded or emarginate at the apex, gradually narrowed at the base into short thick glandular petioles, and entire, with cartilaginous slightly revolute margins; they are coriaceous, dark green and lustrous on the upper surface, paler and yellow-green on the lower surface, six to eight inches long and an inch and a half to four inches wide, with broad stout midribs deeply impressed on the upper side, conspicuous primary veins arcuate and united near the margins, and reticulate veinlets. Unfolding in the spring, they do not fall until their second year. The flowers, which appear in April and May, and also in the autumn, and emit a strong fœtid odor, are solitary in the axils of the upper leaves, and are borne on thick drooping peduncles an inch and a half to two inches long, furnished below the middle with two minute rigid acute bractlets and enlarged at the apex into the thick oblique receptacles. The calyx, which is light green and slightly glandular at the base, forms an obovate rounded bud, and in anthesis splits nearly to the bottom into two ovate pointed lobes which are nearly as long as the tube of the corolla. The corolla is thick and leathery, dull purple except on the lower side, which is sometimes creamy white and marked with narrow purple bands, and two inches long, with a narrow tube creamy white on the inner surface, slightly contracted above the base, ventricose on the lower side by a deep transverse fold, and abruptly dilated into the oblique limb which is erosely cut on the margins, and obscurely two-lipped; the upper lip is slightly divided into two reflexed lobes; the lower is obscurely three-lobed. The stamens are inserted near the middle of the tube of the corolla in two pairs, those of the anterior pair below the others and above the posterior linear staminode. The ovary is obliquely conical, narrowed into a long exserted style divided at the apex into two ovate pointed flat lobes stigmatic on the inner face. The fruit is ovate or oblong, three or four inches long, an inch and a half to two inches broad, umbonate, dark green, minutely rugose-punctulate, and marked with four obscure longitudinal ridges corresponding with the margins and midribs of the carpellary leaves; it is raised on the thickened woody disk, and hangs on a stout drooping stalk an inch and a half to two inches long, much enlarged at the apex; the shell is a sixteenth of an inch thick, ultimately hard and brittle, lustrous on the outer surface, and lined with a thin membranaceous shining light brown coat marked with the broad placental scars. The seed is nearly orbicular, slightly compressed, emarginate at the top and bottom, deeply grooved on both faces, five eighths of an inch long and broad and a quarter of an inch thick, with a minute oblong lateral hilum just above the basal sinus; it is covered with two coats, of which the outer is thin, dark reddish brown, rugose, and separable from the thicker pale felt-like inner coat. The cotyledons, which become black in drying, fill the seminal cavity, and have two ear-like folds near the base; the radicle is short and is inclosed in the lower sinus of the cotyledons.

Crescentia cucurbitina is found in Florida only on the shores of Bay Biscayne, where it grows just east of the mouth of the Miami River on a rich hummock under the shade of the Live Oak, the Red Mulberry, the Gumbo Limbo, the Nectandra, the Pigeon Plum, the Iron Wood, the Palmetto, and *Eugenia Garberi*, and on the banks of Little River. It is a common littoral tree on the Antilles,[1] and extends to southern Mexico, the Pacific shore of the Isthmus of Panama, and Venezuela.[2]

The wood of *Crescentia cucurbitina* is heavy, hard, very close-grained, and contains many small irregularly distributed open ducts and thin hardly distinguishable medullary rays; and is light brown or orange-color, with lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6319, a cubic foot weighing 39.38 pounds.

In Florida *Crescentia cucurbitina* was discovered in 1859 by Mr. J. G. Cooper.[3]

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[1] Tussac (*Fl. Antill.* iv. 50) believed that the fruit of *Crescentia cucurbitina* contained a deadly poison, but as the other plants of the Bignonia family are innocent of poisonous properties the statement is probably incorrect (see Seemann, *Hooker Jour. Bot. and Kew Gard. Misc.* ix. 142), especially as the fruit of the Coco de Mono, as this tree is called in Venezuela, is freely devoured by monkeys, birds, and other animals (*Bonplandia*, v. 44).

[2] Authors before Linnæus appear to have confounded this species with the Calabash-tree. Plukenet's figure (*Phyt.* t. 171, f. 2), quoted by Linnæus under his *Crescentia cucurbitina*, has the narrow leaves and small cuneate seeds of *Crescentia Cujete*. Plumier's figures (*Nov. Am. Pl. Gen.* t. 15, and *Pl. Am.* ed. Burman, t. 109) represent the seeds of both species, while the uncut fruit is evidently that of *Crescentia cucurbitina*, and Browne (*Nat. Hist. Jam.* 266) considered the small-fruited Crescentia a variety of the large-fruited Calabash-tree.

[3] See i. 30.

EXPLANATION OF THE PLATES.

PLATE CCXCIII. CRESCENTIA CUCURBITINA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, the corolla and half of the calyx removed, natural size.
4. A corolla, natural size.
5. Vertical section of a corolla, natural size.
6. An anther, front and rear views, enlarged.
7. Vertical section of an ovary through the median line, enlarged.
8. An ovule, much magnified.

PLATE CCXCIV. CRESCENTIA CUCURBITINA.

1. A fruiting branch, natural size.
2. Cross section of a fruit, natural size.
3. A seed, natural size.
4. Cross section of a seed, natural size.
5. Vertical section of a seed, natural size.
6. An embryo, natural size.
7. Inner face of a cotyledon, natural size.
8. A leaf, natural size.

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pointed flat [illegible] oblong, three or four inches long, an inch and a half [illegible], scantly rugose-punctulate, and marked with four [illegible] with the margins and midribs of the carpellary [illegible] and hangs on a stout drooping stalk an inch and a [illegible] to the apex; the shell is a sixteenth of an inch thick, [illegible] on the outer surface, and lined with a thin membranaceous shining [illegible] broad placental scars. The seed is nearly orbicular, slightly compressed, [illegible] and bottom, deeply grooved on both faces, five eighths of an inch long and broad and [illegible] of an inch thick, with a minute oblong lateral hilum just above the basal sinus; it is covered with two coats, of which the outer is thin, dark reddish brown, rugose, and separable from the [illegible] pale felt-like inner coat. The cotyledons, which become black in drying, fill the [illegible] and have two ear-like folds near the base; the radicle is short and is inclosed in the [illegible] of the cotyledons.

[illegible] *cucurbitina* is found in Florida only on the shores of Bay Biscayne, where it grows [illegible] of the mouth of the Miami River on a rich hummock under the shade of the Live Oak, the [illegible] Mulberry, the Gumbo Limbo, the Nectandra, the Pigeon Plum, the Iron Wood, the Palmetto, and *[illegible] Garberi*, and on the banks of Little River. It is a common littoral tree on the Antilles,[1] and [illegible] to southern Mexico, the Pacific shore of the Isthmus of Panama, and Venezuela.[2]

The wood of *Crescentia cucurbitina* is heavy, hard, very close-grained, and contains many small irregularly distributed open ducts and thin hardly distinguishable medullary rays; it is light brown or orange-color, with lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6319, a cubic foot weighing 39.38 pounds.

In Florida *Crescentia cucurbitina* was discovered in 1859 by Mr. J. G. Cooper.

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[1] [illegible] *Crescentia* [illegible] has the narrow [illegible] Plumier's [illegible] ed. Burman, t. [illegible] the uncut fruit is [illegible] Browne (*Nat. Hist.* [illegible] is a variety of the [illegible]

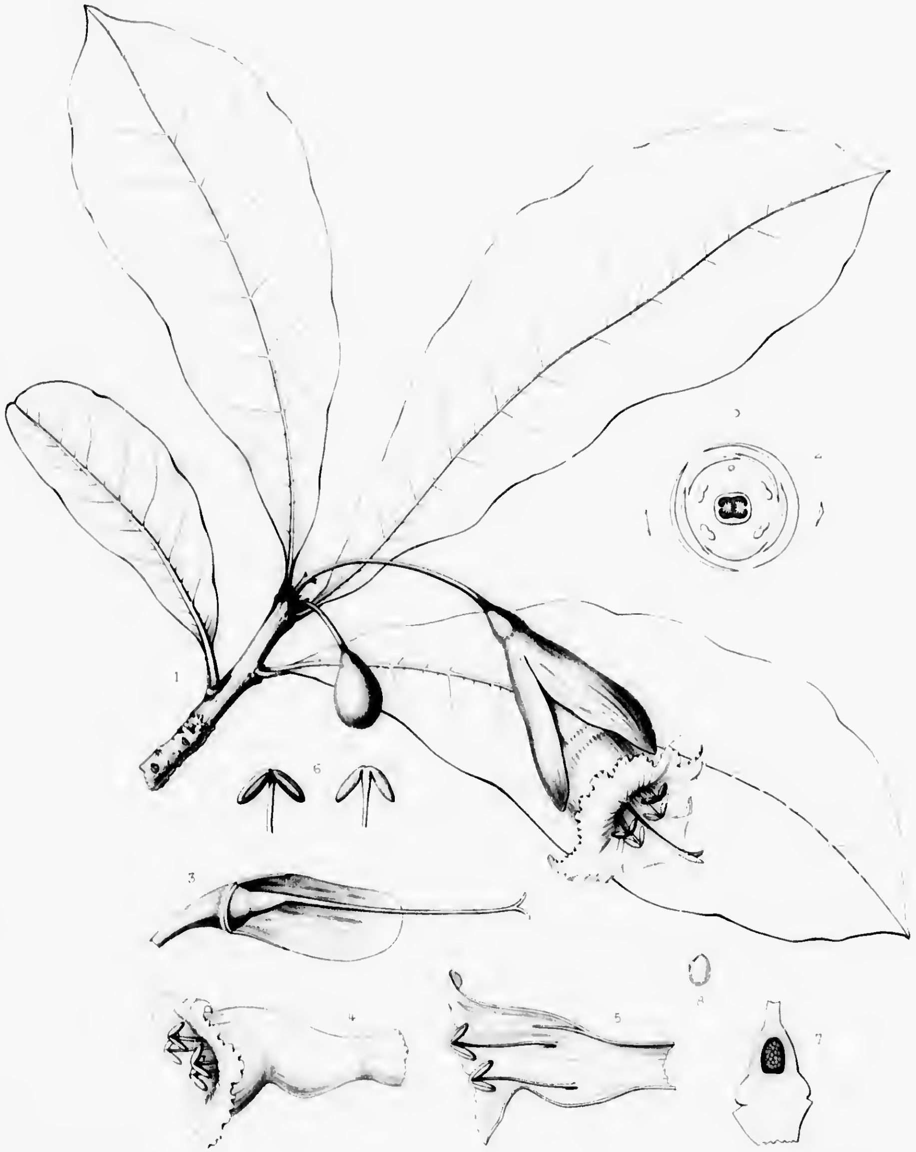
EXPLANATION OF THE PLATES

PLATE CCXCIII. CRESCENTIA CUCURBITINA.

1. A flowering branch, natural size.
2. Diagram of the flower.
3. [illegible] flower, [illegible] and half of the calyx removed, natural size.
4. [illegible] enlarged.
5. [illegible] natural size.
6. An anther, [illegible] views, enlarged.
7. Vertical section of [illegible] ovary through the median line, enlarged.
8. An ovule, much magnified.

PLATE CCXCIV. CRESCENTIA CUCURBITINA.

1. A fruiting branch, natural size.
2. Cross section of a fruit, natural size.
3. A seed, natural size.
4. Cross section of a seed, natural size.
5. Vertical section of a seed, natural size.
6. An embryo, natural size.
7. Inner face of a cotyledon, natural size.
8. A leaf, natural size.



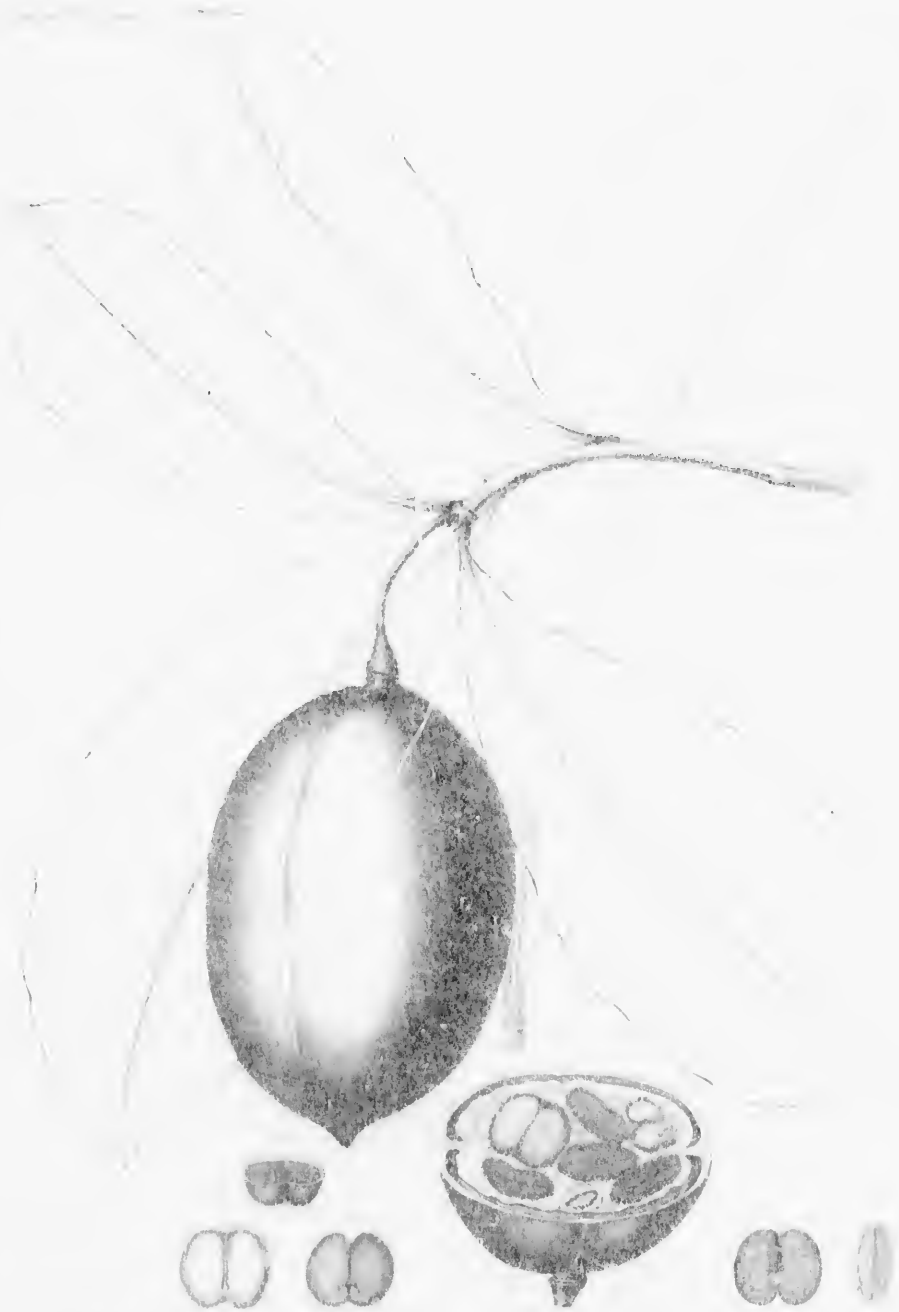
C. E. Faxon del.

Bouely sc.

CRESCENTIA CUCURBITINA L.

A. Riocreux direx.t

Imp. J. Taneur Paris.



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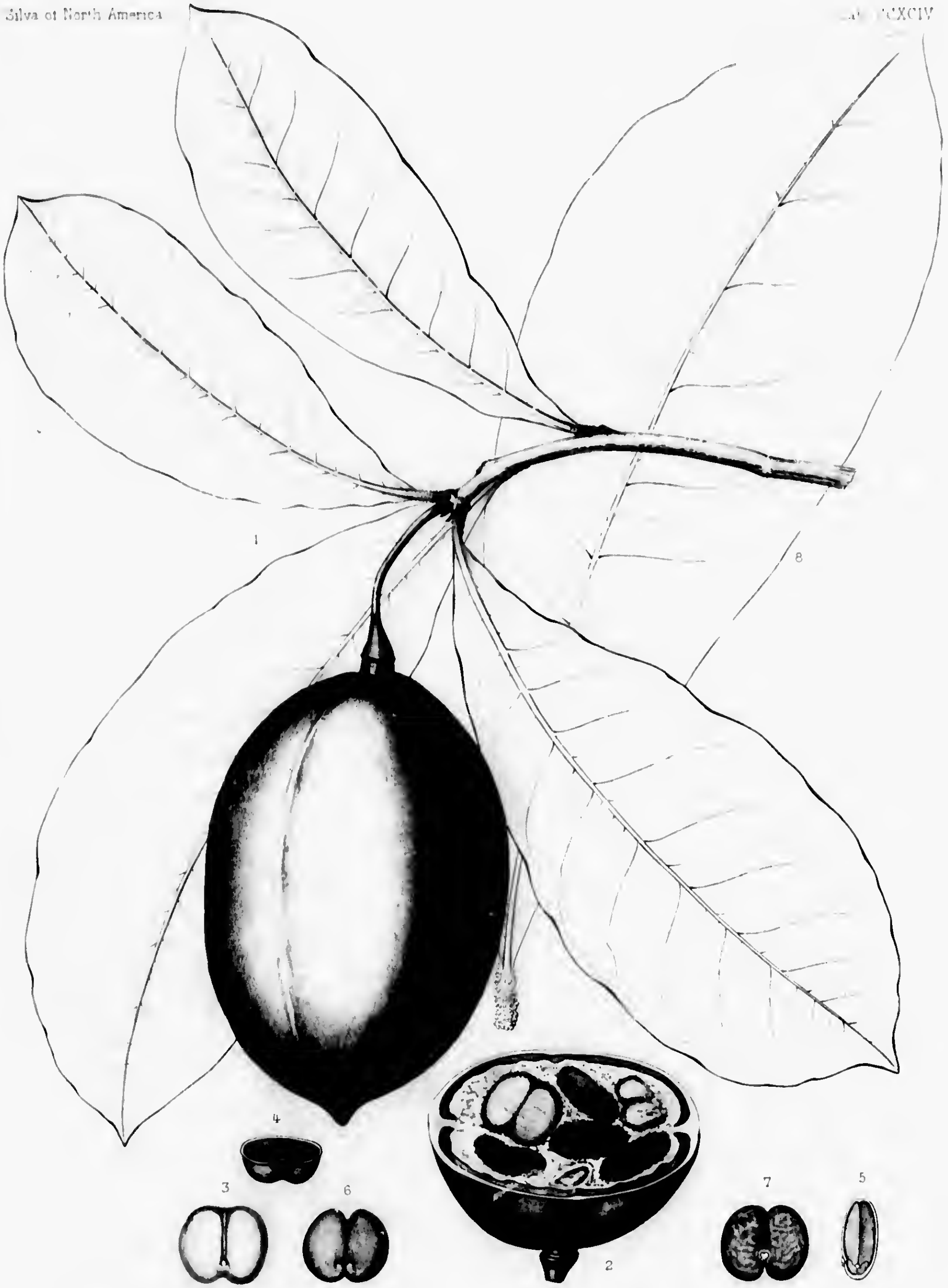

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CRESCENTIA CUCURBITINA, L.

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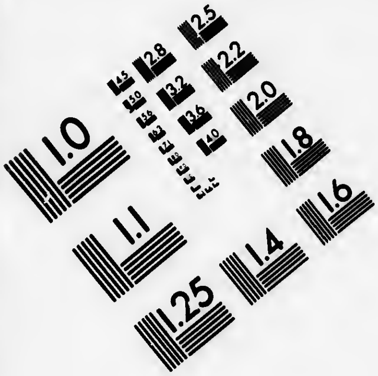

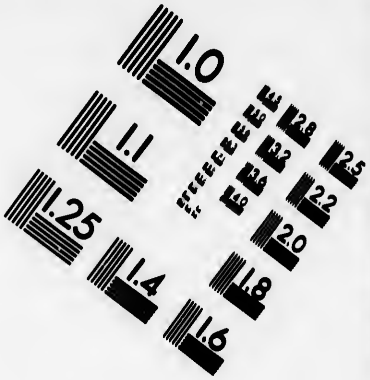

IMAGE EVALUATION
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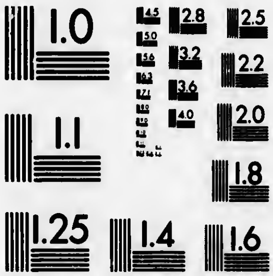

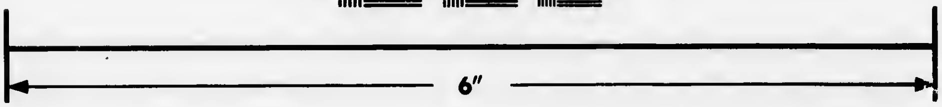

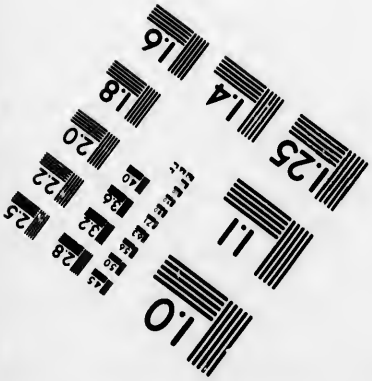

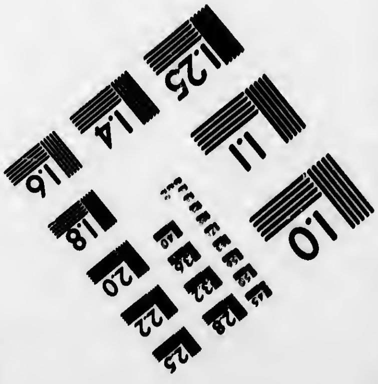

CITHAREXYLON.

Flowers perfect; calyx 5-toothed, accrescent under the fruit; corolla gamopetalous, 5-lobed, the lobes imbricated in æstivation; stamens 4; staminodium 1; disk annular; ovary superior, imperfectly 4-celled; ovules solitary in each cell. Fruit a 2-stoned 4-seeded fleshy drupe. Leaves opposite, persistent, without stipules.

Citharexylon, Linnæus, *Amœn.* i. 406 (1749); *Gen. ed.* 6, 314. — Adanson, *Fam. Pl.* ii. 200. — A. L. de Jussieu, *Gen.* 108. — Endlicher, *Gen.* 636. — Meisner, *Gen.* 291. — Bocquillon, *Adansonia*, iii. 222. — Bentham & Hooker, *Gen.* ii. 1149. — Baillon, *Hist. Pl.* xi. 98.

Rauwolfia, Ruiz & Pavon, *Fl. Peruv.* ii. 26, t. 152 (not Linnæus) (1799).

Trees or shrubs, glabrous, or tomentose with simple or branched hairs, unarmed or rarely armed with axillary spines. Leaves opposite, entire, serrulate or spinosely toothed. Flowers small, in axillary or terminal short or elongated racemes, short-pedicellate, the pedicels ebracteolate, produced in the axils of minute persistent bracts, alternate or scattered on the filiform rachis. Calyx gamosepalous, membranaceous, tubular-campanulate, truncate, minutely five-toothed, persistent and spreading or cup-shaped under the fruit. Corolla salver-form, usually white, inserted on the thin annular hypogynous disk, the spreading limb somewhat oblique, five-lobed, the broadly ovate rounded lobes slightly unequal, the two posterior exterior. Stamens four, inserted on the tube of the corolla below the middle, didymous, introrse, included; filaments short, filiform, slightly thickened at the base, the two anterior longer than the others; anthers oblong, attached on the back near the base, two-celled, the cells parallel, opening longitudinally; staminodium posterior, linear, acute, or rarely antheriferous and fertile. Ovary sessile, ovate, incompletely four-celled by the development of the two parietal placentas, gradually narrowed into a short simple included style slightly two-lobed and stigmatic at the apex; ovules solitary in each cell, erect, attached laterally near the base, ascending, anatropous; micropyle inferior. Fruit drupaceous, surrounded at the base by the persistent calyx, tipped with the remnants of the style; exocarp thin and fleshy; endocarp thick and bony, separable into two two-seeded compressed smooth light brown nutlets, rounded on the back, and concave on the inner face. Seed erect, exalbuminous, filling the seminal cavity; testa membranaceous, light brown. Embryo subterete, straight; cotyledons thick and fleshy, oblong, much longer than the short inferior radicle turned toward the oblong basal hilum.

Citharexylon is confined to tropical America, and is distributed from southern Florida, where one species occurs, through the West Indies to southern Mexico, Lower California, Bolivia, and Brazil. Fifteen or twenty species are distinguished.[1]

Citharexylon produces hard strong wood, but is not known to possess economic properties.

The generic name, from *κιθάρα* and *ξύλον*, is a translation of the English West Indian name Fiddle Wood, a corruption of the earlier French-colonial *Bois* Fidèle, given in allusion to the strength and toughness of the wood produced by the trees of this genus.

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[1] Schauer, *De Candolle Prodr.* xi. 609; *Martius Fl. Brasil.* ix. 267. — Grisebach, *Fl. Brit. W. Ind.* 497; *Cat. Pl. Cub.* 216. — Bocquillon, *Adansonia*, iii. 222. — Hemsley, *Bot. Biol. Am. Cent.* ii. 536. — Watson, *Proc. Am. Acad.* xxiv. 67. — T. S. Brandegee, *Proc. Cal. Acad.* ser. 2, ii. 197 (*Pl. Baja Cal.*); iii. 163.

CITHAREXYLON VILLOSUM.

Fiddle Wood.

FLOWERS in elongated axillary racemes. Leaves oblong-obovate or oblong.

Citharexylon villosum, Jacquin, *Coll.* i. 72 (1786); *Icon. Rar.* i. t. 118. — *Selt. Am. Gewäch.* 57, t. 144. — Willdenow, *Spec.* iii. pt. i. 309. — Persoon, *Syn.* ii. 142. — Aiton, *Hort. Kew.* ed. 2, iv. 36. — Schlechtendal, *Linnæa*, vi. 752 (*Fl. Ins. St. Thom.*). — Dietrich, *Syn.* iii. 614. — Schauer, *De Candolle Prodr.* xi. 610. — Walpers, *Rep.* iv. 76. — Bocquillon, *Adansonia*, iii. 223, t. xiii. f. 1–9. — Chapman, *Fl.* 309. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 340. — Eggers, *Bull. U. S. Nat. Mus.* No. 13, 34 (*Fl. St. Croix and the Virgin Islands*). — Hemsley, *Bot. Biol. Am. Cent.* ii. 537. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 116.

A tree, rarely exceeding in Florida twenty feet in height, with a trunk four to six inches in diameter, and slender upright branches which form a narrow irregularly shaped head; or often a shrub sending up from the ground many low stems. The bark of the trunk varies from a sixteenth to an eighth of an inch in thickness, and is light brown tinged with red, generally smooth, and separates into minute appressed scales. The branchlets, when they first appear, are slender, slightly many-angled, light yellow, and covered with pale simple hairs, which soon disappear; and in their second year they are terete and ashy gray. The leaves are oblong-obovate or oblong, acute, acuminate, rounded or emarginate at the apex, gradually narrowed at the base, and entire, with thickened slightly revolute margins; while young they are pubescent on the lower surface, and at maturity they are glabrous, thick, and coriaceous, conspicuously reticulate-venulose, pale green, three or four inches long, and an inch or an inch and a half wide, with broad pale midribs rounded on the upper side, remote arcuate veins, and stout grooved petioles two thirds of an inch in length, which, when the leaves fall, in their second year, separate from their elevated nearly circular persistent woody bases. The fragrant flowers, borne on slender pedicels produced in the axils of scarious pubescent bracts, appear throughout the year in drooping axillary pubescent racemes crowded near the ends of the branches, and two to four inches in length. The calyx is obscurely toothed, scarious, and coated with pale hairs, or is sometimes nearly glabrous. The corolla, which forms before opening an obovate rounded bud, is an eighth of an inch across the expanded lobes of the limb, and is covered on the inner surface of the tube with pale hairs. The fruit is subglobose or oblong-ovate, light red-brown, very lustrous, a third of an inch in diameter, with thin sweet rather juicy flesh, and is inclosed nearly to the middle in the cup-like pale brown calyx, which is slightly and irregularly lobed or sometimes nearly entire.

Citharexylon villosum, which is also an inhabitant of many of the Antilles, is common in Florida from Cape Canaveral to the southern keys, growing to its largest size in the United States on the shore of Bay Biscayne, near the mouth of the Miami River; farther north it is usually reduced to a low shrub.

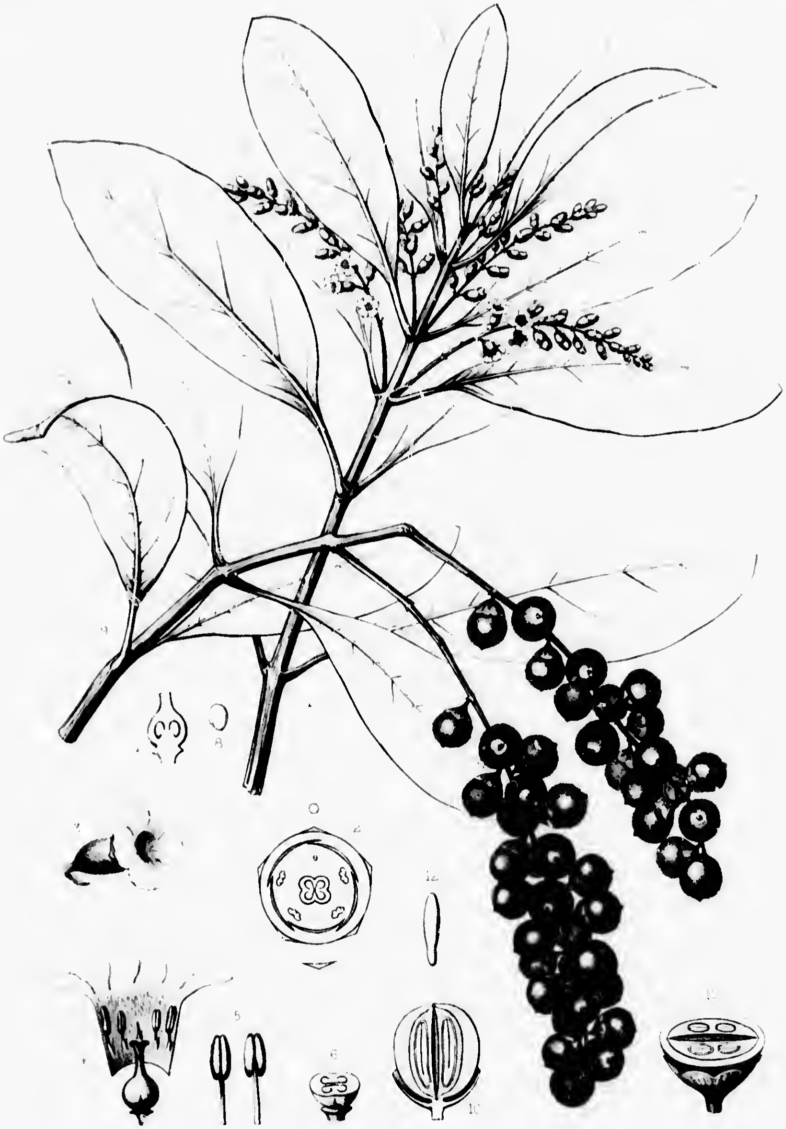
The wood of *Citharexylon villosum* is heavy, exceedingly hard and strong, close-grained, and susceptible of receiving a beautiful polish; it contains numerous small regularly distributed open ducts, and is clear bright red, with thin lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.8710, a cubic foot weighing 54.28 pounds.

In the United States *Citharexylon villosum* was first noticed on Key West by Dr. J. L. Blodgett.

EXPLANATION OF THE PLATE.

Plate CCXCV. Citharexylon villosum.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. A flower, the calyx removed and the corolla displayed, enlarged.
5. A stamen, front and rear views, enlarged.
6. Cross section of an ovary, enlarged.
7. Vertical section of an ovary, enlarged.
8. An ovule, much magnified.
9. A fruiting branch, natural size.
10. Vertical section of a fruit, enlarged.
11. Cross section of a fruit, enlarged.
12. An embryo, much magnified.



C. E. Faxon del. Rapine sc.

CITHARExYLON VILLOSUM Jacq.

A. Riocreux direx. Imp. J. Taneur Paris.

AVICENNIA.

Flowers perfect; calyx 5-lobed, the lobes imbricated in æstivation; corolla gamopetalous, 4-lobed, the lobes imbricated in æstivation; stamens 4; disk annular; ovary 1-celled; ovules 4, suspended. Fruit capsular, 1-seeded, the seed naked. Leaves opposite, entire, without stipules.

Avicennia, Linnæus, *Gen.* 27 (1737). — A. L. de Jussieu, *Gen.* 108. — Endlicher, *Gen.* 638. — Meisner, *Gen.* 292. — Bentham & Hooker, *Gen.* ii. 1160. — Baillon, *Hist. Pl.* xi. 120.

Bontia, Loefling, *Iter*, 193 (not Linnæus) (1758).

Upata, Adanson, *Fam. Pl.* ii. 201 (1763).

Sceura, Forskål, *Fl. Ægypt-Arab.* 37 (1775).

Racka, Gmelin, *Syst. Nat.* i. 245 (1791).

Halodendrum, Du Petit-Thouars, *Roemer Coll. Bot.* 201 (1809).

Seashore trees or shrubs, with stout pithy branches thickened at the nodes and marked by interpetiolar lines, and long thick horizontal roots producing numerous short vertical thick and fleshy leafless stems rising above the surface of the soil. Leaves opposite, entire, coriaceous, persistent. Inflorescence cymose; flowers opposite, in centripetal pedunculate spikes or heads, closely invested by a bract and two bractlets, the peduncles solitary or in pairs in the axils of upper leaves and ternate on the ends of the branches. Bracts and bractlets similar, concave, acute, keeled on the back, apiculate, scarious and slightly ciliate on the margins, shorter than the corolla. Calyx cup-shaped, coated like the bracts and bractlets with canescent pubescence, divided nearly to the base into five concave ovate rounded lobes, persistent. Corolla campanulate, white, inserted on the obscure annular disk, the tube straight, cylindrical, shorter than the glabrous or tomentose spreading four-lobed limb, the posterior lobe usually somewhat larger than the others. Stamens four, inserted on the tube of the corolla, exserted; filaments short, filiform, slightly thickened at the base; anthers ovate, attached on the back near the bottom, two-celled; the cells parallel, opening longitudinally. Ovary sessile, ovate, pubescent, one-celled, gradually narrowed into an elongated slender or abbreviated style divided at the apex into two lobes stigmatic on their inner face; ovules four, suspended from the summit of a free central placenta, orthotropous, without coats.[1] Fruit ovate, oblique, compressed, surrounded at the base by the persistent calyx, bracts and bractlets, apiculate at the apex. Pericarp thin, light green, villose-pubescent on the outer surface, longitudinally veined on the inner, opening by the ventral suture and displaying the enlarging embryo before separating from the branch, ultimately two-valved. Seed naked, exalbuminous. Embryo filling the cavity of the pericarp, light green; cotyledons thick and fleshy, broader than long, slightly pointed, deeply cordate at the base, unequal, conduplicate; radicle elongated, clavate, retrorsely hirsute, inferior, descending obliquely and included between the lobes of the cotyledons, slightly attached near the apex in the bottom of the capsule to the withered columella by a minute papillose point; plumule hairy.[2]

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[1] The ovary of Avicennia has been described as two-celled and as incompletely four-celled by the development of four wings from a central placental column, with a single ovule in each cell, and by Baillon (*Hist. Pl.* xi. 89) as one-celled with a four-winged central placenta and orthotropous ovules. In the flowers of *Avicennia nitida* from Florida that we have examined the ovary is one-celled with a free slightly flattened central placenta without trace of wings and bearing just below the summit four suspended orthotropous ovules attached laterally below their apex.

[2] Schauer (De Candolle, *Prodr.* xi. 699) groups the species of Avicennia in two sections.

Donatia. Style elongated and exserted beyond the calyx after the falling of the corolla; limb of the corolla tomentose.

Upata. Style abbreviated; limb of the corolla glabrous on the upper surface.

In the first group he places *Avicennia nitida* and *Avicennia Africana*, and in the second *Avicennia officinalis* of the Old World and *Avicennia tomentosa* of the New World, which are now usually considered identical. The style of *Avicennia officinalis* is, however, sometimes well developed, and there are really no constant characters that can be relied on to distinguish the different species, which all bear a close resemblance to one another.

Avicennia is widely distributed on maritime shores through the tropics of the two worlds. Three species are now usually recognized: *Avicennia nitida* of the Antilles and Central and South America reaches southern Florida and Louisiana; a second species[1] is widely distributed through tropical America, eastern Asia, the Indian Archipelago, the islands of the Pacific, Australia, New South Wales, New Zealand, and eastern Africa from Natal to the shores of the Red Sea; and *Avicennia Africana*[2] inhabits west tropical Africa.

Avicennia produces hard strong wood.[3] The bark is rich in tannic acid, and is often used in tropical America for tanning leather.[4] In India a preparation of the wood is used for cleaning cotton cloth, and is mixed with paint to increase its adhesiveness.[5] The fruit is bitter, but is sometimes cooked and eaten,[6] and the leaves are used for fodder.[7] The chief value of the plants of this genus, however, consists in their ability to live on low muddy tidal shores, which, with the Red Mangrove, they protect and gradually extend into the ocean. This they are able to do by the structure of the embryo, which is growing and ready to take root as soon as it falls into the soft mud, and of the long horizontal roots; these are furnished with short vertical fleshy leafless branches or aërating roots,[8] and form a close network which holds the soil together, preventing it from being washed away by outflowing tides, and extending the growth of the tree by sending up numerous stems which soon form dense thickets.

The generic name is derived from that of the most illustrious physician of the Orient.[9]

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[1] *Avicennia officinalis*, Linnæus, *Spec.* 110 (1753). — Schauer, *De Candolle Prodr.* xi. 700; *Martius Fl. Brasil.* ix. 306. — Miquel, *Fl. Ind. Bat.* ii. 912. — Bentham, *Fl. Austral.* v. 69. — Brandis, *Forest Fl. Brit. Ind.* 371. — Boissier, *Fl. Orient.* iv. 536. — Kurz, *Forest Fl. Brit. Burm.* ii. 275. — C. B. Clarke, *Hooker f. Fl. Brit. Ind.* iv. 604. — Hemsley, *Bot. Challenger Exped.* i. pt. iii. 178. — Kirk, *Forest Fl. New Zealand*, 130. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 265.

Avicennia tomentosa, Jacquin, *Enum. Pl. Carib.* 25 (1760); *Hist. Stirp. Am.* 178, t. 112, f. 2; *Hist. Select. Stirp. Am.* 87, t. 169. — R. Brown, *Prodr. Fl. Nov. Holl.* 518. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 283. — Kunth, *Syn. Pl. Æquin.* ii. 67. — Blume, *Bijdr. Fl. Ned. Ind.* 821. — Roxburgh, *Fl. Ind.* ed. 2, iii. 88. — Wallich, *Pl. As. Rar.* iii. 44, t. 271. — Miquel, *Lehmann Pl. Preiss.* i. 353. — Walpers, *Rep.* iv. 131. — Schauer, *De Candolle Prodr. l. c.*; *Martius Fl. Brasil. l. c.* — Wight, *Icon. Pl. Ind. Orient.* t. 1481. — Griffith, *Notul.* iv. 185. — Hemsley, *Bot. Biol. Am. Cent.* ii. 540.

Bontia germinans, Linnæus, *Spec.* ed. 2, 891 (1763).

Sceura marina, Forskål, *Fl. Ægypt.-Arab.* 37 (1775).

Avicennia resinifera, Forster, *Pl. Esc.* 72 (1786). — A. Richard, *Bot. Voy. Astrolabe*, 195. — Griffith, *l. c.* 186.

Halodendrum Thouarsii, Roemer & Schultes, *Syst.* iii. 485 (1818).

Avicennia elliptica, Thunberg, *Pl. Brasil. Dec.* iii. 37 (1821).

Avicennia alba, Blume, *l. c.* (1825). — Wight, *l. c.* t. 1482. — Miquel, *Fl. Ind. Bat.* ii. 913.

Avicennia Lamarkiana, Presl, *Abhandl. königl. böhm. Gesell. Wiss.* Folge 5, iii. 529 (*Bot. Bemerk.*).

Avicennia intermedia, Griffith, *l. c.* 188 (1854).

Avicennia officinalis, var. *alba*, C. B. Clarke, *l. c.* (1885).

[2] Palisot de Beauvois, *Fl. d'Oware et de Benin*, i. 79, t. 47 (1804). — Schauer, *De Candolle Prodr. l. c.*; *Martius Fl. Brasil. l. c.*

[3] Moloney, *Forestry of West Africa*, 402. — Madden, *Useful Plants of Australia*, 380.

[4] Maximilian, *Reise nach Brasilien*, 206. — Martius, *Syst. Mat. Med. Brasil.* 49. — Endlicher, *Enchirid. Bot.* 314.

[5] Balfour, *Timber Trees of India*, ed. 3, 25; *Encyclopædia of India*, ed. 3, i. 209.

[6] Madden, *l. c.* 9.

[7] Forskål, *l. c.* — Madden, *l. c.* 120.

[8] Wilson, *Proc. Phil. Acad.* 1889, 69.

[9] Abû Ali el-Hosein Ibn-Abdallah Ibn-Sina (980–1036), in Latin Avicenna, was born in Afshena in Bokhara, the son of a Persian official and of a woman of Bokhara. He was a youth of remarkable precocity and industry, and became a voluminous writer on medicine, which he practiced successfully, philosophy, metaphysics, theology, philology, astronomy, astrology, music, and natural history, producing in his wandering and irregular life more than a hundred volumes. He is best known by his *Canon of Medicine*, which from the twelfth to the seventeenth century served as a guide to medical study in the universities of Europe. He was one of the first to study and apply the principles of chemistry, and is credited with inventing the art of distilling the perfume of flowers.

AVICENNIA NITIDA.

Black Mangrove.

Flowers with elongated styles. Leaves oblong or lanceolate-elliptical.

Avicennia nitida, Jacquin, *Enum. Pl. Carib.* 25 (1760); *Hist. Stirp. Am.* 177, t. 112, f. 1. — Linnæus, *Syst. Nat.* ed. 12, 427. — *Icon. Am. Gewächs.* iii. 47, t. 205. — Willdenow, *Spec.* iii. pt. i. 395. — Persoon, *Syn.* ii. 143. — Chamisso, *Linnæa*, vii. 370. — Sprengel, *Syst.* ii. 768. — Walpers, *Rep.* iv. 133. — Schauer, *De Candolle Prodr.* xi. 699; *Martius Fl. Brasil.* ix. 303. — Dietrich, *Syn.* iii. 619. — Miquel, *Linnæa*, xviii. 264. — A. Richard, *Fl. Cub.* iii. 149. — Grisebach, *Fl. Brit. W. Ind.* 502; *Cat. Pl. Cub.* 217. — Gray, *Syn. Fl. N. Am.* ii. pt. i. 341. — Lefroy, *Bull. U. S. Nat. Mus.* No. 25, 97 (*Bot. Bermuda*). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 117. — Hitchcock, *Rep. Missouri Bot. Gard.* iv. 118.

Avicennia tomentosa, Meyer, *Prim. Fl. Esseq.* 221 (not Jacquin) (1818). — Nuttall, *Sylva*, iii. 79, t. 105. — Chapman, *Fl.* 310. — Vasey, *Cat. Forest Trees*, 19.

Avicennia Floridana, Rafinesque, *Atlant. Jour.* 148 (1832).

Avicennia Meyeri, Miquel, *Linnæa*, xviii. 262 (1844).

Avicennia oblongifolia, Chapman, *Fl.* 310 (1865). — Vasey, *Cat. Forest Trees*, 19.

A tree, in Florida occasionally sixty to seventy feet in height, with a short trunk rarely two feet in diameter, and spreading branches, which form a broad round-topped head; usually not more than twenty or thirty feet tall, with a short slender trunk, and toward the northern limit of its range reduced to a low shrub. The bark of the trunk varies from a quarter to a half of an inch in thickness, and is roughened with thin irregularly appressed scales which are dark brown tinged with red, and in falling display the bright orange-red inner bark. The branchlets, when they first appear, are slightly angled, and coated with fine hoary pubescence, which usually soon disappears, when they are light orange-color; in their second year they are stout and terete, more or less contorted, light or dark gray, and conspicuously marked with the interpetiolar lines, and with the transverse semicircular leaf-scars, in which appear a central row of fibro-vascular bundle-scars. The leaves are oblong or lanceolate-elliptical, rounded or acute at the apex, gradually narrowed at the base, and entire, with slightly thickened and revolute margins; they are thick and coriaceous, dark green and often lustrous on the upper surface, canescent on the lower, two to three inches long, and three quarters of an inch to an inch and a half wide, with broad midribs, thickened and grooved toward the base on the upper side, and oblique primary veins arcuate and joined close to the margins, rounded and conspicuous on the two surfaces, and connected by prominent reticulate veinlets; they are borne on broad channeled petioles, enlarged at the base, and half an inch long, and, appearing irregularly, fall early in their second season. The flowers, which are produced continuously through the year, are borne in few-flowered short spikes, with stout angled canescent peduncles half an inch to an inch and a half in length, the lateral peduncles of the ternate terminal clusters being subtended by oblong acute bracts half an inch in length. The flowers begin to open at the base of the central terminal spike, and are closely invested with the bracts and bractlets, which are nearly a quarter of an inch long, coated with pale or slightly rufous pubescence, and about as long as the lobes of the calyx. The corolla is half an inch across the expanded lobes, which are slightly tomentose on both surfaces, and is nearly closed in the throat in which appear the four anthers and the end of the slender slightly lobed style. The fruit is an inch to an inch and a half long, and from three quarters of an inch to an inch broad; and in Florida is rarely developed.

In the United States *Avicennia nitida* is found on the deltas of the Mississippi in Louisiana, and in Florida from St. Augustine to the southern keys on the east coast, and from Cedar Keys to Cape Sable on the west coast; it is common on many of the Antilles, and ranges southward to Brazil. The

Black Mangrove, which owes its name to the color of the wood,[1] abounds in southern Florida, where it is mingled with the Red Mangrove, *Rhizophora Mangle*, in vast thickets which often line the shores for miles and cover the banks of streams flowing from the Everglades. In the United States the Black Mangrove attains its largest size just north of Cape Sable, where there are open groves of large isolated round-topped trees. North of Matanzas Inlet, on the east coast of Florida, it remains a shrub, with stems only a few feet tall.

The wood of *Avicennia nitida* is very heavy, hard, rather coarse-grained, with numerous medullary rays, and eccentric layers of annual growth marked by several rows of large open ducts; it is dark brown or nearly black, with thick brown sapwood. The specific gravity of the absolutely dry wood is 0.9138, a cubic foot weighing 56.95 pounds.

Some of the early European travelers in America[2] noticed the Black Mangrove; but it is impossible to determine whether their descriptions relate to the species which grows in Florida or to the very similar *Avicennia tomentosa* of the Antilles and Brazil.[3]

In the United States the Black Mangrove appears to have been first distinguished by Dr. Mellins C. Leavenworth,[4] who found it on the east coast of Florida.

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[1] In Florida *Avicennia nitida* is also called Black Tree and Black Wood.

[2] *Cereiba quæ Mangue est alba*, Piso, *Hist. Nat. Bras.* lib. iv. cap. 87.

[3] *Cynoxylum Americanum, folio crassiusculo, molli, & tenaci*, Plukenet, *Phyt.* t. 172, f. 6; *Alm. Bot.* 127.

Mangle laurocerasi foliis flore albo tetrapetalo, Sloane, *Cat. Pl. Jam.* 156; *Nat. Hist. Jam.* ii. 66. — Ray, *Hist. Pl.* iii. *Dendr.* 115.

Bontia ? Foliis integris oblongis oppositis, petiolis crassis brevissimis sub amplexantibus, floribus racemosis, Browne, *Nat. Hist. Jam.* 263.

[3] It is probable that the two species were confounded by all travelers until Jacquin distinguished them about the middle of the last century.

[4] See iii. 60.

EXPLANATION OF THE PLATE.

Plate CCXCVI. Avicennia nitida.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, the calyx removed and the corolla displayed, enlarged.
4. A stamen, front and rear views, enlarged.
5. A pistil, the ovary cut vertically, enlarged.
6. A placental column and ovules, much magnified.
7. An ovule, much magnified.
8. A fruiting branch, natural size.
9. Vertical section of a fruit with half of the two cotyledons removed, displaying the radicle, natural size.
10. A fruit cut transversely, natural size.
11. An embryo displayed, natural size.

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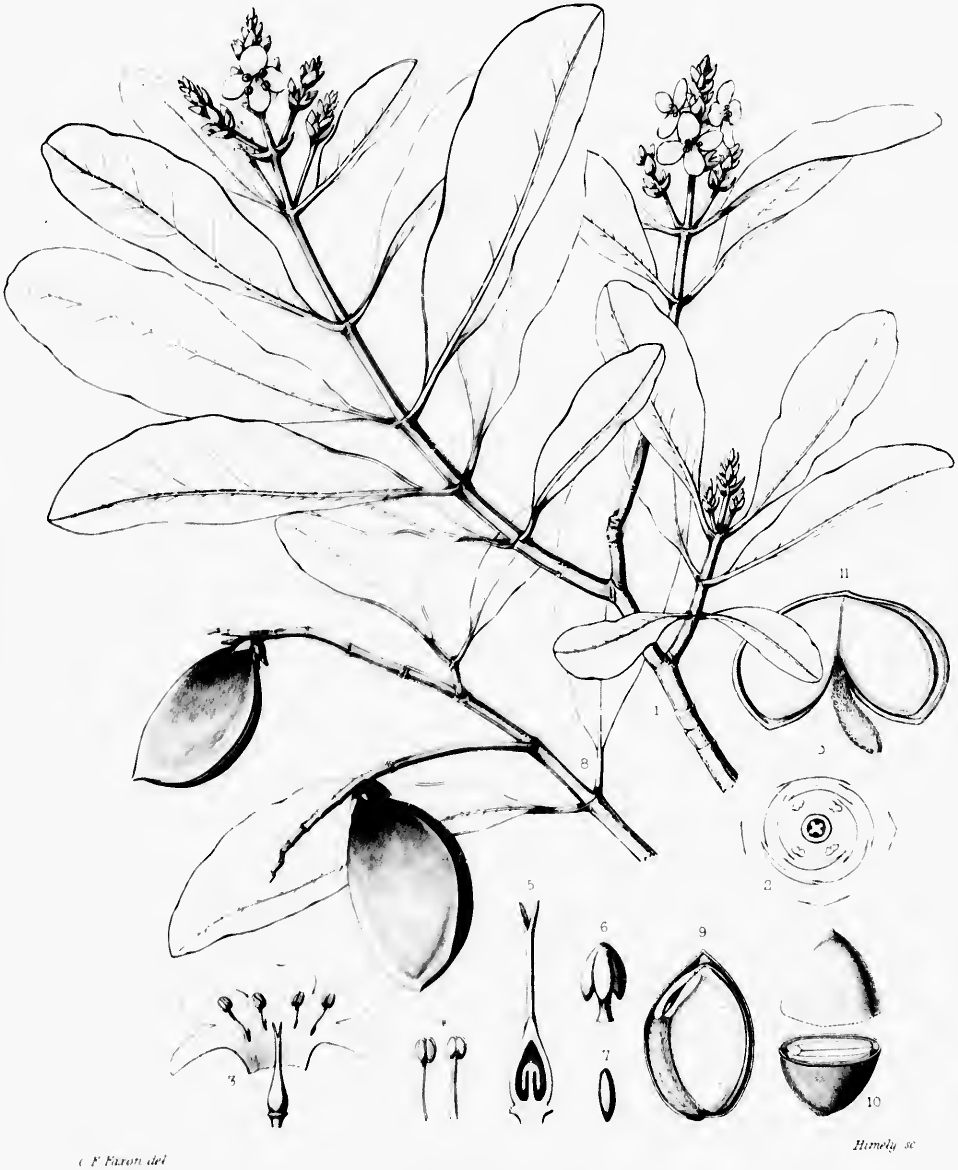

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AVICENNIA NITIDA, Jacq

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PISONIA.

FLOWERS perfect, diœcious or rarely monœcious; calyx 5-lobed or toothed, the divisions induplicate-valvate in æstivation; corolla 0; stamens usually 5-8; ovary superior, 1-celled; ovule solitary. Fruit a utricle inclosed in the thickened perianth. Leaves opposite or alternate, without stipules.

Pisonia, Linnæus, *Gen.* 42 (1737). — Adanson, *Fam. Pl.* ii. 265. — A. L. de Jussieu, *Gen.* 91. — Endlicher, *Gen.* 312. — Meisner, *Gen.* 318. — Schlechtendal, *Linnæa*, xxi. 608. — Baillon, *Hist. Pl.* iv. 20 (excl. *Neea*). — Bentham & Hooker, *Gen.* iii. 9. — Engler & Prantl, *Pflanzenfam.* iii. pt. i. 29.

Calpidia, Du Petit-Thouars, *Hist. Vég. Isles Austr. Afr.* ii. 23, t. 8 (1806).

Torrubia, Vellozo, *Fl. Flum.* 139; *Icon.* iii. t. 150 (1825).

Bessera, Vellozo, *Fl. Flum.* 147; *Icon.* iv. t. 2 (1825).

Pallavia, Vellozo, *Fl. Flum.* 151; *Icon.* iv. t. 12 (1825).

Columella. Vellozo, *Fl. Flum.* 155; *Icon.* iv. t. 17 (1825).

Cephalotomandra, Karsten, *Linnæa*, xxviii. 429 (1856). — Bentham & Hooker, *Gen.* iii. 10.

Timeroya. Montrousier, *Mém. Acad. Imp. Sci. Lyon*, x. 247 (1860).

Vieillardia, Brongniart & Gris, *Bull. Soc. Bot. France*, viii. 375 (1861); *Ann. Sci. Nat.* sér. 5, i. 340.

Glabrous or pubescent trees or shrubs, unarmed or rarely spinescent, erect, or sometimes semi-scandent. Leaves opposite or alternate, oblong-oval or lanceolate, entire, sessile or short-petiolate, persistent. Flowers small, green or yellow, in subsessile or pedunculate cymes, their branches subtended by small bracts, short-pedicellate, the pedicels bibracteolate and produced in the axils of minute bracts. Calyx petaloid, tubular or funnel-shaped in the staminate flower, elongated and often enlarged at the base of the tube in the pistillate flower, the limb five-lobed or toothed, the divisions short, plaited in the bud, erect or spreading. Stamens five to thirty, usually five to eight, inserted on the base of the calyx under the ovary, introrse, exserted; minute or rudimentary in the unisexual pistillate flower; filaments filiform, unequal, free or united at the base into a tube or ring, folded in the bud; anthers oblong, attached on the back below the middle, two-celled, the cells parallel, opening longitudinally. Ovary oblong-ovoid, sessile, one-celled, gradually narrowed into a slender terminal or sublateral style included or exserted; stigma capitate, laciniate or fimbriate; ovule solitary, rising from the base of the cell on a short funicle, campylotropous; micropyle inferior. Fruit anthocarpous, crowned with the persistent teeth of the calyx, coriaceous or indurate, rarely fleshy, oblong-linear or clavate, cylindrical, compressed or pentagonal, terete, sulcate or costate, smooth, tuberculate or furnished with stipitate viscid glands; utricle elongated, membranaceous. Seed erect, the thin transparent testa connate with the endocarp. Embryo erect; cotyledons unequal, thin, broad, cordate at the base, or at the base and apex, cortortuplicate, folded round the scanty soft albumen; radicle short, inferior turned toward the hilum.

Pisonia is tropical, and of the sixty species[1] which are distinguished the larger number are found in the New World. It is represented in southern Asia, the Indian Archipelago, Australia, New Zealand, and the islands of the Pacific by a few species, and in Africa by *Pisonia aculeata*,[2] a shrub with

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[1] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 217. — Kunth, *Syn. Pl. Æquin.* ii. 19. — Blume, *Bijdr. Fl. Ned. Ind.* 731. — Miquel, *Fl. Ind. Bat.* i. pt. i. 989. — Choisy, *De Candolle Prodr.* xiii. pt. ii. 440. — Hooker f. *Fl. New Zealand*, i. 209; *Fl. Brit. Ind.* iv. 710. — Grisebach, *Fl. Brit. W. Ind.* 70; *Cat. Pl. Cub.* 24, 283. — Bentham, *Fl. Austral.* v. 279. — J. A. Schmidt, *Martius Fl. Brasil.* xiv. pt. ii. 351. — Baker, *Fl. Maur. and Seych.* 262. — Kurz, *Forest Fl. Brit. Burm.* ii. 278. — Hemsl *Bot. Biol. Am. Cent.* iii. 8. — Hillebrand, *Fl. Haw. Is.* 367. — Warburg, *Bot. Jahrb.* xiii. 303 (*Papuan. Fl.*).

[2] Linnæus, *Spec.* 1026 (1753). — Miller, *Dict.* ed. 8, No. 1. — Poiret, *Lam. Ill.* iii. 449, t. 861. — Choisy, *l. c.* — Nuttall, *Sylva*,

long semiprostrate vine-like stems, and an inhabitant of nearly all tropical countries, and of southern Florida, where two other species occur; of these one is a small tree, and the other, *Pisonia rotundata*,[1] is a low shrub.

The roots of Pisonia possess purgative and emetic properties, and are sometimes employed in medicine.[2] From the leaves of *Pisonia tomentosa*,[3] the Pao Lepra of Brazil, a black dye is obtained.[4] In India impenetrable hedges are made with the long semiscandent stems covered with stout hooked prickles of *Pisonia aculeata*, which is often planted for this purpose.[5]

The generic name, first proposed by Plumier[6] and adopted by Linnæus, commemorates that of Willem Piso,[7] the Dutch physician and naturalist who first studied the natural products of Brazil.

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iii. 146, t. 121. — Chapman, *Fl.* 374. — Grisebach, *Fl. Brit. W. Ind.* 70. — Bentham, *Fl. Austral.* v. 279. — J. A. Schmidt, *Martius Fl. Brasil.* xiv. pt. ii. 351, 354. — Hemsley, *Bot. Challenger Exped.* i. pt. iii. 181. — Hooker f. *Fl. Brit. Ind.* iv. 711.

Pisonia villosa, Poiret, *Lam. Dict.* v. 347 (1804). — Choisy, *De Candolle Prodr.* xiii. pt. ii. 440.

Pallavia aculeata, Vellozo, *Fl. Flum.* 121; *Icon.* iv. t. 12 (1825).

Pisonia loranthoides, Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* Suppl. vii. 197 (1825).

[1] Grisebach, *Cat. Pl. Cub.* 283 (1866). — Chapman, *Fl.* ed. 2, Suppl. 644.

[2] Rosenthal, *Syn. Pl. Diaphor.* 227, 1111. — Eichler, *Martius Fl. Brasil.* xiv. pt. ii. 375.

[3] Casaretto, *Nov. Stirp. Bras. Dec.* viii. 69 (1844). — Choisy, *l. c.* 445. — J. A. Schmidt, *l. c.* 363, t. 84.

Pisonia noxia, Netto, *Ann. Sci. Nat.* sér. 5, v. 80, t. 7 (1866).

The popular name of this tree, which is also called Pao Judeu, is due to the belief among the inhabitants of Minas Geraes that leprosy is brought on by sleeping under the shade of its leaves, which are furnished on the under surface with short deciduous irritating hairs (Netto, *l. c.* 81).

[4] Netto, *l. c.* 82.

[5] Balfour, *Encyclopædia of India*, ed. 3, iii. 226 (under *Pisonia villosa*).

[6] *Nov. Pl. Am. Gen.* 7, t. 11.

[7] Willem Piso, a Dutch physician and naturalist, practiced medicine in Leyden and Amsterdam, and in 1637 visited Brazil, accompanied by Georg Marggraf, under the auspices of the Duke of Nassau. In 1648, four years after the death of Marggraf, Jan de Laet published in Leyden and Amsterdam the classical *Historiæ Rerum Naturalium Brasiliæ Libri VIII.*, containing a record of the observations of the two naturalists, to which was added a work by Piso upon the Brazilian materia medica. After the death of the Duke of Nassau in 1679, Piso entered the service of the elector Frederick William.

PISONIA OBTUSATA.

Blolly.

FRUIT 10-ribbed, fleshy. Leaves opposite or alternate, obovate-oblong.

Pisonia obtusata, Jacquin, *Hort. Schœnb.* iii. 35, t. 314 (1798). — Swartz, *Fl. Ind. Occ.* iii. 1960. — Sprengel, *Syst.* ii. 168. — Dietrich, *Syn.* ii. 1226. — Choisy, *De Candolle Prodr.* xiii. pt. ii. 443. — A. Richard, *Fl. Cub.* iii. 170. — Chapman, *Fl.* 374. — Grisebach, *Fl. Brit. W. Ind.* 71; *Cat. Pl. Cub.* 24. — J. A. Schmidt, *Martius Fl. Brasil.* xiv. pt. ii. 361. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 117. — Hitchcock, *Rep. Missouri Bot. Gard.* iv. 120.

Pisonia cuneifolia, Schlechtendal, *Linnæa*, xxiii. 571 (1850).

A tree, in Florida thirty to fifty feet in height, with an erect or inclining trunk fifteen to twenty inches in diameter, and stout spreading branches which form a compact round-topped head; or usually much smaller. The bark of the trunk, which is rarely more than a sixteenth of an inch thick, is light red-brown and broken into thin appressed scales. The branchlets are slender and terete, and when they first appear are light orange-color; later they often produce numerous short spur-like lateral branches, and are light reddish brown or ashy gray, and marked with the large elevated semiorbicular or lunate leaf-scars. The leaves are opposite and sometimes alternate, obovate-oblong, rounded or occasionally emarginate at the apex, gradually narrowed at the base, and entire, with slightly thickened revolute undulate margins; they are an inch to an inch and a half long, half an inch broad, thick and firm, light green and glabrous, and paler on the lower than on the upper surface, with stout midribs slightly grooved on the upper side, obscure veins, and stout channeled petioles half an inch in length. The flowers appear in Florida in the autumn in terminal long-stalked open few-flowered panicled cymes with slender puberulous divergent branches, the ultimate divisions being two or three-flowered; they are perfect or unisexual, short-pedicellate, and greenish yellow, with minute acute bracts and bractlets. The calyx is funnel-shaped, divided nearly to the middle into five acute erect lobes conspicuously plaited in the bud and about half as long as the five to eight free stamens. The ovary is oblong-ovoid and gradually narrowed into a slender terminal style about as long as the calyx and crowned with a capitate lacerate stigma. The fruit, which ripens during the winter or in early spring, is clavate, prominently costate with ten rounded ribs, fleshy, smooth, bright red, and three quarters of an inch long; the utricle is terete, and light brown, with a thin membranous wall united with the thin coat of the seed which closely invests the large white embryo, with cotyledons rounded above and cordate at the base.

In Florida *Pisonia obtusata* is common near sea-beaches and the shores of salt-water lagoons from Cape Canaveral to the southern islands, attaining its largest size in the United States on Elliott's Key and Old Rhodes Key. It is common on many of the West Indian islands, and ranges southward to Brazil.

The wood of *Pisonia obtusata* is heavy, rather soft, weak, coarse-grained, and contains numerous large open ducts, the layers of annual growth and medullary rays being hardly distinguishable; it is yellow tinged with brown, with thick darker colored sapwood. The specific gravity of the absolutely dry wood is 0.6529, a cubic foot weighing 40.69 pounds.

In Florida the Blolly[1] was first noticed on Key West by Dr. J. L. Blodgett.

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[1] For the derivation of the name Blolly, see i. 42. On the Florida Keys *Pisonia obtusata* is also called Pigeon Wood, Beef Wood, and Pork Wood.

EXPLANATION OF THE PLATE.

PLATE CCXCVII. PISONIA OBTUSATA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A perfect flower, enlarged.
4. Vertical section of a perfect flower, enlarged.
5. A pistil, cut transversely, enlarged.
6. An ovule, much magnified.
7. A fruiting branch, natural size.
8. A fruit, enlarged.
9. Vertical section of a fruit, enlarged.
10. Cross section of a fruit, enlarged.
11. Cross section of a utricle, enlarged.
12. An embryo, much magnified.
13. An embryo cut transversely, much enlarged.

EXPLANATION OF THE PLATE

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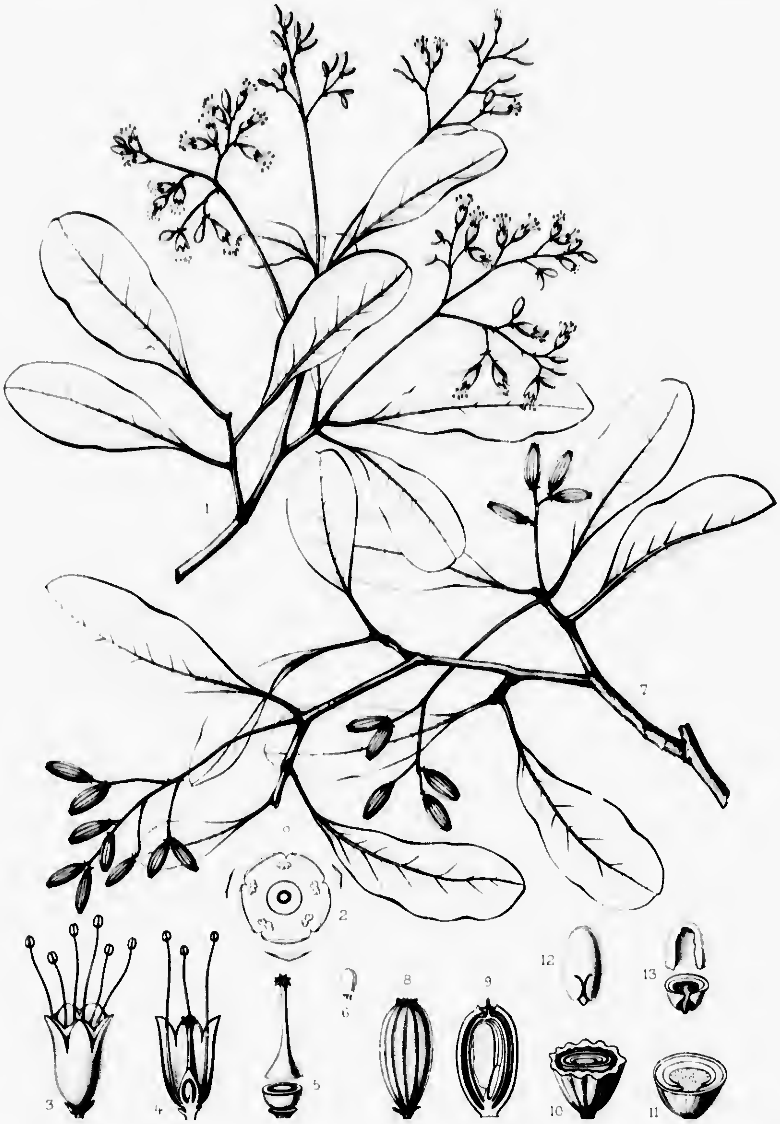

C. E. Faxon del. Lowendal sc.

PISONIA OBTUSATA Jacq.

A. Riocreux direx.t Imp. J. Taneur, Paris.

COCCOLOBIS.

Flowers perfect or rarely unisexual by abortion; calyx 5-lobed, the lobes imbricated in æstivation; corolla 0; stamens 8; disk annular; ovary 3-angled, superior, 1-celled; ovule solitary, erect. Fruit a nutlet, included in the thickened calyx-tube or in its lobes. Leaves alternate, entire, stipulate.

Coccolobis, Browne, *Nat. Hist. Jam.* 209 (1756). — Linnæus, *Syst. Nat.* ed. 10, 1007 (*Coccoloba*) (1759); *Gen.* ed. 6, 196. — A. L. de Jussieu, *Gen.* 82. — Endlicher, *Gen.* 308. — Meisner, *Gen.* 316. — Bentham & Hooker, *Gen.* iii. 102. — Baillon, *Hist. Pl.* xi. 391. — Engler & Prantl, *Pflanzenfam.* iii. pt. i. 33.

Guilabara, Adanson, *Fam. Pl.* ii. 277 (1763).

Campderia, Bentham, *Bot. Voy. Sulphur*, 159, t. 52 (1844). — Bentham & Hooker, *Gen.* iii. 102.

Uvifera, Otto Kunze, *Rev. Gen. Pl.* ii. 561 (1891).

Trees or shrubs, occasionally scandent. Leaves alternate, usually coriaceous, entire, orbicular, ovate, obovate or lanceolate, petiolate, persistent; stipules inclosing the branch above the node with broad or narrow membranaceous truncate lobed or acuminate persistent or caducous sheaths. Flowers articulate on short or elongated ebracteolate pedicels in one or few-flowered fascicles subtended by a minute bract, and surrounded by a narrow truncate membranaceous sheath or ochreola, each pedicel and those above it in the fascicle being surrounded by a similar sheath; fascicles gathered in short or elongated terminal and axillary racemes or terminal panicles inclosed at the base in the sheath of the nearest leaf, and sometimes also in a separate sheath. Calyx cup-shaped, five-lobed, the lobes ovate, rounded, thin and white, spreading; after anthesis thickening and inclosing the nut in the tube or in the lobes. Stamens eight, rarely seven or nine, introrse, exserted or included; filaments filiform or subulate, dilated and connected at the base into a ring or short discoidal cup adnate to the tube of the calyx; anthers ovate, attached on the back below the middle, versatile, two-celled, the parallel cells opening longitudinally. Ovary free, sessile, ovoid or oblong, three-angled, contracted into three stout terminal styles; stigmas slightly or conspicuously dilated, entire or three-lobed; ovule solitary, rising from the bottom of the cell on a short or elongated funicle, orthotropous; micropyle superior. Fruit ovoid or globose, rounded or acute and crowned at the apex with the persistent often connivent lobes of the calyx, rounded or abruptly narrowed at the base; exocarp fleshy, crustaceous or dry, more or less adnate to the thin crustaceous or bony wall of the nutlet often divided on the inner surface near the base into several more or less intrusive plates. Seed erect, subglobose, acuminate at the apex, three to six-lobed, sessile or stipitate; testa membranaceous, porulose, dark red-brown and lustrous. Embryo axillary in more or less ruminate farinaceous albumen; cotyledons suborbicular, white, cordate, flat or involute on the margins; radicle short, superior, cylindrical, erect or incumbent, ascending, turned toward the hilum.[1]

Coccolobis is confined to the tropics of the New World, where about one hundred and twenty

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[1] By Lindau (*Bot. Jahrb.* xiii. 121) the species of Coccolobis are grouped in the following sections: —

Rhigia. Inflorescence few-flowered. Many-branched shrubs with small leaves.

Paniculatæ. Inflorescence panicled. Trees with ample leaves.

Eucoccoloba. Inflorescence racemose, simple or fascicled. Nut included in the thickened tube of the calyx. Trees or shrubs with ample leaves.

Campderia. Inflorescence simple or fascicled; bracts growing dark; ochreolæ lax. Nut chiefly included in the thickened lobes of the calyx. Trees or shrubs with large leaves.

species,[1] distributed from southern Florida to Mexico, Central America, Brazil, and Peru, are distinguished.[2]

Coccolobis possesses astringent properties, which are sometimes utilized in medicine,[3] and many of the species produce hard dark-colored valuable wood.

The generic name, from *κόκκος* and *λοβός*, is in allusion to the character of the fruit.

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[1] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 175. — Kunth, *Syn. Pl. Æquin.* i. 465. — Meisner, *De Candolle Prodr.* xiv. 150; *Martius Fl. Brasil.* v. pt. i. 23 — A. Richard, *Fl. Cub.* iii. 183. — Grisebach, *Fl. Brit. W. Ind.* 161; *Cat. Pl. Cub.* 61. — Lindau, *Bot. Jahrb.* xiii. 120.

[2] Traces of leaves found in the tertiary rocks of Europe (Ettingshausen, *Foss. Fl. Tert. Bilin*, 88, t. 30, f. 1, 2) and in those of the Rocky Mountain region of North America (Lesquereux, *Hayden Rep. U. S. Geolog. Surv.* vi. 387 [1872]) have been referred to Coccolobis; but the specimens upon which the determinations have been made are so fragmentary that it is hardly safe to assume with the existing knowledge that the genus ever inhabited a larger area of the earth's surface than it does at the present time.

[3] Rosenthal, *Syn. Pl. Diaphor.* 223, 1111.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Leaves coriaceous, broadly ovate or suborbicular, cordate at the base	1. C. Uvifera.
Leaves ovate or oblong-lanceolate	2. C. laurifolia.

COCCOLOBIS UVIFERA.

Sea Grape.

Fascicles of flowers in terminal and axillary racemes. Leaves broadly ovate, rounded, cordate at the base, thick, and coriaceous.

Coccolobis Uvifera, Jacquin, *Enum. Pl. Carib.* 19 (1760); *Hist. Stirp. Am.* 112, t. 73; *Hist. Select. Stirp. Am.* 56, t. 110. — Miller, *Dict.* ed. 8, No. 1. — Linnæus, *Spec.* ed. 2, 523. — *Icon. Am. Gewäch.* ii. 29, t. 127. — Gærtner, *Fruct.* i. 214, t. 45. — Lamarck, *Ill.* ii. 445, t. 316, f. 2. — West, *Beskriv. St. Croix*, 281. — Willdenow, *Spec.* ii. pt. i. 457. — Poiret, *Lam. Dict.* vi. 61. — Persoon, *Syn.* i. 442. — Titford, *Hort. Bot. Am.* 61. — Sprengel, *Syst.* ii. 252. — *Bot. Mag.* lix. t. 3130. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 175. — Kunth, *Syn. Pl. Æquin.* i. 465. — Spach, *Hist. Vég.* x. 542. — Nuttall, *Sylva*, iii. 23, t. 88. — A. Richard, *Fl. Cub.* iii. 183. — Meyer, *Prim. Fl. Esseq.* i. 159. — Maycock, *Fl. Barb.* 155. — Chamisso & Schlechtendal, *Linnæa*, vi. 368. — Schlechtendal, *Linnæa*, vi. 760; xxvi. 643. — Miquel, *Linnæa*, xviii. 242. — Meisner, *Mon. Gen. Polyg. Prodr.* 8, 33, t. 1, f. 4; t. 2, B; t. 5, f. 1; *De Candolle, Prodr.* xiv. 152; *Linnæa*, xxi. 263; *Martius Fl. Brasil.* v. pt. i. 42. — Schomburgk, *Fl. and Faun. Brit. Guian.* 820, 934. — Seemann, *Bot. Voy. Herald*, 192. — Dietrich, *Syn.* ii. 1326. — Grisebach, *Fl. Brit. W. Ind.* 161; *Cat. Pl. Cub.* 61. — Chapman, *Fl.* 391. — Eggers, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1876, 142 (*Fl. St. Croix*); *Bull. U. S. Nat. Mus.* No. 13, 88 (*Fl. St. Croix and the Virgin Islands*). — Hemsley, *Bot. Biol. Am. Cent.* iii. 37. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 118. — Lindau, *Bot. Jahrb.* xiii. 204. — Baillon, *Hist. Pl.* xi. f. 444.

Polygonum Uvifera, Linnæus, *Spec.* 365 (1753).

Coccolobis Leoganensis, Jacquin, *Enum. Pl. Carib.* 19 (1760); *Hist. Stirp. Am.* 113, t. 178, f. 33; *Hist. Select. Stirp. Am.* 56, t. 260, f. 30. — Poiret, *Lam. Dict.* vi. 61. — Eggers, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1876, 142 (*Fl. St. Croix*); *Bull. U. S. Nat. Mus.* No. 13, 88 (*Fl. St. Croix and the Virgin Islands*).

Coccolobis Uvifera, var. Leoganensis, Willdenow, *Spec.* ii. pt. i. 457 (1799). — Meisner, *De Candolle Prodr.* xiv. 152. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 118.

Coccolobis Uvifera, var. ovalifolia, Meisner, *De Candolle Prodr.* xiv. 152 (1857). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 118.

Uvifera Leoganensis, Otto Kunze, *Rev. Gen. Pl.* ii. 561 (1891).

A tree, in Florida rarely exceeding fifteen feet in height, with a short gnarled and contorted trunk three or four feet in diameter, and stout branches which form a round compact head; often reduced to a shrub with prostrate stems, and in the West Indies sometimes rising to the height of fifty feet. The bark of the trunk, which is barely a sixteenth of an inch thick, is smooth, light brown, and marked with large irregular pale blotches. The branches, which are stout and terete, with a thick pith, are light orange-color, puberulous, marked with oblong pale lenticels, and gradually grow darker during their second and third years. The leaves are broadly ovate or suborbicular, rounded, and sometimes short-pointed at the apex, deeply cordate at the base, and entire, with undulate margins; they are very thick and coriaceous, minutely reticulate-venulose, dark green and lustrous on the upper surface, paler and puberulous on the lower surface, four or five inches long and five or six inches wide, with stout often bright red midribs rounded and grooved on the upper side and frequently covered with pale hairs below, and about five pairs of conspicuous spreading primary veins red on the upper side, arcuate near the margins and connected by cross veins; they are borne on short stout puberulous flattened petioles abruptly enlarged at the base, and leave in falling large pale elevated orbicular or semiorbicular scars; the stipular sheath is a third of an inch broad, truncate, entire, membranaceous, light brown, slightly puberulous and persistent during two or three years. The leaves sometimes gradually turn red or scarlet, and usually fall during their second and third years. The flowers, which appear almost continuously through the year, are borne on slender puberulous pedicels an eighth of an inch long, in one to six-flowered subsessile fascicles from the axils of minute triangular apiculate dark brown puberulous bracts, and produced in terminal and axillary thick-stemmed puberulous many-flowered racemes six to fourteen inches in length. The sheaths which surround the fascicles and the pedicels of the separate flowers are scarious, light brown, puberulous, about a third of an inch long, and persistent. The calyx is conical, and an eighth of an inch across when expanded, with broadly ovate rounded reflexed white lobes, puberulous on the inner surface, and rather longer than the red stamens. The ovary is oblong, three-angled, and abruptly contracted into three short styles, reflexed and stigmatic on their inner face. The fruit, which hangs in long crowded clusters, is ovoid or obovoid, three quarters of an inch long, rounded and marked at the apex with the conspicuous connivent remnants of the calyx-lobes, and gradually narrowed into a stalk-like base; it is purple or greenish white, translucent, with thin juicy astringent flesh and a thin-walled light red nutlet, and in falling separates from its thickened persistent stalk.

Coccolobis Uvifera inhabits saline shores and beaches, and in Florida is found from Mosquito Inlet to the southern keys on the east coast, and from the shores of Tampa Bay to Cape Sable on the west coast. It is common on the Bermuda[1] and Bahama[2] islands and on the Antilles, and in South America ranges from Colombia to Brazil.

The wood of *Coccolobis Uvifera* is very heavy, hard, close-grained, and susceptible of receiving a beautiful polish; it contains scattered small open ducts and obscure medullary rays, the layers of annual growth being hardly distinguishable, and is dark brown or violet-color, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.9635, a cubic foot weighing 60.05 pounds. It is sometimes used in cabinet-making.

The fruit, which is scarcely edible, and is extremely astringent before it is fully ripe, is sometimes used medicinally in the West Indies;[3] and it is perhaps from the wood of this tree that the Jamaica Kino,[4] a powerful astringent occasionally imported into the United States, is obtained.

The strange sight of a tree covered with clusters of tempting grape-like fruit naturally attracted the attention of the Europeans when they first landed on the burning sands of the Antillean shores, and the beauty and value of the Sea Grape were extolled in the narratives of many of the early voyages[5] to the New World. The first technical description and a figure of this species were published in 1586.[6]

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[1] Lefroy, *Bull. U. S. Nat. Mus.* No. 25, 100 (*Bot. Bermuda*).

[2] Hitchcock, *Rep. Missouri Bot. Gard.* iv. 123.

[3] Barham, *Hort. Amer.* 68. — Lunan, *Hort. Jam.* i. 76. — Duncan, *Edinburgh Med. Dispens.* ed. 2, 162. — Descourtilz, *Fl. Méd. Antill.* ii. 41, t. 77. — Hayne, *Arzn.* x. t. 4. — Rafinesque, *Med. Fl.* ii. 211. — Nees von Esenbeck, *Pl Med.* Suppl. t. 33. — Schomburgk, *Linnæa*, viii. 280. — Grosourdy, *Med. Bot. Crioll.* ii. 107. — Ernst, *Jour. Bot.* iii. 320.

[4] Carson, *Med. Bot.* ii. 21, t. 68. — Karsten, *Pharm. Med. Bot.* 518. — *Nat. Dispens.* ed. 2, 799. — Guibourt, *Hist. Drog.* ed. 7, iii. 434. — *U. S. Dispens.* ed. 16, 856.

[5] "Del arbol llamado guiabara, que los christianos llaman uvero." (Oviedo, *Hist. Nat. Gen. Ind.* lib. viii. cap. 13.)

"And so doe their wild Grapes, which are a fruit growing in Clusters and therein have very little meat upon them." (Layfield, *Purchas his Pilgrims*, iv. 1172.)

"There is a berrie in those parts very excellent against the bloudie-fluxe, by the Indians it is called Kellette." (Harcourt, *Purchas his Pilgrims*, iv. 1276.)

"Acinus qui barbaris dicitur Kellete utiliter adhibetur contra dysenteriam." (Jan de Laet, *Nov. Orb.* 645.)

"Arbor, cujus materies rubra est instar ligni Brasiliani, folia pene orbicularia, fert racematim fructus uvis haud dissimiles, saporis admodum grati; nascitur potissimum juxta littora." (Jan de Laet, *Nov. Orb.* 665).

[6] *Populus Americana*, Dalechamps, *Hist. Pl.* ii. 1830, f.

Guiabara, Dalechamps, *Hist. Pl.* 1850, f. — C. Bauhin, *Pinax*, 19. — Parkinson, *Theatr.* 1667.

Populus rotundifolia Americana, C. Bauhin, *Pinax*, 430. — Jonston, *Dendrographia*, 439.

Arbor insulæ Tahayo materie ligno Brasiliana simili, Jonston, *Dendrographia*, 458, t. 130, f.; ed. 2, ii. 247, f.

Papyracea arbor Guaiabara, J. Bauhin, *Hist. Gen.* i. lib. iii. 374, f.

Populus novi orbis, J. Bauhin, *Hist. Gen.* i. lib. viii. 164, f.

Du Raisinier, Rochefort, *Histoire Naturelle et Morale des Isles Antilles*, 71, f. — Du Tertre, *Hist. Gén. Antill.* ii. 186.

Uvifera arbor Occidentalis folio rotundo, Hermann, *Parad. Bat. Prodr.* 385.

Uvifera litorea foliis amplioribus, fere orbiculatis crassis Americana, Plukenet, *Phyt.* 236, f. 7; *Alm. Bot.* 394.

Prunus maritima racemosa, folio rotundo glabro, fructu minore purpureo, Sloane, *Cat. Pl. Jam.* 183; *Nat. Hist. Jam.* ii. 129, t. 220, f. 3–5. — Ray, *Hist. Pl.* iii. *Dendr.* 40. — Catesby, *Nat. Hist. Car.* ii. 96, t. 96.

Uvifera foliis subrotundis, amplissimis, Linnæus, *Hort. Cliff.* 487. — Royen, *Fl. Leyd. Prodr.* 534.

The Bay-Grape-Tree, Griffith Hughes, *Nat. Hist. Barbados*, 180.

Coccolobis foliis crassis orbiculatis, sinu aperto, Browne, *Nat. Hist. Jam.* 209. — Plumier, *Pl. Am.* ed. Burman, 136, t. 145.

Raisinier du bord de la mer, Nicholson, *Essai sur l'Histoire naturelle de l'Isle de Saint Domingue*, 299.

Coccolobis Uvifera was first noticed in the United States by Bernard Romans, who described it in his *Concise Natural History of East and West Florida*,[1] published in 1775. According to Aiton,[2] it was introduced as early as 1690 into Europe,[3] where, and in Asia,[4] it is occasionally cultivated in botanic gardens.

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[1] "Coccoloba, or seaside plumb, growing in bunches, an almost round veined leaf, & the fruit blue, inclined to purple." (21.)

[2] *Hort. Kew.* ii. 34.

[3] Willdenow, *Enum.* 431. — Link, *Enum.* i. 386. — Desfontaines, *Cat. Hort. Paris*, ed. 3, 69. — Endlicher, *Cat. Hort. Vindob.* i. 273.

[4] Voigt, *Hort. Sub. Calcutt.* 326.

EXPLANATION OF THE PLATES.

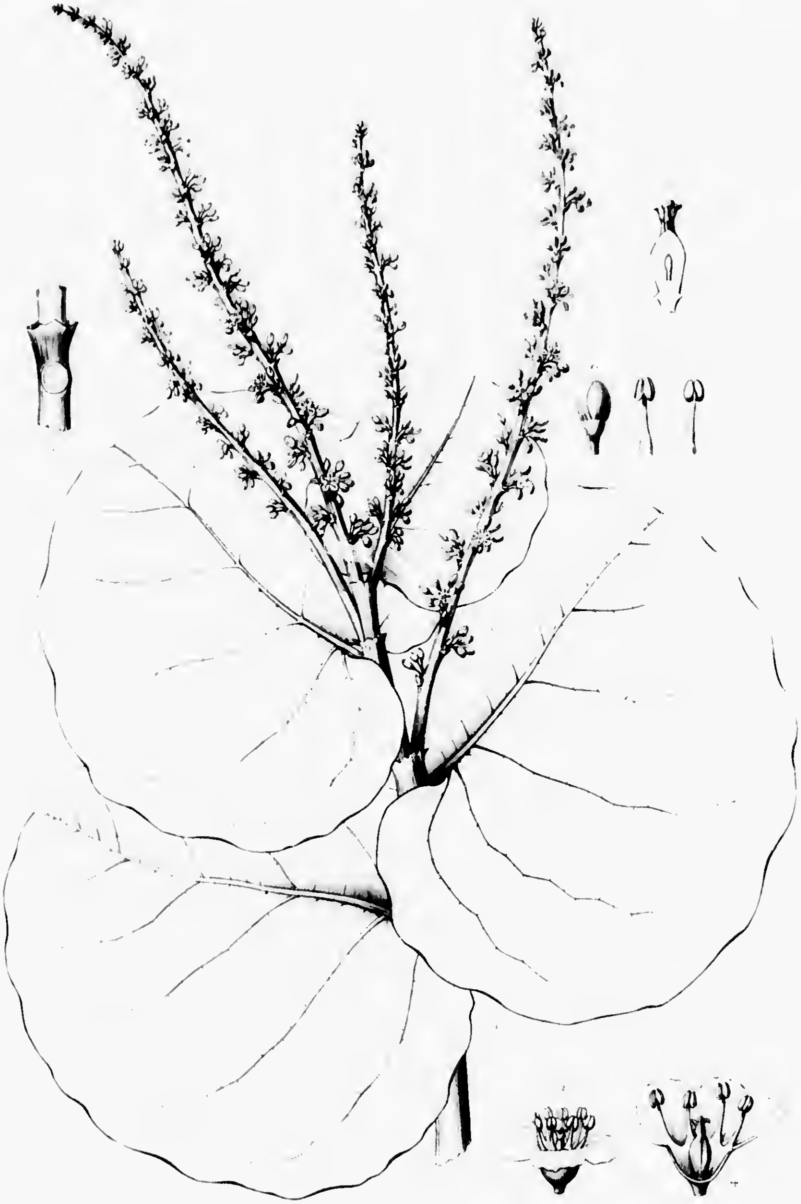
PLATE CCXCVIII. COCCOLOBIS UVIFERA.

1. A flowering branch, natural size.
2. A flower-bud, enlarged.
3. A flower, enlarged.
4. Vertical section of a flower, enlarged.
5. A stamen, front and rear views, enlarged.
6. A pistil, the ovary cut vertically, enlarged.
7. A portion of a branch showing leaf-scar and stipular sheath, natural size.

PLATE CCXCIX. COCCOLOBIS UVIFERA.

1. A fruiting branch, natural size.
2. Cross section of a fruit, enlarged.
3. Vertical section of a fruit, enlarged.
4. A seed, slightly enlarged.
5. An embryo, slightly enlarged.

size.



C. E. Faxon del.

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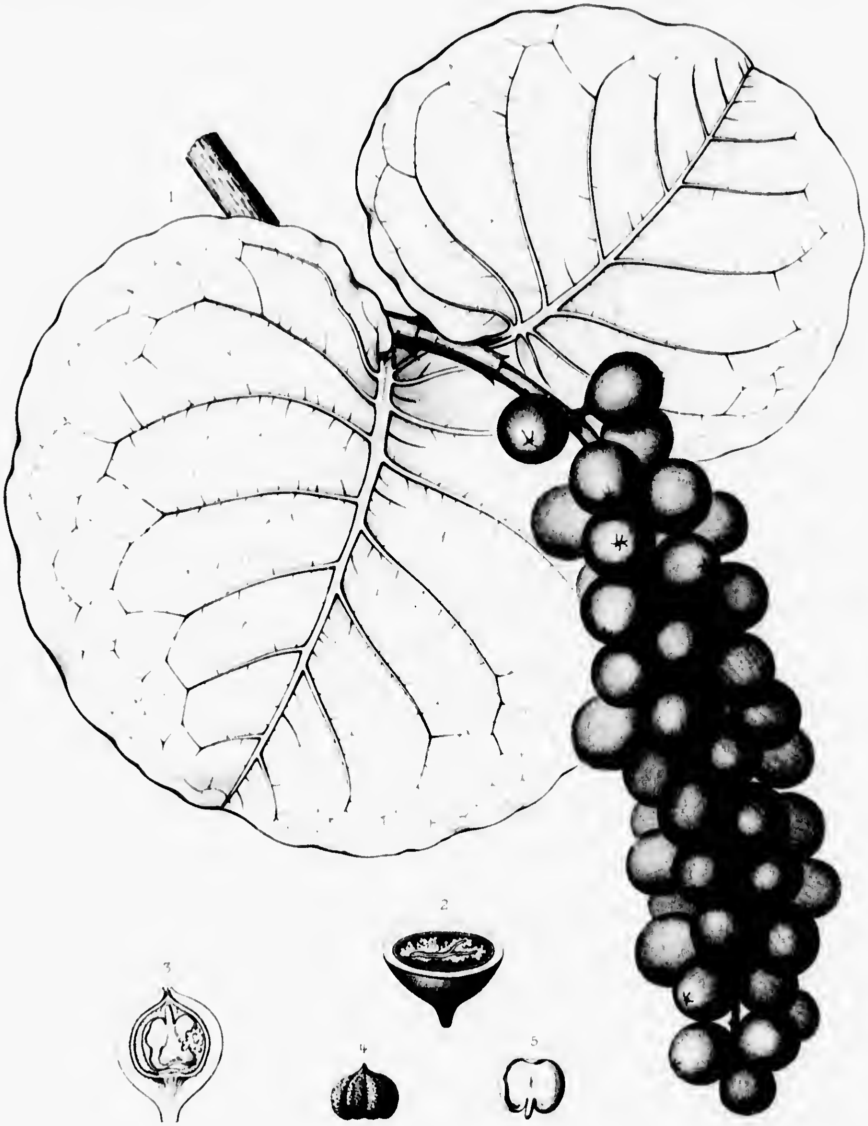
COCCOLOBIS UVIFERA, L.

A. Riocreux direx.

Imp. J. Taneur Paris.



C. F. Faxon del.

Picart sc.

COCCOLOBIS UVIFERA, L.

A. Riocreux direx.t

Imp. J. Taneur Paris

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COCCOLOBIS LAURIFOLIA.

Pigeon Plum.

FASCICLES of flowers in terminal racemes. Leaves ovate or ovate-lanceolate.

Coccolobis laurifolia, Jacquin, *Hort. Schœnbr.* iii. 9, t. 267 (1798). — Poiret, *Lam. Dict.* Suppl. iv. 652. — Meisner, *Mon. Gen. Polyg. Prodr.* 33, t. 2, C; *De Candolle Prodr.* xiv. 165. — Spach, *Hist. Vég.* x. 543. — Eggers, *Bull. U. S. Nat. Mus.* No. 13, 88 (*Fl. St. Croix and the Virgin Islands*). — Lindau, *Bot. Jahrb.* xiii. 158. — Baillon, *Hist. Pl.* xi. f. 445. — Hitchcock, *Rep. Missouri Bot. Gard.* iv. 123.

Coccolobis Floridana, Meisner, *De Candolle Prodr.* xiv. 165 (1857). — Grisebach, *Cat. Pl. Cub.* 61. — Chapman, *Fl.* 392. — Porcher, *Resources of Southern Fields and Forests*, 376. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 117.

Coccolobis parvifolia, Nuttall, *Sylva*, iii. 25, t. 89 (not Poiret) (1849).

Coccolobis tenuifolia, Eggers, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1876, 142 (*Fl. St. Croix*) (not Linnæus).

Coccolobis Leoganensis, Eggers, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1876, 142 (*Fl. St. Croix*) (not Jacquin). — *Bull. U. S. Nat. Mus.* No. 13, 88 (*Fl. St. Croix and the Virgin Islands*).

Coccolobis Curtissii, Lindau, *Bot. Jahrb.* xiii. 159 (1891).

Uvifera Curtissii, Otto Kunze, *Rev. Gen. Pl.* ii. 561 (1891).

Uvifera laurifolia, Otto Kunze, *Rev. Gen. Pl.* ii. 561 (1891).

A glabrous tree, in Florida sixty to seventy feet in height, with a tall straight trunk one or two feet in diameter, and spreading branches which form a dense round-topped handsome head. The bark of the trunk is a sixteenth of an inch thick, gray tinged with red and brown, and broken on the surface into large smooth plates, which in falling display the dark purple inner bark. The branchlets are slender, terete, often slightly zigzag, usually contorted, and covered with light orange-colored bark, which in their second or third year becomes dark gray tinged with red. The leaves are ovate, ovate-lanceolate or obovate-oblong, rounded or acute at the apex, rounded or wedge-shaped at the base, and entire, with slightly undulate revolute margins; they are thick and firm, bright green on the upper surface, paler on the lower surface, three to four inches long and an inch and a half to two inches broad, with conspicuous pale midribs rounded on the upper side, and three or four pairs of remote oblique primary veins forked and arcuate near the margins and connected by prominent reticulate veinlets; they are borne on stout flattened grooved petioles half an inch long and abruptly enlarged at the base; the stipular sheaths are truncate, entire, light brown, glabrous, thin and scarious, and about half an inch wide. The flowers appear in early spring in few or one-flowered fascicles in simple racemes terminal on short axillary branches of the previous year and two to three inches long; they are borne on slender pedicels a quarter of an inch long and much longer than the minute acute bracts and the narrow light brown scarious sheaths. The calyx is campanulate, narrowed at the base, and an eighth of an inch across the expanded lobes, which are cup-shaped, thin, and rather shorter than the stamens composed of slender yellow filaments enlarged at the base and of dark orange-colored anthers. The ovary is abruptly contracted into an abbreviated style, divided into three elongated stigmatic lobes. The fruit, which ripens during the winter and early spring, is ovoid, narrowed at the base, rounded and crowned at the apex with the lobes of the calyx, dark red and a third of an inch long, with thin acidulous flesh and a hard thin-walled light brown nutlet.

In Florida, where it is one of the largest and most abundant of the tropical trees, the Pigeon Plum is found on the seacoast from Cape Canaveral to the southern keys, and on the west coast from Cape Romano to Cape Sable. It is common on the Bahama Islands, and inhabits many of the Antilles and Venezuela.

The wood of *Coccolobis laurifolia* is heavy, exceedingly hard, strong, brittle, and close-grained, and contains small scattered open ducts, the layers of annual growth and the numerous medullary rays being hardly distinguishable; it is rich dark brown tinged with red, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.9835, a cubic foot weighing 61.29 pounds. In Florida it is occasionally used in cabinet-making.

The fruit is devoured by raccoons and other mammals, and by many birds.

Coccolobis laurifolia was discovered on the Bahama Islands by Mark Catesby, and the first account and figure of this tree was published in 1743 in his *Natural History of Carolina*.[1] The earliest mention of it as an inhabitant of Florida is found in Bernard Romans' *Concise Natural History of East and West Florida*, published in 1775.[2] It was introduced early in the present century into European gardens,[3] and in 1820 flowered near Paris.[4]

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[1] *Cerasus latiore folio; fructu racemoso purpureo majore*, ii. 94, t. 94.

[2] "Coccoloba, with oblong egg shaped veined leaves, with pointed grapelike fruit less than currants." (22.)

[3] Willdenow, *Enum.* 431. — Link, *Enum.* i. 386. — Endlicher, *Cat. Hort. Vindob.* i. 274.

[4] Mordant de Launay, *Herb. Amat.* v. t. 323.

EXPLANATION OF THE PLATE.

PLATE CCC. COCCOLOBIS LAURIFOLIA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. Portion of a rachis with two flowers, enlarged, showing the ochreolæ.
4. A flower, enlarged.
5. Vertical section of a flower, enlarged.
6. An ovule, much magnified.
7. A fruiting branch, natural size.
8. Cross section of a fruit, enlarged.
9. Vertical section of a fruit, enlarged.
10. A seed, enlarged.
11. An embryo, enlarged.

F. Faxon del. Barre sc.

COCCOLOBIS LAURIFOLIA.

Cantrel dir. Imp. Taneur Par.

INDEX TO VOL. VI.

Names of Orders are in SMALL CAPITALS; of admitted Genera and Species and other proper names, in roman type; of synonyms, in *italics*.

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